

UNITED STATES DEPARTMENT OF COMMERCE

JESSE H. JONES, *Secretary*

The St. Lawrence Survey

PART III

Potential Traffic on the St. Lawrence Seaway



N. R. DANIELIAN, *Director*

ST. LAWRENCE SURVEY

Reports of the St. Lawrence Survey

- PART I.** History of the St. Lawrence Project.
- PART II.** Shipping Services on the St. Lawrence River.
- PART III.** Potential Traffic on the St. Lawrence Seaway.
- PART IV.** The Effect of the St. Lawrence Seaway upon Existing Harbors.
- PART V.** The St. Lawrence Seaway and Future Transportation Requirements.
- PART VI.** The Economic Effects of the St. Lawrence Power Project.
- PART VII.** Summary Report of the St. Lawrence Survey.

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ST. LAWRENCE SURVEY

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1941

JULY 14, 1941.

THE PRESIDENT,
THE WHITE HOUSE,
Washington, D. C.

DEAR MR. PRESIDENT: I have the honor to transmit herewith Part III of the reports of the St. Lawrence Survey. In this part an attempt is made to indicate the possibilities of traffic through the St. Lawrence Seaway and the savings in transportation costs that will accrue as a result of cheap water transportation. This study is based upon detailed investigation of individual industries.

The summary of facts and conclusions is given in the letter of submittal of Dr. N. R. Danielian, Director of the St. Lawrence Survey.

Very sincerely,

WAYNE C. TAYLOR,
Acting Secretary of Commerce.

LETTER OF SUBMITTAL

JULY 10, 1941.

The Hon. SECRETARY OF COMMERCE,
Washington, D. C.

DEAR MR. SECRETARY: I have the honor to submit herewith PART III of the St. Lawrence Survey reports. This report attempts to evaluate the possibilities of commercial traffic through the proposed St. Lawrence Seaway, and to analyze the rate and cost advantages of the Seaway as compared with alternative means of transportation.

To determine the economic consequences to shippers and consumers the Survey made a study of comparative rates via rail and via Seaway and the indicated savings in transportation charges due to the Seaway are shown in this report.

To determine the economic consequences to the Nation as a whole, a study of comparative costs was made and the indicated savings in total national costs due to the Seaway are also shown here.

The report is in two sections: The first section consists of 4 chapters where there is given an extensive discussion of principles and methods of analysis, and the over-all results of the whole study; the second section includes a series of 17 separate studies, each of which is devoted to an analysis of a different commodity or a group of related commodities suitable for transportation via the Seaway.

It should be made clear that these studies do not purport to include all of the commodities which are produced or consumed in the Great Lakes area and which may utilize the Seaway. Rather, these samplings were selected for their value as representative of the wide range of commodities which are produced or consumed in this area and may be expected to comprise Seaway freight. The 17 selected commodities are:

Automobiles.	Tin.
Grains.	Sulfur.
Soybeans.	Vegetable oils and seeds.
Dairy products.	Machinery.
Green coffee.	Iron and steel.
Fresh and canned citrus.	Wood pulp and newsprint.
Bananas.	Packing-house products.
Wines and liquors.	Burlap and jute.
Crude rubber.	

The results show that during the average year in the depression decade of 1928-37 or 1929-38, there was traffic of over 4,600,000 short tons, which might have been carried over the Seaway, had it been in existence, with a saving in freight rates of 14 to 17 million dollars after allowing for any additional insurance charges. The average savings would be nearly \$4 per ton. In individual cases the savings would vary from time to time and from place to place. If the Seaway is utilized by American interests to the extent of 10,000,000 tons of traffic annually, these savings in freight rates will be as much as \$36,000,000 a year.

Taking the total annual cost of the Seaway estimated by the United States Army Engineers as between 9 and 10 million dollars, including operating costs, interest, depreciation, and amortization, it becomes evident from this limited sample of commodity studies that there was a large volume of annual traffic even during a decade of business conditions as depressed as those experienced in the recent past, on which the savings in freight rates would have amply justified the construction of the project upon a commercial basis.

Caution must be exercised in interpreting the facts in the study. First and foremost, these results are not predictions or forecasts of what the total traffic will be in the future. In view of the many other commodities which are not analyzed in detail, such as sugar, lumber, hides and leather, cottonseed and cottonseed oil, etc., which may utilize this new route, and in view of the probability that this nation is unlikely to allow the conditions of the early 1930's to be repeated again, actual traffic in the future is indeed likely to be of much greater magnitude.

In the second place, in making the individual commodity studies, traffic through the existing 14-foot canal was not included in the calculations. Possible trade with Canada, and with other countries such as Oceania, and United States possessions, with which direct shipping services are not very likely, was likewise left out of consideration. Hence the figures here given are conservative estimates of new potential traffic for the Seaway, under conditions similar to those prevailing in the past decade.

Thirdly, this new traffic, available even during a period of depression, will not necessarily shift from existing modes of transportation to the Seaway within a year or two after completion. The development of Seaway traffic will probably be a matter of years and decades. The Suez Canal was built by de Lesseps upon the assumption that it would carry 3 million tons of traffic, and that at that level it would be a self-liquidating and even profitable enterprise. In fact, however, it was not until 10 years after completion that traffic reached 3 million tons. Thereafter traffic continued to increase, until in 1929 Suez carried 34½ million tons. A similarly slow growth in traffic occurred

in the case of the Panama Canal which now exceeds the volume initially estimated. The same experience may be expected in the case of the Seaway. Over a period of years, commerce expands with the development of new industries, new services, and new shipping facilities. Traffic studies such as the present report only show that interregional and international trade between the mid-continent and other areas already exists to justify the new facilities. The actual traffic that will be realized in future years will not consist *in toto* of a transfer of this traffic from existing channels to the St. Lawrence. Instead, it will consist in large part of future new interregional and international trade both in quantity and in kind of goods. This has been the experience at Suez and Panama. It will surely be the case on the St. Lawrence.

Besides its commercial justification, the Seaway also stands the test of a more fundamental economic analysis—one based not upon the savings in rates by shifting existing traffic from other systems of transportation to the Seaway, but based upon a comparison of the costs involved in carrying new increments of traffic. With the growth of the country's industry and commerce, new investment will undoubtedly be required in additional transportation facilities. Part V of our studies proved this to be the case for the railroads. The question then becomes: Which of the alternative possibilities of expanding transportation facilities is the most economical for the country to undertake?

To answer this question, the Survey has made an exhaustive analysis of the comparative costs of rail and water transportation as applied to the type of traffic that the St. Lawrence Seaway may carry. The results are given in Chapter IV of this report. Assuming an incremental new traffic of 10,000,000 long tons achieved by 1955, the study reveals that new capital costs of railroads, not including fixed plant (trackage and terminal) facilities, would be from \$311,000,000 to \$340,000,000 as compared with \$235,000,000 for the Seaway. On an annual basis, including fixed charges, amortization and depreciation on the foregoing investment as well as rail and ship operating costs, the annual costs would be, for high efficiency traffic, \$92,000,000 via rail as compared with \$21 millions via the Seaway, and on low efficiency traffic, \$86 millions on the railroads, as against \$67,000,000 through the Seaway. There is no question but that in terms of total *national cost* the Seaway would provide a more economic method of carrying its portion of the increase in the traffic of the future.

One final question must be answered: What are the future prospects of world trade? Obviously it would be presumptuous to give a categorical answer to this question. The value of the Seaway can only be judged in relation to various hypotheses of future world conditions.

A brief survey of possibilities indicates that if Great Britain survives and war conditions continue, exports in agricultural products and

luxury goods will remain at a low level, while heavy products, largely military supplies and equipment and machinery—all in major part produced in the Middle West—will grow to larger proportions. Hence Seaway traffic in these products would acquire greater significance.

World peace established under democratic auspices, carrying with it the responsibility of economic rehabilitation and reconstruction of devastated areas of Europe, Africa and Asia, would certainly lead to an unprecedented expansion of exports and imports. If this happens, the St. Lawrence Seaway would take care of a small portion of the added traffic; but to the extent that it does, it will be more economical than any alternative route to and from the Middle West.

Finally, if the conflict abroad should be resolved unfavorably to American interests, if this country and Canada should find themselves surrounded by hostile powers in control of the high seas, then of course the commercial and economic advantages of the Seaway would acquire secondary importance. Military and strategic values would predominate in judging this project. Under such circumstances, the weight of expert and official opinion is that the St. Lawrence Seaway would be of immense advantage, because it will make available a new outlet to the sea, protected for a thousand miles nearer Europe, and because it will make available the managerial ability, the skilled labor and the existing plants of a large number of shipyards on the Great Lakes.

Very truly yours,

N. R. DANIELIAN, *Director,*
St. Lawrence Survey.

Acknowledgments

The St. Lawrence Survey gratefully acknowledges the assistance of the following Government departments in the preparation of this report: Department of the Treasury, Procurement Division (Rates Section); Department of War, Board of Engineers for Rivers and Harbors; Department of Justice, Anti-Trust Division; Department of the Navy, Hydrographic Office; Department of the Interior, Bureau of Mines; Department of Agriculture, Bureau of Agricultural Economics, Agricultural Marketing Service, and Surplus Marketing Administration; Department of Commerce, Bureau of Foreign and Domestic Commerce, and Bureau of the Census; United States Maritime Commission; United States Tariff Commission; Federal Trade Commission; and Interstate Commerce Commission.

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POTENTIAL TRAFFIC ON THE ST. LAWRENCE SEAWAY

CHAPTER I

THE ECONOMIC IMPORTANCE OF THE GREAT LAKES AREA

Before undertaking a major public project, the Government must weigh against the costs of construction and maintenance the potential benefits that will accrue from the program, and define as accurately as possible its beneficiaries.

The St. Lawrence Seaway project is designed to open up a new channel of transportation to a large territory in the mid-continental United States. In order to justify the expenditure of such important sums as this work will involve, the gross economic benefits to be derived from the project must be greater than the costs, when both are reduced to an annual basis. This part of the Survey undertakes to evaluate the amount of savings in transportation costs that may be brought about through the construction of the proposed Seaway. Savings in transportation costs constitute but one of the many advantages of the project. All of the various factors in the whole project will be duly weighed in Part VII of the Survey reports.

Before going into a specific analysis of the methods used and the results obtained by the Survey, we may briefly examine the economic importance of the area around the Great Lakes. The States that have been found likely to be most directly affected by the St. Lawrence development are Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Nebraska, northern New York and western Pennsylvania.

These States as a unit form one of the most important productive regions of the United States. In its output of mining, agricultural and industrial products, this region is unsurpassed on any continent. The population of the States of the area in 1940 is estimated at 40,284,000,¹ or 30.7 percent of the total population of the United States.

¹ Bureau of Census, summary of preliminary population figures, release No. 15826, September 22, 1940.

TABLE 1
Economic importance of the Great Lakes area,¹ 1937

Item	United States total	Total, Great Lakes area	Great Lakes area as percent of United States total
Population ²	131, 410	³ 40, 284	30. 7
Total manufacturing:			
Value of products.....	80, 712, 872	25, 179, 795	41. 5
Value added.....	25, 178, 539	10, 486, 259	41. 7
Wage earners:			
Average number.....	8, 589	3, 147	36. 7
Wages paid.....	10, 113	4, 289	42. 4
Steel: Ingot capacity.....	70, 983	⁴ 53, 438	75. 3
Iron ore production.....	72, 094	¹⁰ 60, 502	83. 9
Bituminous coal production.....	445, 531	¹¹ 182, 075	40. 9
Motor vehicles and parts:			
Value of products.....	5, 176, 236	⁵ 3, 802, 938	73. 5
Value added by manufacture.....	1, 506, 894	1, 226, 681	81. 4
Machinery: Value of products.....	5, 891, 599	⁶ 2, 909, 840	49. 4
Chemicals, n. e. c.:			
Value of products.....	932, 750	⁷ 332, 899	35. 7
Value added by manufacture.....	477, 688	171, 305	35. 9
Drugs and medicines:			
Value of products.....	345, 918	⁷ 139, 517	40. 3
Value added by manufacture.....	247, 097	103, 502	41. 9
Paints, pigments, and varnishes:			
Value of products.....	538, 461	⁷ 227, 755	42. 3
Value added by manufacture.....	226, 375	95, 961	42. 4
Fertilizer:			
Value of products.....	195, 759	⁹ 29, 245	14. 9
Value added by manufacture.....	65, 678	11, 595	17. 7
Power:			
Capacity of generators.....	37, 032	¹² 11, 514	31. 1
Production of electric energy.....	121, 050	¹² 33, 029	27. 3
Farm property:			
Value of all farm property, 1930.....	57, 246	24, 417	42. 6
Value of land and buildings, 1935.....	32, 859	13, 404	40. 8
Foodstuffs:			
Wheat production.....	26, 270	¹³ 9, 516	36. 2
Corn production.....	2, 651	¹³ 1, 774	66. 9
Flour:			
Value of products.....	856, 310	¹⁴ 366, 485	42. 8
Value added by manufacture.....	133, 600	56, 311	42. 1
Meat packing:			
Value of products.....	2, 787, 358	¹⁴ 1, 575, 192	56. 5
Value added by manufacture.....	401, 267	¹⁵ 230, 065	57. 3
Creamery butter, factory production.....	1, 623, 971	¹⁵ 1, 083, 850	66. 7
Whole-milk American Cheddar cheese: Factory production.....	492, 041	¹⁵ 337, 819	68. 7
Egg production.....	36, 647	¹⁵ 14, 385	39. 3
Chickens, production.....	577, 701	¹⁵ 216, 151	37. 4

¹ Includes: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Nebraska, northern New York, and western Pennsylvania. ² 1940 Census figures. ³ Includes:

New York counties—St. Lawrence, Clinton, Franklin, Lewis, Jefferson, Fulton, Oneida, Oswego, Onondaga, Cayuga, Yates, Ontario, Monroe, Orleans, Niagara, Erie, Genesee, Wyoming, Livingstone, Steuben, Allegany, Cattaraugus, Chautauqua, Seneca, and Wayne.

Pennsylvania counties—Warren, McKean, Potter, Cameron, Elk, Forest, Venango, Crawford, Mercer, Lawrence, Beaver, Washington, Allegheny, Butler, Armstrong, Clarion, Jefferson and Westmoreland.

⁴ Annual capacity, 1935, includes:

New York counties—Cayuga, Chautauqua, Cortland, Erie, Niagara, Oneida, and Onondaga.

Pennsylvania counties—Allegheny, Armstrong, Beaver, Butler, Crawford, Erie, Lawrence, Mercer, Vanango, Washington, Westmoreland, Warren.

⁵ Does not include Pennsylvania and includes only Buffalo Industrial Area for New York; also Kansas.

⁶ Minnesota business group omitted to avoid disclosures.

⁷ Includes Buffalo and Rochester Industrial Areas for New York, and Pittsburgh Industrial Area for Pennsylvania.

⁸ South Dakota not specifically shown.

⁹ Minnesota; Rochester, N. Y., and Pittsburgh, Pa., not specifically shown.

¹⁰ Michigan and Minnesota only ones specified.

¹¹ Northern New York excluded but includes Pennsylvania counties—Allegheny, Armstrong, Beaver, Butler, Clarion, Clearfield, Elk, Fayette, Greene, Indiana, Jefferson, McKean, Mercer, Somerset, Venango, and Washington.

¹² Includes only New York counties—Clinton, Franklin, Fulton, Herkimer, Jefferson, Lewis, Oneida, Oswego, St. Lawrence, Erie, Niagara, Orleans, Seneca, Steuben, Wayne, and Monroe.

¹³ Does not include New York or Pennsylvania.

¹⁴ Includes Buffalo and Pittsburgh Industrial Areas.

¹⁵ North Dakota not specifically shown.

In table 1 are presented certain facts which show the importance of the Great Lakes area in manufacturing, mining, and agriculture in the year 1937. Manufacturing is highly concentrated in this area. The value of manufactured products of the area in 1937 amounted to somewhat over \$25,000,000,000. Of that amount, value added by manufacture in the area was almost \$10,500,000,000. In terms of value of products and value added by manufacture the area produced 41.5 percent and 41.7 percent, respectively, of total United States output.

The average number of wage earners in manufacturing employed in the Great Lakes area during 1937 was over 3,100,000, or about 37 percent of the United States total. These workers received \$4,289,000,000 in wages, or 42.4 percent of the manufacturing wages paid in the country.

Steel is one of the basic materials of an industrial civilization. For this important product, the United States depends principally upon the Great Lakes area. In 1935 this region held 75.3 percent of the total steel ingot capacity of the country.² Of the raw materials which move into the manufacture of steel, it produced over 80 percent of the iron ore and about 40 percent of the bituminous coal production in the United States.

The concentration of the motor vehicle and parts industry in the Great Lakes area is well known. The value of products in that industry for the area amounted to 73.5 percent of the nation's total, and the value added by manufacture, 18 percent. The value of all machinery produced in the area was just under 50 percent of the national total. Considering individual types of machinery, 58.4 percent of the value of products of industrial machinery, 95.6 percent of agricultural machinery and 56.1 percent of the business machines were manufactured in the Great Lakes region in 1937.

In chemicals, the Great Lakes area is also important. Nearly 36 percent of chemicals, n. e. c., 41 percent of drugs and medicines, and over 42 percent of paints, pigments, and varnishes, are produced in the territory tributary to the Lakes.

This region is equally important in agriculture. Of all farm property in the United States, 42.6 percent of total value in 1930 was located in the States designated here as tributary to the Great Lakes. Rightly they have been called the granary of the world; 36 percent of wheat production and 67 percent of the corn production of the nation comes from this region. The value of products and the value added by manufacture in the flour industry in this region amounted to about 42 percent of the United States total. Approximately 56.5 percent of the meat-packing industry is found in this region.

² Department of Commerce, Bureau of Foreign and Domestic Commerce, Market Research, Series No. 142. *Basic Industrial Markets in the United States, 1935.* The Iron and Steel Industries, tables 1 and 2.

The dairy-products industry likewise has important producing sections in the Great Lakes area: 69 percent of the factory production of cheddar cheese comes from this region, and over 37 percent of the production of eggs and 37 percent of chickens.

The importance of the tributary area assumes even greater proportions when attention is turned from its production to its surpluses which it sends to other sections of this country and to foreign countries to feed their populations and enable their industries to function. In all these products the Great Lakes area is an exporting region.

Admittedly the analysis of the effects of the St. Lawrence Seaway on the many important industries of this vast area is no easy matter. The problem confronting such a study is not limited merely to the transportation of goods. To consider only possibilities of rerouting of traffic is but one part of the task. The broader aspects are just as important, if not more so. What may happen to location of industry, to shifts of population movements, to consumption habits, and other equally serious repercussions are essential parts of the task. But these long range influences are still less subject to quantitative measurements than traffic movements, difficult though the latter problem is.

Hence, major attention in this report has been centered upon measurable elements of production, consumption, exports, imports, commodity movements and costs of transportation as they have existed in the recent past. Some consideration to the qualitative aspects of the problem is given in Part VII of these reports.

CHAPTER II

CONSIDERATIONS OF METHOD

Section 1

DELINEATION OF THE TRIBUTARY AREA

The first step in the analysis of the volume of traffic is delineation of the territory affected. In discussions of the economic feasibility of the St. Lawrence Seaway, this territory is generally called the "tributary area." It may be defined as that geographical region within which it will be cheaper to ship commodities via the St. Lawrence Seaway than by any available alternative route.

The outer rim of this tributary area will be marked by a line to which the rates via the Seaway and the rates to or from the three sea coasts will be equalized. Previous studies have generally employed the broad over-all method of determining the tributary area for all commodities produced in the Middle West. Ritter,¹ for instance, established the tributary area by taking fifth-class rail rates, plus general cargo ocean rates, and tracing the boundary line where the alternative cost of shipment by existing routes, as against the estimated cost via the Seaway, would be the same. This method, of course, had the disadvantage inherent in the fact that since all commodities do not carry fifth-class rates and general cargo ocean rates, the area defined by those rates is not applicable to all commodities, and specific instances can be cited to cloud the validity of the general conclusions. The method does have the advantage in giving by a simple stroke a territory that may, in general, be acceptable. Moulton and associates,² on the other hand, make no attempt to establish a tributary area, either in general or for specific commodities.

The Interdepartmental Report established a territory by an over-all method assuming that the bulk of the commodities would move under the rates prescribed for Class 5.³

The Niagara Frontier Planning Board presents no specific outline of its method. However,⁴ in the case of every commodity it studied, the Interdepartmental Board's tonnage figure was the starting point of the discussions by the Niagara Frontier Planning Board. Sub-

¹ Alfred H. Ritter, *Transportation Economics of the Great Lakes-St. Lawrence Ship Canal*.

² Harold G. Moulton, Charles S. Morgan, Ada L. Lee, *The St. Lawrence Navigation and Power Project*.

³ S. Doc. No. 116, 73d Cong., 2d sess.

sequently the tonnage figure of the Interdepartmental Report was modified in the light of the Planning Board's peculiar statistical methods.⁴

The method employed here in our study is particularized and differentiated for each commodity. Where commodities are produced over a wide area in the Middle West, such as grains and dairy products, or where the imported commodity is consumed generally in the area in its original form, without processing (citrus fruit, bananas), the tributary area was determined for each commodity by a study of the specific commodity rates, rail and ocean. By this method, of course, the tributary areas for different commodities vary, since the rates are different in each case.

On the other hand, in the case of exports that are manufactured and in the case of imports that are processed, the exact centers of manufacturing or processing were located by a study of the structure of that industry, and the location of those centers in or outside the tributary area was determined by a study of the rates via alternative routes. It has been necessary to do this for automobiles and parts, iron and steel, machinery, packing-house products, vegetable oils and seeds, wheat flour, wood pulp and newsprint, sulfur, and tin.

In domestic movement, the method followed for commodities moving out-bound is similar to that used for exports, and for commodities moving in-bound into the Great Lakes region from other parts of the country the method followed is similar to that used for imports.

This technique has resulted in variations of the tributary area not only from commodity to commodity, but also in the case of imports of the same commodity from different parts of the world. Thus, the tributary area for imported tin has no relation to the tributary area for imported iron and steel products and the area found likely to be affected by the proposed Seaway is found to be different for imports from the United Kingdom and from the Dutch East Indies.

Section 2

DETERMINATION OF POTENTIAL TRAFFIC

In the past, several methods have been used to determine the traffic potentialities of the St. Lawrence Seaway. Ritter applies a general method of estimating St. Lawrence traffic. In the case of export commodities, he assumes the same proportion of total exports as production in the tributary area bears to the total production in the country. It has already been mentioned that Ritter's method

⁴Niagara Frontier Planning Board, *The St. Lawrence Seaway Project*, 1940.

suffers from the disadvantage that the transportation rates of different commodities vary widely. It has the additional disadvantage that the tributary area does not always contribute the same share of exports as its share of the national production. This is true, for instance, of wheat, machinery, packinghouse products, lumber and other products.

The Interdepartmental Report⁵ used a similar method. Taking a fixed tributary area, the Interdepartmental Committee studied a list of 21 commodities and determined potential export tonnage from this area on the basis of the proportion of total production assignable to the tributary area. For imported goods of general consumption, a per-capita basis was applied to the population in the fixed tributary area. For imported materials used by industries, the consumption of the consuming industries located in this fixed tributary area was estimated. The import and export trade statistics were based on the year 1929, excluding trade with Canada. The final estimates were reduced by one-third to compensate for the closed season of navigation.

This method, of course, suffers from the same disadvantages as those of Ritter. In addition, the use of 1929 figures led to overstatement insofar as subsequent developments in trade and commerce proved 1929 to be an exceptional rather than a representative year.

Moulton and associates again have no definite method of estimating potential tonnage. Generally, it is fair to say that their individual commodity studies fail to include all traffic potentialities insofar as they fail to examine exhaustively available data on production and movements of commodities in the Great Lakes region; and also because they seem to proceed upon the general theory in all their arguments that cheaper transportation will not cause producers, dealers, and consumers to change their present habits in favor of a less costly method of transporting goods. Beginning with this conception they, therefore, whittle down traffic potentialities on each commodity to the vanishing point.

In contrast to these previous methods, the Survey tried first to find the actual amounts of production in the tributary area, the actual amount of exports from each producing center in this area and the actual routes over which these commodities now move. For instance, in the study of grains and wheat flour, potential traffic was estimated by tracing the quantities moving from the Great Lakes area towards the eastern ports by lake, rail, or lake-rail. In the case of dairy products, the actual movement during the season of open navigation from dairy producing centers to the consuming centers

⁵ S. Doc. No. 116, 73d Cong., 2d sess.

was obtained. In the analysis of wood pulp imports, the exact deficiency in the consumption requirements of the tributary area and the sources supplying this deficiency were ascertained on the basis of actual figures secured by the United States Tariff Commission. Wherever it was possible to obtain such actual figures of production, exports or imports, and transportation routes, they were secured in great detail. Where no such figures were available, however, it was necessary to estimate the potential traffic.

For example, production and export figures on machinery are in terms of dollar values instead of weights. It was necessary to obtain conversion factors for each type of machinery in order to calculate weight. The dollar values of production for each type of machinery were allocated to states and industrial areas tributary to the Great Lakes on the basis of an analysis furnished through the courtesy of the Bureau of the Census. The amount of exports from each center of production was based chiefly on the results of questionnaires, consultations, and thorough study of trade journals and industrial and trade directories which made it possible to determine the principal centers of production in the tributary area and the exports therefrom. Allowance, of course, was made for the closed season of navigation and the retentive force of present methods of transportation.

Where possible, traffic to destinations to which direct service from the Great Lakes is unlikely, such as Africa, Oceania, and United States possessions, was eliminated from consideration of potential traffic. Again, exports to Canada were in large part deleted from the final estimates insofar as the present 14-foot canals on the St. Lawrence already provide a means of transportation to and from Canada. Similar specific treatment was given to imported commodities.

In making allowance for the closed season of navigation, the actual movement in export and import trade of each commodity was studied for the years 1936 to 1938 inclusive, month by month, and the average percentage of imports or exports in the period May to November, inclusive, to the total, was obtained for each commodity. The final estimates were corrected by this factor.

The selection of the proper period over which import and export trade in and out of the Great Lakes area should be studied, is important insofar as the magnitude of commerce during the selected period will affect very seriously the final estimates. The Interdepartmental Report, as stated above, selected 1929 figures as the basis of their estimates. Moulton and associates again found no definite solution to this problem and selected at random periods and figures, sometimes for 1 year, sometimes for 2 or 3 years. In selecting the basic figures of exports and imports, the Survey uniformly followed the practice of taking an average of a ten-year period, usually 1928-37 or 1929-38, where the facts were available for such periods. Only in

a few cases was it necessary to take other periods. Where census figures had to be used, either 1937, or wherever it was possible, an average for 1933, 1935, and 1937 was employed.

Sometimes, as in the case of liquors, the period over which trade is a matter of record is restricted to an interval less than a decade. On occasion, the most serviceable data covered a particular year, as with wood pulp, which was studied exhaustively by the United States Tariff Commission for the year 1935. In such cases, the Survey tried to compare the characteristics of the brief period selected with the trends in the industry.

The periods 1928-37 or 1929-38 were selected with deliberation. These periods appeared most useful for present purposes because they included three prosperous years, 1928, 1929 and 1937, 4 or 5 years of very depressed conditions and 2 or 3 years of average conditions, depending on the industry. Admittedly this decade will probably not be duplicated again on the same level. This is not to deny the possibility of business recessions in the future. However, the likelihood is that business fluctuations in future decades will vary around a higher average than during the last business cycle. This period was selected specifically to put the estimates beyond the possibility of criticism as too optimistic.

The basic theory in the selection of average value over a decade is, of course, the fact that a project such as the St. Lawrence Seaway, once constructed, will be available for use as a permanent addition to the transportation system of the continent; hence, estimates of traffic should not aim at predicting traffic in any given year, but must try to define the probable average traffic possibilities over a number of years. These results are achieved here by estimating the traffic that might have moved over the St. Lawrence in each commodity, on the average, if the Seaway were available during the past decade. If it is true that conditions of trade may not be allowed to reach the very low levels of the past decade, then the average estimates of traffic given in this report for selected commodities must be considered too low.

Section 3

DETERMINATION OF UNIT SAVINGS

Unit savings may be defined as the excess of the freight rates per unit of weight from point of origin to the point of destination via the present modes of transportation over the rates that may prevail via the St. Lawrence route. Unit savings are the basic factor upon which any analysis of the economic effect of the St. Lawrence must be built. They determine the extent of the tributary area for each commodity which moves into or out of the area and the tonnage of the commodity

that can be expected to move by the Seaway. Finally, in relation to this total tonnage, they determine the total estimated savings in transportation costs.

The problem may be divided into two phases: First, the determination of the present modes of transportation and the costs of moving commodities by them; second, estimate of feasible rates via the St. Lawrence. The difference between present and estimated rates is by definition the unit saving.

Before any analysis of the savings can be made, the movement of each commodity must be particularized. The points of origin and destination must be determined as nearly as possible. To trace the movement of every ton of freight into or out of the Great Lakes area is, of course, impossible; in a study of this nature, representative points of origin or destination must be chosen. For this purpose every available source of data was studied: Census data as to the distribution of industry, trade journals, directories, field reports, consultations with experts and with persons in the industry, statistics of imports and exports by countries and by customs districts, and of water-borne commerce on the inland waterways, the Great Lakes and the St. Lawrence.

The question of determining the present costs of transportation with reasonable accuracy is relatively easy. For this purpose the rail rates currently in effect during the fall and winter of 1939 have been added to the ocean rates in effect in the month of August 1939. The rail rates are relatively stable but water rates fluctuate considerably. August 1939 was selected for the water rates because it is the date just before the outbreak of the present war. Any rates in effect since that date have been, of course, violently affected by risks of warfare and the shortage in shipping facilities. The rates in August 1939 were compared in many instances with those existing at quarterly intervals in the preceding 5 years, and they were found quite in line.

The question of feasible rates is far more difficult and involves the exercise of considerable judgment. On imports, feasible rates must be estimated from the foreign port to the point of destination in the tributary area. If this involves a trip inland the rail rate inland from the Great Lakes port to the point of destination must be added to an estimated water rate.

On exports, the feasible rate must embrace costs of transportation to the shipper from the point of origin within the Great Lakes area to the foreign port of destination. It must include rail rates to the Lake port and estimated water rate from the Great Lakes port to the port of destination.

For domestic shipments the feasible rate must include the movement from the point of origin to the point of destination. In other

words, not only the estimated water rate from Lake port to the coastal domestic ports, or from coastal domestic ports to the Lake port, but also any rail or truck rates that may be involved at either end of the shipment. Of course transfer charges are involved, but in instances of export and import movements the imposition of a loading or unloading charge at Lake ports is considered to be offset by the elimination of a similar charge presently in effect at ocean ports. In the case of export grain, for example, the direct movement eliminates entirely all intermediate elevation charges.

Section 4

METHODS OF DETERMINING FEASIBLE SEAWAY RATES

Methods employed by previous studies.

Various methods were used in past reports to determine the feasible rates. Alfred Ritter, for example, applied to the contract or going New York rate, a cost factor. This factor represented the costs of the operation of a typical ship while at sea to or from Great Lakes ports over and above the cost to North Atlantic ports. The result was expressed as a percentage. Thus, the costs of operation of a typical vessel to South Africa from Cleveland are estimated to be 110 percent of the cost of operation from New York. Ritter then assumed for purposes of his study that the rates from Cleveland would be 110 percent of the rate from New York. In his study of costs and rates he disregarded express liners and combination liners which he did not expect to move into the Great Lakes, and based his study of costs on two categories of ships—tramp steamers and cargo liners. He applied the cost of operations factor of one category or the other, depending upon the nature of the commodity and the type of ship which was likely to move the particular cargo.

Ritter applied the various factors to obtain feasible rates between Great Lakes ports and various ports of the world, although he expressed the opinion that in many cases the rates to the Great Lakes would be equalized with those to New York, and the rate from the Great Lakes would be the same as those from New York. On grain exports, however, he chose his typical rate from a comparison of the rates then in effect, pointing out that the rate per bushel to Liverpool was 8 cents from the North Atlantic ports, 11 cents from the Gulf ports, and 22 cents from Pacific ports, and after consideration of the various elements involved, he decided 10 cents was a satisfactory feasible rate. In other words, in the case of grain, Ritter based his feasible rates on competition alone not modified by a factor based upon costs of operation.

Moulton and associates in their highly condemnatory treatise evince a complete disregard for rates, actual or feasible. Their studies of individual commodities contain exhaustive analysis of the intangible factors affecting the choice of routes but scarcely a mention of rates or costs of transportation. Even their outline of the problem involved in estimating traffic makes no reference to rates:

Each class of potential traffic presents a special problem for analysis. For example, as to each item of possible export traffic it is necessary to study the precise points of origin, the trade regions and individual countries to which exports move, the alternative routes available, the possibility of return boat cargoes, the months during which exportation largely occurs, the general character of the commodity—whether of high or low value, requiring fast movement and regular time schedules—and methods of sale, marketing arrangements, and established routings. A similar range of considerations is involved in connection with import traffic and also with traffic that might move between the Lakes and the American coasts.

Of particular importance are the methods of sale, marketing, and routing—that is, the general commercial organization that has been built up for the handling of the product in question.⁶

All these factors are important, of course, but of rates or costs of transportation they have little to say. On the few occasions when feasible rates are mentioned they make such statements as:

To say that rates on iron and steel products to Northern Europe would have to be only 25 percent higher than those from New York and 50 percent higher to other destinations, is to be quite liberal in judging the handicaps of the St. Lawrence route.^{6a}

It might be expected that such statements would be based upon a careful analysis of either the structure of ocean rates or the cost of operation of ocean vessels, but even in the chapter devoted to the ship operator there is no specific mention of rates or analysis of costs. In fact the Moulton report seems based upon a conviction that other factors are so important that rates or costs of operation will not affect the choice of route to a degree great enough to warrant their study.

The Interdepartmental Board's report made no effort to establish feasible rates. It based its estimates of unit savings upon a comparison of operating cost per ton as estimated for typical vessels with typical movements to or from Lake ports as compared with ocean ports. For the rail rates involved in either case it assumed fifth-class rates, except for those items which moved under special commodity rates. In analyzing the costs of operation of a vessel via the St. Lawrence, a typical voyage was determined by a study of the following factors: The days at sea (including the days of voyage in the St. Lawrence, the Canals, and the Lakes); days in port; additional ex-

⁶ Moulton, Morgan, and Lee, *op. cit.*, p. 105.

^{6a} *Ibid.* p. 413.

penses of pilotage, handling in locks and other expenses. On shipments to or from the North Atlantic ports, as distinct from the St. Lawrence route, the cost analysis took account of the days at sea; the same days in ports as had been used for the Great Lakes ports; additional expenses of pilotage, handling, and other expenses.

The Interdepartmental Board's report justifies its use of costs of operations as distinct from rates on the grounds that the rates in effect at the time the report was prepared were so low as to include no profit to speak of. To use these rates it felt would give exceedingly distorted values. In the Interdepartmental Board's report careful weight was given to the degree in which individual items of costs varied with the length of the run.

The Niagara Frontier Planning Board based its estimate of savings on vessel costs but made no distinction between fixed and variable items. Taking the vessel costs as used by the Interdepartmental Board, the Niagara Frontier Planning Board reduced them to a per ton-hour basis. It multiplied this per ton-hour cost by the number of hours necessary either to ship into the Great Lakes or to ship out of the Great Lakes. This method makes the unwarranted assumption that total costs, including port charges, stevedoring, etc., vary in direct proportion to number of hours at sea. The Niagara Frontier Planning Board errs further than the others in not distinguishing the degree of variability of costs. Some costs of operation vary almost directly with the length of the run: For example, wages, crew maintenance, fuel, supplies, etc. Other costs may be the same regardless of how long the run may be: For example, port charges and stevedoring. Between these two extremes there are costs that vary more or less directly with the length of the run.

In weighing the validity of these methods used in previous reports, it must first be realized that rates are not based directly on costs. Fundamentally, transportation rates are prices. Prices are set in such an industry as ocean transportation primarily by competition.

That rates do not vary greatly with distance, or with time at sea which is in most cases roughly a function of distance, is brought out in table 2. The extreme distance shown in table 2 is that to Manila, which is 353 percent of the distance from New York to Liverpool. However, the rate from New York to Manila on boxed autos is \$9.50 per measurement ton, or 132 percent of the rate from New York to Liverpool. On machinery, the comparison is even more striking, for the rate from New York to Manila is only 75 percent of the rate to Liverpool. On iron and steel products it is 117 percent, and on general cargo 125 percent. To Capetown the distance from New York is 211 percent of the distance to Liverpool, and the rates on the items shown range from 90 percent of the rate from New York to Liverpool to a maximum 111 percent. To Rio de Janeiro the lack of relationship

between distance and rates, as compared with the distance to Liverpool and the rates to Liverpool, is less extreme, but at the same time just as obvious. The distance is 182 percent of the distance to Liverpool, and the rates shown range from 80 percent to 125 percent. The same lack of correlation between distance and the ocean rates can be found in each of the destinations shown.

Thus the Niagara Frontier Planning Board errs not only in that it includes among costs per incremental ton-hour (a novel concept) all charges at port, but it errs in the fundamental assumption that rates vary according to distances or hours. Actual experience in the shipping world repudiates this assumption.

TABLE 2

The relationship between distance and shipping rates on selected commodities between New York and selected world ports

[W=per weight ton of 2,240 pounds; M=per measurement ton of 40 cubic feet; W/M=per ton weight (2,240 pounds) or measurement (40 cubic feet) at ship's option]

Destinations	Distance		Ocean rates from New York							
	From New York (nautical miles)	Percent of New York to Liverpool	Autos boxed		Machinery		Iron and steel		General cargo	
			Ocean rate	Percent of rate to Liverpool	Ocean rate	Percent of rate to Liverpool	Ocean rate	Percent of rate to Liverpool	Ocean rate	Percent of rate to Liverpool
Liverpool.....	3, 219	100	\$7. 20 M	100	\$20. 00 W/M	100	\$8. 00 W	100	\$20. 00 W/M	100
London.....	3, 369	105	7. 20 M	100	20. 00 W/M	100	6. 00 W	100	20. 00 W/M	100
Antwerp.....	3, 419	106	6. 20 M	86	20. 00 W/M	100	6. 00 W	100	20. 00 W/M	100
Rotterdam.....	3, 415	106	6. 20 M	86	20. 00 W/M	100	6. 00 W	100	20. 00 W/M	100
Copenhagen.....	3, 730	116	6. 80	94	22. 00 W/M	110	5. 50 W	92	22. 00 W/M	110
Stockholm.....	4, 265	132	6. 80	94	22. 00 W/M	110	5. 50 W	92	22. 00 W/M	110
Rio de Janeiro.....	4, 770	148	9. 00 M	125	16. 00 W/M	80	7. 00 W	117	23. 00 W/M	115
Buenos Aires.....	5, 871	182	9. 00 M	125	16. 00 W/M	80	7. 00 W	117	22. 00 W/M	110
Freetown.....	3, 757	117	17. 00 M	236	15. 00 W/M	75	11. 50 W	192	24. 00 W/M	120
Capetown.....	6, 786	211	8. 00 M	111	18. 00 W/M	90	5. 50 W	92	20. 00 W/M	100
Lorenzo Marques.....	7, 857	244	10. 00 M	137	20. 00 W/M	100	7. 00 W	117	22. 00 W/M	110
Auckland, New Zealand.....	8, 529	265	12. 00 M	167	22. 50 W/M	125	11. 50 W	192	34. 50 W/M	173
Sidney, Australia.....	9, 691	301	12. 00 M	167	22. 50 W/M	125	10. 00 W	167	34. 50 W/M	173
Calcutta.....	9, 830	305	8. 00 M	111	17. 00 W/M	85	7. 00 W	117	20. 00 W/M	110
Manila.....	11, 364	353	9. 50 M	132	15. 00 W/M	75	7. 00 W	117	25. 00 W/M	125
Hong Kong.....	11, 212	348	9. 50 M	132	15. 00 W/M	75	9. 00 W	117	25. 00 W/M	125
Yokohama.....	9, 699	301	9. 00	125	15. 00 W/M	75	7. 00 W	117	25. 00 W/M	125

Source: Distances taken from "Table of Distance Between Ports via the Shortest Navigable Routes" Hydrographic Office, Navy Department.

Types of Shipping Service.⁷

Since the Seaway is a long-term project, the savings should be measured primarily in costs because costs to the carriers in the long run determine the level of rates. In theory this may be true, but in practice it is extremely difficult to determine what costs shall be used.

⁷ For a more complete exposition of types of vessel, water carriers, charters, and services incidental thereto, the reader is referred to any of the numerous treatises on the subject, such as *Principles of Water Transportation* by G. Lloyd Wilson (Traffic Service Corp., 1939); *Ocean Transportation*, by Abraham Berglund (Longmans, Green 1931).

Costs of operation of a vessel today vary not only with the size and speed of the vessel, but with its nationality, depending upon such factors as wages, construction costs, and major repairs. Furthermore, under the pressure of national policy most important maritime nations furnish subsidies to the ships of their flag operating in foreign trade. Most of these subsidies are impossible to determine. In view of the extreme variations that may be found in costs, it would be difficult to determine what is a typical sample. To achieve a proper understanding of this subject, it is necessary to distinguish between three principal types of vessel carriers.

Privately owned ships or barges engaged solely or primarily in the transportation of goods usually in bulk, belonging to their own proprietors, constitute the first type. Vessels which are owned and operated through subsidiary corporations are sometimes called "industrial carriers" or "captive carriers." Charges for private steamship or barge services are not available to the public and will not be considered in this discussion. They are merely bookkeeping entries if the service is operated by the proprietary industries. If the services of the captive carriers are not available to the public the charges cannot be considered as rates comparable to those charged by other types of steamship operators.

A second type of water carrier generally recognized is the "tramp" or contract carrier. These terms are not precisely synonymous, as many contract carriers, particularly those engaged in such trades as the grain and ore trades on the Great Lakes, operate over relatively fixed routes. Tramp vessels, properly so called, operate over irregular trade routes, according to the availability and demand for cargo and for vessels at various ports.

A vessel in contract service may be chartered or leased by a shipper for a definite period of time under a time charter or for a particular voyage under a voyage charter. Terms are more or less fixed by custom, but details are arranged to suit the parties to the lease or charter. A tramp carrier is ordinarily leased as a whole, but it may contract through a broker with several large shippers to perform definite services for them on the same voyage. This practice is known as putting the vessel "on the berth."

The term *contract carrier* by water as the term is used in the regulation of water transportation in the United States under the Transportation Act of 1940, includes persons who engage in the transportation of passengers or in interstate commerce under individual contracts or agreements, except as a common carrier and excepting transportation by water by an express company subject to part I of the Interstate Commerce Act.⁸ The essence of the con-

⁸ Interstate Commerce Act, part III, sec. 302 (e).

tract carrier status is the performance of service under individual contract or agreements between shippers and carriers.

The third type of water carrier to be considered is that offering regular line service for patronage by the general public. This term signifies that the owners operate a vessel line between specified ports or groups of ports, on regular schedules, in large or small lots. Many lines operate faster and more attractive vessels than those used in irregular services, especially if passenger traffic is solicited.

A common carrier by water, as defined by the Transportation Act of 1940, is a person which holds itself out to the general public to transport passengers or property, or any class or classes of property, by water, for compensation. Water transportation conducted by express companies subject to Part I of the Interstate Commerce Act in the conduct of their express business is regulated.⁹ In the Federal statutes prior to the Transportation Act of 1940, common carriers by water in interstate commerce were defined as those engaged in the transportation of persons or property on the high seas or the Great Lakes on regular routes.

The rates charged are published and apply to practically the same categories of goods as do the tariffs of railroad companies. Such lines are regarded as common carriers, and in the United States, at least, are now subject to regulation. Liners, the same as railroads, publish class rates governing all articles catalogued under any particular class, and specific commodity rates, which are usually lower for the commodity concerned than the rate for the class to which that commodity belongs. General commodity rates, covering any or all goods in a specified list, are also employed.

It is not unusual for companies operating slower vessels with infrequent sailings, to offer "differential" rates, which are graded below the standard rates on the same classes and commodities between the same origins and destinations. Differential rates are usually set by agreement between the lines involved, with or without intervention of the regulatory authority. Sometimes the standard lines offer "berth rates" on individual nonperishable categories, which are lower than standard rates, but do not guarantee the shipper immediate carriage. Berth rates may be instituted either in competition with differential lines or with tramp and contract carriers.

The provisions of the Interstate Commerce Act omitting any reference to regular route operation supersedes this statutory definition limiting common carriers to those engaged in regular route operation.

The classification here outlined, as to private, contract and line carriers, is not rigid. Certain water carriers operate over fixed routes,

⁹ Interstate Commerce Act, part III, sec. 302 (d).

carrying principally goods of ownership common to themselves, but accommodating passengers and incidental freight for others. These are known as "industrial" carriers. Again, a vessel in private or contract service in one direction may handle general cargo on the return trip; and ships which are liners for part of the twelve months may be leased to other lines or be used as tramps for the rest of the year.

Consideration of Feasible Seaway Rates in Ocean Shipping.

In general, the rates charged for the use of an entire vessel are an illustration of the law of supply and demand, the demand for cargo space at any port against the potential supply of ships. With any given supply of cargo, the rate will be set by competition between carriers. In this connection, it should be stated that water transportation reaches its highest level of efficiency in the movement of bulk cargo, between two ports of call. With any appreciable excess of available ships, this means especially severe competition; and over a period of normal operation, rather wide fluctuations in rates. This is the condition prevailing in the grain trade.

It is perhaps axiomatic that steamship lines using the St. Lawrence route will not cut their rates any more than is necessary to obtain business. Undoubtedly the existing rail-water rates would set the upper limit above which rates via the Seaway could not go, except in those instances where there is some special convenience to the shipper, such as saving in packaging or greater safety against damage as a result of direct delivery to shiphold. At the other extreme, rates would not be any lower than those applicable at Montreal or New York; in fact it is certain that in most instances they would be higher at least by the incremental cost of steaming into the Lakes. In considering these limits, it must be kept in mind that besides rates for standard rail service, there are the so-called differential all-rail rates, standard lake and rail, and differential lake and rail rates to and from the Lake ports and the east.

Charges by rail are frequently reduced 10 percent or more for furtherance by ocean lines for export or import, by the filing of so-called proportional rates; and the ocean rate may also be lowered on traffic originating inland rather than at the port. It is the sum of such special proportionals which governs in such cases.¹⁰ The railroads often use proportional rates from or to lake ports, too; and there is also an effort to obtain special rates for export and import movements by rail and lake.

¹⁰ From certain points in the Corn Belt in Illinois, rates to New Orleans and Mobile for export range from 19 to 24 cents; for coastwise movement to Florida from 20 to 24.5 cents; and for intercoastal movements from 21 to 24 cents. Domestic rates to New Orleans vary between 30 and 36.5 cents and to Mobile between 35 and 41.5 cents. (237 I. O. C. 671.)

In general, therefore, it would appear that the rates for line service via the Seaway could not exceed those for export and import by the differential lake-and-rail lines, and would probably be somewhat less.

The minimum rate in line service, where the vessel is obligated to call at ports on regular schedule, would be set on the most important or key items of traffic by overall costs, and for other business—helping to complete their cargoes—by marginal or incremental costs, i. e., the cost of taking on the extra load. Once a vessel is committed in line service, it is not likely to cut rates at random, because of fear of reprisals over competing routes.

Between the limits just described, water transportation rates are set by competitive factors.

Transportation economists generally recognize three theoretical bases of setting rates: Costs, value of service, and what the traffic will bear. Of these three, primarily the last, what the traffic will bear, comes into use in the actual making of a rate. When a new means of transportation enters a field already occupied by other agencies, the fundamental principle it follows in setting its rates is competition. The traffic manager of a line considering the possibility of establishing a route in competition with an existing route asks himself the questions: Shall the rates be the same as the effective rates, lower or higher? If they are to be lower or higher, by how much? This has always been the procedure in such situations. Railroads, when they came into being gauged their rates by the competitive rates of wagons, canals, and coastwise ships. Motor-truck carriers originally charged higher rates than the railroads because of speed and flexibility of service, but competition forced rates downward toward parity. In competition for the trade between the East and West coasts of the United States, railroad rates were originally set to meet the existing Cape Horn water rates, or the rates involved in shipment by water to Panama, by rail across the Isthmus, and by water from Panama to the West coast. When by the construction of the Panama Canal through-water transportation between the West coast and the East coast became feasible, the water carriers set their rates with an eye to the rates of the then entrenched rail carriers. In more recent years, air rates have been set in relation to the existing rail rate or Pullman rate, as far as domestic service is concerned; for overseas service, they have been set in comparison with the rates of super liners and where in existence, in comparison with zeppelin rates. This competitive method was likewise the foundation of the basing point system of the railroads in the southeast and on the Pacific coast of the United States.

The application of this fundamental factor of competition to determine the rates feasible on shipments via the St. Lawrence route must be different on shipments in foreign trade and in domestic trade.

In foreign trade one of the most noteworthy practices is the practice of blanketing rates; i. e., grouping certain areas into one region and applying to that region the same rate regardless of what the actual distances may be. For example, the rates from Liverpool to the United States are the same whether the shipment be made to North Atlantic ports, South Atlantic ports, or even sometimes to Gulf ports. In other words, the ocean rate from Liverpool to Portland, Maine, is the same as the rate from Liverpool to Galveston, Tex., despite the fact that Galveston is 2,850 statute miles farther from Liverpool than is Portland.

In consideration of this general phenomenon in ocean rate-making on shipments from Europe into the Great Lakes over the St. Lawrence route, the same rate may be applied as on shipments to North Atlantic ports and Gulf ports. The extra distance from Liverpool to Chicago as compared to New York is 905 statute miles, whereas it is 2,850 extra miles to Galveston. Buffalo is approximately the same distance from British ports as New York. It would not be unusual, therefore, to find that North Atlantic rates are blanketed into the Great Lakes. Many of the rates applied by the Fjell Line operating small boats in direct service between the Great Lakes and Europe follow this practice.

In general, the rates used in this report from North European ports to Great Lake ports are blanketed in from Montreal and New York. This was considered a minimum, however. In many cases appropriate upward adjustments were made, in the light of relevant factors, such as availability of return cargo, cost of operations, comparable existing rates and competitive routes. The rates between the Great Lakes ports and points other than northern Europe invariably carried a surcharge over North Atlantic rates sufficient to meet the incremental costs of going into the Lakes.

The resulting rates were compared with costs of ship operations of Maritime Commission's C-type boats and were found quite profitable, sometimes even too profitable. The individual rates adopted are explained in each of the appendices to this report.

The Problem of Unbalanced Cargoes.

Frequently the possibility that feasible rates comparable with those to North Atlantic ports may be established to the Great Lakes is questioned on the grounds that the trade will not be balanced. Balance of trade is, of course, highly desirable from the point of view of the operator of a ship, but balance of traffic is rarely achieved in any form of transportation or at any terminal ports.

The railroads of the United States, for example, have tremendous movements from the Middle West, the far West and the South towards the northeastern section of the country. The movements

in the opposite directions are comparatively small. This is bound to be the case wherever there is an interchange of traffic between areas producing raw materials and areas either of great industrial production or of large groups of population with high per-capita consumption of consumers' goods.

Foodstuffs and the raw materials of industry are heavy and bulky, whereas the finished goods of industry, which move towards the agricultural or mining regions, are much lighter and as a group more compact. The same one-sided condition of traffic is found at North Atlantic ports, the most important ocean trade route in the world. The west-bound volume is small compared with the east-bound. The traffic on the Panama and Suez Canals likewise shows lack of balance. On the Great Lakes themselves, the movement of grain and of iron ore from the head of the Lakes to the lower Lakes is vast compared with the movement in the opposite direction, even considering the volume of coal moving from Lake Erie to the upper Lakes. Tankers are a specialized type of ocean carrier, whose traffic is almost invariably one way and yet they are known to be much more prosperous than many other types of ocean carriers. Industrial carriers likewise generally face an unbalanced freight in the direction contrary to the movement of their own major commodities. Sometimes this unbalance is partially corrected by offering common carrier service in the opposite direction, or by contract service. Generally, however, the unbalance of out-bound and in-bound traffic is quite pronounced in the case of industrial carriers.

Oceangoing vessels are among transportation carriers most flexible. They have relatively small investments in terminals and no investments in road bed or ways. Once a vessel has left its port deep water is its only track and it may sail for any port that can accept a vessel its size or can take or supply a cargo sufficiently handsome to attract it. The existence and habits of tramp steamers are a demonstration of this flexibility; but even liners are not by any means definitely limited to sailing between one port and a second or even between one group of ports and a second group. There are for example round-the-world routes such as the Nippon Yusen and Kaisha Line, which sprang into being after the World War; the Dollar Line, now the American President Lines, Limited, and the Isthmian Steamship Co. Furthermore, there are many triangular or quadrangular services. In the days of sailing vessels triangular voyages were extremely common. Their existence was dictated partly by the search for cargo and partly by the desire of taking advantage of prevailing winds. For example, freighters going to New Zealand from North Atlantic ports sailed around the Cape of Good Hope but returned around Cape Horn in order to avail themselves of the westerly "roaring forties." The classical triangular voyage runs from England to Brazil or the Argen-

tine, from there to the United States, and finally a return to the United Kingdom. Vessels going to South Africa often continue on to pick up cargo at other ports for New York.

A similar practice could spring up in the trade of the Great Lakes with various parts of the world. If, for example, return cargo is not immediately available from the United Kingdom a vessel might take coal from Wales to South America and then coffee or rubber to New York, or hides or wool to Boston. Or it might take all these South American commodities into the Great Lakes.

Section 5

FEASIBLE RATES FOR DOMESTIC TRAFFIC

Rate-making for the St. Lawrence routes in various domestic trades would be much the same as in foreign business but for one difference—governmental regulation. Under present legal dispensations, this control will be exercised by the Interstate Commerce Commission. The Commission has but limited jurisdiction in the case of contract carriers, except in the case of intercoastal traffic, and even here it can enforce only minimum rates. The following discussion, therefore deals almost entirely with common carrier service. Being subject to regulation, coastwise and intercoastal domestic rates probably will be based upon the rate patterns already adopted by the regulatory commissions. The basic principle established by the Interstate Commerce Commission is the application of differentials for water carrier rates below all rail rates, based on distance, quality of service, and, of late, cost of service.

Distance principle.

As a guide to the exercise of its power to fix maximum joint rail and water rates, the Commission has employed "constructive" mileages for the water portion of the haul, partly to test the degree of circuitry involved. The Commission has given practical recognition to the fact that water transportation costs less to supply in typical instances than rail between the same points and that water routes are often longer than the short-line railroad mileages between the same points. One ratio used for coastwise service was 3 to 1 in which 900 miles by water were considered the equivalent of 300 miles by rail.¹¹ To the Gulf ports, from New York, a ratio of 3.6 to 1 was used, because of the longer haul.¹² In an older case, also involving the Gulf trade, the Commission found that rates were based upon 6 and 7 miles of water on routes to the Gulf were the equivalent of 1 rail-mile for rate-making purposes and for divisions of rates between Atlantic seaboard

¹¹ 211 L. O. C. 367, 370, 1935.

¹² 211 L. O. C. 371, 1935.

territory and points in southwestern territory.¹³ For short hauls, New York to New Haven and New London, the Commission has assumed equality of mileage, while from New York to Portland, Maine, 296 actual miles were reduced to 250 constructive miles.¹⁴

For hauls of over 300 miles on the Great Lakes, the Commission has used the ratio of 2 to 1; for less than that distance, no mileage discount is allowed.¹⁵ On the Missouri River, the Commission decided that the Federal barge lines were entitled to a ratio of 1.5 to 1.¹⁶ From these precedents it may be predicted that distances via the St. Lawrence Seaway would be subjected by the Commission to an analysis of each section of the route.

Using constructive mileages, in the southern class-rate investigation, the Commission worked out a scheme of differentials between east and south for rail-and-water rates under all-rail rates whereby, beginning with port-to-port rates which were perhaps 60 percent of all-rail, the differential was sharply reduced as more and more rail service was used to and from each port, until for hauls at some distance inland the differential disappeared altogether.¹⁷

The implications of constructive mileages become most apparent in examining the Commission's attitude toward the Federal barge lines of the Inland Waterways Corporation. This was a case of a new water route being established under act of Congress, and several railroads were required to join with it in establishing through rates.

The Commission was here directed in 1928 by Congress, under Section 3 of the Inland Waterways Corporation Act, that it should—

by order, direct all connecting common carriers and their connections to join with such water carrier in through routes and joint rates with reasonable rules, regulations, and practices, * * * and * * * in such order, fix reasonable minimum differentials between all rail rates and joint rates in connection with said water service; and that it should require the interested common carriers to enter into negotiations for the purpose of establishing equitable divisions of the aforesaid joint differential rates within thirty days after such joint rates are established.¹⁸

The Transportation Act of 1920 declared it to be the policy of Congress that transportation both by rail and water be maintained "in full vigor." The Commission interpreted this as meaning that it should not divert business from the rails to the barge lines unless the latter afforded reasonably direct and economical transportation

¹³ 24 I. C. C. 570, 583, 1912.

¹⁴ 211 I. C. C. 403, 411, 1935.

¹⁵ *Ibid.*

¹⁶ 192 I. C. C. 661, 669, 1933.

¹⁷ 100 I. C. C. 677, 703, 1925.

¹⁸ *Ex parte 66*, (153 I.C.C. 129), 1929

in connection with the rail lines concerned. Accordingly, in *Inland Waterways Corporation et. al. v. Alabama Great Southern Railway Co. et. al.*, the Commission found—

that such routes should be established only (1) where the distance via the rail lines through the port of interchange does not exceed by more than 40 percent the shortest all-rail distance between point of origin and point of destination, and (2) where the shortest all-rail distance between the inland point of origin or destination and the port of interchange does not exceed three-fourths of the shortest all-rail distance between point of origin and point of destination. Over such routes, it required the establishment of joint rates constructed by deducting from the all-rail rates over the most direct routes differentials equivalent to 20 percent of the all-rail rates between the port of interchange and the port of origin (or destination, as the case may be), where the excess under (1) was not more than 20 percent and the fraction under (2) was not greater than two-thirds. In the remaining instances, differentials equivalent to 10 percent of the all-rail rates between the ports where prescribed.¹⁹

In *Inland Waterways Corporation et al. v. Chicago Great Western Railroad Co. et al*, the Commission required—

rail-barge-rail routes to be established where the short-line rail distance via the ports of interchange did not exceed the short-line rail distance over the most direct route by more than one-third and where the short-line rail distance from point of origin to the first port of interchange plus the short-line rail distance from the second port of interchange to destination did not exceed two-thirds of the short-line rail distance between point of origin and point of destination. For application in cases which fell within these limitations, it prescribed differentials equivalent to 20 percent of the all-rail rates between the ports.²⁰

Furthermore, the Commission refused later to order barge-rail rates between Kansas City and Upper Mississippi River points because of the undue circuitry of the route.²¹

In the consolidated Southwestern Cases, the Commission said, "it is not our province to require circuitous or more expensive routes to meet the rates of short or less expensive routes."²²

In the *23d Supplemental Report, Consolidated Southwestern Cases*, after quoting section 500 of the Transportation Act of 1920, "to foster and preserve in full vigor both rail and water transportation," the Commission observed:

In making other departures from the prescribed rates, all carriers concerned should avoid undue prejudice and preference

¹⁹ 151 I. C. C. 126, 149, 1929. Note that only the all-rail rates between the points where *physical substitution of barge-line service* occurred were made subject to differential, not the rates between first origin and final destination.

²⁰ 129 I. C. C., 521, 532, 534; 1927.

²¹ 192 I. C. C., 670; 1933.

²² 123 I. C. C., 203, 374; 1927.

as between competing shippers, communities, and routes. In order to conform to the declaration of Congress quoted above, the latitude here afforded the regulated lines in establishing port-to-port rates should be used with reason, and should not be employed for the purpose of unfairly deflecting traffic from the nonregulated lines, from all-rail routes, or from competing ocean-rail routes, or for the purpose of creating undue advantages for shippers in Atlantic seaboard territory to the disadvantage of competing points in the Middle West.²³

The Commission further stated:

Many discriminatory situations were found in both, and it was decided that these could best be removed and the rights of all parties best conserved by prescribing systems of rates which, although recognizing other factors, should be founded upon distance.

* * * * *

Nothing in the record on further hearing convinces us that we should discard the distance principle in prescribing ocean-rail rates for application between the territories here considered. It is true that we have in certain cases prescribed rail-water rates on the basis of fixed differentials below the corresponding all-rail rates. This was done in *Lake and Rail Class and Commodity Rates* (205 I. C. C. 101), decided January 7, 1935. There the general direction of the rail-water routes and the all-rail routes was the same, so that a differential basis, while relating the two rate structures directly to each other, nevertheless did not cause the lake-rail rates to depart greatly from the distance basis upon which the all-rail rates were fixed.

* * * * *

From many parts of seaboard territory to the southwestern territories the ocean-rail distances increase as the all-rail distances decrease. In these circumstances it is obvious that it would be impossible to devise any system of ocean-rail rates differentially related to all-rail rates which would be reasonable and at the same time nondiscriminatory. We are convinced that the only means by which equal justice can be accorded all parties is by the use of a rate structure based primarily on distance. However, in arriving at the rates hereinafter prescribed, we have given consideration also to matters other than distance including transfer services at the port, the ratio of rail to water haul, and to the competition of the respective ocean-rail routes with each other and with the all-rail routes between the same points.²⁴

In I. C. C. Docket No. 25727, called "*Seatrail Lines, Incorporated, v. Akron, Canton & Youngstown Railway Co. et al.*," decided by the full Commission on December 23, 1940, the Interstate Commerce Commission refused to continue differential rates in connection with rail lines in favor of break-bulk routes as against the "superior serv-

²³ 211 I. C. C., 601, 621; 1935.

²⁴ *Ibid.*, 607-8.

ice" offered by Seatrain Lines when the latter were able to demonstrate that their costs were lower as well. The effect was to replace distance as a rough measure of costs when costs themselves were available.

Certain extracts from the Commission's decision are illuminating:

The main defense is that we have in some cases, in prescribing or sanctioning water-rail routes made differentially lower than the corresponding all-rail rates, mentioned the inferior service of the water-rail routes as one of the reasons.

With respect to such cases certain things are to be noted. One is that in prescribing maximum reasonable rates for all-rail routes we have never made them higher than they otherwise would have been, on the ground that the all-rail routes provided better service than competitive water-rail or water routes. Another is that in prescribing differentially lower water-rail rates, we have generally mentioned lower cost as a factor, as well as inferior service, and have made it clear that the shrink is to be borne by the water line.

* * * * *

It is true that we have in effect sanctioned by a grant of fourth-section relief, although we have not prescribed differentially lower water-rail rates where there was no advantage, and in some instances, a clear disadvantage in cost and in comparison with the competitive all-rail routes, but such rates had been voluntarily maintained for many years, and doubts were resolved in their favor because of their competitive origin and long standing.

To arrive at truly accurate figures of costs by water carrier, concerning which there has been perpetual disagreement, the Interstate Commerce Commission has been conducting two studies, one on barge line costs, the other on costs to lake vessels in the automobile-carrying trade. A number of interested parties have contributed material to those analyses, and the results will undoubtedly have considerable bearing on the rates which will be authorized by the Commission for St. Lawrence service in the Great Lakes coastwise and land-water trades.

Feasible Coastwise Rates.

On the basis of this historical background, what assumption can be made as to the differential relationship of water or rail-water coastwise or intercoastal rates via the St. Lawrence Seaway as compared with existing competitive routes, principally all rail?

The actual setting of a feasible rate for domestic trade must, of course, be based primarily upon competition. In general, the rates in this report have been set either as a percentage of the rail rate or

at a fixed amount per hundred pounds below the corresponding rail rate. The difference between the water rate and the rail rate will vary depending on various factors: for example, the relative time in transit over the all-rail route and the water route, the handling required, the location of steamship piers as compared with railroad terminals, drayage charges, the danger of damage to the goods, and the desirability of the two services for the specific commodity in question.

Generally, it may be assumed that in domestic movements water transportation excepting for its rate advantages is less desirable than rail transportation for many high-grade cargoes. In domestic commerce the requirements of speed are more intense and rail hauls frequently eliminate handlings. Usually, too, rail hauls have more flexible in-transit privileges. The advantage of rail over water service is not an inviolable rule, however. Water transportation, for example, is favored for citrus fruit moving northward from Florida to certain points, especially to Philadelphia and beyond. Since 1933 the coast-wise carriers have handled more than half the trade to Philadelphia and points north. In one year they exceeded the rail movement by a ratio of nearly 6 to 1. This preference for water transportation is based upon both the cheaper freight rates and the superior service that the steamships supply in the form of high-grade refrigeration.

For some commodities studied in this report there were available existing water rates over routes sufficiently long which could be extended into the Great Lakes by the addition of a differential in a manner similar to that employed in the case of foreign trade. Such procedure was adopted in the case of sulfur with regard to the competitive methods of shipment. Where no domestic water rates were available, an effort was made to approximate the type of rate that would be acceptable to the regulating body or the Interstate Commerce Commission. For this purpose, the relationship existing between class rates for all-rail, rail-water, and all-water were analyzed. A study of these relationships shows that there are certain definite differentials between identical class rates of the various modes of transportation. For example, to Jacksonville, Fla., from Cleveland, Ohio, the combination rail-water class rates via New York on commodities in class 1, 2, and 3, run roughly 77 percent of the all-rail rate. The combination rail-water rates from Detroit, Michigan, to

Jacksonville, via New York, run about 83 percent of the all-rail rates. The through rail-water rates from Buffalo, New York, to Jacksonville are about 60 percent of the all-rail rates.

Class rates on the all-water route from New York City show a similar pattern. To Jacksonville, the local all-water rates are about 66 percent of the all-rail rates for classes 1 to 5. It will be noted that the rates on 4th, 5th, or 6th class commodities which comprise generally low valued products, do not show the same regularity of relationship. Usually the all-water combination rates in these cases are a smaller percentage of the all-rail rates than in the cases of classes 1, 2, or 3. Typical comparisons upon which the preceding discussion is based are presented in tables 3, 4, and 5.

These relationships are those of rates actually in effect in the spring of 1940. They reflect the factors which the Interstate Commerce Commission would take into consideration, namely, their estimate of the relative costs or economic efficiency of the two modes of transportation. They, therefore, reflect also the varying relationship of distance by water and distance by rail.

Thus, in the study of the domestic movement of those commodities for which no existing water rate could be extended into the Great Lakes, the feasible rates used in this survey were based upon a study of relationship actually in existence as much as possible. As each specific movement of a commodity from one point to another was studied a comparison was made with the relationship of rail-water or all-water rates to rail rates accepted by the Interstate Commerce Commission applicable to situations approximately the same as in the haul under consideration. Naturally, such an empirical method calls for exercise of considerable judgment. It has the advantage of coming close to actuality.

For movements originating at inland points within the Great Lakes region feasible rates were obtained based on the relationship of combination rates of approximately the same water- and rail-haul relationships. For example, on dairy products the feasible rail-water rate via the St. Lawrence from interior points to Boston was set at about 88 percent. The feasible port-to-port water rate was established on the basis of a percentage of the all-rail rate and that percentage as obtained by a study of the relationship of all-water rates to all-rail rates under somewhat similar lengths of water and rail hauls.

TABLE 3

All-rail and combination rail-water class rates to Pacific coast ports from selected points

[Cents per 100 pounds]

	Classes									
	1	2	3	4	5	A	B	C	D	E
Chicago: ¹										
All-rail ² -----	561	487	404	342	284	293	229	182	151	119
			R-25-3	R-26	4	5	6			
Rail to New York ³ ..	157	134	111	88	80	57	45			
			3	4	5	A	B			
Water to Pacific coast ⁴ -----	440	380	314	270	226	226	182	143	127	99
Combination-----	597	514	425	358						
Detroit: ¹										
All-rail ² -----	578	501	416	355	290	300	235	190	154	122
			R-25-3	R-26	4	5	6			
Rail to New York ³ ..	135	115	95	74	68	47	37			
			3	4	5	A	B			
Water to Pacific coast ⁴ -----	440	380	314	270	226	226	182	143	127	99
Combination-----	575	495	409	344						
Cleveland: ¹										
All-rail ² -----	594	512	429	363	305	309	244	194	166	131
			R-25-3	R-26	4	5	6			
Rail to New York ³ ..	115	98	81	65	59	42	34			
			3	4	5	A	B			
Water to Pacific coast ⁴ -----	440	380	314	270	226	226	182	143	127	99
Combination-----	555	478	395	335						
Buffalo: ¹										
All-rail ² -----	594	512	429	363	305	309	244	194	166	131
			R-25-3	R-26	4	5	6			
Rail to New York ³ ..	100	85	70	55	50	35	28			
			3	4	5	A	B			
Water to Pacific coast ⁴ -----	440	380	314	270	226	226	182	143	127	99
Combination-----	540	465	384	325						

PERCENTAGE RAIL-WATER OF ALL-RAIL

Chicago-----	106	106	105	104						
Detroit-----	100	99	98	97						
Cleveland-----	93	93	92	90						
Buffalo-----	91	91	90	89						

¹ T. C. F. B. 39-F, I. C. C. 1453. L. E. Kipp, agent. ² Western classification. ³ Official classification.

Tariff authorities:

Chicago to New York... }
 Cleveland to New York... } Jones, I. C. C. 2787.
 Detroit to New York... }
 Buffalo to New York, Curlett and I. C. C. A-694.

TABLE 4

All-rail and combination rail-water class rates to Jacksonville, Fla., from selected points

[Cents per 100 pounds]

From—	All-rail class rates											
	1	2	3	4	5	6	7	8	9	10	11	12
Chicago, Ill. ^{1 2} -----	263	224	184	145	118	105	92	79	66	59	53	46
Detroit, Mich. ^{1 4} -----	266	226	186	146	120	106	93	80	67	60	53	47
Cleveland, Ohio ^{1 4} -----	261	222	183	144	117	104	91	78	65	59	52	46
Buffalo, N. Y. ^{1 6} -----	255	217	179	140	115	102	89	77	64	57	51	45

COMBINATION RAIL-WATER CLASS RATES VIA NEW YORK

	1	2	R-25-3	R-26	4	5	6
Chicago:							
Rail to New York ^{2 6} -----	157	134	111	88	80	57	45
			3		4	5	6
Water to Jacksonville ¹ -----	85	72	59		45	37	32
Combination-----	242	206	170		125		85
			R-25-3	R-26	4		5
Detroit:							
Rail to New York ^{2 6} -----	135	115	95	74	68	47	37
			3		4	5	6
Water to Jacksonville ¹ -----	85	72	59		45	37	32
Combination-----	220	187	154		113		75
			R-25-3	R-26	4		5
Cleveland:							
Rail to New York ^{2 6} -----	115	98	81	65	59	42	34
			3		4	5	6
Water to Jacksonville ¹ -----	85	72	59		45	37	32
Combination-----	200	170	140		104		70
Buffalo ^{1 7} -----	152	129	107		86	65	53

PERCENTAGE RAIL-WATER OF ALL-RAIL

Chicago-----	92	92	92	86	92
Detroit-----	83	88	83	77	81
Cleveland-----	77	77	77	72	77
Buffalo-----	59	59	60	61	56

¹ Southern classification.
² Official classification.
³ R. A. Sperry, I. C. C. 485—Tariff 15-E.
⁴ B. T. Jones' I. C. C. 3316—Tariff 450-E.
⁵ W. C. Curlett, A-712—Tariff 44 H.
⁶ All-rail rates—B. T. Jones—Tariff I. C. C. 2767.
⁷ Curlett's A 635.

CHAPTER III

SUMMARY OF TRAFFIC POTENTIALITIES OF THE ST. LAWRENCE SEAWAY

Section 1

TONNAGE AND SAVINGS

Pursuant to the general principles outlined in chapter II, a series of studies were undertaken by the Survey to discover the traffic possibilities through the St. Lawrence Seaway. The results of the traffic analyses of individual commodities are presented in appendices "A" to "Q," inclusive. The specific methods employed in the treatment of each commodity are described in those individual studies.

The commodities that are treated in separate analyses are the following:

- | | |
|----------------------------|-----------------------------|
| A—Automobiles. | J—Tin. |
| B—Grains. | K—Sulfur. |
| C—Soy beans. | L—Vegetable Oils and seeds. |
| D—Dairy products. | M—Machinery. |
| E—Green coffee. | N—Iron and steel. |
| F—Fresh and canned citrus. | O—Wood pulp and newsprint. |
| G—Bananas. | P—Packing-house products. |
| H—Wines and liquors. | Q—Burlap and jute. |
| I—Crude rubber. | |

This list is not exhaustive. It does not include all commodities that may utilize the Seaway. Although it includes many staple products, at best the list is a representative sample. Several important commodities were left out of consideration because upon a preliminary examination of the available data it was found that the effect of the Seaway on their transportation was indefinite. Coal, petroleum, lumber, and sugar are among these products.

Furthermore, in the very assumptions underlying these commodity studies, trade in entirely new products, or in products that do not now enter into interregional or international trade, was left out of consideration. Among these one may mention fruits and vegetables from Michigan and fish and other sea food from eastern Canadian ports.

Again, a large number of commodities in which interregional trade is practically certain to exist, and which may well utilize the St. Lawrence Seaway, were not studied separately because of limita-

tions of time and resources. Such important commercial products as canned goods from the West coast, leather goods from New England, cotton products, cotton seed and oil from the South, flaxseed, linseed oil and cake from Minnesota and the Dakotas, will probably utilize the Seaway under varying conditions. Similarly, products from foreign countries, such as fruits and nuts from the Mediterranean countries, kaolin from England, pottery products from different parts of Europe, could well utilize Seaway transportation.

The reason why these products were not treated exhaustively for our purpose is very simple. In the commodities that were studied, there is sufficient justification in the amount of transportation savings, conservatively estimated, to prove the feasibility and the economic justification of the Seaway. Any further extensions of these commodity studies would be merely contributory and supplemental, and would add nothing further to the economic reasoning upon which the justification of the Seaway must be based.

It must be clearly understood, therefore, that the results herein described apply only to a partial list of commodities selected for special treatment. These results show that in the case of the commodities analyzed there will be at least an annual savings in transportation costs of \$18,000,000 to \$21,000,000 on a tonnage of over 4,600,000. These savings are distributed among the commodities and between foreign and domestic trade as shown in Table 6. If insurance rates from Lake ports were as much as one-half of one percent higher than from North Atlantic ports on a total value of over \$800,000,000 for the cargo herein envisaged, a deduction of at least \$4,000,000 should be made from these estimated savings.

These savings are based upon average trade conditions existing in the decade 1928-37, or 1929-38, with the exception of a few commodities, where because of limitations of data other intervals were used.

The tonnage on which this amount of savings is obtained is estimated at somewhat less than 5,000,000 short tons. The average saving, therefore, is approximately \$4.00 per ton. It must be remembered that this is entirely new cargo, over and above the American traffic traversing the present 14-foot St. Lawrence Canals during the past decade.

In 1929 a study of potential traffic through the St. Lawrence Seaway came to the conclusion that there would be approximately 5,500,000 tons of American traffic, of which 2,000,000 tons would be in grains.¹ The estimate in this study did not exclude the traffic that utilized the existing St. Lawrence Canals. Hence, since 1929 the traffic on the 14-foot canals has practically reached the level then

¹ Moulton, Morgan, Lee, *The St. Lawrence Navigation and Power Project*, 1929, p. 109.

TABLE 6
*Summary of potential tonnage and savings on selected list of commodities*¹

Item	Domestic		Export		Import		Total		Average savings per short ton
	Tonnage	Saving	Tonnage	Saving	Tonnage	Saving	Tonnage	Saving	
	<i>Short tons</i>		<i>Short tons</i>		<i>Short tons</i>		<i>Short tons</i>		
Autos and parts.....	359,000	\$3,993,000	201,000	\$2,883,000			560,000	\$6,856,000	\$12.24
Grain and flour.....	585,000	626,000	708,000	1,458,000			1,293,000	2,084,000	1.61
Soybeans.....			148,000	164,000			148,000	164,000	1.04
Dairy products.....	314,000	{ 743,000 952,000 }					314,000	{ 743,000 952,000 }	{ 2.37 3.03 }
Green coffee.....					131,000	\$612,000	131,000	612,000	4.67
Citrus fruit.....	97,000	449,000	15,000	110,000			112,000	559,000	4.99
Bananas.....					163,000	{ 1,196,000 1,849,000 }	163,000	{ 1,196,000 1,849,000 }	{ 7.34 11.34 }
Wines and liquors.....					15,000	145,000	15,000	145,000	9.67
Crude rubber.....					151,000	{ 757,000 1,105,000 }	151,000	{ 767,000 1,105,000 }	{ 5.08 7.32 }
Tin.....					25,000	113,000	25,000	113,000	4.52
Sulphur.....	{ 179,000 307,000 }	{ 185,000 317,000 }					{ 179,000 307,000 }	{ 185,000 317,000 }	{ 1.03 1.03 }
Vegetable oils and seeds.....					116,000	629,000	116,000	629,000	5.42
Machinery.....			167,500	{ 769,000 2,071,000 }			167,500	{ 769,000 2,071,000 }	{ 4.59 12.36 }
Iron and steel.....	389,000	535,000	208,000	664,000	75,000	758,000	672,000	1,957,000	2.91
Woodpulp and newsprint.....	50,000	100,000			310,000	385,000	360,000	485,000	1.35
Packinghouse products.....	58,000	286,000	139,000	{ 408,000 874,000 }			197,000	{ 694,000 1,160,000 }	{ 3.52 5.89 }
Burlap and jute.....					28,000	116,000	28,000	116,000	4.14
Total.....	{ 2,031,000 2,159,000 }	{ 6,917,000 7,258,000 }	1,586,500	{ 6,426,000 8,194,000 }	1,014,000	{ 4,721,000 5,712,000 }	4,631,500	{ 18,064,000 21,164,000 }	{ 3.90 4.45 }

SOURCE: Summarized from Appendices A to Q.

¹ The figures bracketed together indicate alternative totals based upon different assumptions as explained in the corresponding appendices.

anticipated for a 27-foot channel.² Since the St. Lawrence Survey estimates exclude existing traffic over the present canals, the conclusion is that the estimated traffic for the St. Lawrence Seaway during a period of the depression would have been at least twice as much as that conceded by this previous study.

In view of the fact that so many important commodities have been omitted from the present study, it would not be excessive to assume that the potential annual traffic would be much greater than indicated by our figure of 4,600,000 or 4,750,000 tons. For instance, other studies have included in their estimates large items such as petroleum, 500,000 tons; sugar, 500,000 tons; fertilizers, 555,000 tons; coal, 350,000 tons; lumber 41,500 tons; pulpwood, 82,500 tons, or a total of 2,029,000³ tons—all of them being items which are not included in our studies. Adding to our studies the items which are included in other studies, but excluded from ours, will yield 7,000,000.

Before the present world conflagration the mistaken notion had gained currency that this nation had stopped growing. This is definitely erroneous, being merely a misunderstanding of the conclusion that the *rate of growth* is slowing down. In the quantity of production, ton-miles of transportation required, and number of people, the next quarter of a century is bound to witness very great increases over past levels.

The significance of national growth for the St. Lawrence should be fairly obvious. If national income, production and population continue to grow, there will be increased need for transportation facilities. The St. Lawrence Seaway, as an integral and important component of the transportation system will become more and more useful.

The rate of growth of population—a basic factor in determining the trends of the future—has declined in recent years and is expected to decline further. However, in absolute numbers the population will be much larger. The work of the National Resources Committee on population trends, the most authoritative in existence, indicates that a conservative estimate of population in 1955, assuming medium mortality, medium fertility, and no immigration, would be 144,093,000, and in 1965, 149,341,000:

Year:	Population of the United States	Increase
1930.....	122, 775, 046	-----
1940.....	131, 669, 275	8, 894, 829
1955.....	144, 093, 000	12, 423, 725
1965.....	149, 341, 000	5, 248, 000

² The annual traffic of United States origin over the existing canals had varied between 1,000,000 and 3,500,000 tons. Since a great amount of traffic transhipped at Montreal for United States Great Lakes ports is recorded as of Canadian origin, the trade for United States account must have reached well over 4,000,000 tons in some years. Hence, the Moulton estimate of traffic was realized almost to the full extent by the existing St. Lawrence traffic.

³ Moulton et al., *op. cit.*, p. 110.

The increase in the next decade and a half will be 12½ million people, and in the following 15 years, over 5 million, or a total of nearly 18 million in the next 30 years.

The basic period used in the calculations of this report included the depression of the "thirties," when employment, national production and transportation activity were low. From 1916 through 1928, the annual average of revenue freight tons carried by class I railroads in the United States was 1,204,881 tons. In the base period, 1929-38, the average was 903,284 tons. This drop of 25 percent occurred in spite of the increased population and productivity per man hour of the later period.

The question is whether over the long life of the St. Lawrence the economic machinery of the country will function at a higher level of activity. The answer must be in the affirmative because all of the nation's energy will have to be directed towards that end. The requirements of the nation for transportation facilities will be much greater than in the 1930's.

The productivity of labor has been growing rapidly, and there is every reason to believe that this growth will continue. The index of productivity per man-hour has steadily increased during the past two decades, from 86 in 1919 to 159 in 1939 (1920-24=100). If this rate of growth were to continue, the average index of productivity during the decade of 1950 would be 220, an increase of 40 percent as compared with 1939.

Along with increased productivity, it can be expected that, even aside from the defense program, some practical solution to the problem of unemployment will have been found. Whatever the political form of this solution, the economic effect would be to increase employment, which at a higher productivity per hour should result in greater commercial activity.

Upon careful examination of the possibilities in future employment, production and population growth, it was estimated in Part V of the Survey reports that in the decade of the fifties the ton-miles of revenue freight traffic would be 37 percent higher than in the decade just past.⁴

The preceding discussion has shown that the base period used in estimating the potential traffic of the Seaway was abnormally low. If a higher level of employment will obtain on the average for the future, the utilization of this waterway will be much more intensive than estimated. Under the most conservative estimates, the increased growth in transportation requirements is so large as to dwarf the capacity of the Seaway.

⁴ Part V, p. 66.

With a fuller utilization of the resources in manpower and materials which may raise the average national income to levels higher than those which existed in the years 1928-37 or 1929-38, the potential traffic would surely be higher than that which existed in the depression decade under study.

If we were to add to our estimates the commodities that were omitted from our specific studies, and the increased trade that would be created as a result of cheap transportation, it is not improbable that actual American traffic within a reasonable period will be as much as 10,000,000 tons, with a potential savings of at least \$36,000,000 in transportation costs.

The conclusion is that if savings in transportation costs to American producers and consumers are considered justification for a public undertaking such as the St. Lawrence Seaway, the benefits would certainly be large enough to compensate for the annual cost. At an annual cost of approximately \$9,000,000, the savings on the commodities herein studied in detail would be twice this cost, and the probable savings on a more inclusive list of commodities would, in all likelihood, be three or four times as much as the annual cost.

Section 2

THE FUTURE PROSPECTS FOR THE SEAWAY

The results discussed in the previous section apply to conditions that existed in a time of peace. Although political factors were already at work during the preceding decade tending to strangulate foreign commerce, still the movement of commodities across international boundaries was not subject to military interference. Until 1939 production and international trade in all countries increased considerably and showed promise that trade would be re-established upon a higher level than had been experienced in the first half of the decade. Under those conditions the present study would have had some validity as indicating potentialities of traffic in the future. Since 1939, however, the world has entered a period of violent revolutionary changes leading to complete interruption of normal trade. These cataclysmic developments naturally invalidate any studies based upon assumptions of normal trade relations, at least until such time as such relations are re-established. It behooves us, therefore, to examine the St. Lawrence Seaway project in the light of these violent changes and in the light of possible future developments in international relations.

In the course of the present conflict, and in the light of our national policy, it is certain that trade with continental Europe will be practically at a standstill. Our principal outlet for transatlantic commerce

is largely the British Isles, and such portions of the European continent as are permitted to receive shipments from our shores. Spain, Portugal, and Russia, to a limited extent, are the only countries besides Britain now open for trade under severe restrictions.

The effect of the blockade, and the change over from peace to wartime trade, have naturally had the effect of restricting agricultural exports in favor of other commodities more directly needed in military operations. This trend is distinctly discernible in table 7, which shows severe restrictions in the exportation of agricultural products. Exports of scrap iron have also declined due to governmental restrictions. Exports of automobiles and trucks also have diminished. On the other hand, table 8 shows that various classes of machinery exports have increased greatly. As the results of our rearmament effort flow from the assembly line, it is to be expected that exports of heavy iron and steel products will increase.

By the very nature of this change, the Middle West, where the products of the iron and steel and machinery industries largely originate, will participate to an increasing extent in international trade; hence, traffic in those commodities through the St. Lawrence would be expected to increase under wartime conditions, while traffic in agricultural products would diminish. If the war should continue beyond the period of completion of the Seaway, there is no doubt that it would become a valuable artery of traffic for heavy military goods, in addition to the food stuffs that would have to be carried to Great Britain and other friendly nations.

It is necessary to examine the future of foreign trade under all possible assumptions as to the course of world affairs and the role of the United States therein. If Great Britain and the democracies are successful in their struggle against the totalitarian states, there will be a long period of rehabilitation all over the world, predicated upon a more free interchange of goods and services than has prevailed in the past. Just as important is the corollary objective that economic security, the announced goal of the free democracies of the world, will be obtained by opportunities for productive employment. Furthermore, the United States would play a leading part in rehabilitating the countries severely damaged by war.

TABLE 7

Monthly exports of the United States, selected commodities, 1936-41

	Prin- ciple grains	Lard	Scrap iron and steel ¹		Prin- ciple grains	Lard	Scrap iron and steel ¹
	<i>1,000 bushels</i>	<i>Short tons</i>	<i>Long tons</i>		<i>1,000 bushels</i>	<i>Short tons</i>	<i>Long tons</i>
Annual monthly average:				Monthly total 1940—Con.			
1936.....	2,384	4,873	161,344	June.....	6,289	6,348	318,369
1937.....	7,120	5,609	241,796	July.....	10,673	14,119	327,129
1938.....	24,039	8,525	249,883	August.....	6,630	5,090	355,991
1939.....	11,615	11,553	298,119	September.....	5,789	4,978	255,608
1940.....	7,051	8,390	235,257	October.....	10,141	5,099	258,926
Monthly total 1940:				November.....	5,210	5,144	74,349
January.....	8,332	13,994	187,457	December.....	2,559	6,151	69,980
February.....	10,204	12,566	234,716	Monthly total 1941:			
March.....	9,324	10,327	206,928	January.....	2,812	6,833	45,055
April.....	5,636	9,424	221,152	February.....	3,279	7,415	74,378
May.....	3,825	7,444	312,483	March.....	4,244	12,164	54,383

¹ Including tin-plate scrap, tin-plate circles, strips, cobbles, etc. and waste-waste tin-plate.

	Automobiles			Automobiles	
	Passenger cars	Trucks		Passenger cars	Trucks
	<i>Short tons</i>	<i>Short tons</i>		<i>Short tons</i>	<i>Short tons</i>
Annual monthly average:			Monthly total 1940—Con.		
1936.....	24,966	15,050	June.....	10,663	13,848
1937.....	31,828	23,540	July.....	6,149	12,811
1938.....	22,435	16,677	August.....	3,859	7,140
1939.....	19,159	16,296	September.....	4,275	5,375
1940.....	12,535	14,966	October.....	11,667	16,636
Monthly total 1940:			November.....	15,716	17,711
January.....	22,235	16,245	December.....	12,840	17,399
February.....	16,231	17,524	Monthly total 1941:		
March.....	17,923	26,578	January.....	11,955	14,732
April.....	13,503	12,935	February.....	11,455	17,525
May.....	15,356	13,389	March.....	14,576	20,791

Sources: Grains, lard, scrap iron and steel; Passenger cars, and Trucks, *Survey of Current Business*, 1940 Supplement, and April, March, and May, 1941; Industrial and electrical machinery, *Statistical Abstract of the United States*, Monthly Summary, 1940 and 1941.

TABLE 8

Monthly exports of machinery from the United States, 1936-41

	Industrial machinery					Electric machinery				
	En- gine lathes	Tur- ret lathes	Tool grind- ing, cutter grind- ing, and uni- versal	Pneu- matic port- able tools	Hoists and der- ricks, except mining	Pumps	Gen- er- ators	Trans- formers	Frac- tional motors	Port- able electric tools
Annual monthly aver- age:										
1936.....	187	65	157	1, 143	217	4, 015	157	3, 043	9, 683	1, 721
1937.....	287	103	133	1, 813	313	4, 997	292	4, 340	11, 460	2, 250
1938.....	327	112	174	1, 199	237	3, 974	205	5, 274	9, 560	2, 371
1939.....	361	150	216	1, 912	354	4, 997	185	7, 204	12, 731	2, 738
1940.....	672	340	308	2, 326	367	3, 454	282	28, 381	14, 132	3, 259
Monthly total 1940:										
January.....	558	193	309	2, 718	415	3, 786	188	13, 096	10, 542	2, 376
February.....	717	220	252	2, 760	412	2, 809	102	22, 073	6, 348	1, 998
March.....	722	277	413	6, 012	378	4, 474	333	28, 091	13, 614	2, 484
April.....	661	421	248	2, 893	279	3, 202	319	18, 698	9, 782	3, 565
May.....	605	381	235	2, 338	310	4, 507	233	16, 978	11, 749	2, 745
June.....	563	338	171	829	400	3, 577	299	11, 106	12, 188	2, 506
July.....	338	229	197	2, 913	328	4, 352	218	13, 107	13, 508	3, 579
August.....	629	386	331	1, 667	431	2, 620	215	17, 744	15, 386	2, 881
September.....	651	407	228	1, 588	373	2, 610	300	14, 496	13, 644	3, 070
October.....	804	446	575	1, 685	337	2, 805	580	45, 201	21, 454	3, 138
November.....	1, 020	387	363	1, 223	369	3, 817	375	56, 759	24, 013	4, 837
December.....	791	396	370	1, 383	372	2, 886	226	83, 227	17, 356	5, 926
Monthly total 1941:										
January.....	616	434	269	1, 481	478	3, 282	259	60, 378	14, 734	5, 802
February.....	768	230	323	1, 364	332	3, 022	314	38, 618	17, 219	4, 329
March.....	723	751	338	1, 879	576	4, 866	386	44, 736	12, 753	6, 889

Sources: See table 7.

Under these conditions the foreign trade of this country would rise to unprecedented levels. Although no specific estimates can be made, a few facts can indicate the range of magnitude which may be involved. During the past decade, roughly equivalent to the base period used in estimating potential Seaway traffic, the United States foreign trade had fallen sharply. Table 9 shows the changes in the quantity of imports and exports.

TABLE 9

Indexes of quantity of exports and imports of the United States, 1921-39

[1923-25=100]

	Exports of United States merchandise	Imports for consumption		Exports of United States merchandise	Imports for consumption
1921-25 ¹	97	94	1936.....	82	118
1926-30 ¹	122	116	1937.....	105	131
1931-35 ¹	76	92	1938.....	105	94
1934.....	74	86	1939.....	110	108
1935.....	78	106			

¹ Average.Source: United States Department of Commerce, Bureau of Foreign and Domestic Commerce, *Foreign Commerce and Navigation of the United States, 1939*, p. XI

The average for 1931-35 was only 60 percent of the average for 1926-30. The following three years were 60, 64, and 67 percent, respectively, of the 1926-30 average level. In value terms, the picture is much worse, of course. From \$13½ billions in 1920, the exports fell to less than \$3 billions in 1932.

Table 10 reveals not only the sharp decline of the national income during the 1930's, but also the percentage which foreign trade bears to national income. In the years following the first World War this rose to 20 percent in 1920. During the 1920's the figure hovered around 12 and 13 percent, while in the past decade it was in the neighborhood of 7 and 8 percent.

TABLE 10

National income and merchandise imports and exports of the United States, 1909-39

	National Income Produced	Total Imports and Exports	Percent of National Income		National Income Produced	Total Imports and Exports	Percent of National Income
	<i>Millions of dollars</i>	<i>Millions of dollars</i>			<i>Millions of dollars</i>	<i>Millions of dollars</i>	
1909.....	27, 726	2, 975	10. 7	1924.....	69, 924	8, 201	11. 7
1910.....	29, 175	3, 302	11. 3	1925.....	75, 918	9, 136	12. 0
1911.....	29, 056	3, 577	12. 3	1926.....	77, 177	9, 240	12. 0
1912.....	31, 604	3, 858	12. 2	1927.....	77, 003	9, 050	11. 8
1913.....	33, 309	4, 279	12. 8	1928.....	79, 679	9, 220	11. 6
1914.....	32, 254	4, 259	13. 2	1929.....	82, 885	9, 640	11. 6
1915.....	35, 200	4, 443	12. 6	1930.....	68, 901	6, 904	10. 0
1916.....	43, 823	7, 874	18. 0	1931.....	54, 310	4, 515	8. 3
1917.....	51, 307	9, 186	17. 9	1932.....	40, 074	2, 934	7. 3
1918.....	56, 770	9, 180	16. 1	1933.....	42, 430	3, 125	7. 4
1919.....	63, 880	11, 825	18. 5	1934.....	50, 947	3, 788	7. 5
1920.....	67, 325	13, 506	20. 0	1935.....	55, 870	4, 330	7. 8
1921.....	52, 745	6, 994	13. 3	1936.....	65, 165	4, 879	7. 5
1922.....	59, 602	6, 945	11. 7	1937.....	71, 172	6, 438	9. 0
1923.....	68, 381	7, 960	11. 6	1938.....	63, 610	5, 055	7. 9
				1939.....	69, 378	5, 495	7. 9

Source: Foreign trade from Department of Commerce, *Statistical Abstract of the United States, 1940*, p. 487. National income from after 1929 from same source, p. 314; previous years from Brookings Institution, *American Capacity to Consume*, Washington, 1934, p. 152.

Under the post-war conditions which the democracies hope to establish, the United States may look forward to higher national incomes, with an increased percentage of it going into foreign trade. A concrete illustration of possibilities is in the estimates which have been made that the national income will be \$100 billion in 1942, 25 percent higher than any previous level. At this level, should the percentage of foreign trade to national income equal the level of 1916, namely, 18 percent, the value of foreign trade would be \$18 billions. Again, these figures are merely illustrative of the magnitudes involved and are not predictions. It is certain that if the democracies win and their hopes and plans are realized, the foreign trade traffic of the Seaway would be much larger than estimated in this report.

Should the world situation develop in the opposite direction, however, what would then be the position of United States foreign trade and the role of the Seaway in transportation. It is possible that a large part of the trade of the European continent would be lost. This would be serious, for Europe has taken over 40 percent of the value of United States merchandise exports each year since the World War, as shown in table 11. Europe has been at least 4 or 5 times as large a customer as South America and has supplied 2 or 3 times as much of the United States imports.

TABLE 11

United States foreign trade with Europe and South America

[Values in millions of dollars]

Exports and imports	1921-25 average	1926-30 average	1931-35 average	1936	1937	1938	1939
EXPORTS							
Total United States.....	4,310.2	4,687.8	1,988.9	2,419.0	3,298.9	3,057.2	3,123.3
To Europe.....	2,279.5	2,206.6	944.2	1,028.2	1,337.9	1,311.4	1,265.0
To South America.....	294.1	445.4	140.1	202.6	316.4	298.1	326.5
IMPORTS							
Total United States.....	3,450.1	4,033.5	1,707.6	2,424.0	3,009.9	1,949.6	2,276.1
From Europe.....	1049.5	1210.5	512.7	719.3	820.8	568.1	611.3
From South America.....	421.3	545.8	243.2	290.5	411.7	263.0	300.7

SOURCE: *Statistical Abstract of the United States, 1940, p. 564.*

The conclusion is clear that United States foreign trade will be smaller in the event that Europe remains under German domination. Using foreign trade as a weapon of political domination, Axis-controlled countries would probably exclude as much American products as consistent with their policy of self-sufficiency, and furthermore would fight American producers in every market of the world. This does

not mean that United States foreign trade will be less than it has been in the depressed years of the 1930's, since foreign trade of the United States, exclusive of European trade, has been higher in some years than total trade during the depression years. And of course, it is fallacious to assume that the results of an Axis victory can be measured simply by deducting all trade with Europe, for there are certain essential products which will form the basis of trade with Europe. Against this must be set the increases in South American trade which may result from an extensive program of hemispheric economic defense, as well as the impetus to trade from the growth and higher levels of income of the nations of the Americas.

These conclusions by no means fully express the importance of the St. Lawrence Seaway in its relation to foreign trade if the totalitarian powers are victorious. The total volume of foreign trade could be very much lower than the estimates and at the same time the Seaway could be of far greater importance than anyone has anticipated. This would be the case if the foreign traffic of the Seaway were composed of imports and exports of South America which might otherwise be captured by the Axis. In a post-war world as is here visualized, trade with the other Americas would be more than a matter of dollars and cents. This trade will prevent the South American countries from being completely dependent upon the Axis economically. A South America so dependent becomes an easy mark for political and military domination. There can be no doubt that such a chain of events is part of the plan of the opponents of democracies. Even if the Seaway contributes only a little to forestall this occurrence by helping to retain politically strategic trade with the rest of the hemisphere, its ultimate value to the country would be established. With the Seaway, the Middlewestern products would be in a better position to compete with Axis products in South American markets because of savings in transportation costs. Instead of taking the impact of such competition by lowering wage scales, we shall be better able to maintain the American standards at the same time as we undersell Axis powers. It might be said that this same result could be accomplished by a subsidy to importers and exporters equivalent to the savings which the Seaway could effect. This is an unnecessary waste of money, because the Seaway can provide this impetus at much less cost over the long run than direct subsidies.

Nor does the normal advantage of Seaway transportation in foreign trade measure the entire extent of the advantage which will ensue under the kind of world now being created. Normally, the additional shipping space for the additional St. Lawrence ton-miles of transportation must be counted as a cost of transportation. However, the experience of these last two years have shown that the nation has to main-

tain a large merchant marine for purposes of National Defense, on a scale much larger than the Maritime Commission's 10-year, 500-ship program. In the construction of this merchant marine, as well as its utilization during peacetime, the St. Lawrence Seaway would aid greatly. Having made an investment for national defense, the American public could at least obtain the benefits of cheap transportation. This would keep the merchant marine in good operating condition, and help defray part of the expenses.

Clearly the United States is going to have a large merchant marine for a long time to come, a merchant marine whose existence can only be attributed to one phase or another of National Defense. This is true regardless of the outcome of the war. If Britain wins, there will be a large supply of ships as a result of the recently begun program for the "Battle of the Atlantic." If Britain loses, there will be an impetus to a large merchant marine in the economic battle for the western hemisphere, for it would not be wise to have United States foreign trade dependent upon foreign shipping to an overwhelming extent.

The most important reason for a large merchant marine resides in sound naval policy. Even before the huge expansion of the Navy was begun, the merchant marine was inadequate in its function as an auxiliary force to the fleet. In 1937, the Maritime Commission made this plain:

Although it is difficult to cite the exact number of each type of vessel that would be required to meet a given situation, it appears that the defense needs of the United States dictate the replacement of the bulk of the present fleet. * * *

This statement was made before the war and before the world situation developed to its present critical stage. Furthermore, it was made before the policy of a two-ocean Navy was adopted. If the bulk of the fleet had to be replaced in 1937 to serve, in part, as auxiliaries to the one-ocean Navy, it can be seen that a Navy twice as large designed to operate as two independent fleets may require twice the number of merchant marine auxiliaries.

The conclusion is inevitable that regardless of the immediate course of events, this nation must own a merchant fleet far in excess of that needed for commercial purposes alone. It is the part of wisdom to make use of them in the most valuable manner possible, instead of letting them stand idle waiting for M-day. The opening of the Great Lakes to large ocean-going vessels will provide increased commercial usage for these ships. And this means essentially that ships can be provided for the trade at practically no overhead cost, which would be chargeable to National Defense, thus increasing the economy of this

* United States Maritime Commission, *op. cit.*, p. 12.

mode of transportation. There will be the added advantage that the St. Lawrence trade will also help to bear the cost of training the necessary ship operating personnel.

There are other aspects, too numerous to treat in a brief summary, which define and emphasize the importance of the waterway under any possible set of circumstances. One concrete case may be presented to illustrate its potentialities in case of emergency. The large steel producing plants on the Atlantic coast, particularly in Sparrows Point, Md., and Philadelphia, import their ores from Cuba and Chile. The iron ore imports of the United States, the bulk of which is of this nature, follows:

	<i>Million long tons</i>
1926-30 average.....	2, 709
1931-35 average.....	1, 166
1936.....	2, 232
1937.....	2, 442
1938.....	2, 123
1939.....	2, 413

In the event of actual combat to prevent control of the Western Hemisphere by European powers, these sources of supply might be impaired or totally cut off. At just this time, steel would be of vital importance. The cost of obtaining alternative supplies from the head of the Lakes in the absence of the Seaway would be prohibitive, and an added burden which would seriously impair the prosecution of the war even if it could be met. This contingency would be avoided by the Seaway.

Before closing, a final point of broad significance must be made. An Axis victory, as has been pointed out, would mean a curtailment of foreign trade as compared to a universe devoted to the promotion of trade between nations. The impetus towards regional and national self-sufficiency would negate the comparative advantages of geographical specialization. This factor of itself tends to make for less efficient utilization of resources which, in turn, exerts downward pressure upon the standard of living. It then becomes imperative to utilize every resource to the full and most efficiently in order to offset as much as possible the undesirable effects of self-sufficiency upon the standard of living. This applies to the transportation functions of an economy. The net result is that the economies of any resource like the St. Lawrence Seaway reaches a magnified importance.

The conclusion is justified that the potential value of Seaway transportation when estimated on the basis of recent statistics gives only a partial view of its advantages. If the world regains its equilibrium of political comity and freer exchange of commerce under democratic leadership, the St. Lawrence Seaway will be a great

advantage to the landlocked interior. If the world, on the contrary, falls under the domination of the totalitarian powers, the Seaway will become an asset in preserving, even if partially, the American standard of living in the great Middle West, in putting American producers in a better competitive position *visa vis* hostile economies, and in the National Defense program which will become a lasting aspect of American life as long as we are surrounded by potentially enemy countries.

CHAPTER IV

COMPARATIVE COSTS OF FREIGHT TRANSPORTATION WITH AND WITHOUT THE SEAWAY

Heretofore, the discussion has centered upon the savings in transportation rates to the shippers. This is the traditional yardstick used by the United States Army Engineers in studying the advisability of undertaking waterway improvements. By this method it is found that there would be enough tonnage and savings on traffic via the Seaway even in a depression period, such as the country experienced in the past decade, to justify the expenditures of money involved in this project.

An examination of possible alternative future developments in the political and economic structure of the world, affecting foreign commerce, indicates that under one set of conditions actual traffic via the St. Lawrence may increase to its full capacity—at least 10,000,000 tons of new American tonnage, with commensurately larger savings to shippers. Under another set of assumptions, where world commerce is subject to the strangulating influence of totalitarian countries dominating the high seas, then the National Defense value of the Seaway comes forward as the determining factor.

There is a third basic standard of evaluation that must be applied before final approval can be given to this project. From a national (as against the individual shipper's) point of view, the Seaway can be justified if transportation *costs* (as distinct from rates) are lower by the use of the Seaway than they would be by alternative means.

Of what value for transporting freight will the Seaway be in the long run under future peace-time conditions? Will the construction and use of the Seaway afford a saving to the Nation or would the Nation find it more economical, in respect to the transportation of this freight, not to build the Seaway but to use other means of transport?

To answer this question an attempt has been made to draw up a comparative cost statement, showing the total costs to the Nation, whether met by governmental or private funds, on the one hand, of transportation via the Seaway, and on the other hand, of the most economical alternative method of transportation.

Section 1

METHOD OF ANALYSIS

Costs can be measured in several ways, each of which will have economic importance. One measure is the dollar cost (in 1939 dollars). Another is the labor requirements. A third is the time of transportation. Of these the dollar-cost is analyzed in greater detail. The labor requirements have been shown both in terms of man-days and in terms of pay rolls. The dollar-costs are measured both as to capital outlays required and as to the annual costs required completely to finance such outlays, operate the necessary facilities, and transport each year an assumed average of 10 million tons of American freight between points served both by the Seaway and by alternative routes. These annual costs are also shown on a per-ton basis.

The costs here referred to are not to be confused with rates. Whether or not the rates will in the long run tend to reflect the carriers' portion of the costs, the rates cannot be taken to include governmental costs when the latter are not passed on to carriers through tolls and charges. Hence any estimates of rates, even if these could be accurately predicted, would not be a complete picture of the total costs to the Nation. What is here attempted is an estimate of the entire national cost for transportation with and without the Seaway, including true costs to the public through governmental as well as private expenditures.

The methods by which these cost comparisons are reached are easily described, though the computations are necessarily detailed and voluminous. The methods are dictated by the following basic assumptions which have been made: First, that no consideration should be given to defense or military programs or purposes, but the costs should be appraised under peace-time conditions of a presumably "normal" post-war character in the decade 1950 to 1959; second, that the freight to be carried over the Seaway should be assumed to be long-haul freight between lake ports and ocean ports, for which the most efficient and economical alternative method of transportation to or from ocean side would be transportation by rail; and third, that no capital outlays or annual carrying charges should be included for facilities which will, it is believed, be available whether the Seaway be built and used or not—and that for the purposes of this investigation the ships and the railway trackage, structures and terminals are facilities of this character, while the Seaway itself and certain railroad rolling stock equipment are not such facilities and their cost must be included in this analysis.

The assumption of "normal" growth determines the framework of analysis in respect to trends and changes. It dictates that, for the

purposes of the present analysis, unless new trends are clearly predictable, the known trends and tendencies which have held in the past shall not be assumed likely to be departed from in the future up to the year 1955. It dictates that where no consistent trend has existed in the past, the conditions as of 1939 shall be assumed to represent those of 1955.

An exception to this principle is to be noted in certain cases where a trend is believed to exist but is found difficult to measure reliably. In such cases the method followed has been determined by the desire to avoid overstatement of the advantages of use of the Seaway, and the figures indicated to be most favorable to the rails were used.

An example of this will be found in the failure to apply to ship operating costs any allowance for technological progress between 1939 and 1955, owing to the difficulty of estimating the probable extent of such progress. In computing railroad operating costs in 1955, allowance has been made for continuance of technological progress and increased efficiency, since these are clearly measurable in the past. But in computing ship operating costs and cargo-handling expenses, the actual average per-diem and per-ton costs of American merchant marine in intercoastal, domestic and overseas foreign service, which obtained in 1939, have been taken to be representative of costs which will obtain in 1955. In view of the virtual certainty of future technological progress, the costs for the use of the Seaway will, of course, prove to have been exaggerated; the costs of using the rails tend, on the contrary, because high rates of technological improvement are used, to be, if in error, understated.

As a yardstick of measurement of costs without the Seaway, the cost of transportation via rail is used. It would be possible to use other methods of transport for such a yardstick, but the rails are the traditional and the most important alternative to the waterways, and, for long-haul freight, appear to be the logical choice.

Another detail of method is with respect to the choice of terminal points. It would be possible, and proper, to assume that the Seaway will tend to be used by shippers for freight for which it is most economical and efficient. If a sufficient volume of such freight is available to be carried, it is reasonable to expect that such freight will be carried to the exclusion of freight for which the Seaway route is less efficient.

The freight for which the Seaway is best suited can be briefly described as port-to-port ocean-going freight, meaning that it will move between overseas ocean-ports and Great Lakes ports without additional rail-haul between the latter ports and inland points. For

such freight the use of the Seaway affords greatest saving since it eliminates a present unloading and reloading at domestic ocean-ports and a rail-, truck-, or barge-haul between these ports and the Great Lakes ports.

Will such "high-efficiency" freight be available in sufficient volume to make unnecessary the use of the Seaway in part for the transport of freight for which its use is less efficient? There is, of course, no way of knowing, although in the available statistics of 1939 foreign trade cleared through interior customs offices on the Great Lakes, there is evidence which strongly suggests that such freight will be available.

But to cover the possibility that the volume of such "high-efficiency" freight may prove insufficient with the result that the Seaway will also be used to carry much other freight, the present study of costs has been carried out in two ways. One set of estimates has been made upon the assumption that all of the freight carried will be freight for which the Seaway is best suited. A second set of estimates has been made on the basis of freight only 40 percent of which is of the kind for which the Seaway is most efficient, while 60 percent comprises domestic freight between Great Lakes ports and coastal ports, with approximately one-quarter of this domestic freight involving a joint rail-water haul to or from points inland from either the lake ports or the coastal ports.

By computing the figures of cost for both of these types of freight it is hoped to bracket the future possibilities in such a manner as to show the Seaway on the one hand in the most favorable light as respects the terminal points of freight hauls and, on the other hand, in the least favorable light that can reasonably be anticipated.

The assumption as to adequacy of existing facilities decides several important questions of method. It eliminates from the cost figures the capital value of ships which will use the Seaway, and it eliminates also the capital value of railroad trackage, structures and terminal facilities over which the same freight, if rail-borne, would be transported. It dictates that the capital value of the Seaway itself shall be included in the cost figures of transportation via the Seaway; and it dictates that the capital value of any rolling stock which would have to be acquired by the railroads if the same freight were wholly rail-borne, should be included in the cost figures of transportation without the Seaway.

In computing the cost of the Seaway for the purposes of this analysis, the costs of the St. Lawrence Power Project are not included. The figure of \$200,000,000 has been taken to be the sum of the United States Army Engineers' latest estimates of construction costs, including interest during construction for the navigation project, and

including a share of the costs necessary both for power and navigation facilities. To this has been added an additional capital outlay of \$35,000,000 which is believed adequate, at \$1,500,000 per harbor for deepening channels and at \$2,000,000 per harbor for modern terminals at each of ten Great Lakes ports.¹ It is to be doubted whether any of this improvement of Great Lakes harbors will really be made necessary by the Seaway, or unnecessary by failure to build and use the Seaway, and the item is largely intended as a comfortable allowance for the completion, in conjunction with the Seaway, of independently desirable improvements which may be in fact undertaken more readily under the stimulus of Seaway activity.

As to rail equipment, Part V of the St. Lawrence Survey Reports has shown that the present rolling stock of the rails is inadequate to meet the minimum increases in freight traffic which can be reasonably anticipated before 1955 by an amount greatly in excess of the entire 10 million tons taken to be the magnitude of additional American Seaway freight. The conclusion is that the railroads must acquire additional freight cars and freight locomotives before 1955 in any case. If the Seaway be built and used, the rails will still have to acquire much new rolling stock. If the Seaway is not built the railroads will have to acquire a somewhat larger amount of new rolling stock.

The amount of such new acquisitions has been estimated, limited to that portion of rolling stock which would be needed to carry, during the peak month in rail traffic, the Seaway freight apportioned to that particular month. From a study of the length of haul and time of transit, the number of freight cars needed for that freight in that month has been calculated, together with the necessary locomotives. The capital cost of such equipment, in 1935 dollars after allowing for continuance of past technological trends in running time, loading time, and tractive effort, has been arrived at and used in these cost studies.

That shipping will be available for use over the Seaway, after the second world war, without creating shortages or bottlenecks in other American shipping routes, is indicated by the experience after the

¹ The costs of improvements in harbor facilities herein considered are not comparable to those presented by the U. S. Army Engineers. The jurisdiction of the Army Engineers extends to the approach channels and outer harbors, and they estimate that the cost of improving these channels and harbors in ten Great Lakes ports will be close to \$10,000,000. The figures used in the present study include also the cost of deepening of inner harbors and ships, and the establishment of terminal facilities and warehouses. The Army Engineers' estimates include only costs which are traditionally assumed by the Federal Government. The costs considered in this study are all inclusive, regardless of the incidence of the original investment, whether assumed by the Federal Government, the municipalities or private interests. Much of the \$35,000,000 figure used in this study is self-liquidating, supported by charges on cargo passing through the ports. It is included in the total costs of transportation via the Seaway since this part of the study is concerned with total national outlays regardless of the initial source of funds.

first world war, as well as by the outlook which is presented by the shipbuilding programs of the second world war. It is arguable, of course, that there will be a great destruction of American ships and a great volume of American overseas foreign trade after the war, which will overtax the capacity of the remaining American merchant marine; just as it is arguable that there will be no overseas foreign trade whatever for this nation after the second world war; but neither of these extreme views appears to the present investigators to be reasonable foundations for long-range national planning. A realistic view must recognize the probability that shipbuilding programs will be greatly stimulated during this war as during other wars; that government subsidies will finance such shipbuilding; and that when the emergency is over there will remain a large supply of American vessels suitable for use over the Seaway, which will be placed into operation at virtually no capital outlays.

It is recognized that a certain amount of new shipbuilding tends to go on each year among the maritime nations and that such new ships are often specially designed for service over particular routes. If the Seaway be available, it is recognized that some of the normal new shipbuilding may be designed for this route, releasing other vessels from this route to other routes. Examples of such efficient vessels may be the so-called "sea-train" ships which transport entire loaded freight cars, and the so-called "colossus-type" of grain vessels which may be developed in the future for fast loading, fast unloading, and large cargoes of special bulk freight.

But the benefits of savings in cargo-handling which would be afforded by these ships have not been taken into account in computing the costs of transportation via Seaway; and the capital outlays for such ships, being merely a substitution for the capital outlays for other new ships, have not been included. On the ground that the capital outlays for ships do not depend upon the construction and use of the Seaway, it would not be proper to include them in the costs of transportation via Seaway unless one were willing to include them also in the figures of cost of transportation without the Seaway. Similarly the capital value of railroad trackage, structures and terminal facilities has not been included in either figure, since no additional outlays would be, it is believed, required if the Seaway traffic were wholly rail-borne.

Section 2

RESULTS

The reader who has patiently followed this discussion of method may now be prepared to understand better the conclusions which have been reached. The conclusions can be summarized briefly as follows:

Capital Outlays.

The rails will require between 34 and 47 percent greater capital outlay than the Seaway \$316,084,000 or \$344,338,000 for rails as compared with \$235,000,000 for the Seaway, depending whether the freight carried via the Seaway originates or terminates inland or at port cities.

Annual Costs.

The use of the railroads will cost 30 percent more than the Seaway every year to carry freight for which the efficiency of the Seaway is relatively low (\$87,000,000 for rails as compared with \$67,000,000 for the Seaway); and the railroads will cost 340 percent more than the Seaway to carry freight for which the efficiency of the Seaway is highest (\$92,600,000 as against \$21,000,000).

Transport Time.

The use of the Seaway will require more time than the rails to carry freight for which its efficiency is relatively low; but will take less time for freight for which its efficiency is high. For "high-efficiency freight" the Seaway will do in an average of 4 days what the rails would take, on the average, about 18 days to do because the average ocean-going vessel will reach Chicago or Detroit in about 4 days longer time than the same vessel requires to reach a coastal port such as New York; and the loading, transit, and unloading the same freight when carried by rail between the coastal port and the Great Lakes port will consume, on the average, about 18 days. For domestic freight between the Great Lakes ports and coastal ports, the time by boat will be somewhat longer by vessel over the Seaway than by rail; so that the average time for the particular proportions "low-efficiency freight," which have been here assumed, will involve somewhat slower transport than the use of the rails (24 days instead of 18 days).²

The first three sets of conclusions have been set forth in tabular form for convenient reference.

Cost Per Ton.

In terms of cost per ton of freight carried, it is apparent from the foregoing that the Seaway will provide transportation more economically than the railroads.

In the case of freight for which the efficiency of the Seaway is relatively low, the cost via rail is estimated to be, in 1939 dollars, 30 percent higher than the cost via Seaway (\$8.68 per ton by rail against \$6.70 per ton by Seaway).

² These conclusions are based on studies of average performance of railroads on the type of traffic that may utilize the Seaway, and should not be compared with the special fast services which some railroads provide on particular routes.

If the Seaway is used exclusively for types of freight for which it is most efficient, the cost via rail is estimated to be 340 percent higher than the cost via Seaway (\$9.24 per ton by rail against \$2.10 per ton by Seaway).

Other Factors.

A limitation of this analysis is that it takes no account of the secondary benefits in increased consumption and higher standards of living which follow in the wake of the indicated economies. Lower costs and greater incomes enable people to purchase more goods and services. They enable people to consume more and enjoy higher living standards. Markets are created for more products and for new products not previously produced or distributed. But while the fact of these benefits is clear, it is difficult to forecast their dimensions. It is not possible to foresee the character of the goods for which consuming power will be created, and the theoretical proof is not easy to demonstrate. Therefore, this economic benefit has not been appraised in the present analysis.

A further limitation may be seen in the fact that the study does not adequately reflect the gains or losses to the railroad industry or to the railroad and motor trucking industries combined, which will follow from the construction and use of the Seaway. It should not be assumed from the cost figures shown that the rails, for example, necessarily stand to lose. History has provided precedents by which the effects upon the rails can be foreshadowed. When the Panama Canal was proposed, the fear was felt that the railroads would suffer.²

² "The Panama Canal, when it was first considered, was opposed by the railroads, especially the trunk lines, on the same grounds that are now being urged against the proposed St. Lawrence Waterway. It was claimed that the transcontinental railroad system already possessed surplus facilities sufficient to handle all future traffic developments between the east and west coasts. It was also predicted that the western railroads as a whole would suffer severely from this new waterway constructed with public funds and a subsidized waterway of this form would bring disaster to railroad investors and employees.

"Because of this analogy with present-day railway opposition to the St. Lawrence Waterway, it will be profitable to review the operations of the Panama Canal from its beginnings to the present time, in connection with the history of western railroads for the same period, to ascertain the extent, if any, to which the fears and predictions of railroad interests in opposing the project were later substantiated. * * *

"As an indication of what may be expected from the opening of the St. Lawrence waterway, it should also be especially noted that the commodities transported through the Canal from the Atlantic to the Pacific consisted chiefly of the products of agriculture such as cotton, sugar, and tobacco, and other bulky extractive products as coal, coke, sulphur, and mineral oils. Manufactured products transported west-bound were principally those of the heavy industries such as cement, iron and steel products, railroad materials, and machinery, together with finished products of mass production in the transportation of which the time element was not the ruling factor, such as automobiles, textiles, paper, and canned goods.

"The movement eastward from the Pacific to the Atlantic consisted principally of mineral oils, lumber, nitrates, iron ores, sugar, wheat, wool, beans, coffee, rice, and other extractives and agricultural commodities. The movement of manufactured products was small and restricted to such products as wood pulp, paper, flour, various metals, and canned goods.

"In other words, the development of Panama Canal traffic in both directions has centered chiefly around ore, oils, agricultural products, and the output of heavy- or mass-production industries, or, in other words, upon heavy, bulky raw materials and manufactures of low-revenue yields in the transportation of which the time element is not of importance. * * *

"The effect of the Panama Canal traffic development upon the competing trunk-line railways, together with its stimulating effect upon railways serving Atlantic, Pacific, and Gulf ports, may also be considered as

Now we know that the Panama Canal, carrying bulk cargoes which afford the rails low revenue, have left to the rails an increased proportion of package freight requiring greater speed in transportation, greater expense in handling, and providing greater revenue to the rails. It can be argued that the Seaway will similarly relieve the rails of some bulk freight and leave to the rails a greater proportion of higher-revenue freight. That seems to be a possibility and is believed by many students to be a probability, but it is of a speculative character and lies outside the field of this analysis.

Conditions have changed since 1934. At that time the rails had ample rolling stock for much future expansion of traffic. Today it is clear that rolling stock will be inadequate for the needs of the immediate future years owing to defense program requirements. We must, without the Seaway, figure on the purchase of much new rolling stock of which the small portion here dealt with can be dispensed with if the Seaway is used, and we can realistically count upon adequate shipping facilities as being available for use over the Seaway without shipbuilding costs due to the Seaway.

It should be made clear that the present analysis has probably understated the cost savings from the use of the Seaway for transporting freight, by reason of the fact that this analysis has used the vessel expense figures per ton in cargo-handling and per day in port-day and sea-day expenses, which actually obtained in 1939 for American vessels in intercoastal, domestic, and overseas foreign trade. It is known that these vessels are not of the most modern types—indeed

(Footnote continued from p. 54.)

indicative of the effect of construction of the St. Lawrence Waterway upon parallel railroads and those serving the Lake and North Atlantic ports. An analysis of the operating and financial experience of the western railroads since the opening of the Panama Canal will, therefore, be of great value in forecasting the results, so far as the eastern railroads are concerned, of the opening of the Great Lakes to world commerce. * * *

"Upon referring to the foregoing tables which show the operating record of the western railroads before and since the opening of the Panama Canal, it will be seen that as compared with the period before the Canal was constructed or before the year 1915 the volume of freight traffic on western railroads has increased 64 percent.

"Along with this increase in the volume of traffic there also proceeded an increase in receipts for each unit of traffic carried. By way of illustration, the revenue per ton-mile for freight transported prior to the opening of the Canal, amounted to 0.0089 cent as compared with 0.0116 cent since the Canal was put in operation. The net revenue per ton-mile has increased 34 percent since 1920, figures prior to that date not being available. Although the effect of freight rate changes during this period cannot be accurately estimated, this increase in revenue ton-mile receipts indicates that not only did the volume of railroad traffic increase since the opening of the Canal, but due to changes to the advantage of the railroads in the form of such traffic, the average receipts per ton-mile transported increased. In other words, although the Canal took a considerable portion of the heavier, bulky traffic which the railroads otherwise would have carried, on the other hand, the railroads gained, as a result of the increased traffic, a larger proportion of manufactures and miscellaneous commodities which the Canal could not handle because of the time element involved but which paid a higher rate of return to the railroads as compared with the traffic which was absorbed by the Canal itself. * * *

"* * * An unprejudiced analysis of the relevant facts, as well as the teachings of the experience gained from the operation of the Panama Canal and internal waterways, during past years, the opening up of the St. Lawrence Waterway will also add another favorable factor to the financial gains of the steam railroad transportation industry."—Interdepartmental Report on *Survey of the Great Lakes-St. Lawrence Seaway and Power Project*, S. D. No. 116, 73d. Cong. 2d sess. 1934, p. 377 ff.

many of them are relics from the first world war, acquired by carriers at low cost when these were sold off by the Government. There is much belief among experts that more modern vessels, and particularly future vessels of the "sea-train" and of the "colossus" grain-ship types, for example, will operate at a very much lower cost over the Seaway than would the vessels for which costs have been used in this analysis.

In short, no allowance has been made for future technological progress in shipping, of which predictable examples have just been given, and by which shipping costs (in 1939 dollars) will surely be materially reduced in the future. On the other hand, there has been applied to the figures of transportation cost-via-rail, every cost reduction which could be made, on the basis of past trends, by extending these technological trends into the future for over a period of 15 years, before arriving at estimates of the probable 1955 costs.

Obviously the result of these differences has been to make the rail costs low enough to be reasonable estimates, while substantially overstating the costs via Seaway. Were it possible to correct for this error, the estimates of savings via Seaway would be correspondingly greater than here stated.

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Appendix A

THE AUTOMOBILE INDUSTRY

Section 1

PRODUCTION OF AUTOMOBILES, PARTS, AND ACCESSORIES

The purpose of this report is to indicate the probable effects of the proposed St. Lawrence Seaway upon the automobile industry—upon the price of motor vehicles, the cost of transporting them, and the location of the industry. The motor-vehicle industry, the fourth largest manufacturing industry in the United States, gave direct employment in 1937 to an average of 194,527 wage earners, not including salaried employees. In that year the total value of the products of this industry was placed at \$3,096,219,000 (table A-1), and the total number of passenger and commercial vehicles produced by the industry was 4,808,974 (table A-3). The production of motor-vehicle bodies and parts engaged an additional 284,814 wage earners (table A-2) making a total of 479,341 wage earners for the industry as a whole.

The major part of the industry is located in the area tributary to the Great Lakes, principally at Detroit, Flint, Pontiac, and Lansing, Mich.; Toledo, Ohio; South Bend, Ind.; and Kenosha, Wis. On the basis of the value of products in 1937, the States tributary to the Great Lakes accounted for 85.5 percent of the total output of the industry. This figure is perhaps slightly understated, since the census allocates assembly plants belonging to the companies with headquarters in the tributary area to States in which such plants are established, even though the parts used in the production of the finished product are actually manufactured and shipped to the assembly plants from the tributary area. The relative importance of the various producing States in this industry on the basis of number of establishments, number of wage earners, and value of products is shown in tables A-1 and A-2.

From the beginning of the industry in the early part of the century through 1929, it showed a steady progress and expansion equalled by few industries in the country. In 1929 the industry reached a peak production of 5,358,420 passenger cars and trucks. Following the business reaction of 1929, for several years the industry was operating far below capacity. It was not until 1937 that progress comparable to 1928 and 1929 was indicated by the volume of production. After a recession in 1938, the industry again forged forward in 1939, with total production of 3,577,292 cars, both passenger and commercial (table A-3). The average annual production during the 10 years 1928-37, a period which includes 4 especially active years of production and 5 years of depression, was 3,471,678 passenger cars and trucks.

It has been difficult to obtain consistent figures on the production of parts and accessories. Census of Manufactures data for motor vehicle bodies and parts do not include such parts as engines, springs, ignition apparatus, batteries, starting, and lighting systems, etc. These items are allocated by the census to various

other industries such as engines and electrical machinery. It has been necessary, therefore, to rely upon information provided by the Automobile Manufacturers' Association in *Automobile Facts and Figures* pertaining to sale of parts and accessories. This information is given in table A-4. It will be seen therefrom that sales of parts for replacement have varied less violently during the depression years after 1929 than parts and accessories for original installation. This, of course, is due to the fact that whereas sales of new automobiles declined very materially, the average age of automobiles remaining on the roads was greater, and hence the sale of replacement parts remained fairly steady. Even in this case, however, there was a decline from 644 million dollars in 1929 to 372 million dollars in 1932. However, by 1936 and 1937 the peak of 1929 was well surpassed. The average sales of parts and accessories during the years 1928 to 1937 for replacement purposes was 541 million dollars.

Section 2

EXPORTS OF AUTOMOBILES, PARTS AND ACCESSORIES

A considerable portion of motor-vehicle production has entered into export trade. The annual exports of passenger cars and trucks from 1921 to 1939 are shown in table A-5. Total exports of passenger cars and trucks have gone as high as 12 percent of total United States production, or approximately 507,000 cars a year. The average for the 10-year period 1928 to 1937 was 277,276 cars annually. This includes some especially low years, such as 1932, when the total exports were a little over 65,000 cars, and 1933, when they were 107,000. These low years, however, are offset by the 2 highest years in our history—namely, 1928 and 1929, when exports were beyond the half-million mark.

The exports of automobile parts and accessories have shown practically the same gyroscopic changes as those of finished automobiles. Statistics of parts and accessories are available only in terms of dollar values and not in weight units. The dollar values of total exports of this type of equipment have varied in the 14-year period, 1924-38 inclusive, from \$195,000,000 in 1929 down to \$39,000,000 in 1933. However, in 1937, another good year, exports amounted to \$112,000,000. The average for the 10-year period, 1928-37, was \$96,000,000. These facts are given in table A-6.

On the basis of the biennial Census of Manufactures of 1937, the Great Lakes tributary area must be credited with at least 85.5 percent of the exports of automobile parts and accessories, as well as completed automobiles.

An analysis of the destinations of the shipments of automobiles, as shown in table A-7, indicates that Europe receives, on the basis of averages of the 1928-37 decade, nearly 28.8 percent of the total exports of passenger cars and trucks. South America is next in importance with 17.82 percent. Asia has been receiving a little over 15 percent of American exports; Oceania, including Australia, New Zealand, and French Oceania, 10.45 percent; and Africa, 12.35 percent.

The proportion of total exports of parts and accessories shipped to the different parts of the world followed closely that of new cars. This is shown in table A-8. This table, however, is somewhat different from table A-7, in that it covers a 6-year period, 1933 to 1938, inclusive. In spite of the difference in the period covered by the two tables, approximately the same proportion of parts and accessories were shipped to different parts of the globe as the shipment of complete motor vehicles.¹

¹ There was only one exception to this—namely, shipment of parts and accessories to northern North America, that is, Canada, was much greater than that of new cars. This of course is mainly due to the assembly of American made cars on the Canadian side of the frontier.

Section 3

ESTIMATE OF POTENTIAL AVAILABLE EXPORT TRAFFIC
VIA ST. LAWRENCE SEAWAY

In order to determine what part of American exports of automobiles, parts, and accessories might be affected by the St. Lawrence Seaway, it is necessary to determine what portion of exports may be shipped during the season when the Seaway is free of ice. For this purpose, one must consider the exports during the months from May to November inclusive, for this is generally the open season for the Great Lakes and the St. Lawrence River.

Domestic production and sales, as well as foreign shipments, have been affected by the change in the seasonal schedule of production which took place in the automobile industry when the annual automobile show was moved forward to October. Consequently, to obtain an average picture of recent seasonality of exports, taking into account also this change in the production schedule, a calculation was made of average exports from May to November inclusive, during the 4-year period 1936-39. This calculation is presented in table A-9.

It appears that during those 4 years, 47.7 percent of the total exports of passenger cars were shipped during the 7-month period May to November, and 52.9 percent of trucks were exported during those months. Of parts for assembly, 48.2 percent were shipped during the 7-month period.

Applying these percentages to the total movement of exports, during the 7 months constituting the open season on the St. Lawrence, to the average annual exports from 1928-37, inclusive, we obtain an estimate of the average annual exports over this 10-year period of passenger cars, trucks, parts, and accessories that may have been shipped on an average during this season.

The results are given in table A-10, which shows that during this 10-year period, on the average, 84,567 passenger cars, 52,873 trucks, and \$46,340,000 worth of parts and accessories were exported during the open season.

Our next problem is to convert these figures of exports into weights. This procedure is complicated by two characteristics present in our export trade: First, passenger cars and trucks carry varying weights per unit; secondly, exports are shipped principally in two forms—namely, unboxed set-up and boxed. Unboxed cars have a lower per unit average weight than boxed cars, since the latter includes the weight of the appurtenances and boxing, which are necessary in order to protect the car in transit.

Information was obtained from two of the larger motor car manufacturers and three independent producers on the average weights of their passenger cars and trucks, boxed and unboxed separately. This information has been incorporated without revealing individual operations in table A-11. The average weight of unboxed passenger cars as given by these five producers varied between 2,965 pounds and 3,420 pounds, the latter being the figure supplied by one of the larger exporters. The average weight of passenger cars, boxed, supplied by these five producers varied between 4,265 pounds and 5,000 pounds. On trucks, unboxed, the average weights ranged from 2,945 pounds to 3,800 pounds; and boxed from 4,060 pounds to 5,000 pounds.

Information was also obtained from the same five motor car producers on the proportion of their foreign shipments in boxed and unboxed form. This information is tabulated without revealing individual operations in table A-12. These proportions varied greatly among the different producers, presumably because of the different agency, marketing, and service arrangements they have in the importing countries. These proportions were also weighted and averaged on

the basis of 1938 relative exports. In this way, it appears that about 58 percent of passenger cars and 27 percent of trucks are shipped unboxed. On the other hand, 42 percent of passenger cars and 73 percent of trucks are sent abroad boxed. Applying weights in proportion to the export sales of these five producers to these average export figures of individual shippers, an average of 3,369 pounds was obtained for unboxed passenger cars and for boxed passenger cars an average of 4,634 pounds. It was, therefore, decided to take 3,300 pounds as the average weight of unboxed passenger cars exported, and 4,600 pounds as the average weight of passenger cars boxed. For trucks, the average weight on unboxed shipments obtained in the same manner was 3,459, and on shipments in boxes 4,688 pounds. It was, therefore, decided to take 3,400 pounds as the average weight of unboxed truck shipments, and 4,600 pounds as the average weight of a truck shipped boxed.

Applying these respective percentages of boxed and unboxed shipments and their applicable average weights to the in-season exports as calculated in table A-10, the total weight in pounds of average in-season exports during the decade 1928-37 was obtained. These calculations are carried out in table A-13. The total weight found in this manner was 471,390,000 pounds, or approximately 235,695 tons. This figure includes only open-season movement of passenger cars and trucks in export trade, based on average exports during 1928-37. However, table A-7 shows that 31 percent of exports of passenger cars and trucks went to Canada, Africa, Oceania, and United States possessions. On the assumption that there may not be sufficiently frequent service to those places direct from the Great Lakes, the above estimate may be lowered by 31 percent, which gives total available tonnage of 162,628 short tons.

The potential movement of open-season exports of automobile parts and accessories, expressed, in weight, had to be calculated in a different manner, because the only available export statistics on parts and accessories are dollar values. The annual average value of exports of parts and accessories during the years 1928-37 was \$96,062,000, as shown in tables A-6 and A-10, and the average value of annual exports during the 7 months May to December was estimated as \$46,340,000. On the basis of information supplied to the Survey by automobile manufacturers, the average value per pound of parts and accessories shipped in boxing is assumed to be about 30 cents per pound. On this basis, the weight of exports of parts and accessories during the open season is estimated at 154,467,000 pounds. The proportion of this produced in the tributary area is 85.5 percent. This would amount to 132,069,000 pounds. This is equivalent to little over 66,000 short tons.

It is necessary to modify this figure by the amount of exports which may not move through the St. Lawrence for various reasons. Exports to Canada (see table A-8), which amount to nearly 33 percent must be eliminated because exports of parts for assembly are destined mainly for points in Great Lakes, Canada. Furthermore, any shipments that could be made by water can now use the existing canals. Hence, no additional Canadian traffic will be assumed, even though it is not unlikely that with more frequent direct service through the St. Lawrence, shipments to Montreal and Quebec will be made by water.

In addition, exports to Africa, Oceania, and United States possessions, or 9 percent, will be deducted from potentially available traffic, for the same reason as in the case of finished automobiles—possibly infrequent shipping services. As a whole then, 42 percent of total exports, as shown by table A-8, must be eliminated from consideration. Taking 58 percent of the in-season movement of 66,000 short tons would give a potential tonnage of 38,300 short tons in parts and accessories for export.

The total tonnage for automobiles, parts, and accessories would be 200,930 tons or roughly 200,000 tons, based on the open-season movement during the decade 1928-37, modified as explained above.

These figures are, perhaps, understated; the likelihood is that manufacture of automobiles and parts outside the tributary area of the Great Lakes will revert back to the main producing centers in the Lake States. Furthermore, the few small independent automobile manufacturers that are located outside of the tributary area do not possess as large a foreign market in relation to their total output as the major automobile concerns located in the Great Lakes area. Finally, there may be a greater concentration of shipments during the open season than appears to be true of late years. All these factors have not been used in arriving at the estimated potential tonnage of the St. Lawrence canal. Hence, it is justified to consider this estimate as very conservative.

Section 4

THE COST OF TRANSPORTATION OF AUTOMOBILES IN EXPORT TRADE AND ESTIMATED POTENTIAL SAVINGS VIA ST. LAWRENCE SEAWAY

The next problem is to indicate the possible savings that may exist in the export of automobiles and parts as a result of the construction of the St. Lawrence Waterway. To determine this we must know the present routes and cost of transportation from the principal producing centers to the Atlantic seashore and the prospective shipping rates via the Seaway. Table A-14 is introduced to show the rail rates on export trade in automobiles and trucks from the principal producing centers to New York. The principal centers for which rates have been obtained are Kenosha, Wis., where the Nash Motor Co. has its principal plant; Lansing, Flint, and Pontiac, Mich., where General Motors Corporation has plants; Detroit, Mich., where General Motors, Ford, Chrysler, Hudson Motors, and others have plants; and South Bend, Ind., where the Studebaker Corporation operates. Rail rates are taken as the basis of estimating cost of transport to seashore because questionnaire responses obtained from the various motor manufacturers indicate that for export trade, rail haul is the principal way of transporting automobiles from factory to shipside. New York City is taken as the destination, even though rates to New York City are, on the average, 3 cents per hundred pounds higher than to Baltimore, Md. This is done because an examination of export shipments of automobiles from different harbors indicates that New York is the predominating harbor for out-bound traffic in automobiles. It will be noted in table A-14 that passenger cars, complete, without boxing, carry a much higher rate—as much as $1\frac{1}{2}$ times over the rate on boxed cars. Boxed trucks also carry a higher rate in comparison with trucks unboxed. The reason for this, of course, is the fact that cars, set-up without boxing, take up more space on the trains than automobiles that are boxed. At the same time, boxing adds to the cost of the shipper on account of increased weight.

The rates on passenger cars, set-up, from center of production to New York, vary from a low of \$1.21 per hundred pounds from Detroit, to a high of \$1.53 per hundred pounds from Kenosha, Wis. The rates on trucks, set-up, unboxed, range considerably lower, from 70 cents per hundred pounds from Detroit to New York, to 80 cents per hundred pounds from South Bend, Ind., to New York. No trucks are manufactured at Kenosha, Wis.

The rates on passenger cars, trucks, and auto parts in boxes are identical, and vary between 48 cents per hundred pounds between Detroit to New York and 62 cents per hundred pounds from Kenosha, Wis., to New York.

On the basis of these rates, the cost of shipping a small car weighing 3,300 pounds, unboxed, by rail to New York for export purposes varies from \$39.93 when shipped from Detroit, to \$50.49 when shipped from Kenosha, Wis. The cost of transportation per truck, unboxed, varies between \$21 for a truck weighing one and a half tons, when shipped from Detroit, and \$24 when shipped from South Bend. The total cost of transportation of passenger cars and trucks boxed, weighing 4,600 pounds amounts to \$22.08 from Detroit to New York and \$28.52 from Kenosha, Wis., to New York. In the case of cars shipped boxed, the cost of boxing must be added to the cost of transportation. This cost is reported to range from \$40 to \$100 per car.

The ocean rates from New York to the various parts of the world are given in table A-15. Those rates have been obtained from shipping lines operating out of New York, and represent the charges in effect on August 15, 1939, before the beginning of the present European war. A tabulation of rates on automobiles and parts during several years past, as given in table A-16, shows that the rates in effect on August 15, 1939, were not too far out of line, with the exception of the severest depression years, as compared with the historical trend in those rates.

The ocean rates to foreign ports, as shown in table A-15, indicate that the transportation cost of American exports are a very substantial part of the total cost of cars. To the United Kingdom, for instance, the cost of shipment from New York on a small car of 3,000 pounds was \$103.20 on August 15, 1939. On an average weight of 3,300 pounds per passenger car, the cost would be \$113.52. To points in Atlantic France the corresponding figure on a car weighing 3,300 pounds would be \$101.64, and to Mediterranean ports, \$122.76. If we add to these the cost of rail shipment from Detroit to New York of \$39.93, the total cost of shipment for a passenger car weighing 3,300 pounds to England is \$153.45; to Atlantic France, \$141.57; and to Mediterranean ports, \$162.69. The rail rates from centers of manufacture to the seacoast, therefore, amount to 25 to 28 percent of the total cost of shipment of export automobiles on the average size.

We must now determine what the feasible Seaway rates on automobile exports may be. Upon the general theory that the automobile trade is a profitable trade for shipping lines, and in view of the general practice of shipping lines to have identical or nearly identical rates on the same or similar commodities over a wide range of distances on the Atlantic and Gulf coasts, it is assumed at first that the rates in effect from New York and Baltimore to foreign ports may be extended to cover Great Lakes ports after the construction of the Seaway. This is an assumption based upon the practice of rate-making by shipping lines. It is, however, a minimum assumption, since it is possible that the savings to the motor manufacturer will be so great when shipping from factory to ship line at Great Lakes ports, that the shipping lines will be in a position to charge higher rates than those existing at Atlantic ports.

As a starting point, therefore, we must first determine the possible potential savings on available traffic upon this first assumption, which involves blanketing rates into Great Lakes ports. For manufacturing plants located at Lake ports, such as Detroit, obviously the saving would be equivalent, per 100 pounds or per ton or per car, to the rail rate from Lake ports to New York. From table A-14, it can be seen immediately what the exact saving will be upon this assumption; for example, in the case of shipments from Detroit, the potential saving will be \$1.21 per 100 pounds, \$24.20 per short ton, or \$39.93 per car weighing 3,300 pounds. To obtain the figure of potential savings for plants located away from

the Lake ports, such as Lansing, Flint, and Pontiac, Mich., and South Bend, Ind., one must of necessity deduct the cost of transporting automobiles from plant to Lake shore from the present cost of transportation from plant to New York City. This requires exact knowledge of the proportion of total exports which come from these points. Such information, by point of origin and type of car and weight of shipments, is not now available. This refinement in the calculation of potential savings, though desirable, is impossible of achievement with the information at our disposal. The absence of such information, however, is not fatal to our study, since all of the major low-priced cars, Plymouth, Chevrolet, and Ford are produced in plants in and near Detroit, which is on the Detroit River. Plymouths, Fords, and Chevrolets, constitute the bulk of our exports. This is indicated by the fact that the majority of our exported cars are in a class valued at less than \$850. Although Lansing, Mich., where Oldsmobiles are produced, is not located on the lake shore, it is so near to Detroit that it may be assumed that exportable cars will be hauled away from factory to shipside in Detroit, in all likelihood, by means owned and operated by the car manufacturers. Kenosha, Wis., is by the lake shore, and it will be assumed that shipping facilities would be provided by the Nash Motor Co. South Bend, Ind., where Studebaker has its main plant, may have to utilize Chicago as its point of shipment, although it is not beyond future possibilities that direct facilities may be provided at Toledo on Lake Erie, or Michigan City and Benton Harbor on Lake Michigan.

Potential savings for shipments from Kenosha, Wis., would amount to \$1.53 per 100 pounds, or \$50.49 per passenger car weighing 3,300 pounds, shipped unboxed. Shipments from South Bend, on the other hand, would save \$1.36 per 100 pounds minus the cost of hauling export shipments to the nearest lake port. Similar savings from Lansing, Mich., would be \$1.28, minus the cost of hauling cars to Detroit, and from Flint and Pontiac, Mich., the savings would be \$1.25 minus haulage to Detroit. However, in the light of the increased saving from Kenosha and the fact that Detroit by the lake shore will provide by far the major part of the shipments and that plants located off shore may provide their own haulage to shore points, taking an over-all saving of \$1.21 per 100 pounds, the potential saving from Detroit on passenger cars, set up, is not, perhaps too unrepresentative.

On this basis, therefore, the average saving per passenger car of 3,300 pounds when shipped from Detroit unboxed would be \$39.93. One of the larger manufacturers reported that the average weight of its unboxed passenger cars was 3,420 pounds. This manufacturer should save \$41.38 per average car exported unboxed. On trucks unboxed, and on passenger cars and trucks boxed, the savings should be slightly lower, as indicated in table A-14, which shows the rail cost per hundred pounds. On unboxed trucks of the average weight of 3,400 pounds, the saving would amount to \$23.80. On shipments of passenger cars, as well as trucks boxed, for which the average weight was given as 4,600 pounds, the saving would be \$22.08.

In table A-13, the potential estimated weight of passenger cars and trucks, shipped unboxed and boxed from the tributary area, was 471,390,000 pounds. In table A-17, the corresponding savings per hundred pounds of passenger cars, boxed and unboxed, trucks, boxed and unboxed, and parts and accessories are applied to the total weights estimated to be available for shipment from the tributary area during the open season, on the basis of 1928 to 1937 averages. Assuming rail rates in force in 1940 and projected Seaway rates on the basis of extending August 1939 rates from Atlantic ports to foreign destinations into the Great Lakes ports, principally Detroit, we obtain a total saving of \$3,616,405 on shipments of passenger cars and trucks, and \$633,931 on shipments of parts and

accessories, or a total of \$4,250,336. If exports of automobiles to Canada, Africa, Oceania, and United States possessions are not considered potential tonnage then the estimated savings on this traffic may be reduced by 31 percent. Making a similar allowance in the case of parts and accessories, including one-half of the exports to Canada, would reduce estimated savings by 42 percent. With these deductions, the estimated potential savings on export trade of 200,930 tons would be as follows:

	<i>Short tons</i>	<i>Savings</i>
Automobiles.....	162, 630	\$2, 495, 319
Parts and accessories.....	38, 300	367, 680
Total.....	200, 930	2, 862, 999

These figures do not include any possible savings as a result of simplification of shipment operations where manufacturers and middlemen can supervise delivery of their consignments to shipboard. It is true that at New York certain services are available. Only on the Jersey side are there facilities for delivering rail shipments direct to wharf. Consequently, almost everything has to be transferred from rail to steamer either by lighter or truck. On carload shipments the railroad delivers to the wharf as part of its inland freight charge. On less than carload shipments the cost of transfer must be paid for as an extra. This puts a heavy burden on the L. C. L. shipment, of which there is a great and increasing volume. Furthermore, this transfer must be arranged for and supervised by a local agent, usually a forwarder, and his services also must be added to the cost. These encumbrances would not be present if shipments could be made direct from Detroit, and thus additional savings could be affected.

Similarly considerable savings may result by an increase in the proportion of shipments unboxed. If these occur, there may be additional savings ranging between \$40 and \$100 per car.

Section 5

POTENTIAL COASTWISE MOVEMENT OF AUTOMOBILES VIA THE ST. LAWRENCE SEAWAY

Hitherto we have considered only the potential traffic by the Seaway destined for export trade. A more important advantage in the construction of the Seaway may be found in the coastwise shipment of automobiles, both passenger cars and trucks, from the tributary area, principally Detroit, to Atlantic, Gulf, and Pacific coast ports. It is a well-known fact that shipments to Pacific coast ports now move by water, principally through New York, having traveled the distance from Detroit to New York either by train by or a combination of lake carrier to Buffalo and rail or haulaway to New York. Indeed, the results of an investigation conducted by the Interstate Commerce Commission through questionnaires addressed to carriers, covering the year 1938, indicate that a considerable part of automobile traffic from Detroit moves to New York by highway (haulaway) or a combination of water and highway. There is also some traffic by driveaway-towbar. Manufacturers and dealers have resorted to these latter means of transportation for as little saving as 10 or 15 cents per hundred pounds, which, for an ordinary passenger car, would amount to a saving of about \$5.²

On the basis of rail rates in effect in the spring of 1940, a car of 3,300 pounds would cost \$49.17 to transport to Portland, Maine, \$44.22 to Boston, Mass., \$41.58 to New Haven, Conn., \$39.93 to New York, \$39.27 to Philadelphia, and \$38.94 to Baltimore. On the basis of 3,400 pounds, an average truck would cost

² I. C. C. Docket No. 28,190, *Transportation of New Automobiles*.

\$26.52 to transport to Portland, Maine, \$25.16 to Boston, Mass., \$24.48 to New Haven, Conn., \$23.80 to New York or Philadelphia, and \$22.78 to Baltimore, Md. The costs to other points farther removed in the South Atlantic States, the Gulf States, and West Coast States, of course, are correspondingly higher. To Jacksonville, Fla., an average passenger car would cost about \$75 to ship by rail. To Houston, Tex., it would cost nearly \$96, and to Pacific coast ports, \$168.96.

Competitive with these rail rates to coastal points combination routes are used in order to reduce the total cost of transportation. As pointed out above, cars are shipped to New York and Baltimore by rail, by combination lake carrier-rail, and by direct drive-away or haul-away, or by combination Lake carrier and drive-away or haul-away. Then, at these ports, cars are placed upon coastwise ships to be sent down south and through the Panama Canal to the west coast. In these ways shippers of automobiles have been able to save as much as \$34 in the shipment of passenger cars to the west coast, and lesser amounts to intermediate points on the South Atlantic and Gulf coasts. For reasons of economy, apparently, New York, Philadelphia, and Baltimore have developed considerable coastwise traffic in motor vehicles. These three ports, in 1937, shipped 62,000 tons of motor vehicle freight in coastwise trade.³ Approximately one-half of this tonnage moved to ports on the Pacific coast, but in neither case is it possible to break down the figures as between new and used cars.

At what rates comparable with existing direct-rail rates and rail-water combination rates would it be possible for shipping services operating via the St. Lawrence to transport this traffic direct? At present, all-water rates are established between Baltimore and New York, on the one hand, and such other points as Charleston, S. C.; Savannah, Ga.; Jacksonville, and Tampa, Fla.; Mobile, Ala.; New Orleans, La.; Houston, Tex.; and Pacific coast ports. The rates to some of these points on passenger cars are given in table A-18. It will be observed there that from New York or Baltimore to Jacksonville, Fla., and Tampa, Fla., the rates are 88 and 93 cents, respectively. To Mobile, New Orleans, and Houston, the rate is uniformly \$1.10 per hundred pounds; and to all West coast ports, over a range of nearly 1,500 miles from Los Angeles, Calif., to Seattle, Wash., the rate is \$2.84 per hundred pounds.

On trucks, the coastwise rates (see table A-9) from New York are—to Jacksonville, 72 cents; to Mobile, Ala., New Orleans, and Houston, \$1.10; and to Pacific coast ports, \$1.75. In other words, uniform rates are applicable to all important Gulf coast ports and to all principal Pacific coast ports regardless of varying distances to New York and Baltimore.

In short, passenger cars weighing 3,300 pounds are carried to South Atlantic ports, for \$29.04, to Gulf coast ports for \$36.30, and to Pacific coast ports for \$93.72. It is also known that passenger cars are shipped from Detroit to Lake Superior points for about \$10 and \$15 per car. In view of the fact that, depending on the weight, it costs approximately \$40 per passenger car to transport by rail from Detroit to New York or Baltimore, and higher figures when shipped from Kenosha, Wis., or South Bend, Ind., and even from Toledo, Ohio, and in view of the fact that manufacturers and dealers take to the roads rather than the rails for savings of 4 or 5 dollars per car, it would seem that shipment via the St. Lawrence in coastwise trade would provide attractive possibilities of savings to the manufacturers and traffic in sufficient quantities at profitable rates for shipping lines. It is not beyond the range of possibility that for a surcharge of as much as \$30 per car over the effective rates from New York, shipping lines would be glad to pick up this traffic at Detroit. This would mean practically doubling their revenues where shipments to South Atlantic and Gulf ports are concerned, and adding 50

³ Chief of Engineers, U. S. Army, *Water-borne Commerce of the United States, 1937.*

percent to their revenues on shipments to the Pacific coast. This same advantage would be present in the shipment of trucks, as shown in table A-19, just as in the case of passenger cars.

What is the potential traffic likely to be during the open season in coastwise movement of automobiles? In estimating this traffic, one must have two important considerations in mind. In the first place, competitive rail rates could not be improved upon by any feasible Seaway rate for points removed from the coastal trading areas. This consideration restricts the availability of traffic by the Seaway to shipments which are destined for the coastal plains on the Atlantic, Gulf, and Pacific coasts. To go any distance into the interior from these ports would require an additional expense of hauling or shipping by rail, which would soon eliminate the advantage of the Seaway because of competitive direct rail rates to such interior points. The second consideration is the fact that two of the principal producers of automobiles have established assembly plants covering the principal areas of the country. These companies transport mainly automobile parts for assembly. It is not likely that automobile parts for assembly and automobile parts and accessories for replacement will move over the Seaway, because already the rail rates applicable to these commodities between Detroit and New York or Baltimore are at a comparatively low level. From Detroit to New York the rate on auto parts is 48 cents per hundredweight. Therefore, those companies which have assembly plants at strategic places, and which ship from the main producing area near the Great Lakes only parts for assembly, may not utilize the Seaway. At least one of these companies claims that it will not do so. No word from the other of these two major companies was received. Consequently, any estimate of potential traffic should leave out the possible shipment of cars by these firms. The estimated potential traffic on the Atlantic, Gulf, and Pacific coasts in new passenger cars and trucks, which is presented in tables A-20 and A-21, eliminates the new passenger cars and trucks produced by these two major manufacturers in the automobile industry.

For all the other manufacturers, the average registration of new cars for the 10-year period 1929-38 was taken. Since the registration of cars manufactured by these two principal producers in the industry were eliminated from the total, no correction was made, as in the case of foreign exports, to allow for production outside of the tributary area, because the 14.5 percent of the industry outside of the tributary area reported by the census includes assembly plants. Having disregarded the contribution of these assembly plants to the new car registration of the particular States taken into account, it was assumed that the remainder of the industry would be located in major part in the tributary area. Hence, the total registration of new cars of all automobile producers other than cars manufactured by these two producers was considered as originating in the tributary area.

To this figure a correction for seasonality of new registration to segregate shipments during the open season was made. An examination of all registration of new cars during the months May to November inclusive indicated that 60 percent of new cars are registered during those months. Hence, 60 percent of the total new car registrations were taken to indicate potential number of cars which might be shipped via the St. Lawrence.

The resultant figure, which is in the second column of table A-20, was again corrected to take only such portion of these registrations as might take advantage of water transportation by virtue of their sale within easy access of Atlantic or Gulf ports. In the case of Florida and the Pacific Coast States, 100 percent of all registrations of the particular makes of cars taken into the calculations were considered. For Maine, Massachusetts, Rhode Island, Connecticut, and New Jersey, 75 percent is the factor adopted. For New York and Pennsylvania, correction was made to eliminate the western parts of those States, taking only

the eastern metropolitan markets as potential tributary markets for St. Lawrence shipments. This correction was made on the basis of the relative population of the eastern metropolitan trading areas to the total for the State. In the case of New York, this factor was 66 percent of the total for the State, and in the case of Pennsylvania, 28 percent. Similar corrections were made for other States assumed as likely to be markets. Then, applying an average weight per passenger car of 3,300 pounds, a total weight was obtained. This amounts to about 643 million pounds, or 321,500 tons.

In a similar fashion, the potential traffic in assembled trucks was estimated. This is shown in table A-21. In this case, too, the production of the particular manufacturers which have assembly plants outside the tributary area were eliminated. After application of the correction factors for seasonality, and to limit the territorial area to the markets immediately adjacent to ports on the Atlantic and the Gulf coasts, a total traffic of slightly over 74 million pounds or 37,000 short tons was obtained. The total potential tonnage available for coastwise shipment of assembled passenger cars and trucks, therefore, amounts to 358,500 short tons.

On the basis of average registration figures of new cars, corrected for seasonality, during the years 1929 to 1938, this is deemed to be very conservative since it not only excludes two of the principal producers in the industry and shipments of parts and accessories both for assembly and replacement, but it also is based on the average of a number of years during which economic conditions were considered by all informed students as far below normal; in fact, the period 1929 to 1938 includes only 2 peak years—1929 and 1937—and 4 or 5 very depressed years. On this basis, one may consider 358,500 tons of traffic as practically a minimum available tonnage in coastwise shipments.

Section 6

POTENTIAL SAVINGS ON AVAILABLE COASTWISE TRAFFIC IN AUTOMOBILES VIA THE ST. LAWRENCE SEAWAY

The savings on this traffic, of course, will be determined by the rates that would be established competitively by the shipping lines. In view of the uniformity of rates habitually maintained by shipping lines over a wide area, such as the west coast ports and the Gulf ports, it is assumed that shipping lines would be induced to take a cargo of passenger cars and trucks at Detroit for rates which, compared with other routes, are substantial and reasonable, and which, added to the existing rates in effect from New York, would increase their revenues sufficiently to justify the trip into the Great Lakes. It is not possible to state definitely what this rate will be. For the traffic terminating in the North Atlantic ports, one may apply a practice of shipping lines differentiating their rates from rail rates by 20 percent. One may assume, therefore, that applying this relationship of shipping rates to rail rates, 80 percent of the existing rail rates would be a satisfactory compensation. Therefore, 80 percent of the rate from Detroit to Portland, Boston, Providence, New Haven, New York, and Philadelphia, may be considered a satisfactory rate for traffic terminating at those ports. This, in effect, would mean that the shippers would be able to save 20 percent of the present cost of rail haul, both in passenger cars and trucks assembled. This would give a rate per average car of about \$30. Likewise, in developing a possible Seaway rate to Southern and Pacific Coast points, 80 percent of the rail rate to Baltimore, which is the lowest rate between Detroit and any North Atlantic port, has been combined with the existing water rate out of Baltimore to such points, as shown in tables A-18 and A-19. The unit savings as shown in these tables are determined by comparing

the estimated Seaway rate with the all-rail rate to ports on the South Atlantic, Gulf and Pacific coasts. Available data covering waterborne commerce between the Atlantic and Pacific coasts show actual shipments of vehicles from New York, Philadelphia, and Baltimore, for example, to ports in California, Oregon and Washington. From these data it is estimated that the traffic averaged annually about 23,000 units during the period 1933-38. Here again it is not possible to differentiate between new and used units or between manufacturers, but in an effort not to overstate possible Seaway transportation cost reductions, the registration figures shown in the first column of tables A-20 and A-21 have been reduced by 21,000 passenger cars and 2,000 trucks, respectively, before applying a comparison of the possible Seaway rate with the all-rail rate.

Estimating potential savings on the available traffic on the basis of these considerations, tables A-20 and A-21 show that there is a possible saving of \$3,671,000 in passenger cars and a saving of \$323,000 on traffic in trucks, or a total saving of \$3,994,000 roughly \$4,000,000.

Section 7

THE ATTITUDE OF THE AUTOMOBILE MANUFACTURERS

The question arises: Will the automobile manufacturers and manufacturers of automobile parts use the St. Lawrence Seaway if it becomes available? It is significant that all but two of the principal manufacturers of automobiles expressed the opinion to representatives of this Survey that they would use the Seaway if it provided convenient shipping services and if it lowered the cost of transportation. Of the two remaining companies, one did not supply any information and the other, a major producer, which has assembly plants all over the United States, was definitely opposed. Even this latter company, however, in 1939 used the 14-foot canals on the St. Lawrence to export the products of a Canadian plant to the United States, because, as it stated, "it was the cheapest, quickest, and most direct route."

The comments of other manufacturers were quite informative. One small manufacturer of automobiles stated: "The major portion of the business could be routed via the St. Lawrence Waterway, providing that the cost would be the same or lower than rail or driveaway cost." A major manufacturer of motor trucks stated that it would use the St. Lawrence Waterway even for a saving of 5 cents per hundredweight of freight. A manufacturer of trailers commented: "Any appreciable reduction from present average rate would be the deciding factor on routing of future traffic." Another independent manufacturer of automobiles stated that it would be inclined to use the Waterway if it could obtain "approximately 15 percent saving in rates" which it had been paying. This manufacturer added, however, that "if the service and handling were good, no saving would be necessary to induce use of the St. Lawrence." An important independent producer stated that in the domestic shipments it would require a saving of at least \$5 per automobile, which would be about 15 cents per hundredweight. A large manufacturer of motor trucks stated that it would be led to use the Seaway for a saving of "about 50 percent of present rail rates, the same as in Europe, to justify cost of storage, advance manufacture, extra handling, et cetera." Another manufacturer of motor trucks stated that to use the Seaway, "assuming that services of Waterway lines will be comparable with those of lines operating from New York, no savings are necessary." A manufacturer of automobile wheel rims stated that he would use the Seaway for a saving of at least 10 cents a hundredweight. Another manufacturer of automotive parts agreed that he would consider using

the Seaway for a saving of "one-half carload rate to New York." A manufacturer of automobile axles stated "that it would be induced to use the Seaway in cases where time was not a factor for a differential of between 10 and 15 cents per hundredweight."

As a whole, therefore, one is led to the conclusion that there are no insuperable difficulties to the use of the Seaway by manufacturers of automobiles and automobile parts and accessories. The one case of definite opposition found among the automobile manufacturers is perhaps partly explained by the fact that it already enjoys an advantage over other producers insofar as it has assembly plants on the eastern coast, from which both foreign and domestic shipments of completed cars are made. As the rail rates on parts and accessories are nearly one-third as high as those on completed cars per hundred pounds, this producer has a definite competitive advantage over others in the industry. Hence, any move that will lower the cost of transportation of the completed cars to any of its competitors could not be considered a favorable development from their point of view. In the light of the analysis presented in this study, however, one must conclude that the major portion of the automobile industry can look forward to advantages in lower cost of transportation when the Seaway is constructed. Since they have expressed a willingness to utilize the Seaway for rather modest differentials in the cost of transportation, in comparison with existing routes, one must conclude, therefore, that the major portion of the automobile industry and producers of parts and accessories would utilize the Waterway.

The final question to consider is: Who is likely to benefit by the lower cost of transportation provided by the St. Lawrence Seaway? In the foreign field, this question is hard to answer in the light of policies crystallized in the recent past, where advantages enjoyed by American manufacturers utilizing mass-production methods have often been upset by quota and tariff regulations. If the American exporters could save as much as 30 or 40 dollars per car on the export trade, one should assume that their sales abroad would be stimulated. However, if these savings are not passed on to the foreign consumer, then naturally the profits on the export trade of these producers would be enhanced by the amount of saving in transportation costs. This additional profit would naturally be available to the stockholders, or could be distributed in benefits to the workers employed by the industry.

The problem is slightly more complicated in the case of domestic shipments, because the industry has been in the habit of pricing its products f. o. b. factory, plus rail costs. This is done even in those cases where the cars are hauled away by truck or driven away from factory to market. If the Seaway were usable 12 months of the year, then it is conceivable that this method of pricing might be changed to a basis of f. o. b. factory plus actual transportation costs. In this case, in an industry as competitive as the automobile industry, the advantage of the lower cost of transportation via the Seaway would be passed on to the customers in those areas which could take advantage of the lower cost of cars brought through the St. Lawrence, such as those located on the west coast or in Florida and Atlantic and Gulf coasts. However, the seasonality of the St. Lawrence would probably make this scheme impractical, since it would be difficult to establish dual scales of prices on the same cars for summer and winter delivery. Hence, if the present scheme of pricing f. o. b. Detroit plus rail is maintained, one would expect the profits of the producing companies to be substantially augmented by the saving in transportation costs. This does not mean, however, that the consumers would not benefit by the Seaway. The probable effect of the higher profits obtained by the companies in a fiercely competitive industry such as this would in all likelihood lead to lower prices on all deliveries throughout the country. The

savings might be evenly spread on all sales. In other words, the savings in transportation costs effected by the St. Lawrence Seaway could be passed on to every purchaser of automobiles throughout the United States.

TABLE A-1

Motor vehicles: Number of establishments, wage earners, wages, and value of products—1937

States	Establishments	Wage earners ¹	Wages	Value of products
United States.....	131	194,527	\$316,141,000	\$3,096,219,000
Indiana.....	11	11,279	18,499,000	188,594,000
Michigan.....	27	121,312	203,344,000	1,613,226,000
City of Detroit.....	13	53,366	90,077,000	746,833,000
Remainder of State.....	14	67,946	113,267,000	866,393,000
Ohio.....	15	12,811	21,390,000	167,917,000
Pennsylvania.....	8	7,191	9,868,000	76,241,000
Other States ²	70	41,934	63,040,000	1,050,241,000

PERCENTAGES

States	Establishments	Wage earners ¹	Wages	Value of products
United States.....	100.00	100.00	100.00	100.00
Indiana.....	8.40	5.80	5.85	6.09
Michigan.....	20.61	62.36	64.32	52.10
City of Detroit.....	9.92	27.43	28.49	24.12
Remainder of State.....	10.69	34.93	35.83	27.98
Ohio.....	11.45	6.59	6.77	5.43
Pennsylvania.....	6.11	3.70	3.12	2.46
Other States ²	53.43	21.55	19.94	33.92

¹ Average for the year.

² California, Colorado, Connecticut, Delaware, Georgia, Illinois, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Missouri, New Jersey, New York, North Carolina, Tennessee, Texas, Virginia, Washington, Wisconsin.

SOURCE: *Census of Manufactures, 1937.*

TABLE A-2

Motor-vehicle bodies and parts: Number of establishments, wage earners, wages, and value of products—1937

States	Establishments	Wage earners ¹	Wages	Value of products
United States.....	936	284,814	\$439,940,000	\$2,080,018,000
Illinois.....	83	5,804	7,174,000	35,114,000
Indiana.....	56	21,281	29,514,000	131,260,000
Iowa.....	11	188	212,000	754,000
Kansas.....	8	139	136,000	605,000
Michigan.....	150	176,165	285,147,000	1,313,376,000
City of Detroit.....	63	58,349	99,343,000	446,488,000
Remainder of State.....	87	117,816	185,804,000	866,888,000
Minnesota.....	21	819	1,063,000	4,539,000
New York.....	105	15,052	21,598,000	114,924,000
Ohio.....	81	28,366	42,528,000	206,134,000
Pennsylvania.....	60	9,009	13,098,000	49,904,000
Wisconsin.....	32	13,284	19,793,000	90,701,000
Other States ¹	329	14,707	19,677,000	132,707,000

See footnotes at end of table.

TABLE A-2—Continued

Motor-vehicle bodies and parts: Number of establishments, wage earners, wages, and value of products—1937—Continued

PERCENTAGES

States	Establishments	Wage earners ¹	Wages	Value of products
United States.....	100.00	100.00	100.00	100.00
Illinois.....	8.87	2.04	1.63	1.69
Indiana.....	5.98	7.47	6.71	6.31
Iowa.....	1.18	.07	.05	.04
Kansas.....	.85	.05	.03	.03
Michigan.....	16.03	61.85	64.81	63.14
City of Detroit.....	6.73	20.49	22.58	21.46
Remainder of State.....	9.30	41.36	42.23	41.68
Minnesota.....	2.24	.29	.24	.22
New York.....	11.22	5.28	4.91	5.52
Ohio.....	8.65	9.96	9.67	9.91
Pennsylvania.....	6.41	3.16	2.98	2.40
Wisconsin.....	3.42	4.66	4.50	4.36
Other States ²	35.15	5.17	4.47	6.38

¹ Average for the year.

² Montana, Nevada, New Mexico, Vermont, and Wyoming did not report any establishments.

SOURCE: *Census of Manufactures, 1937, p. 1211.*

TABLE A-3

United States factory sales of passenger cars and trucks, 1921-39

Year	Passenger cars	Trucks	Total	Year	Passenger cars	Trucks	Total
1921.....	1,468,067	148,052	1,616,119	1931.....	1,973,090	416,648	2,389,738
1922.....	2,274,185	269,991	2,544,176	1932.....	1,135,491	235,187	1,370,678
1923.....	3,624,717	409,295	4,034,012	1933.....	1,573,512	346,545	1,920,057
1924.....	3,185,851	418,659	3,602,540	1934.....	2,177,919	575,192	2,753,111
1925.....	3,735,171	530,659	4,265,830	1935.....	3,252,244	694,690	3,946,934
1926.....	3,783,987	516,947	4,300,934	1936.....	3,669,528	784,587	4,454,115
1927.....	2,936,533	464,793	3,401,326	1937.....	3,915,889	893,085	4,808,974
1928.....	3,815,417	543,342	4,358,759	1938.....	2,000,985	488,100	2,489,085
1929.....	4,587,400	771,020	5,358,420	1939.....	2,866,796	710,496	3,577,292
1930.....	2,784,745	571,241	3,355,986	Average, 1928-37.....	2,888,524	583,154	3,471,678

SOURCE: Department of Commerce, *Current Statistical Service*.

TABLE A-4

Sales of automobile parts and accessories, 1928-38

[Thousands of dollars]

Year	For original installation	For replacement	Total	Year	For original installation	For replacement	Total
1928.....	632,000	613,000	1,245,000	1934.....	341,660	514,000	855,660
1929.....	669,920	643,650	1,313,570	1935.....	442,147	580,446	1,022,593
1930.....	392,833	511,181	904,014	1936.....	535,936	654,725	1,190,661
1931.....	261,888	403,833	665,721	1937.....	592,350	698,055	1,290,405
1932.....	155,327	372,142	527,469	1938.....	(¹)	506,645	.....
1933.....	195,617	418,464	614,081	Average, 1928-37.....	421,968	540,949	962,917

¹ Not available.

SOURCE: Automobile Manufacturers' Association, Inc., *Automobile Facts and Figures*

TABLE A-5
*United States exports of passenger cars and trucks, 1921-39*¹

Year	Passenger car exports		Truck exports		Total exports	
	Number	Percent of total United States factory sales	Number	Percent of total United States factory sales	Number	Percent of total United States factory sales
1921	30,950	2.1	7,840	5.3	38,790	2.4
1922	66,791	2.9	11,443	4.2	78,234	3.1
1923	127,035	3.5	24,859	6.1	151,894	3.8
1924	151,380	4.8	27,352	6.6	178,732	5.0
1925	244,306	6.5	58,625	11.0	302,931	7.1
1926	238,540	6.3	66,880	12.9	305,420	7.1
1927	278,748	9.5	105,447	22.7	384,195	11.3
1928	368,329	9.7	138,768	25.5	507,097	11.6
1929	339,447	7.4	196,760	25.5	536,207	10.0
1930	153,069	5.5	84,512	14.3	237,581	7.1
1931	82,457	4.2	48,248	11.6	130,705	5.5
1932	40,656	2.6	24,837	10.6	65,493	4.8
1933	63,754	4.1	43,277	12.5	107,031	5.6
1934	143,914	6.6	92,397	16.1	236,311	8.6
1935	172,572	5.3	98,811	14.2	271,383	6.9
1936	179,957	4.9	105,800	13.5	285,757	6.4
1937	229,486	5.9	165,713	18.6	395,199	8.2
1938	161,612	8.1	115,597	23.7	277,209	11.1
1939	143,909	5.0	116,913	16.5	260,822	7.3
Average, 1928-37	177,364	6.1	99,912	17.1	277,276	8.0

¹ Exports do not include units assembled abroad and exported as "parts for assembly."

SOURCE: Release of October 1939, Automotive-Aeronautics Trade Division, Department of Commerce.

TABLE A-6
United States exports of automobile parts and accessories, 1924-38

[Thousands of dollars]

Year	Automobile parts	Automobile accessories	Automobile engines	Asbestos brake linings	Total
1924	66,940	6,821	4,188	(¹)	77,949
1925	67,748	8,611	15,290	863	92,512
1926	74,610	9,279	12,526	1,040	97,455
1927	91,472	7,874	10,886	379	110,611
1928	122,755	9,281	13,028	1,422	146,484
1929	173,703	9,406	10,216	1,521	194,846
1930	106,062	5,544	5,626	1,372	118,604
1931	67,431	3,218	2,370	1,140	74,157
1932	37,326	1,753	1,870	696	41,645
1933	35,109	1,845	1,463	725	39,142
1934	62,676	3,123	1,952	862	68,613
1935	75,147	3,586	3,001	882	82,616
1936	71,856	4,031	5,658	1,025	82,570
1937	96,495	5,292	9,041	1,114	111,942
1938	87,042	4,198	6,099	920	98,259
Average, 1928-37	84,856	4,708	5,422	1,076	96,062

¹ Not specified.

² Advance data. Does not include shipments to Virgin Islands.

SOURCE: *Foreign Commerce and Navigation of the United States, 1924-38*, as summarized by the Bureau of the Census *Statistical Abstract of the United States, 1939*.

TABLE A-7

Average annual exports of motor vehicles,¹ by continents, 1928-37

Continent	Trucks and buses	Percent of total	Passenger cars	Percent of total	Total	Percent of total
Europe.....	30,092	29.67	51,888	28.32	81,980	28.80
Canada.....	2,721	2.68	14,015	7.65	16,736	5.88
Southern North America.....	6,591	6.50	13,315	7.27	19,906	6.99
South America.....	19,628	19.35	31,107	16.97	50,735	17.82
Asia.....	20,841	20.55	22,029	12.02	42,870	15.06
Oceania ²	9,742	9.61	20,008	10.92	29,750	10.45
Africa.....	10,248	10.11	24,889	13.58	35,137	12.85
United States possessions.....	1,550	1.53	5,994	3.27	7,544	2.65
Total.....	101,413	100.00	183,245	100.00	284,658	100.00

¹ Includes chassis.² Includes British and French Oceania, Australia and New Zealand for 1928 and 1929; from 1930-37 includes Australia and New Zealand only.

SOURCE: Computed from figures of the Department of Commerce, Automotive-Aeronautics Trade Division.

TABLE A-8

United States exports of automobile parts and accessories, by regions, 1933-38

[Thousands of dollars]

Destination	1933	1934	1935	1936	1937	1938	Average	
							1933-38	Percent of total
Europe.....	10,934	16,405	20,529	20,037	28,004	28,318	20,705	25.68
Northern North America.....	12,509	24,465	29,376	30,292	36,607	26,293	26,590	32.97
Southern North America.....	1,786	2,928	3,867	4,827	6,953	4,717	4,180	5.18
South America.....	4,728	8,077	10,254	11,751	19,225	18,980	12,169	15.09
Asia.....	5,220	9,780	9,295	9,121	12,703	12,910	9,838	12.20
Oceania.....	830	1,964	2,503	2,070	2,531	2,177	2,013	2.50
Africa.....	1,668	3,036	3,792	4,397	5,949	4,865	3,951	4.90
U. S. possessions.....	864	987	1,060	1,153	1,514	1,572	1,190	1.48
Total.....	38,539	67,642	80,666	83,648	113,486	99,832	80,636	100.00

Source: Department of Commerce, Automotive-Aeronautics Trade Division.

TABLE A-9

Total United States exports of passenger cars, trucks, and parts for assembly, 1936-39, compared with exports during open season of navigation.

Type	Total	May-November, inclusive	Percent of total
Passenger cars.....number..	708,921	337,989	47.68
Trucks.....do.....	501,773	265,532	52.92
Parts for assembly.....value..	\$184,651,233	\$89,072,336	48.24

SOURCE: Automotive-Aeronautics Trade Division, Department of Commerce.

TABLE A-10

Estimated average exports of passenger cars, trucks, and accessories from the Great Lakes tributary area

Type	Average annual exports, 1928-37	Exports in season, percent of total 1936-39 average	Exports in season 1928-37 average
Passenger cars.....	<i>Number</i> 177,364	<i>Percent</i> 47.68	<i>Number</i> 84,567
Trucks.....	99,912	52.92	52,873
Total.....	277,276		137,440
Parts and accessories.....	<i>Value</i> \$96,062,000	48.24	<i>Value</i> \$46,340,000

SOURCE: Based on Department of Commerce figures.

TABLE A-11

Average weight of cars exported

[Pounds]

Motorcar manufacturer	Passenger cars		Trucks		Motorcar manufacturer	Passenger cars		Trucks	
	Unboxed	Boxed	Unboxed	Boxed		Unboxed	Boxed	Unboxed	Boxed
A.....	2,965	4,265	2,945	4,060	D.....	3,100	4,500	3,700	4,350
B.....	3,000	4,700	3,800	5,000	E.....	3,420	4,820	3,390	4,800
C.....	3,300	5,000							

TABLE A-12

Proportion of cars exported, boxed and unboxed

Motorcar manufacturer	Passenger cars		Trucks		Motorcar manufacturer	Passenger cars		Trucks	
	Boxed	Unboxed	Boxed	Unboxed		Boxed	Unboxed	Boxed	Unboxed
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>		<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
A.....	75	25	40	60	D.....	65	35	75	25
B.....	40	60	80	20	E.....	30	70	73	27
C.....	40	60							

TABLE A-13

Estimated weight of passenger cars and trucks, boxed and unboxed, on the basis of 1928-37 open-season exports

Type	Average open-season exports 1928-38	Average weight	Total weight	Exports from tributary area, 85.5 percent of total United States
Passenger cars:	<i>Number</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Unboxed (58 percent).....	49, 049	3, 300	161, 861, 700	138, 391, 753
Boxed (42 percent).....	35, 518	4, 600	163, 382, 800	139, 692, 294
Total.....	84, 567		325, 244, 500	278, 084, 047
Trucks:				
Unboxed (27 percent).....	14, 276	3, 400	48, 538, 400	41, 500, 332
Boxed (73 percent).....	38, 597	4, 600	177, 550, 800	151, 806, 934
Total.....	52, 873		226, 089, 200	193, 307, 266
Total.....	137, 440		551, 333, 700	471, 391, 313
Net St. Lawrence traffic ¹			380, 420, 253	325, 259, 316

¹ Deduction of 31 percent from the total weight (551,333,700 pounds) column 3, represents total percentage of exports during 1928-37 destined to Canada, Africa, Oceania, and United States possessions, as shown in table A-7.

TABLE A-14

All rail export rates on passenger cars and trucks

[Cents per hundred pounds]

From--	To New York, N. Y.				
	Passenger cars (set up)	Trucks (set up)	Passenger cars (boxed)	Trucks (boxed)	Auto parts in packages
Kenosha, Wis.....	153	(¹)	62	(¹)	62
Lansing, Mich.....	128	76	57	57	57
Flint, Mich.....	125	74	54	54	54
Pontiac, Mich.....	125	74	51	51	51
Detroit, Mich.....	121	70	48	48	48
South Bend, Ind.....	136	80	58	58	58

¹ No trucks manufactured.

TARIFF AUTHORITY: JONES I. C. C. 3192-3372.

TABLE A-15

Ocean rates on passenger cars and trucks to foreign destinations, 1939

[Dollars per hundred pounds]

New York	Passenger cars	Trucks	New York	Passenger cars	Trucks
United Kingdom.....	\$3. 44	\$2. 34	Capetown.....	3. 57	2. 63
Hamburg-Bremen-Trieste.....	3. 36	2. 25	Rangoon - Colombo - Calcutta -		
Baltic base ports.....	3. 28	2. 20	Bombay-Karachi.....	3. 72	2. 63
Marseilles and other Mediter-			Madras.....	4. 43	3. 29
anean ports.....	3. 72	2. 50	Fersian Gulf.....	4. 80	3. 62
French Atlantic.....	3. 08	2. 00	Manila-Hong Kong.....	4. 46	3. 12
Antwerp-Rotterdam-Amsterdam.....	3. 08	2. 04	Shanghai.....	4. 65	3. 39
Rio de Janeiro-Santos-Montevi-			Kobe-Osaka-Yokohama.....	4. 28	2. 96
deo-Buenos Aires.....	4. 06	2. 96	Tampico.....	1. 75	1. 75
Maracaibo.....	3. 25	2. 25	Vera Cruz.....	1. 75	1. 75

TABLE A-16

Ocean freight rates on automobiles, unboxed,¹ quarterly, 1935-39

Year and quarter	From New York		Year and quarter	From New York	
	To Hamburg and Bremen	To Antwerp, Rotterdam, and Amsterdam		To Hamburg and Bremen	To Antwerp, Rotterdam, and Amsterdam
1935:			1938:		
First.....	\$3.58	\$3.29	First.....	4.00	3.72
Second.....	3.58	3.29	Second.....	4.00	3.72
Third.....	3.58	3.29	Third.....	4.00	3.72
Fourth.....	3.58	3.29	Fourth.....	3.36	3.08
1936:			1939:		
First.....	3.58	3.29	First.....	3.36	3.08
Second.....	3.58	3.29	Second.....	3.36	3.08
Third.....	3.58	3.29	Third.....	3.36	3.08
Fourth.....	3.58	3.29	Fourth.....		
1937:					
First.....	3.58	3.29			
Second.....	3.29	3.29			
Third.....	3.29	3.29			
Fourth.....	4.00	3.72			

¹ Tariff rates quoted in cents per cubic foot. Converted to dollars per 100 pounds—conversion factor 14.3 cubic feet per 100 pounds.

SOURCE: North Atlantic Continental Freight Tariff No. 15.

TABLE A-17

Potential savings on export shipments of passenger cars, trucks, parts and accessories, via the St. Lawrence Seaway

Type	Exports from tributary area, 85.5 percent of United States total	Savings per 100 pounds	Total potential savings
Passenger cars:	<i>Pounds</i>	<i>Dollars</i>	<i>Dollars</i>
Boxed.....	138,391,753	0.480	664,280
Unboxed.....	139,692,294	1.210	1,690,276
Trucks:			
Boxed.....	41,500,332	.480	199,201
Unboxed.....	151,806,934	.700	1,062,648
Total cars.....	471,391,313		3,616,405
Parts and accessories.....	132,069,000	.480	633,931
Grand total.....	603,460,313		4,250,336
Net potential savings:			
Total cars ¹	325,259,316		² 2,495,319
Parts and accessories ³	76,600,020		⁴ 367,680
Total net potential savings.....	401,859,336		2,862,999

¹ Deducting 31 percent of potential tonnage and saving from exports of passenger cars and trucks to allow for shipments to Canada, Africa, Oceania, and United States possessions.

² 3,616,405×0.69.

³ Same as under footnote 1 but 42 percent deducted from parts and accessories.

⁴ 633,931×0.58.

TABLE A-18

Rail, rail-water, and estimated St. Lawrence Seaway rates on coastwise movement of passenger automobiles

[Cents per 100 pounds]

Destination	All-rail from Detroit	Coastwise from New York or Baltimore	Rail-water via Baltimore	Estimated Seaway rate	Indicated savings	
					Over all-rail	Over rail-water
Portland, Maine.....	149			94	55	
Boston, Mass.....	134			94	40	
Providence, R. I.....	134			94	40	
New Haven, Conn.....	126			94	32	
New York, N. Y.....	121			94	27	
Trenton, N. J.....	120			94	26	
Philadelphia, Pa.....	119			94	25	
Jacksonville, Fla.....	227	88	206	182	45	24
Miami, Fla.....	297	152	270	246	61	24
Tampa, Fla.....	240	93	211	187	53	24
Mobile, Ala.....	241	110	¹ 230	204	37	26
New Orleans, La.....	263	110	228	204	59	24
Houston, Tex.....	291	110	228	204	87	24
Pacific coast ports.....	512	284	² 405	378	134	27

¹ Applies via Philadelphia.² Applies via New York.

TABLE A-19

Rail, rail-water, and estimated St. Lawrence Seaway rates on coastwise movement of trucks

[Cents per 100 pounds]

Destination	All-rail from Detroit	Coastwise from New York or Baltimore	Rail-water via Baltimore	Estimated Seaway rate	Indicated savings	
					Over all-rail	Over rail-water
Portland, Maine.....	78			54	24	
Boston, Mass.....	74			54	20	
Providence, R. I.....	74			54	20	
New Haven, Conn.....	72			54	18	
New York, N. Y.....	70			54	16	
Trenton, N. J.....	70			54	16	
Philadelphia, Pa.....	70			54	16	
Jacksonville, Fla.....	151	72	139	126	25	13
Miami, Fla.....	190	109½	178½	163½	28½	13
Tampa, Fla.....	172	93	160	147	25	13
Mobile, Ala.....	215	110	¹ 179	164	51	15
New Orleans, La.....	224	110	177	164	60	13
Houston, Tex.....	263	110	177	164	99	13
Pacific coast ports.....	319	175	² 245	229	90	16

¹ Applies from Philadelphia.² Applies from New York.

TABLE A-20

Potential traffic and savings on the coastwise movement of new passenger cars, based on 1933-38 registration figures

State	Registration of new cars, average 1933-38 ¹	Registration during open season 60 percent of total	Percent of open-season registration	Potential traffic		Potential savings	
				Number of cars	Weight in pounds (assumed weight per car, 3,300 lbs.)	Over all-rail (cents per 100 lbs.)	Total savings
Maine.....	7,656	4,594	75	3,446	11,374,275	55	\$62,559
Massachusetts.....	48,101	28,861	75	21,646	71,434,275	40	285,737
Rhode Island.....	8,284	4,970	75	3,728	12,302,400	40	49,210
Connecticut.....	21,743	13,046	75	9,785	32,290,500	32	103,330
New York.....	138,300	82,980	66	54,767	180,731,100	27	487,974
New Jersey.....	48,499	29,099	75	21,824	72,019,200	26	187,250
Pennsylvania.....	104,794	62,876	28	17,605	58,096,500	25	145,241
Florida.....	12,457	7,474	100	7,474	24,694,200	49	120,855
Alabama.....	8,128	4,877	16	780	2,574,600	37	9,526
Mississippi.....	4,394	2,636	18	474	1,664,200	37	5,787
Louisiana.....	8,863	5,319	48	2,553	8,424,900	59	49,706
Texas.....	42,523	25,514	20	5,103	16,839,900	87	146,507
Pacific Coast States ^{2,3}	76,018	45,611	100	45,611	150,516,300	134	2,016,918
Total.....	629,760	317,856	-----	194,796	642,832,350	-----	3,670,600

¹ Excluding manufactures by 2 major producers who have assembly plants outside the tributary area.

² Excluding 2 other makes in addition to those in footnote 1.

³ Excluding estimated receipts of passenger cars by water from New York, Philadelphia, and Baltimore.

Source: Computed from figures obtained from *Automotive Daily News*, 1935, for the year 1929; *Automotive News*, 1939, for the years 1930-38.

TABLE A-21

Potential traffic and savings on coastwise movement of new trucks, based on 1933-38 registration figures

State	Registration of new trucks, average 1933-38 ¹	Registration during open season 60 percent of total	Percent of open-season registration	Potential traffic		Potential savings	
				Number of trucks	Weight (lbs.)	Over all-rail (cents per 100 lbs.)	Total
Maine.....	922	553	75	415	1,411,000	24	\$3,386
Massachusetts.....	4,239	2,543	75	1,907	6,483,800	20	12,968
Rhode Island.....	679	407	75	306	1,040,400	20	2,081
Connecticut.....	2,417	1,450	75	1,088	3,699,200	18	6,659
New York.....	13,047	7,828	66	5,166	17,564,400	16	28,103
New Jersey.....	4,916	2,950	75	2,213	7,524,200	16	12,039
Pennsylvania.....	12,401	7,441	28	2,083	7,082,200	16	11,332
Florida.....	750	450	100	450	1,530,000	25	3,825
Alabama.....	1,098	1,199	16	192	652,800	51	3,329
Mississippi.....	1,307	838	18	151	513,400	51	2,618
Louisiana.....	1,750	1,050	48	504	1,713,600	60	10,281
Texas.....	7,284	4,370	20	874	2,971,600	99	29,419
Pacific Coast States ^{1,2}	10,717	6,430	100	6,430	21,862,000	90	196,768
Total.....	62,517	37,509	-----	21,779	74,049,600	-----	322,798

¹ Excluding manufactures by 2 major producers who have assembly plants outside the tributary area.

² Weight per truck: 3,400 pounds.

³ Excluding estimated receipts of trucks by water from New York, Philadelphia, and Baltimore.

Appendix B

GRAIN TRAFFIC

INTRODUCTION

In this report an attempt will be made to estimate the tonnage of traffic in grain products that might utilize the St. Lawrence Seaway when constructed, and the possible savings in transportation costs that might be realized. In previous studies dealing with the St. Lawrence Seaway, grains were given a prominent place, since the tributary area of the Great Lakes is the most important grain-producing area in the country. Previous estimates of available tonnage for shipment via the St. Lawrence were based, however, on statistics of export trade during the decade of the 1920's. At that time export trade in grain products was very substantial, though considerably lower than the preceding decade, which included the war years.

Since 1930, however, grain exports have declined very substantially in the same measure as other countries have encouraged policies of self-sufficiency in food products, and in the same degree as other regions of the world, such as South America and the Far East and Oceania, have increased their production and export of grain products.

This situation creates a considerable difficulty in the selection of a period in the past which may be utilized in a test study of available potential traffic. Not only have exports over the past decade diminished substantially, but the variations of exports from year to year in individual grain products have been violent. In the middle thirties we even imported certain grains. Hence the annual average exports for such a low export period as the 1930's would not give a statistically significant base figure to work with.

It is necessary, therefore, to examine production, exports, world output, and world trade in detail for each grain product, in order to determine recent conditions in export trade and to examine future traffic potentialities. This study of potential traffic in grains will include an analysis of exports of wheat, barley, corn, oats, and rye, in the form of grains or flour, meal and malt.

Section 1

EXPORTS OF GRAINS AND GRAIN PRODUCTS

Total exports of grains and grain products from 1918 to 1937, inclusive, are shown in table B-1. In this table flour and meal and malt are presented in equivalent bushels of their respective grains. The most important items of export in the past have been linseed cake and meal, wheat and flour, and corn and corn starch. Of all the grain products, linseed cake and meal are the only ones which have retained their importance as export commodities. However, this export trade originates on the Atlantic seaboard from the crushing of Argentine flaxseed by paint and oil producing concerns mainly located in the area between New York City and Philadelphia.

Exports of wheat declined steadily, after reaching 369 million bushels in 1920, to 131 million bushels in 1930 and 16 million in 1935. In 1937, however, exports of wheat and flour increased to 107 million bushels. This presumably was due to the stocking-up of food products by foreign countries preparing for war. Similarly, starch, including corn starch, reached a peak of 387 million pounds in 1921, and then declined steadily to a low of 33 million pounds in 1936. In 1937, again, exports of this product increased to 123 million pounds. Exports of corn and corn meal, never very important except in 1 or 2 years—such as 1921, when total exports jumped to a peak of 179 million bushels, and 1922, with 97 million bushels—declined in importance until in 1936 the exports were 553,000 bushels. In 1937, however, there was a very unusual spurt in exports, which reached 104 million bushels. This, too, would appear to have been due to the accumulation of food products in European countries.

Converted to equivalent tons by applying average conversion ratios from bushels to pounds for each product, the total tonnage of our exports of these seven products diminished from 15,466,000 tons in 1920 to 1,059,000 tons in 1935, and increased to 7,121,000 tons in 1937, as shown in table B-2. The conversion factors, of course, relate to the grains, and not to the flour and meal. To the extent that every bushel of wheat or corn that is converted into flour has waste material, these weights in tonnages are somewhat overstated. On the other hand, no allowance was made for the weight of bagging and other containers in which some of these products may have been shipped. This element, of course, would diminish the overstatement just noted.¹

The foregoing facts describe the general situation with regard to exports of grains and grain products in the past 20 years. Further analysis is necessary to determine the amount of these exportable products produced in the tributary area which might have utilized the Seaway in the past and which may utilize it in the future. The first step in this procedure is to determine the tributary area for all grain products.

Section 2

THE ST. LAWRENCE TRIBUTARY AREA FOR GRAIN PRODUCTS

The tributary area for all types of grains is identical, for the reason that the continental domestic transportation rates, as well as the ocean rates, are nearly the same per unit of weight.

The tributary area is determined by comparing cost of transportation on the present routes with cost of transportation that might be obtained if the St. Lawrence were constructed. It spreads out from the Great Lakes to points where the transportation costs between the present route and the deepened St. Lawrence route will be identical. This procedure assumes the existence of a reasonably defensible rate for the prospective St. Lawrence route from Great Lakes ports to countries of destination.

Grain rates are peculiarly subject to competitive shipping conditions. Grain is a bulk commodity carrying traditionally low transportation rates by water. Consequently, there are great variations in grain rates, not only from year to year but also from month to month and from day to day, depending on the competitive shipping condition at any given time and place. Table B-3 gives the high, low, and average rates on wheat per hundredweight during each year from 1924 to 1938 between Montreal and Liverpool and between New York and Liver-

¹ The conversion factors applied were as follows: Wheat, 60 pounds per bushel; barley, 48 pounds; oats, 32 pounds; rye, 56 pounds; corn meal, 50 pounds; corn, shelled, 56 pounds. Department of Agriculture, *Agricultural Statistics*, 1938.

pool. It will be observed that from Montreal to Liverpool, rates per hundred-weight have varied from a high of 40 cents in 1926 to a low of 8.5 cents in 1930. The 1926 rate was very unusual. Exceptionally high rates occurred in 1925 and 1937, when rates as high as 20 and 27 cents per 100 pounds were obtained. In most years even the highest rates have been well below 20 cents per hundredweight, and the lowest rates have ranged below 15 cents per hundredweight.

The average rate for the whole 15-year period from Montreal to Liverpool was 12.1 cents; from New York to Liverpool, 10.4 cents. The average annual rates during those 15 years have gone above 15 cents but three times, and were 12.5 cents or lower in 10 of the 15 years.

Another characteristic of grain rates is that distance is not a determining factor in rate-making. Rates over greatly different distances are often the same; for instance, rates from New Orleans, New York, and Montreal to the United Kingdom are usually very close to each other. Similarly, at the other end, rates over long distances are blanketed. Vessels go from Montreal to Genoa, Italy, 1,442 statute miles farther than Liverpool, for the same rate. To Piraeus, Greece, which is 2,198 miles farther than Liverpool, the rate increases only 1 cent, while to Helsinki, Finland, a distance of 1,668 miles beyond Liverpool, the rate increases only 2 cents.

With these factors in mind, we must assume a probable rate for the shipment of grain from Duluth and Chicago to European points via the all-water route through the St. Lawrence. The distance from Chicago to Liverpool is 1,242 miles longer than from Montreal, and from Duluth to Liverpool, 1,337 miles longer.

To assume a rate of 16 cents per 100 pounds (9.6 cents per bushel) from Chicago or Duluth to Liverpool would allow 3.9 cents over the 15-year average of 12.1 cents from Montreal to Liverpool. A 16-cent rate would be higher than any year in all the 15 years shown in table B-3, except 1926 and 1937. These latter 2 years are biased, because of unusually high rates for short periods of time during those years. Even then the low rates in each year were lower than the 16-cent rate here used.

It need not be claimed that the 16-cent rate will be an actual rate at any given time. Just as at Montreal, New York, and New Orleans, ocean rates on grains vary from day to day, similarly they may be expected to vary at Chicago and Duluth, dependent on availability of shipping and cargo. However, if over a number of years the 16-cent rate may be approximated as an average, then it would be permissible to use such a rate in calculating potential savings over the present cost of shipment through the Great Lakes ports. Just as the actual rates would not be identical with the average rate assumed, similarly the resultant estimates of savings would not be realized, necessarily, every year. It would, however, give us an estimate of average potential savings over a period of years, reduced to an annual basis. Depending on average shipping rates in each year, the actual savings in one year may be larger or smaller than the potential savings that we may estimate.

This 16-cent rate will be assumed for each one of the principal grain products since ocean rates on bulk wheat, corn, barley, and rye usually are identical. Rates on oats often range $\frac{1}{2}$ cent per bushel lower. Consequently, applying the same rate to oats would be conservative. Wheat flour and meal would carry different rates. These will be discussed later with reference to each commodity.

We are, then, faced with the problem of determining the tributary area for grains on the basis of a 16-cent Seaway rate, in comparison with existing cost of transportation. After establishing the tributary area, then it will be possible to estimate the potential available tonnage for movement via the Seaway, and with a per unit saving calculated by comparing the 16-cent rate with existing cost of

transportation, it should be possible to estimate the average potential savings that may be utilized in the future.

As stated above the tributary area is determined by comparing existing rates via the nearest port over the cheapest form of transportation, with the rate that would be obtained by adding the rail rates to lake ports, to the ocean rate from lake ports overseas of 16 cents. This area includes all of the following States: North Dakota, South Dakota, Nebraska, Kansas, Iowa, Minnesota, Wisconsin, and Michigan. It also includes the eastern part of Montana from the North Dakota border to Savoy, Mont., and from the South Dakota border to Huntley, Mont. It includes almost half of Wyoming, from the South Dakota border to Frannie in the north, and from the Nebraska border to and including nearly all of Albany County. The tributary area will also cover over one-third of Colorado, including Denver and Trinidad. Most of Missouri, with the exception of the southeastern counties, and a large part of Illinois, down to Livingston, Mitchell, and Salem, would fall within the tributary area. Southeastern Missouri and southern Illinois are not considered to be tributary to the St. Lawrence so far as grains are concerned, because low bulk rates on grains are available over Mississippi River barge lines. Hence, it is assumed that the grain traffic from southeastern Missouri and southern Illinois, just as the whole States of Oklahoma and Arkansas, will continue to move down the Mississippi to New Orleans. Most of Indiana and nearly all of Ohio, with the exception of the Ohio River Valley, are considered to be tributary to the Great Lakes, on the basis of equalization of rates between the present cheapest route of transportation as compared with the St. Lawrence route on a 16-cent lake-ocean rate basis. This tributary area would vary, of course, with changes in ocean and rail rates. It is only useful as indicating the area that would be affected by cheaper means of transportation if present rail rates remained and a 16-cent rate were effective from lake ports to North European ports.

Section 3

SHIPMENTS OF AMERICAN GRAINS TO EASTERN PORTS

In order to be able to determine the effect of the St. Lawrence Seaway upon grain movements, and the average savings that may be anticipated for future years, it is necessary to estimate the quantities of the various kinds of grain that may move over the lakes and the St. Lawrence River to open water. This may be accomplished in one of two ways. The first, which has been the traditional method, is to estimate the amount of wheat production in the tributary area and to estimate again the proportion of the export trade that may come out of the tributary area to be shipped via the St. Lawrence. The second method, the one adopted in this study, attempts to get closer to the practices of the grain trade, and estimates potential traffic on the basis of the actual movement of grains by the several routes now employed to eastern seaports. In doing this, account is taken not only of all grain that is exported from the United States, but also of a good portion of grain products that move to the eastern coast for local retention and consumption. Hitherto the greatest emphasis has been placed upon the advantages of the St. Lawrence in saving transportation expenses on exports, with little or no consideration given to the advantages of cheaper transportation cost not only to the Middle West producers, but also to the consumers in the congested industrial areas of the eastern coast.

Large amounts of grain shipments now move eastward from upper Lake ports by water. Table B-4 shows total grain shipments by water, in bushels, from Duluth-Superior, Milwaukee, and Chicago, from 1920 to 1938. It will be observed that in the 10 years 1929-38 the annual shipments of grains from these ports via

the Lake route have amounted to between 48 and 184 million bushels a year, although in the preceding decade shipments reached as high as 264 million bushels.

Duluth-Superior is the principal port of shipment for grains on the Great Lakes. Chicago is a close second. In the case of Duluth-Superior and Chicago, a large share of this shipment is wheat. In the case of Milwaukee, the most important grain shipped is barley. Rye in Duluth and corn in both Milwaukee and Chicago are the second most important grains.³

From each of these ports a large amount of grain shipments go out by rail. The quantities of these shipments for the years 1920-38 are presented in table B-5. On the average, about 22 percent of the total shipments from these three ports are by rail, and the rest by lake.

Buffalo is the principal recipient of grain shipped from Duluth-Superior, Milwaukee, and Chicago. A considerable amount of American grain moves to Georgian Bay points such as Port McNicoll, Depot Harbor, Tiffin, and Midland, presumably for storage or for transshipment to Montreal. Similarly, some grain of American origin is grain sent to Port Colborne on the Welland Canal, Toronto on Lake Ontario, Kingston at the entrance to the St. Lawrence River, and Prescott on the St. Lawrence. At each of these Canadian points grain is transhipped to shallower bottom carriers in order to traverse the 14-foot canals to Montreal, where it is again transhipped to oceangoing vessels. Thus export grain moving from lake ports to Europe is at present usually transhipped twice.

The grain received at Buffalo is to a large degree milled locally and then shipped in the form of flour. A good portion of the grain arriving in Buffalo, however, is transhipped, just as at Port Colborne, for transportation to Montreal via the St. Lawrence, or to Albany and New York via the New York State Barge Canal. These three places are the principal points of destination for grain transhipped at Buffalo. Of course, other ports, such as Kingston, Prescott, and Quebec, receive grain sent from Buffalo. A substantial part of it also is sent by rail to the New England States, New York, Pennsylvania, New Jersey, and points south. Oswego, at the Lake Ontario entrance of the New York Barge Canal, also engages in the transfer of grain received from upper lake ports.

The average annual receipts and shipments of grains by water from Buffalo during the decade 1929-38 are indicated in table B-6. Wheat is the largest single item among all the grains received and shipped by water. However, shipments of wheat are less than one-third of the receipts, indicating local milling and rail shipments to points south and east. This situation is typical of all the grains reaching Buffalo by water. Of the shipments, little more than a quarter went to Canada, and about 70 percent via the New York State Barge Canal.

The destinations of grains shipped by water from Buffalo are shown in table B-7. Shipments to Montreal, New York, and Albany predominate. Other points important in some years are Sorel, Quebec and Toronto.

A great deal of grain is sent from Buffalo by rail. In 1935 more than three times as much was shipped by rail than by water. Table B-8 shows that most of the rail shipments are consigned to Middle Atlantic States.

Section 4

RATES ON SHIPMENTS OF GRAIN

The variety of routes that grain takes from the producing centers to ports of shipment complicates the problem of estimating potential available tonnage for the St. Lawrence, and the savings that may be achieved on such tonnage. The rates

³ U. S. Army, Corps of Engineers, Transportation Series No. 1, *Transportation on the Great Lakes* (revised 1937), pp. 143-4.

from Duluth, Milwaukee, and Chicago by rail to Atlantic shore points and by lake to Buffalo or Port Colborne or Montreal direct, and the transshipment rates from Port Colborne and Buffalo to Montreal, must be separately studied. Furthermore, the calculations of potential savings must be based upon an allocation of shipments to the various routes and by comparison of the rates on the various routes with the proposed Seaway rate.

From Duluth to Buffalo the rates on wheat have averaged, during the 15 years 1924 to 1938 inclusive, 2.56 cents per bushel. The highest average annual rate during that period was 4 cents in 1937, and the lowest 1.5 cents in 1933. From month to month and within each month, rates vary according to the competitive conditions of shipping, and supply of grain offered for shipment. In 1938, for instance, rates from Duluth to Lake Erie points varied between 1.75 cents in May and 4.75 cents at the close of the season as compared with the average rate to Buffalo of 2.5 cents. In 1939, the rates varied more broadly, between 1.75 cents in June and 5.5 cents at the close of November and the first week of December.³

The rates from Milwaukee to Buffalo show less variation. In 1938 the rates on wheat and corn varied between 1.75 cents per bushel and 2.5 cents per bushel.⁴ Grain transshipped at Port Colborne to Montreal in 1938 averaged, during the season, 3.52 cents per bushel, and varied between a minimum of 2.43 cents in May and 4.02 cents in November.⁵ From Buffalo to Montreal, in 1938, the average rate was 3.23 cents per bushel.

The average through rate from Duluth to Montreal via Buffalo was 5.73 cents per bushel in 1938. This compares with the average rate for the same season of 5.57 cents per bushel for wheat transported from Port Arthur-Fort William to Montreal direct, or a rate between the same two points via Port Colborne of 5.97 cents per bushel.

The average rate from Duluth to Montreal via Buffalo, during the 15 years 1924-38 inclusive, was 7.58 cents per bushel, including the cost of trimming cargo and transfer of cargo from upper lake to canal-size vessels. This would amount to 12.6 cents per hundredweight or \$2.52 per short ton. As the average rate during the same period from Montreal to Liverpool was 7.25 cents per bushel, or 12.08 cents per hundredweight, the over-all cost from Duluth to Liverpool during that period was 14.83 cents per bushel, or 24.70 cents per hundredweight, which amounts to \$4.94 per short ton. A comparable study of rates from Duluth to New York, via Buffalo and the New York State Barge Canal, during the 15-year period 1924-38, indicates the following costs:

	<i>Cents per bushel</i>
Duluth to Buffalo.....	3.06
Transfer at Buffalo.....	1.00
Buffalo to New York (canal).....	4.01
Transfer at New York.....	1.00
New York to Liverpool.....	6.25
Through, Duluth to Liverpool.....	15.32

The average rate per hundredweight via the New York State Barge Canal and New York City, during those years, would be 25.50 cents per hundredweight, or \$5.10 per ton. This rate, it will be observed, is slightly higher than the rate through Buffalo and Montreal, in spite of the fact that the ocean rate from New York to Liverpool is lower. The lower ocean rate is achieved by reason of the fact that regular service lines often will take grain at very low rates. On the other

³ *Annual report of Duluth Board of Trade, 1938, p. 7.*

⁴ *Milwaukee Grain Stock Exchange, 81st Annual Report, p. 65.*

⁵ *Canada, Dominion Bureau of Statistics, Transportation and Public Utilities Branch, Canal Statistics, 1938, p. 28.*

hand, this advantage seems to be counterweighted by the transfer charges both at Buffalo and at New York. The rates from Milwaukee and Chicago, of course, will be slightly lower to the extent that the lake rates from these two points to Buffalo are lower. This differential may be as much as 1 or 2 cents per bushel below the rates from Duluth. The rates on wheat which have just been quoted apply equally to corn, barley, and rye. The rates on oats are sometimes as much as $\frac{1}{2}$ cent lower than the rates on wheat.

Grain is also shipped from Chicago and Buffalo to Atlantic seaboard points by rail. Usually there are two rate classifications for grains and grain products, one for domestic use without transshipment privileges, and the other for export. The export rate is considerably below the domestic rate; in fact, in the case of Chicago, it has been brought down to a level almost competitive with the rates on the lake route. In 1938 the rates effective from Chicago to Philadelphia, Albany, New York, Boston, and Montreal are shown in table B-9. It will be observed that grain for export passing through Chicago carried a rate of 16.5 cents per hundredweight to Philadelphia and Albany, and 17.5 cents to New York and Boston, whereas rates for domestic use coming through Chicago carried a rate to the same points of between 24 and 28 cents per hundredweight. The 17.5 cent rate is comparable with the lake-barge rate via Buffalo including all elevation charges which ranged between 5.75 and 11 cents per bushel, equivalent to 9.6 and 18.3 cents per hundredweight in 1939, or the lake-rail rate on export grain ranging from 20.2 to 23.5 cents. The lake-rail domestic grain rate ranged between 23.7 and 27.0 cents per hundredweight.

The rates in effect from Milwaukee to the seacoast are given in table B-10. It will be observed that these rates are practically the same as from Chicago. In practice, through traffic via Milwaukee from points west may be obtained on the same conditions as via Chicago.

From Minneapolis the domestic all-rail rate to New York in 1938 was 39 cents per hundred pounds. This would compare with a rail-lake-barge movement via Duluth and Buffalo of 21.5 cents, including elevation charges or with a rail-lake-rail movement of 33 cents per hundredweight. The export all-rail rate from Minneapolis to New York was 30.5 cents in 1938 and the export rate via rail-lake-rail was 29 cents.

It has been estimated that a 16-cent rate per hundredweight from Duluth or Chicago to Liverpool for direct shipment via the deeper St. Lawrence might be feasible. Considering all of the above various alternative routes and rates, it would seem that the Seaway, permitting ocean-going vessels to enter Lake Superior and Lake Michigan, would be able to save an average of between 8.7 cents a hundredweight, compared with lake-river via Montreal; 9.5 cents compared with lake-canal via New York and about 17 cents, compared with lake-rail via New York. Assuming the Montreal route as the severest competitor, the 8.7 cents saving, equivalent to 5.2 cents per bushel, would seem to be conservative.

Section 5

POTENTIAL TRAFFIC AND SAVINGS VIA THE ST. LAWRENCE SEAWAY

In estimating probable savings over a number of years, we must have some conception of the quantities that have moved by the various routes, and of the amount of traffic that may be diverted to the Seaway. For this purpose, the receipts and shipments of grain at the various North Atlantic ports have been studied for the period 1929-38. This period was one of very depressed agricul-

tural markets, including also 2 or 3 years of severe drought conditions, which, in 1935, for instance, eliminated practically all exports. Consequently, the average figures for this decade are severely understated. On this very conservative basis, it is estimated that in the five ports, including New York, Boston, Portland (Maine), Philadelphia, and Baltimore, on the average 34,531,000 units of 100 pounds of grain were received every year. This amounts to 1,726,550 short tons. Of this, 24,618,100 units of 100 pounds were exported, giving a net retention of 9,823,100 units of 100 pounds each. The figures for each port are presented in table B-11.

Since New York is by far the largest transshipment point for grains, the receipts of grains by routes and by commodities, and the exports by commodities, are given in greater detail in table B-12. These indicate that wheat was by far the largest item, accounting for 18,913,800 units of 100 pounds, out of a total of 23,145,900 units received in New York, with corn holding second place of importance. Of the total receipts, more than half—namely, 12,712,000 units of 100 pounds—were received via the New York State Barge Canal, and the rest—10,333,900 units—by rail.

Before we can estimate potential tonnage via the St. Lawrence of American grain which in the past decade used New York City as a transshipment point, it is necessary to eliminate that portion of the grain which came from Canada, for New York is a very important transshipment point for Canadian grain. To do this, a separate tabulation has been made of all American grain that was exported via New York during the same period. This is given in table B-13. It will be seen therefrom that the average amount of American grain that cleared New York City for export in each year during this period amounted to 3,714,718 units of 100 pounds, as compared with total exports of 20,226,500 units. The difference, presumably, is Canadian grain. There are, therefore, two items upon which savings must be calculated: 3,714,718 units of 100 pounds of American exports going out of New York, and 2,919,400 units of 100 pounds, which were apparently retained in New York, as shown in table B-12.

The seasonality of exports has varied between 63 percent in the case of wheat and 75 percent in the case of oats during the open navigation season. Since wheat is the largest item of export, it may be more nearly accurate to apply this 63 percent to the total exports of all grains. By this method we obtain 2,340,272 units of exports of American grains via New York which may become potential tonnage for the St. Lawrence, on the basis of 1929-38 average exports via New York. Practically all of the exports via Portland, Maine, consist of Canadian grain shipped in the wintertime; hence, this shipment will be ignored. The exports from Boston of American grains during the same decade amounted to 250,034 units of 100 pounds; from Philadelphia 685,646 units of 100 pounds; and from Baltimore, 1,118,689 units, shown in table B-13. By applying also the seasonality factor to these quantities, the average exports during the open navigation season of domestic grains from these three ports were 1,294,252 units. If this is added to the average exports through New York, there results average annual exports via United States ports on the North Atlantic during the season of open navigation of 3,634,524 units of 100 pounds or 181,726 tons. At 8.7 cents a hundred pounds savings or \$1.74 per ton, this traffic would yield \$316,204 in total savings.

In addition to American grains moving through the North Atlantic ports, a large quantity finds its way to foreign countries through Canadian ports. Some of this transshipment through Canada travels through two or three stages. For instance, consignments of American grains may travel from Duluth to Georgian

Bay points by lake and from there to Montreal by rail, to be loaded on oceangoing vessels. Other consignments from Duluth or Chicago may be transshipped at Port Colborne to canal vessels whence they travel down the St. Lawrence Canals to Montreal to be again transshipped to oceangoing vessels.

For the decade 1929-38, table B-14 presents total amount of American grain, which cleared through Canadian eastern seaboard ports, not including soybeans and flour and meal. The amounts have varied violently from year to year during this period. In the 12 months ending July 31, 1929, the total amount of American grains clearing through Canadian eastern ports amounted to 83 million bushels. On the other hand, in 1935 no American grains were exported through Canada. In the 12 months ending with July 31, 1938, exports of American grains clearing through Canadian eastern ports again reached a high level of 62.5 million bushels. The average for this erratic decade was little short of 19.7 million bushels a year. The largest Canadian transshipment center has been Montreal.

As the average annual export via Canada of American grains during the decade 1929-38 has an abnormal downward bias on account of the unusual drought conditions during the middle thirties, the average of 19,700,000 bushels is perhaps too low. However, for convenience it is assumed that about 20 million bushels of grains, not including soybeans and flour, is a proper average on the basis of which potential traffic via the St. Lawrence of this portion of American exports in grains may be estimated.

First, it is necessary to convert this amount of traffic in bushels into equivalent weights. The average annual exports of American grain via Canada of 19,700,000 bushels consisted of 46 percent wheat, 25.8 percent of corn, 19.5 percent of barley, 6.7 percent of rye and 2 percent of oats.⁶ By applying the appropriate weight factors per bushel of each type of grain,⁶ the total average tonnage of American grains clearing through eastern Canada during the decade 1929-38 is 10,980,646 units of 100 pounds or, 549,032 short tons.

Since wheat is the largest item of export, the percentage of wheat movements in the open season of navigation—63 percent of the annual exports—will be applied to the total of all grains even though in the case of the other grains the movement during the open season of navigation is a larger percentage than that of wheat. Applying this factor of 63 percent to 10,980,646 units of 100 pounds, there were 6,917,807 units of 100 pounds, or 345,890 short tons, which constituted the average traffic for movement via the St. Lawrence on the very conservative, in fact abnormally low, basis of the average conditions during the decade 1929-38. Combining this potential traffic with the estimated potential traffic of grains which in the past decade moved via American North Atlantic ports, a total of 527,616 short tons (345,890 plus 181,726) is obtained. This is on the basis of 1929-38 averages, and does not include soybeans and flour.

At a saving of 8.7 cents a hundredweight, or \$1.74 a ton, the total potential saving on this traffic would amount to \$918,000. This saving is based on a comparison with the lowest cost existing route. It is possible that the saving would more closely approach 10 cents per hundredweight considering the other rates and routes to Liverpool. If this assumption is correct, then the saving on this highly conservative estimate of traffic would be \$1,055,000.

It was shown in table B-12 that New York City reserved, and retained, presumably for local consumption, an average of 2,919,400 units of 100 pounds each during the decade of 1929-38. Similar amounts were retained by other North

⁶ Canada, Dominion Bureau of Statistics, Agricultural Branch, *Report on Grain Trade of Canada, 1929-38*.

Atlantic ports. Summarizing these amounts the total average retention of grain appears to be as follows:

	<i>Hundreds of pounds</i>
New York, N. Y.-----	2, 919, 400
Boston, Mass.-----	745, 900
Portland, Maine.-----	80, 400
Philadelphia, Pa.-----	2, 044, 200
Baltimore, Md.-----	4, 033, 200
Total.-----	9, 823, 100

The amount of local retention in Portland is small. This may be eliminated altogether from our consideration of coastwise trade. The rest, 9,742,700 units of 100 pounds, or 487,135 short tons, represents grains received from the tributary area and retained for local consumption or processing. Even if only 60 percent were received in the open navigation season, there would be 5,845,620 units of 100 pounds or 292,281 tons of potential coastwise traffic. As the tributary area produces mainly spring and durum wheat, harvested during the season of open navigation, it is possible that a larger percentage may be shipped through the St. Lawrence. This tendency is further encouraged by the fact that lake-rail and all-rail rates on domestic shipments are substantially higher than export rates. For this reason, the potential saving on all-water transportation of grain to North Atlantic ports, New York excepted, might approach that on export trade. Possible coastwise movements to New York via the Seaway are arbitrarily dismissed in view of the competitive Barge Canal. Boston, Philadelphia, and Baltimore, however, receive their grain chiefly via lake-rail or all-rail routes. If a saving of 6 cents per hundredweight is assumed on the potential traffic as shown above, excluding New York, a total of \$245,638 would result. If a larger volume of traffic is obtained by virtue of increase in the total receipts in the eastern ports for local consumption, or because a larger percentage is shipped via the St. Lawrence than it was here assumed, then the total tonnage may go up to as much as 300,000 tons. And if the saving reached that estimated for export grain, 8.7 cents per 100 pounds, or \$1.74 per ton, then the total savings may be as much as \$525,000 per year. This would be the average benefit not in 1 year, but over a period of years.

Section 6

POTENTIAL TRAFFIC IN FLOUR

As in the case of grains, the United States has lost its leading position in the export of flour, as shown in table B-15. It will be noticed that American flour exports reached a peak of 1,400,457 tons in 1929 and then diminished steadily until they reached a low of 380,373 tons in 1935. In 1938, exports were again up to 575,396 tons. Although exports in 1935 declined to about 25 percent of the 1929 level and in 1938 still were about 40 percent, the production of flour in the United States declined but slightly, as shown by the following figures for crop years:

<i>Crop year</i>	<i>Thousands of short tons</i>	<i>Crop year</i>	<i>Thousands of short tons</i>
1938-39-----	10, 259	1931-32-----	10, 372
1937-38-----	9, 899	1930-31-----	10, 774
1936-37-----	9, 830	1929-30-----	11, 233
1935-36-----	9, 649	1928-29-----	11, 303
1934-35-----	9, 472	1927-28-----	10, 905
1933-34-----	9, 233	1926-27-----	10, 878
1932-33-----	10, 143	1925-26-----	10, 224

Within the framework of national production, however, there has been considerable redistribution of production centers. Minneapolis used to be the premier flour milling center in the United States, producing more than 10 percent of the national total. Since 1929, however, Minneapolis has lost its position of leadership. In the meantime, Buffalo has moved forward and is the principal milling center of the country. This becomes apparent from a glance at table B-16, which presents total output of flour in Minneapolis and Buffalo from 1910-39. Minneapolis used to be, also, an important center of flour exports. In the season 1899-1900, total exports of flour from Minneapolis amounted to 478,196 tons, or 4,877,600 barrels.⁷ Minneapolis has lost its position of leadership in the export trade steadily, particularly since 1920. In the past decade exports of flour from Minneapolis were practically nil.⁸ This may be accounted for by the fact that Buffalo, which increased its output during this period, stood in a better geographical position and enjoyed the advantage of lower transportation costs in export trade. Many of the milling companies which had plants in Minneapolis established branches in Buffalo.⁹

Although the United States does not export flour in as large quantities as formerly, total exports are still sizeable. In the decade 1929-38, the average exports amounted to 656,000 short tons. Table B-17 indicates that the Caribbean countries were the largest importers with 185,000 tons or about one-half of the United States exports. The United Kingdom and North European countries accounted for about one-fifth of United States exports.

A study of shipments of flour by customs districts over the decade 1929-38 indicates that New York has been the principal port of shipment as shown in table B-18. On the basis of calendar years, the average exports from New York in the decade 1929-38 were 297,838 tons a year. Substantial exports clear through New Orleans, Galveston, and West Coast ports. It is probable that shipments from New York are sent mainly to European ports, whereas a large part of the shipments from Gulf ports and some from west coast ports must find their way to the West Indies and Central American ports. This does not mean, of course, that all of the exports from New York go to no other destination but Europe, or that all of the exports from the Gulf States go exclusively to Caribbean destinations. There must be some crisscrossing of shipments; generally, however, in view of the more frequent shipping facilities between New York and European ports on the one hand, and between Gulf ports and Cuba and West Indies ports on the other, it must be assumed that generally the movements from New York are east-bound and those from Gulf Coast south-bound. The question is, what amount of shipments from New York find their origin in the Great Lakes region and what proportion may in the future use the St. Lawrence Seaway for direct transportation?

Even though Buffalo is the largest milling center at the present time, there is still considerable shipment of flour eastward from the three principal flour centers on the Great Lakes—namely, Duluth, Milwaukee, and Chicago. Table B-19 indicates shipments of flour by lake from these three cities. It will be seen that in the period 1929-38, shipments from Duluth varied between 451,000 tons in 1929 and 191,000 tons in 1938.

Milwaukee, over the same period, has shipped by lake variously between 365,000 tons in 1932 and 197,000 in 1938. Shipments from Chicago by lake have varied extensively between 169,000 tons in 1931 and 70,911 tons in 1937. In 1938 they were 147,000 tons. A large part of these shipments must be destined for Buffalo,

⁷ *The Northwestern Miller*, Apr. 24, 1940, sec. 2, p. 27.

⁸ *Ibid.*

⁹ Docket No. 130 (AAA), pp. a-35 to a-66, Hearings on Proposed Code of Fair Competition in Wheat Flour Milling Industries, submitted by Miller's Federation, January 16, 1934.

because Buffalo, in addition to milling over 2 million tons of flour a year, receives substantial amounts from other lake ports. Lakewise receipts of flour at Buffalo since 1929, as shown in table B-20, indicate that Buffalo acts as a transshipment center for flour milled at other points around the lakes. In 1930, for instance, lakewise receipts at Buffalo amounted to nearly 560,000 tons of wheat flour. In 1938, they stood at 330,000 tons. There were between 10 and 15 thousand tons of rye flour received annually during the same decade. Shipments from Duluth are not for export trade, since, as previously cited, in the past decade, Minneapolis, which is the principle source of flour shipped from Duluth, is not exporting any flour, but it is not known whether any part of flour coming from Chicago or Milwaukee by lake to Buffalo is for export trade. However, it may be assumed that since Minneapolis is not an element in export trade, the total exports from New York, as above indicated, must originate principally in Buffalo, and to some extent, perhaps, in Chicago and Milwaukee. From Buffalo, flour moves to New York in small amounts by barge and to a much larger extent by rail. The shipments by barge are given in table B-21. They indicate that shipments via the New York State Barge Canal do not account for a very large proportion of either the exports or the total receipts in New York. With the exception of 1933, when the barge canal transported over 100,000 tons of flour, the traffic has been generally between 30,000 and 79,000 tons a year. It must be concluded, then, that the largest portion of flour transported from Buffalo to New York goes by rail.

Even if it is assumed that all of the flour exports originate in Buffalo, there would still be an opportunity of exports of flour to European ports direct, if the St. Lawrence Seaway were available. The distance from Buffalo to North European ports, via the St. Lawrence, is only very little longer than from New York. With cargoes of woodpulp being brought to Lake Erie and Lake Michigan points from Scandanavian countries, and kaolin from England, shipping would be available to take flour as well as grains direct to European ports. In fact, the shipping time would not deviate from New York more than a day or two, and considering the fact that barge lines take from 4 to 7 days from Buffalo to New York, and rail deliveries at least 2 days, direct shipment from Buffalo can be considered quite competitive, both as to rates and service.

If all of the export flour moving out of New York originated in Buffalo, one may assume that as much of it as is shipped during the open navigation season could use the St. Lawrence. An examination of the seasonal character of exports of wheat flour indicates that during the years 1936-38 inclusive, 60 percent of total exports moved out during the months of May to November, inclusive. It may be assumed, therefore, that 60 percent of the total exports from New York of approximately 300,000 tons, the average of the decade 1929-38, or 180,000 tons, would be available for shipment via the St. Lawrence. However, it is very likely that with the opening of the Seaway, Milwaukee and Duluth will be able to enter the export trade.

The calculations of potential savings may, therefore, be based first on the assumption that all of the exports might go from Buffalo. This has validity insofar as many of the milling companies that are located in other milling centers such as Minneapolis also have mills in Buffalo, and it would be assumed that they would allocate their export trade to the Buffalo mills. However, certain assumptions with regard to increased export trade from other milling centers may be made in estimating the total potential savings.

In addition to this export trade, calculated on the basis of 1929-38 averages, there would be substantial amounts of coastwise shipments of flour from upper lake ports to the Atlantic seacoast. In table B-22, it is shown that during the years 1929-38, 12 million units of 100 pounds, or 600,000 short tons of flour, were received and retained in New York City. Similarly, 2,214,000 units of 100 pounds, or 110,700 tons of flour, were retained in Boston. Philadelphia retained an average

of 3,132,000 units of 100 pounds, or 156,600 tons; and Baltimore, 1,358,000 units of 100 pounds, or 67,900 short tons. These four North Atlantic ports accounted, therefore, for an average retention during the decade 1929-38 of 935,200 tons.¹⁰ From whence these large amounts of flour retained in these North Atlantic port cities were received is not definitely known. What is known is that Buffalo produces an average of 2 million tons of flour a year and receives about 380,000 tons additional flour from other lake ports. There are no known facts indicating the allocation of this market in the North Atlantic cities between Buffalo and other points further west. Since Minneapolis flour that is shipped eastward is not exported, it can be assumed that some of it comes to the East for local consumption. However, how much of it finds its way to the North Atlantic coast is impossible to calculate. This point is vital, since it is probably a fact that flour milled in Buffalo will not use the Seaway to arrive at Boston or New York, but will continue to be shipped by the present routes. On the other hand, flour that is shipped from Duluth or Milwaukee or Chicago may take to coastwise shipping all the way to Boston and New York via the St. Lawrence. For the differential in rates between a direct rail or lake-rail rate and the St. Lawrence rate will probably permit a saving. Assuming that all of the lakewise receipts in Buffalo are consigned to the eastern shore, we may consider all of that tonnage—between three and four hundred thousand tons a year—as potential traffic on the Seaway. Of course, it may not be true that all of this flour coming from the upper lake ports is destined to the four principal cities on the Atlantic seacoast. Some of it may be shipped farther south. However, whether they are consigned to the North Atlantic ports or to points farther south they would constitute potential traffic on the St. Lawrence Seaway, as long as a saving in transportation cost could be indicated. It is indeed likely that the potential traffic on the St. Lawrence would be larger than this figure, insofar as flour at the present time is actually being shipped by rail east and south from Minneapolis, Milwaukee, and Chicago. As a conservative estimate, however, we might take the 10-year average of lakewise receipts of flour at Buffalo of 380,000 tons as a possible potential tonnage of coastwise movement of this commodity via the St. Lawrence.

The 180,000 tons of wheat flour exports going out of New York during the open season probably all come from Buffalo. This could be shipped direct via the St. Lawrence, at the same ocean rates as prevail from New York. Any increased insurance rates would be but fractionally higher than from New York. Hence, all of the rail cost from Buffalo to New York may be considered potential savings. The export rate on wheat flour from Buffalo to New York for export has ranged between 14 and 16 cents per 100 pounds in carload lots. If a saving of 15 cents is assured, Buffalo millers would save \$3 per ton, or \$540,000 on total shipments of 180,000 tons. Of course it is likely that not all of this advantage will go to millers, but will be shared with foreign purchasers. In any event, Buffalo millers will improve their position in the foreign markets.

The coastwise shipments from Duluth to north Atlantic ports for domestic consumption would also benefit, perhaps not to the full extent of the rail rates between Buffalo and New York. On through domestic shipments, lake and rail via Buffalo, flour from Duluth pays a rate of 30 cents per 100 pounds. Of this, 12 cents are retained by the lake carriers and 18 by the railroads. If a direct Seaway rate of 25 cents is assumed, then the saving would be 5 cents per hundred pounds or \$1 per ton making a total saving of \$380,000 on the above estimated movement of 380,000 tons. A feasible rate of 25 cents per hundred is believed

¹⁰ These figures have been calculated by deducting from the average receipts the average exports during the period 1929-38, as given in United States Army, Corps of Engineers, Transportation Series No. 1—*Transportation on the Great Lakes* (Revised 1937), *op. cit.*, for the period 1929-35, supplemented by figures from *The Northwestern Miller*, April 24, 1940, *op. cit.*; the figures of exports as given in *The Northwestern Miller* and United States Army, Corps of Engineers, *Commercial Statistics of Waterborne Commerce of the United States*.

to be most conservative in view of the prevailing rate on wheat flour between the Pacific and the Atlantic via the Panama Canal of 40 cents per hundred pounds on lots of 12 tons or more. This rate includes a toll for passage of the Canal and a haul, say of 7,000 miles from the flour mills of Tacoma, Washington, to New York. The distance from Duluth by way of the St. Lawrence River and Atlantic is 3,000 miles.

In summary, therefore, the possible traffic in grain and flour with estimated reductions in transportation costs appear as follows:

Item	Tons	Saving per short ton	Total saving
Grain (export)-----	527, 600	\$1. 74	\$918, 000
Grain (domestic)-----	204, 700	1. 20	245, 600
Flour (export)-----	180, 000	3. 00	540, 000
Flour (domestic)-----	380, 000	1. 00	380, 000
Total-----	1, 292, 300	-----	\$2, 083, 600

As touched upon above, there is a chance that the saving per ton might be slightly greater or that an increased tonnage might be attracted to the new deep water route. In view of these possibilities the tonnage of grain and flour might reach 1,400,000 and the savings \$2,500,000.

It must be remembered that all these estimates are based upon average actual shipments during the decade 1929-38, a decade that included periods of very low export trade, and some years when there were actually considerable amounts of imports due to domestic deficiencies on account of drought. What prospect the future holds is difficult to foretell. War conditions abroad and the Naval blockade of the European continent have drastically cut American agricultural exports, on the other hand, post-war Europe will have such an accumulated shortage of foodstuffs that a great surge of exports may be expected. This, however, is contingent upon the outcome of the war and the political forces that will dominate world trade.

TABLE B-1

Exports of selected grain products, 1918-37

Year ¹	Linseed cake and meal	Starch, including cornstarch	Barley, including flour and malt ²	Corn, including corn meal	Oats, including oatmeal	Rye, including flour	Wheat, including flour ³
	1,000 lbs.	1,000 lbs.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.	1,000 bu.
1918-----	202, 788	143, 788	26, 997	23, 019	109, 005	36, 467	287, 402
1919-----	336, 336	237, 609	34, 555	16, 729	43, 436	41, 531	222, 030
1920-----	391, 264	135, 365	27, 255	70, 906	9, 391	47, 337	369, 313
1921-----	484, 059	386, 873	27, 543	179, 490	21, 237	29, 944	282, 566
1922-----	574, 612	260, 796	21, 909	96, 596	25, 413	51, 663	224, 900
1923-----	560, 114	262, 842	13, 913	23, 135	8, 796	19, 902	159, 880
1924-----	691, 126	214, 247	28, 543	9, 791	16, 777	50, 242	260, 803
1925-----	589, 166	224, 569	30, 449	24, 783	39, 687	12, 648	108, 035
1926-----	625, 121	233, 111	19, 655	19, 819	15, 041	21, 697	219, 160
1927-----	606, 304	281, 368	39, 274	19, 409	9, 823	26, 346	206, 269
1928-----	645, 120	235, 660	60, 295	41, 874	16, 251	9, 488	163, 687
1929-----	624, 960	203, 343	24, 054	10, 281	7, 966	2, 600	153, 245
1930-----	304, 640	104, 807	11, 443	3, 317	3, 123	227	131, 475
1931-----	443, 520	73, 071	5, 469	3, 969	4, 438	909	135, 797
1932-----	241, 920	62, 969	9, 399	8, 775	5, 361	311	41, 211
1933-----	546, 560	73, 922	6, 111	4, 965	1, 405	21	37, 002
1934-----	380, 800	40, 468	4, 126	2, 324	1, 147	(⁴)	21, 532
1935-----	459, 300	55, 342	9, 926	816	1, 430	9	15, 929
1936-----	562, 240	32, 882	5, 269	533	912	248	21, 584
1937 ⁵ -----	557, 760	122, 569	17, 776	104, 061	12, 331	6, 578	107, 194

¹ Year beginning July.

² Includes barley flour, 1919-22. Barley flour not separately reported prior to 1919 nor since 1922.

³ Includes domestic flour and exports made from foreign wheat milled in bond.

⁴ Less than 500 bushels.

⁵ Preliminary.

SOURCE: Department of Agriculture, *Agricultural Statistics*, 1939, table 601, pp. 433-4.

TABLE B-2

Exports of selected domestic agricultural products during designated years, 1920-37

[Short tons]

Commodity	1920	1925	1930	1935	1937 ¹
Linseed cake and meal.....	195,632	294,583	152,320	229,600	273,880
Starch, including cornstarch.....	67,682	112,285	52,404	27,671	61,285
Barley, including flour and malt.....	654,120	730,776	274,632	238,224	426,624
Corn, including cornmeal.....	1,772,650	619,575	82,925	20,400	2,601,525
Oats, including oatmeal.....	150,256	634,992	49,968	22,880	197,296
Rice, including flour, meal, and broken rice.....	220,428	24,088	140,503	42,265	155,066
Rye, including flour.....	1,325,436	354,144	6,356	252	184,184
Wheat, including flour.....	11,079,390	3,241,050	3,944,250	477,870	3,215,820
Total.....	15,465,594	6,011,493	4,703,358	1,059,162	7,120,680

¹ Preliminary.

SOURCE: Department of Agriculture, *Agricultural Statistics, 1939*, table 601.

TABLE B-3

Ocean freight rates on wheat from Montreal and New York to Liverpool, 1924-38

[Cents per hundred pounds]

Year	Montreal to Liverpool			New York to Liverpool		
	High	Low	Average	High	Low	Average
1924.....	18.7	11.4	15.0	18.4	8.7	13.7
1925.....	20.0	7.5	12.5	19.4	7.5	11.7
1926.....	40.1	8.9	17.9	35.1	7.5	15.9
1927.....	17.5	7.5	12.0	16.0	7.5	11.9
1928.....	17.5	8.7	12.4	15.0	7.5	9.5
1929.....	12.5	7.5	9.2	12.5	6.5	8.2
1930.....	10.0	7.5	8.5	8.2	7.5	7.5
1931.....	13.7	7.5	10.0	8.9	7.5	7.7
1932.....	11.9	7.5	10.0	7.5	7.5	7.5
1933.....	10.2	7.7	8.7	7.5	7.5	7.5
1934.....	11.5	7.0	9.0	7.5	7.5	7.5
1935.....	14.0	9.2	10.2	11.5	7.5	8.5
1936.....	15.0	11.0	12.9	13.0	11.4	11.9
1937.....	27.1	14.9	18.4	16.9	13.4	13.0
1938.....	16.4	14.2	15.4	19.4	12.9	14.9
Average 1924-38.....			12.1			10.4

TABLE B-4

Grain shipments by water at upper lake ports, 1920-38¹

[Bushels]

Year	Duluth-Superior	Milwaukee	Chicago	Year	Duluth-Superior	Milwaukee	Chicago
1920.....	60,686,819	3,145,887	24,306,750	1930.....	87,625,748	6,258,891	39,550,000
1921.....	74,916,491	29,067,195	127,034,011	1931.....	53,976,509	19,948,100	66,555,000
1922.....	113,891,974	14,151,896	96,917,874	1932.....	49,836,255	2,859,534	83,462,000
1923.....	69,044,509	7,024,753	34,861,618	1933.....	62,662,649	14,082,969	51,942,000
1924.....	175,314,950	14,314,796	74,030,000	1934.....	47,696,997	3,804,116	37,926,000
1925.....	129,510,042	7,955,689	41,885,000	1935.....	38,240,103	2,918,350	6,821,976
1926.....	72,557,821	9,345,894	50,030,000	1936.....	27,110,000	4,294,000	19,424,000
1927.....	165,246,622	16,515,893	48,629,000	1937.....	53,565,000	4,942,000	33,076,000
1928.....	145,228,980	10,487,018	29,030,000	1938.....	73,638,000	14,833,000	95,531,000
1929.....	95,969,890	12,253,817	35,323,000				

¹ These figures include wheat, corn, oats, rye, barley, flaxseed; they do not include flour and soybeans. Chicago shipments do not include shipments of flaxseed for the years 1936-38.

Sources: 1920-35: United States Army, Corps of Engineers, Transportation Series No. 1—*Transportation on the Great Lakes* (Revised 1937), p. 145. 1936-38: Duluth-Superior, *The Northwestern Miller*, April 24, 1940. *Almanack of the Food stuffs Industries*: Milwaukee, United States Army, Corps of Engineers, *Commercial Statistics of the Waterborne Commerce of the United States, 1937-39*; Chicago, *Eighty-second Annual Report of the Chicago Board of Trade*, p. 121.

TABLE B-5

Grain shipments by rail at upper lake ports, 1920-38¹

[Bushels]

Year	Duluth-Superior	Milwaukee	Chicago	Year	Duluth-Superior	Milwaukee	Chicago
1920.....	11,440,982	30,619,664	108,131,250	1930.....	6,506,757	16,267,925	59,477,000
1921.....	8,378,876	22,623,872	98,468,989	1931.....	7,407,792	12,464,865	42,118,000
1922.....	4,766,829	34,303,950	155,360,126	1932.....	5,075,394	7,478,955	28,293,000
1923.....	5,794,635	35,635,840	122,607,382	1933.....	3,022,679	11,023,825	37,284,000
1924.....	8,104,676	24,259,888	93,143,000	1934.....	12,211,363	13,948,210	40,130,000
1925.....	6,880,118	15,787,634	82,985,000	1935.....	10,872,367	11,062,162	45,068,024
1926.....	8,102,612	12,001,151	62,799,000	1936.....	21,446,000	11,675,000	36,582,000
1927.....	8,533,248	14,296,125	53,782,000	1937.....	18,251,000	10,145,000	45,928,000
1928.....	6,633,058	19,873,701	86,878,000	1938.....	37,638,000	11,472,000	40,455,000
1929.....	9,035,982	22,265,020	70,146,000				

¹ These figures include wheat, corn, oats, rye, barley, flaxseed; they do not include flour and soybeans.

² Chicago shipments do not include shipments of flaxseed for the years 1936-38.

SOURCES: 1920-35, United States Army, Corps of Engineers, Transportation Series No. 1—*Transportation on the Great Lakes* (Revised 1937), p. 145. 1936-38: Duluth-Superior, *The Northwestern Miller*, April 24, 1940, *Almanack of the Foodstuffs Industries*. Milwaukee, derived by subtracting water shipments as given in United States Army, Corps of Engineers, *Commercial Statistics of Waterborne Commerce of the United States, 1937-39*, from total shipments as given in *The Northwestern Miller*, April 24, 1940, *Almanack of Foodstuffs Industries*. *Eighty-second Annual Report of the Chicago Board of Trade*, p. 122.

TABLE B-6

Average annual waterborne commerce of grains, at Buffalo, N. Y., 1929-38

[Short tons]

Kind of grain	Receipts				Shipments					
	Total receipts	Imports ¹		Lake-wise receipts	Receipts via New York State Barge Canal	Exports ¹		Shipments via New York State Barge Canal		
		Total imports	From Canada			Total exports	To Canada			
Wheat.....	2,946,272	1,589,864	1,589,864	1,343,853	12,555	866,714	252,720	252,720	12,455	601,539
Barley.....	159,583	52,303	52,303	103,459	3,821	43,202	15,866	15,866	1,585	25,751
Corn.....	473,656	42,087	42,087	408,344	23,225	67,366	2,050	2,050	5,700	59,616
Oats.....	96,102	6,217	6,217	86,907	2,978	13,457	703	703	698	12,056
Rye.....	64,463	18,531	18,531	35,975	9,957	27,321	5,469	5,469	9,764	12,088
Total grains.....	3,740,076	1,709,002	1,709,002	1,978,538	52,536	1,018,080	276,808	276,808	30,202	711,050
Flour.....	385,673	1,405	1,405	384,121	147	48,851	9,908	7,903	1,403	37,540

¹ There were no receipts from overseas in this period; there were no shipments except for 2,005 short tons of flour which were exported.

² Includes meal.

SOURCE: United States Army, Corps of Engineers, Lake Series No. 1—*The Port of Buffalo, New York* (Revised 1939), p. 129.

TABLE B-7

Destination of grain shipped from Buffalo by water, for specified years

[Bushels]

Destination	1923	1928	1929	1935	1938
Duluth-Superior.....	797, 200			554, 520	
Milwaukee.....				800, 442	
Chicago.....				1, 408, 872	
Toledo.....	325, 275				
Cleveland.....				217, 500	
Albany (via Oswego).....				273, 275	
Albany (via barge canal).....					1, 880, 043
New York (via Oswego).....		2, 019, 700		303, 500	237, 500
New York (via barge canal).....	21, 431, 634	38, 467, 430	28, 893, 616		7, 137, 657
Troy, New York.....					743, 153
Port Colborne.....				55, 395	1, 056, 833
Cayuga, N. Y.....					675, 786
Toronto.....				743, 900	
Kingston.....		58, 174		392, 500	
Cardinal.....	142, 500				
Prescott.....				220, 951	
Ogdensburg.....	71, 000				
Montreal.....	3, 942, 134	66, 027, 622	18, 106, 182	5, 001, 350	2, 347, 329
Sorel.....				1, 743, 001	49, 900
Quebec.....	18, 500	175, 927	940, 433	1, 637, 046	94, 067
Various St. Lawrence ports.....		134, 530			
Others.....			1, 750		90, 833
Total.....	26, 728, 243	106, 883, 383	47, 941, 981	13, 352, 252	14, 213, 101

SOURCE: United States Army, Corps of Engineers: 1923, Transportation Series No. 1—*Transportation on the Great Lakes*, 1926, p. 141. 1928, Transportation Series No. 1—*Transportation on the Great Lakes*, (Revised 1930), p. 136. 1929, Lake Series No. 1—*Port of Buffalo, N. Y.*, 1931, p. 146. 1935, Transportation Series No. 1—*Transportation on the Great Lakes*, (Revised 1937), p. 168. 1938, Lake Series No. 1—*Port of Buffalo, N. Y.* (Revised 1939), p. 155.

TABLE B-8

Destination of grain shipped from Buffalo by rail, 1935

Destination	Bushels	Destination	Bushels
Local.....	3, 700, 571	Delaware, Maryland, Virginia, and North Carolina.....	824, 122
Export.....	3, 144, 131	Unknown.....	12, 130, 633
New England States.....	2, 742, 297		
Ohio, Pennsylvania, New York, and New Jersey.....	26, 816, 727	Total.....	49, 358, 481

SOURCE: United States Army, Corps of Engineers, Transportation Series No. 1—*Transportation in the Great Lakes* (Revised 1937).

TABLE B-9

All-rail freight rates on grains from Chicago to Philadelphia, Albany, New York, Boston, and Montreal, 1938

[Cents per one hundred pounds]

Particulars	Philadel- phia	Albany	New York	Boston	Montreal
January 1 to March 27, inclusive:					
Grain for domestic use.....(a)	30.5	31.5	32.5	34.5	38
(b)	22.5	23.5	24.5	26.5	30
Grain products for domestic use....(a)	31	32	33	35	38.5
(b)	23	24	25	27	30.5
Grain for export.....(a)	29.5	-----	30.5	30.5	29.5
(b)	21.5	-----	22.5	22.5	21.5
Grain products for export.....(a)	30.5	-----	32.5	32.5	30.5
(b)	22.5	-----	24.5	24.5	22.5
March 28 to June 9, inclusive:					
Grain for domestic use.....(a)	32	33	34	36	40
(b)	24	25	26	28	32
Grain products for domestic use....(a)	33	34	35	37	40
(b)	24	25	26	28	32
Grain for export.....(a)	31	-----	32	32	31
(b)	23	-----	24	24	23
Grain products for export.....(a)	32	-----	34	34	32
(b)	24	-----	26	26	24
June 10 to December 31, inclusive:					
Grain for domestic use.....(a)	32.5	33.5	34.5	36.5	40.5
(b)	24	25	26	28	32
Grain products for domestic use....(a)	33	34	35	37	41
(b)	24.5	25.5	26.5	28.5	32.5
Grain for export.....(a)	31	-----	32	32	31
(b)	22.5	-----	23.5	23.5	22.5
Grain products for export.....(a)	32.5	-----	34.5	34.5	32.5
(b)	24	-----	26	26	24
October 21 to December 31, inclusive:					
Grain for export.....(a)	25	25	26	26	31
(b)	16.5	16.5	17.5	17.5	22.5
Grain products for export.....(a)	32.5	32.5	34.5	34.5	32.5
(b)	24	24	26	26	24

(a) Local rates, applying on shipments not entitled to reshipping or proportional rates.
 (b) Reshipping or proportional rates, applying on shipments received from connecting rail or lake lines, handled under rules and conditions covering Transit and Milling and Malting in Transit privileges at Chicago District points; also applying on through billed shipments originating at points from which no through joint rates are in effect and not stopped in transit.

¹ Flour, 1 cent less.

Source: *Eighty-first Annual Report of the Chicago Board of Trade*, p. 117.

TABLE B-10

Domestic freight rates by rail from Milwaukee to Atlantic Seaboard, during 1938

[Cents per one hundred pounds]

Particulars	January 1 to March 28		March 28 to December 31	
	Car ferry	All-rail	Car ferry	All-rail
To New York:				
Grain products.....	25	25	26.5	26.5
Grains ¹	24.5	24.5	26	26
To Boston:				
Grain products.....	27	27	28.5	28.5
Grains.....	26.5	26.5	28	28
To Philadelphia:				
Grain products.....	23	23	24.5	24.5
Grains.....	22.5	22.5	24	24
To Baltimore:				
Grain products.....	22	22	23.5	23.5
Grains.....	21.5	21.5	23	23
To Montreal:				
Grain products.....	30.5	38.5	32.5	41
Grains.....	30	38	32	40

¹ "Grains," to all destinations, includes wheat, rye, corn, oats, and barley.

Source: *Milwaukee Grain & Stock Exchange, Eighty-first Annual Report, 1938-39*.

TABLE B-11

Total receipts, exports and apparent retention of grains at specified North Atlantic ports, annual averages, 1929-38

[One hundred pounds]

Cities	Receipts	Exports	Apparent retention
New York.....	23,145,900	20,226,500	2,919,400
Boston.....	1,789,000	953,900	745,900
Portland, Maine.....	648,500	568,100	80,400
Philadelphia.....	3,741,500	1,697,800	2,044,200
Baltimore.....	5,206,100	1,172,900	4,033,200
Grand total.....	34,531,000	24,618,100	9,823,100

SOURCES: Receipts: 1929-35, United States Army, Corps of Engineers, Transportation series No. 1—*Transportation on the Great Lakes* (Revised 1937), pp. 177-82. 1935-38, *The Northwestern Miller*, April 24, 1940, section 2, *Almanack of the Breadstuffs Industries*, pp. 55-7 and 59. Exports: United States Army, Corps of Engineers, *Commercial Statistics of the Waterborne Commerce of the United States*, 1930-39.

TABLE B-12

Internal receipts, exports, and apparent retention of grains at New York annual averages, 1929-38

[One hundred pounds]

Commodity	Internal receipts			Exports	Apparent retention
	By New York State Barge Canal	By rail	Total		
Barley.....	514,500	416,100	930,600	911,000	19,600
Corn.....	821,500	1,370,900	2,192,400	513,500	1,678,900
Oats.....	261,800	498,500	760,300	89,300	671,000
Rye.....	170,200	178,600	348,800	211,100	137,700
Wheat.....	10,944,000	7,969,800	18,913,800	18,501,600	412,200
Total grains.....	12,712,000	10,433,900	23,145,900	20,226,500	2,919,400
Flour.....	(¹)	(¹)	17,636,000	5,623,200	12,012,800

¹ No figures available.

SOURCES: Receipts by New York State Barge Canal: 1929-35, United States Army, Corps of Engineers, Transportation Series No. 1—*Transportation on the Great Lakes* (Revised 1937) pp. 177-83. 1936-38: State of New York, Department of Public Works, *Annual Report of the Superintendent*, 1936-38. Total receipts, 1929-35: United States Army, Corps of Engineers, Transportation Series No. 1—*Transportation on the Great Lakes* (1937) pp. 177-83; 1936-38: *The Northwestern Miller*, April 24, 1940, *Almanack of the Breadstuffs Industries*, p. 59. Exports: 1929-31: *The Northwestern Miller*, April 24, 1940, *Almanack of the Breadstuffs Industries*, p. 59. 1932-38: United States Army, Corps of Engineers, *Commercial Statistics of the Waterborne Commerce of the United States*, 1933-39.

TABLE B-13

United States exports of domestic grains and flour from New York, Boston, Baltimore, Philadelphia, and Portland, Maine, annual average, 1929-38

[One hundred pounds]

Kind of grain	New York	Boston	Baltimore	Philadel- phia	Portland, Maine
Barley.....	340,843	15,916	32,561	27,104	9,082
Corn.....	1,257,075	606	261,771	183,067	5,610
Oats.....	41,463	272	199	514	316
Rye.....	229,697	—	1,578	1,301	41,045
Wheat.....	1,845,640	233,240	822,580	473,660	182,000
Total grains.....	3,714,718	250,034	1,118,689	685,646	238,053
Total modified by seasonality factor, 63 percent.....	2,340,272	157,521	704,774	431,957	149,973

SOURCE: Compiled from data obtained from Department of Commerce, *Foreign Commerce and Navigation of the United States*.

TABLE B-14

Shipments of United States grain by vessel to overseas countries, by Canadian eastern seaboard ports, crop years 1929-38

[Bushels]

Year ending July 31	Sorel	Montreal	Quebec	Total, Sorel, Montreal, Quebec	Saint John	Halifax	Total, Saint John, Halifax	Grand total
1929		65,121,466	68,841	65,190,307	16,643,341	1,216,276	17,859,617	83,049,924
1930	509,998	19,146,645		19,656,643	3,840,170		3,840,170	23,496,813
1931	254,239	9,841,660		10,095,899	509,272		509,272	10,605,171
1932	1,519,106	5,786,830	984,026	8,289,962	1,813,369	112,990	1,926,359	10,216,321
1933	145,455	4,220,319	534,008	4,809,782	494,594	24,211	518,805	5,418,587
1934	274,847	442,941	15,614	733,402	88,912		88,912	822,314
1935								
1936		189,170		189,170				189,170
1937		444,978		444,978				444,978
1938	16,106,658	31,636,314	2,859,828	50,602,800	1,120,371		1,120,371	62,551,921
Average, 1929-38				16,010,294			2,586,351	19,679,520

¹ Includes 10,828,750 bushels shipped through "Three Rivers."

SOURCE: Canada, Dominion Bureau of Statistics, Agricultural Branch, *Report on the Grain Trade of Canada*, 1934, 1936, and 1938.

TABLE B-15

Export of wheat flour of major wheat flour exporting countries, calendar years 1929-38

[Short tons]¹

Year	Canada	United States	Argentina	Australia	Hungary	U. S. S. R.	Yugoslavia	British India	Rumania	Algeria	All other	Grand total
1929	938,617	1,400,457	151,057	544,449	289,386	14,101	11,693	52,525	9,043	7,853	763,443	4,182,624
1930	736,744	1,341,330	115,017	483,930	253,727	17,051	8,281	58,026	23,292	13,602	947,437	3,998,437
1931	558,556	1,004,477	84,991	554,884	137,503	33,160	3,771	49,301	43,040	6,286	1,137,360	3,622,329
1932	503,121	625,990	63,905	615,183	65,945	33,954	4,356	31,461	7,840	16,376	1,147,350	3,115,481
1933	546,117	447,035	109,107	612,933	54,200	34,604	2,338	13,037	298	30,535	1,381,521	3,231,745
1934	495,468	464,921	121,755	624,898	54,035	56,847	2,591	13,079		49,878	1,309,346	3,192,818
1935	478,541	380,373	97,649	685,539	58,082	33,292	2,525	19,210	99	43,205	1,204,396	3,003,011
1936	478,437	420,756	87,978	559,339	59,736	61,854	4,885	19,927	55	37,924	970,336	2,698,287
1937	400,686	501,555	104,862	568,261	63,717	63,111	8,800	61,721	761	26,218	858,561	2,658,367
1938	383,516	575,396	92,675	678,889	42,291		10,840	73,984	99	31,153	937,209	2,826,052

¹ Conversion factor: 10.2 barrels of wheat flour equal one short ton.

SOURCE: Canada, Dominion Bureau of Statistics, Agricultural Branch, *Report on the Grain Trade of Canada* 1924-38.

TABLE B-16

Annual flour output in Minneapolis and Buffalo 1910-39

[Short tons]¹

Year	Minneapolis	Buffalo	Year	Minneapolis	Buffalo
1939	545,044	998,855	1924	1,145,013	685,158
1938	562,418	1,000,041	1923	1,322,398	633,585
1937	557,000	1,005,079	1922	1,533,568	657,140
1936	632,614	1,022,092	1921	1,458,015	656,201
1935	650,604	944,618	1920	1,470,901	514,055
1934	694,297	943,631	1919	1,715,774	655,715
1933	714,044	958,949	1918	1,413,121	583,109
1932	708,548	959,713	1917	1,726,553	532,978
1931	894,272	1,085,912	1916	1,817,809	577,071
1930	1,058,548	1,202,933	1915	1,773,450	646,113
1929	1,058,493	993,428	1914	1,742,086	560,642
1928	1,200,368	986,277	1913	1,732,718	500,770
1927	1,131,378	983,511	1912	1,669,798	477,381
1926	1,156,202	948,219	1911	1,548,575	463,824
1925	1,182,310	927,703	1910	1,507,427	369,103

¹ Conversion factor: 10.2 barrels of wheat flour equal one short ton.

SOURCE: *The Northwestern Miller*, April 24, 1940, p. 28.

TABLE B-17

United States exports of wheat flour by specified destinations, average 1929-38

Destination	Short tons	
	Destination	Regional
British West Indies.....	3,953	185,419
Cuba.....	95,357	
Other West Indies.....	35,856	
Central America.....	50,253	
Brazil.....	25,249	25,249
United Kingdom.....	46,774	52,618
Ireland.....	5,844	
Germany.....	10,839	
Netherlands.....	45,461	
Norway.....	19,039	85,410
Finland.....	10,071	
Greece.....	1,466	17,221
Egypt.....	15,755	
Total specified above.....	365,917	365,917
Total United States exports.....	656,000	656,000

NOTE.—Classification: No. 1072 wheat flour 1929-34. No. 1073 wheat flour wholly of United States wheat and No. 1074 other wheat flour 1935-38.
Conversion factor: 1 barrel of wheat flour=106 pounds or 10.20408 barrels per short ton. 1 barrel=0.0980 short tons.

SOURCE: Foreign Commerce and Navigation of the United States, 1929-38.

TABLE B-18

United States exports of wheat flour by customs districts, calendar years 1929-38

[Short tons]

Year	Maine and New Hampshire	Masachusetts	Buffalo	New York	Philadelphia	Maryland	New Orleans	Galveston	All other	Grand total
1929.....	2	9,419	5,678	503,328	6,695	19,197	186,871	96,110	512,255	1,339,555
1930.....	1	10,272	9,202	500,133	7,203	21,050	189,092	147,015	396,387	1,280,355
1931.....	241	10,666	23,830	379,921	1,206	13,289	91,803	55,699	369,839	946,494
1932.....		2,563	15,043	212,960	274	4,396	50,657	20,051	262,239	568,183
1933.....		612	14,061	209,877	35	2,358	29,346	9,106	123,170	388,565
1934.....	7	711	10,042	228,646	186	977	17,827	3,581	146,192	408,169
1935.....		295	12,464	230,732	62	1,630	15,635	6,444	56,115	323,277
1936.....		72	14,078	259,532	132	1,084	14,448	8,984	60,453	358,783
1937.....	35	789	9,713	237,702	636	2,622	35,805	28,074	121,204	436,580
1938.....		564	15,922	215,546	878	5,463	59,617	33,511	179,691	511,192
Average, 1929-38.....	29	3,596	13,003	297,638	1,731	7,207	69,100	40,858	222,750	656,115

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1927-38.*

TABLE B-19

Shipments of flour by lake from Duluth, Milwaukee, and Chicago

[Short tons]

Year	Duluth	Milwaukee ¹	Chicago	Year	Duluth	Milwaukee ¹	Chicago
1938.....	191,495	196,926	147,029	1933.....	262,787	363,662	100,741
1937.....	247,581	212,153	70,991	1932.....	235,628	365,416	127,400
1936.....	255,698	222,666	156,819	1931.....	248,168	298,979	169,400
1935.....	277,343	304,320	132,875	1930.....	417,296	247,135	161,451
1934.....	237,357	325,499	114,562	1929.....	451,171	270,679	150,666

¹ Tonnages for Milwaukee include feed.

SOURCE: United States Army, Corps of Engineers, *Commercial Statistics of the Waterborne Commerce of the United States, 1930-39.*

TABLE B-20

Lakewise receipts of flour at Buffalo

[Short tons]

Year	Wheat	Rye	Total	Year	Wheat	Rye	Total
1938.....	330,540	11,944	342,484	1932.....	261,049	11,703	372,752
1937.....	290,932	15,597	306,529	1931.....	467,567	12,944	480,511
1936.....	251,417	15,604	267,021	1930.....	559,629	13,616	573,245
1935.....	400,020	14,457	414,477	1929.....	316,996		316,996
1934.....	329,761	9,288	339,049	Average 1929-38.....	372,079	11,504	383,583
1933.....	312,859	10,785	323,644				

¹ Flour and meal.

SOURCE: United States Army, Corps of Engineers, *Commercial Statistics of the Waterborne Commerce of the United States, 1930-39.*

TABLE B-21

*Shipments of flour via the New York State Barge Canal*¹

Year	Short tons	Year	Short tons
1938.....	43,686	1933.....	106,456
1937.....	38,292	1932.....	30,220
1936.....	70,628	1931.....	38,792
1935.....	53,981	1930.....	2,950
1934.....	78,842	1929.....	

¹ All but $\frac{1}{4}$ to 2 percent eastbound.

SOURCE: State of New York Department of Public Works, *Annual Report of the Superintendent, 1939.*

TABLE B-22

Average annual total receipts, exports, and apparent retention of flour at specified North Atlantic ports, 1929-38

[One hundred pounds]

Cities	Receipts	Exports	Apparent retention
New York.....	17,636,000	5,623,200	12,012,800
Boston.....	2,424,500	209,700	2,214,800
Portland, Maine.....	66,600	66,600	(¹)
Philadelphia.....	2,169,300	37,200	2,132,100
Baltimore.....	1,603,300	145,000	1,458,300
Grand total.....	24,799,700	6,081,700	18,718,000

¹ No figures available.

² Wheat flour only, 1936-38.

³ Wheat flour only, 1929-33 and 1937.

Appendix C

POTENTIAL TRAFFIC IN SOYBEANS

Section 1

UNITED STATES PRODUCTION AND EXPORTS OF SOYBEANS

Domestic production of soybeans has increased sharply in recent years. As a farm crop the soybean has been of some importance in this country since 1880, mainly as a forage crop. By 1918 there were 169,000 acres planted that produced over 3,000,000 bushels of soybeans. Six years later almost 5,000,000 bushels were harvested from 448,000 acres. Since 1925, soybean production in this country has increased even more rapidly. Preliminary figures indicate that the 1939 output exceeds 87,000,000 bushels, as shown in table C-1.

The rapid growth in the domestic production of soybeans is attributable to several important factors. In the first place, the soybean has a very high yield per acre, is a hardy plant, and is economical to harvest. In these respects it excels other legumes. It has therefore become increasingly popular as a forage crop. Moreover, due to the greatly increased production in the last few years, the American product has been able to compete with the Asiatic bean in the European market. Second, new uses for the joint products of the soybean have been found as valuable human food and as an industrial raw material. From the soybean are derived oil, meal, biscuits, milk powder, chocolate and soy sauce, as well as material for automobile accessories, paints, and lacquers.

Since more uses for soybeans are being found continually, it may be assumed reasonably that domestic production of this commodity will continue to increase.

The States tributary to the Great Lakes are important producers of soybeans. The annual and average production of these States is shown in table C-2.

The percentage of the total domestic production originating in the tributary area has been increasing constantly. This condition should continue to exist, since the plant thrives well in the soil of this area.

United States exports of soybeans are a recent development, made possible by surplus production. In 1932, due to the extremely low price of soybeans from the 1931 crop (48 cents per bushel), about 4,000,000 bushels or 120,000 short tons (figured on the basis of 60 pounds to the bushel) were exported. From then until 1938, however, soybean exports were negligible.¹ Domestic exports in 1938 were about 2,644,661 bushels or almost 79,338 short tons.² The 1939 exports amounted to approximately 10,470,000 bushels or 314,100 short tons,³ an increase of about 295.6 percent over the 1938 exports. This product promises to be of growing importance as an exportable commodity.

The largest portion of total domestic exports of soybeans is shipped from Chicago, as shown in table C-3, which gives exports by customs districts. In 1938, the Chicago customs district, together with that of Michigan, handled 88.1

¹ Small quantities were included in oilseed exports.

² Department of Commerce, *Foreign Commerce and Navigation of the United States, 1938*, p. 476.

³ Department of Commerce.

percent of the domestic exports. Although this figure dropped to 47.8 percent in 1939 while the export percentage from New York and Maryland greatly increased, it is reasonable to assume that the 1938 figures are the more normal ones because the situation in 1939 was affected by the European war which began in September of that year. This is borne out by the fact that New York and Maryland exported 99.9 percent and 98.0 percent, respectively, of their total 1939 soybean exports during the last two months of the year, as shown in table C-4, which would indicate rush exports at a time when the navigation season on the Great Lakes was nearing the close.

As shown in table C-3, the customs district of Chicago exported 296,961,102 pounds or 148,480 short tons of soybeans in 1939. This entire quantity was exported during the open season of navigation on the Great Lakes, May through November (see table C-5).

The 1939 domestic exports of soybeans from the tributary area, therefore, were 296,961,102 pounds. However, if the normal seasonality of exports had been maintained in 1939 as in 1938, a much larger amount of the 1939 exports would probably have moved via Chicago, which is the principal exporting center for soybeans. The percentage of shipments through Chicago in 1938 was 87.08 of total exports.

The principal foreign importing countries that receive most of the United States soybeans have been Belgium, Denmark, Finland, Netherlands, Sweden, Norway, Canada, and the United Kingdom. Germany was formerly a major market for soybeans and again may become so in the future. In recent years these countries have been the heaviest importers of soybeans.

Section 2

MARKETING AND TRANSPORTATION OF SOYBEANS

Marketing channels of soybeans are comparable to those of the grains. Farmers usually bring their soybeans by truck to "primary receiving points" scattered throughout the producing area. From these primary receiving points they are moved by rail to large milling points nearby for processing or they are moved by rail, barge, or lake boat to distant processing plants, all carriers permitting the same or similar in-transit privilege or service, such as milling, mixing, handling, loading and unloading, etc., that grains are allowed.

The bulk of the domestic soybean movement, as stated above, is by rail from primary receiving points to milling centers where the beans undergo processing.

Domestic export movement of soybeans is by rail from primary receiving points to Chicago and Baltimore, by rail and barge to New Orleans, or by rail and barge to New York. At these shipping points they are loaded into ocean vessels for exportation. Ever since soybeans began to be exported in large quantities, Chicago has had a wide margin over all shipping points in the amount of exports handled. And the greater part of the exports from Chicago have been shipped over the Great Lakes-St. Lawrence route to Montreal where they have been transshipped to the European consumers. When the smaller vessels reach Montreal, the soybeans are transferred to larger vessels for transportation to the final destination, which is usually Europe. Chicago and Baltimore handle most of the exports, although a sizable quantity moves through New Orleans when the lake navigation system is closed for the winter months.

Soybeans are harvested in the fall. This fact does not affect the domestic movement to a great degree, as the railroads can continue to move them regardless of seasonal conditions.

The reverse is true, however, regarding exports. This is due to the fact that the season of open navigation on the Great Lakes is closed at the end of November. Thus, when the soybeans are harvested, the surplus is shipped over the lakes as soon as possible before the season of navigation is closed for the winter.

During the summer of 1939, soybean rates from Chicago to Montreal averaged about 4.5 cents per 100 pounds. The rate from Montreal to Europe varied from 15 to 21 cents per 100 pounds, depending on the country of destination. Taking the 15-cent rate from Montreal to Rotterdam as an example, the rate from Chicago to Rotterdam, under normal conditions, would be 19.5 cents per 100 pounds. The transfer charge at Montreal is 1 cent per bushel of soybeans or 1.7 cents per 100 pounds. Ordinarily, therefore, the total rate from Chicago to Rotterdam would be 21.2 cents per 100 pounds (see table C-6).

If the St. Lawrence Seaway development were carried out, it would be possible to make a through Seaway rate from the lake ports to Europe, as in this case, grains, of 16 cents per 100 pounds. Using the Rotterdam example again, therefore, means that there would be a total charge of 16 cents from Chicago to Rotterdam via the St. Lawrence River. This Seaway rate to Europe would have a differential of 5.2 cents per 100 pounds under the prevailing cost in 1939.

Since Chicago exported 296,961,102 pounds of soybeans in 1939, it is possible to estimate a savings of over \$154,000 if the St. Lawrence development were carried out and the Seaway rate set up. If in 1939 the direct shipments from Chicago during the open season were on as large a scale proportionately to total exports as in 1938, the potential tonnage might be as much as 270,000 tons and the estimated savings over \$284,000.

The estimated soybean production for 1950 is 115,000,000 bushels or 3,450,000 short tons. By 1965 production is expected to reach 140,000,000 bushels or 4,200,000 short tons. These estimates represent increases of approximately 31.6 percent and 59.4 percent, respectively, over the 1939 production of 87,409,000 bushels, or 2,622,270 short tons.⁴

In 1938 the States from which soybeans moved north to the lake ports⁵ produced about 57,009,000 bushels which represented approximately 91 percent of total domestic production. Applying this percentage to the above estimates, therefore, production in the tributary area in 1950 and 1965 would amount to about 104,650,000 bushels and 127,400,000 bushels, respectively.

Even though estimates of future soybean consumption must take into account the ever-increasing discoveries of industrial uses for soybeans, a substantial surplus of the production should be available for exportation. Exports in 1950 and 1965, if conditions are normal, will probably constitute the same proportion of domestic production as in the last few years; viz., from 5 percent to 10 percent of the production, depending on the prices that our foreign consumers are willing to meet, other factors being equal. Estimated total United States exports of soybeans for 1950 and 1965 are 11,500,000 bushels and 14,000,000 bushels, respectively.⁶

Estimated savings on the export movement of soybeans from the tributary area via the St. Lawrence in 1950 and 1965, if conditions are normal, would therefore amount to \$326,508 and \$397,488, respectively, based on a differential of 5.2 cents per 100 pounds under the cost prevailing in 1939.

⁴ 1950 and 1965 estimates by Department of Agriculture.

⁵ Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa, and Minnesota.

⁶ Estimated by the Department of Agriculture.

TABLE C-1
United States production of soybeans, 1924-39

[Thousands of bushels]

Year	Quantity	Year	Quantity
1924.....	4,947	1932.....	14,975
1925.....	4,875	1933.....	13,147
1926.....	5,239	1934.....	23,095
1927.....	6,938	1935.....	44,378
1928.....	7,880	1936.....	26,938
1929.....	9,398	1937.....	45,272
1930.....	13,471	1938.....	62,729
1931.....	16,733	1939.....	87,409

¹ Preliminary.

SOURCE: Department of Agriculture: *Agricultural Statistics, 1940*, p. 306.

TABLE C-2
Production of soybeans in the Great Lakes tributary area States, 1927-39

[Thousands of bushels]

Year	Ohio	Indiana	Illinois	Michigan	Wisconsin	Minnesota	Iowa	Total	Percent of total shown to total United States	Total United States
1927.....	304	884	2,392	16	10	-----	276	3,882	56.0	6,938
1928.....	360	1,000	3,069	30	25	-----	357	4,841	61.4	7,880
1929.....	347	1,425	3,842	20	23	-----	576	6,232	66.3	9,398
1930.....	434	2,114	6,970	10	22	-----	1,023	10,574	78.5	13,471
1931.....	940	3,115	7,704	36	20	-----	790	12,605	75.3	16,733
1932.....	527	2,256	7,760	117	36	-----	936	11,632	77.7	14,975
1933.....	528	1,800	5,415	96	34	-----	1,615	9,488	72.3	13,147
1934.....	697	2,960	13,756	84	24	-----	2,070	19,591	84.8	23,095
1935.....	2,604	6,970	24,012	232	26	-----	6,600	40,444	91.1	44,378
1936.....	2,046	4,186	17,216	180	20	-----	2,548	26,196	87.4	29,938
1937.....	3,249	5,797	27,040	224	39	-----	4,236	40,585	89.6	45,272
1938.....	5,754	9,540	34,122	560	112	180	6,741	57,009	90.9	62,729
1939¹.....	9,681	13,962	45,423	960	320	400	10,227	80,973	92.6	87,409
Average, 1928-37.....	1,173	3,162	11,678	103	27	-----	2,075	18,218	83.4	21,833

¹ Preliminary.

SOURCES: Department of Agriculture: *Agricultural Statistics, 1927-36*. Department of Agriculture, Agricultural Marketing Service: Division of Agricultural Statistics, 1937-39.

TABLE C-3
United States exports of soybeans by principal customs districts, 1938-39

Customs district	1938		1939	
	Amount (pounds)	Percent of total United States	Amount (pounds)	Percent of total United States
New York.....	1,437,669	0.91	152,680,335	24.32
Maryland.....	6,237,224	3.93	111,877,825	17.82
New Orleans.....	8,108,805	5.11	22,586,623	3.60
El Paso.....	893,980	.57	946,497	.15
Arizona.....	2,163,260	1.36	-----	-----
Michigan.....	1,617,953	1.02	3,361,550	.54
Chicago.....	138,189,960	87.09	296,961,102	47.31
Total.....	158,650,851	99.99	588,413,932	93.74
Total United States.....	158,679,669	100.00	627,741,363	100.00

SOURCE: 1938: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1938*, p. 673. 1939: Department of Commerce.

TABLE C-4

Exports of soybeans from the customs districts of New York and Maryland during November and December 1939

[Pounds]

Month	New York	Maryland
November.....	65,830,164	63,512,243
December.....	86,760,380	46,111,490
Total.....	152,590,544	109,623,733
Year's total.....	152,680,335	111,877,825
Percent of year's total.....	99.9	98.0

SOURCE: Department of Commerce.

TABLE C-5

Domestic exports of soybeans from the customs district of Chicago, by months, 1939

Month	Pounds	Month	Pounds
January.....		August.....	2,032,520
February.....		September.....	
March.....		October.....	151,475,660
April.....		November.....	62,561,810
May.....	25,477,032	December.....	
June.....	13,688,892	Total.....	298,961,102
July.....	41,725,288		

SOURCE: Department of Commerce.

TABLE C-6

Indicated savings on exports of soybeans in 1939 from Chicago to Europe via the proposed St. Lawrence Seaway

Point of origin	Cents per 100 pounds						Available traffic in 100-lb. units	Savings
	Rate to Montreal	Transfer charges at Montreal	Rate from Montreal to Europe ¹	Total cost from origin to destination	Feasible through rate to Europe via St. Lawrence Seaway ¹	Differential of feasible rate under present rate		
A. Chicago.....	4.5	1.7	15	21.2	16	5.2	2,989,611	\$154,419.77
B. Chicago.....	4.5	1.7	15	21.2	16	5.2	5,466,000	284,232.00

¹ The rate to Belgium and Netherlands is used here as an example. Although the rates to the various European countries vary, the differential of the feasible rate under the present rate would always be the same, since the feasible rate is the Montreal rate plus a 1-cent blanket rate into all lake ports.

² Actual exports from the Chicago customs district in 1939.

³ Indicates the amount of exports from the Chicago customs district if the percentage of exports from Chicago to United States total had been the same in 1939 as in 1938.

Appendix D

THE DAIRY INDUSTRY

INTRODUCTION

The territory tributary to the Great Lakes is the principal dairy producing center in the United States. Dairy production is as important to States like Wisconsin and Minnesota as corn is to Iowa and wheat and flaxseed to North and South Dakota. In addition to the possibility of large movement via the St. Lawrence for grain products, one of the principal motivating interests of this region in the support of the St. Lawrence Seaway is the possibility that the dairy industry will find wider outlets for its products through cheaper means of transportation. The reason for this urgent interest in the St. Lawrence by the dairy producers of the Middle West is in the fact that rail rates on dairy products are among the highest commodity rates in existence.

The dairy products which will be examined in this report in relation to the St. Lawrence are butter, cheese, evaporated and condensed milk, eggs, and dressed poultry. In each case the export trade will be analyzed and the potentialities of domestic trade to the Atlantic coast by the all-water route will be explored.

Section 1

PRODUCTION CENTERS OF DAIRY PRODUCTS

The importance of the tributary area of the Great Lakes as the principal production center of dairy products is easy to establish. A series of tables are presented to indicate production of dairy products in those States considered tributary to the Great Lakes. In table D-1 the distribution of United States production of cheese during the years 1935-37 is given. It is there seen that Wisconsin is the largest single producer of cheese, with 313,000,000 pounds in 1937 out of total United States production of a little less than 777,000,000 pounds, or over 40 percent. In 1935, the percentage of total production that was produced in Wisconsin was 47.6. Illinois, with nearly 5 percent in 1935, and 6 percent in 1937, was the second largest cheese producing State in the United States, followed by Indiana and Ohio. The percentages of total production in certain States tributary to the Great Lakes during 1935 and 1937 are given in table D-2.

The Great Lakes tributary area is also important in the production of creamery butter. Table D-3 presents production of creamery butter by specified States during the years 1927-37. During 1937, for instance, those specified States produced the following percentages of the United States total:

	<i>Percent</i>		<i>Percent</i>
Illinois.....	4.2	North Dakota.....	2.6
Indiana.....	4.0	Ohio.....	4.8
Iowa.....	12.3	South Dakota.....	2.1
Kansas.....	4.2	Wisconsin.....	10.8
Michigan.....	5.0		
Minnesota.....	17.0	Total.....	70.9
Nebraska.....	3.9		

Without doubt, in the production of creamery butter, also, the Great Lakes area is the principal dairy center.

Wisconsin also predominates in the production of condensed, evaporated, dried, or powdered milk as shown in table D-4. In 1937 it produced nearly 815,000,000 pounds, out of a total of 2,837,000,000 pounds of these products, or 28.7 percent of the total. Ohio, with 9.1 percent, Illinois with 5 percent, and Michigan with 4.9 percent are other principal sources of production of condensed, evaporated, dried, or powdered milk. In addition to 2,837,000,000 pounds of these products, there were over 2 billion pounds of other cased goods, but for these there was no available distribution by States in the Census of Manufactures.

The distribution of the number of chickens and eggs sold from farms, by States, was more even. The tributary area, however, in both of these products accounted for about 50 percent of the total national production, as shown in tables D-5 and D-6. In a later section it will be shown that the great metropolitan centers of the Atlantic coast depend upon this area for the major share of their receipts for consumption of these products.

Section 2

UNITED STATES EXPORTS OF PRINCIPAL DAIRY PRODUCTS

The United States does not export large amounts of dairy products. The principal exports of dairy products during the fiscal years 1930-38 are shown in table D-7, indicating that exports of butter and cheese are not very important. The major items of dairy exports are condensed and evaporated milk. Combined exports of these two products have varied during this period between 77,000,000 pounds in the fiscal year 1930-31 and 25,700,000 pounds in the fiscal year 1936-37. The total exports of butter, cheese, and condensed and evaporated milk have varied between 83 million pounds or 41,500 short tons in the 1930-31 season and 27.6 million pounds or 13,822 short tons in the 1936-37 fiscal year.

In table D-8 are presented the 10-year averages of annual exports for the period 1928-37, fiscal years, in butter, cheese, condensed and evaporated milk, and eggs in the shell. The total average annual exports during this decade amounted to only 33,210 short tons. Of this total, 28,530 short tons were the average annual exports of condensed and evaporated milk. Potential tonnage of dairy products that may utilize the St. Lawrence route need only be studied, therefore, with regard to condensed and evaporated milk.

A study of the destination of exports of evaporated milk as shown in table D-9 indicates that by far the largest single customer is the Philippine Islands. In the years 1933-38 the Philippine Islands received between 38 and 53 percent of the total United States exports of evaporated milk. Average United States exports of condensed milk to the Philippine Islands for the years indicated in table D-10 amounted to approximately 40 percent of the total condensed milk exported. This traffic cannot be considered potential to the St. Lawrence, since in all likelihood exports to Philippine Islands are shipped principally from the west coast regions. There are small amounts of exports to European points of both evaporated and condensed milk, principally to the United Kingdom. Some of this may be picked up by outgoing vessels, but it is so infinitesimal in amount that it can be disregarded in our calculations of potential traffic. The only export trade in evaporated and condensed milk that need be considered in relation to the St. Lawrence is that sent to Caribbean countries. The following summary based on tables D-9 and D-10 indicates the amounts in thousands of pounds of evaporated

and condensed milk exported to Caribbean countries during the fiscal years 1933-38:

Commodity	Thousands of pounds				
	1933-34	1934-35	1935-36	1936-37	1937-38
Evaporated milk.....	6,942	7,178	7,437	4,939	6,041
Condensed milk.....	2,051	1,712	1,515	832	3,416
Total.....	8,993	8,890	8,952	5,771	9,457

From this summary we might estimate a potential tonnage of about 3,000 short tons a year as available for shipment through the St. Lawrence during the open navigation season. It is very likely that nearly all exports to Caribbean countries might move during the open navigation season, since condensed and evaporated milk are preservable and can be stored. It would not be surprising if most of the imports of those countries should take place in the late summer months for storing over the winter. However, for reasons of conservatism, only about 3,000 short tons will be considered potential tonnage of exports to Caribbean countries of evaporated and condensed milk. Considering that some amount of cheese and butter may also be exported to those countries 4,000 short tons of potential tonnage of dairy products would not be excessive.

Section 3

COASTWISE TRADE IN DAIRY PRODUCTS

The Atlantic coastal regions are dependent upon the Middle West for a major part of the consumption requirements of dairy products. In section 1 above it was shown that the tributary area of the Great Lakes, particularly west of Lake Michigan, is the principal center of production of dairy products. The industrial population of the Northeast, as well as the urban population of southeastern United States, depend upon the tributary area of the Great Lakes for a substantial part of their requirements for dairy products. It is here proposed to investigate the possibilities of domestic shipments of dairy products from Great Lakes ports to the Atlantic ports. This will be analyzed for five principal dairy products—namely, butter, cheese, eggs, poultry, and canned milk.

Extensive statistics are compiled by the Department of Agriculture on the receipts of dairy products in the principal North Atlantic ports of Boston, New York, and Philadelphia. These receipts are analyzed in *Agricultural Statistics* both by States of origin, as well as months of shipment. Consequently, it is possible to have exact figures with regard to amounts of receipts from individual States in the tributary area and the movement during the open navigation season.

Such statistical data are available on eggs, butter, cheese, and poultry. In the case of canned milk, the analysis will have to be somewhat varied by estimating the consumption in the trading areas of the Atlantic coast and the proportion of the total consumption requirements that may be shipped from the tributary area. The receipts of all five types of dairy products herein analyzed in the southeastern coastal plain will have to be based, similarly, upon estimates of deficiencies in consumption requirements, after allowing for local production, which may be obtained from the tributary area.

First, let us examine the over-all figures of shipments to Boston, New York, and Philadelphia of eggs, butter, cheese, and poultry. In order to eliminate annual variations, here also we have adopted a 10-year average as the basis of our estimate of potential available traffic. In table D-11 below a summary is pre-

sented of the 10-year annual average of receipts of eggs, butter, cheese, and poultry in these three North Atlantic harbors. This table shows that the annual average gross receipts of dairy products in these three markets amounted to 686,195 short tons during the years 1928-37. Of this amount New York received by far the largest share, with 455,880 short tons; Boston was next with 117,158 short tons; and Philadelphia next with 113,157 short tons. Surprisingly enough, eggs constituted the largest single item of consumption by weight, and butter next, followed by poultry and cheese. These figures are the annual receipts at the three eastern markets.

The share of these shipments to New York, Boston, and Philadelphia which comes from the tributary area of the Great Lakes is given in table D-12. In this table are summarized the receipts at the three markets of each of the four dairy products listed from the following States: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, Ohio, and Wisconsin. This shows that during the 10-year period the average annual receipts at these three markets from the aforementioned States amounted to 477,983 short tons, or more than two-thirds of the total annual average receipts from all sources. Butter, in this case, is the largest importation in all three markets from the tributary area, with 196,682 short tons. Eggs are second in rank, with 142,640 short tons. Again New York is the principal recipient of dairy products from the tributary area, with 303,456 short tons as an annual average during the 10-year period. Boston received 94,089 short tons, and Philadelphia 80,438 short tons.

The next problem is how much of this annual gross receipts from the tributary area may be considered available during the open navigation season. To obtain this break-down it was necessary to take, for each individual commodity and for each market, the sum of receipts for the 7 months, May to November inclusive, of each year from 1928 to 1937. Then the average receipts during the 10-year period in these months of open navigation were obtained for each commodity and each locality. Finally the proportions of these 7-month, 10-year averages to the total annual averages for the 10 years were obtained. The resultant percentages are presented in table D-13. It must be noted that these are the average percentages for the 10-year period of gross receipts of each commodity in each one of these markets during the 7 months of open navigation to the gross average annual receipts from all sources. The facts available did not permit of obtaining the figures for actual monthly receipts from each State. Hence, it is not possible to obtain the exact figures of seasonal receipts from each state in the tributary area. However, since the major part of the total receipts come from the tributary area, it can be assumed that the proportion of average seasonal receipts to the average annual receipts from the tributary area would not differ greatly from the percentages given in table D-13. Applying these percentages to the receipts from the tributary area as given in table D-12, we obtain the figures in table D-14, which give in season movement of all four products to these eastern markets from the tributary area. The average tonnage that moved east during the open navigation season has been during the years 1928-37, 284,628 short tons. This can be considered almost an irreducible minimum, since the average period under consideration covers the worst depression era that the country had ever seen. Furthermore, the percentages of seasonality that were applied to obtain these figures described the seasonality of all receipts rather than the receipts from the tributary area. Since, however, production of these products in the tributary area reaches a seasonal height in the summer months, it would not be unrealistic to assume that a larger proportion of the receipts in the Eastern markets during the summer months come from the States tributary to the Great Lakes than is indicated in table D-13. Hence, we may say that a conservative average annual tonnage of available traffic during the open navigation season from the tributary

area to New York, Boston, and Philadelphia alone, comprising eggs, butter, cheese, and poultry, would be about 300,000 short tons.¹

In addition to the commodities above considered, the receipts of condensed and evaporated milk from the tributary area at North Atlantic urban districts are substantial. Unfortunately, no data on receipts of this product comparable to those for butter, cheese, and eggs were obtainable. Consequently, it was necessary to estimate the amount of receipts of this product in the industrial region of the Northeastern coast by calculating consumption requirements of the trading areas immediately adjacent to the seacoast, on the basis of average per capita consumption figures obtained from a study of the Department of Agriculture.² Allowance was made for local production, and the net deficiency in the industrial area was estimated. After obtaining the figure for net deficiency in the urban areas, under consideration, 50 percent was allocated as the probable receipts from the Middle Western area. This was considered conservative, since about 55 percent of the total national production takes place in the States tributary to the Great Lakes. Indeed, most of the exportable surplus of condensed and evaporated milk is in Wisconsin, which in 1937 produced 23.7 percent of the total production in the United States (see table D-4). Ohio, with 9.1 percent, and Illinois with 5.0 percent, were next as large centers of production. It is likely then that these States are exporting States, and consequently most of the Eastern centers that buy their evaporated and condensed milk from other regions import it from this area. Hence, the estimate that 50 percent of the deficiency in the urban areas is supplied by the tributary area, is very conservative. On this basis, the trading areas on the North Atlantic coast from Maine to New Jersey and Pennsylvania would import between 23 and 24 thousand short tons of canned condensed milk from the Great Lakes area. Estimating that 70 percent of this may move during the season of open navigation from May to November inclusive, there would be a total of 16,300 short tons of traffic of this product to North Atlantic ports.

In a similar manner, the deficiency in the trading areas in South Atlantic States from Delaware to Florida was estimated.³ The following imports of various dairy products from the tributary area were estimated:

	South-eastern coastal urban areas, including Florida			South-eastern coastal urban areas, including Florida	
	Short tons	Short tons		Short tons	Short tons
Eggs.....	7,781	4,031	Evaporated and condensed milk.....	18,230	6,324
Butter.....	12,357	2,234			
Cheese.....	8,342	1,296			
Poultry.....	1,112	1,112			
Total.....						47,822	14,997

On this conservative basis, the Southeastern coastal areas appear to receive 47,822 short tons of these products from the tributary area. On the basis of 60 percent moving during the open navigation season, the potential tonnage might be calculated at 28,693 short tons. However, since the shipments to such places as

¹ It is believed that this average figure would not be subject to violent fluctuations from year to year since our tabulations of annual receipts by States and by markets for each commodity indicate that even during the years 1928-38 there has not been great variation from year to year.

² Department of Agriculture, *Diets of Families of Employed Wage Earners and Clerical Workers in Cities*, Circular No. 507, January 1939.

³ Account was taken of the difference in per capita consumption of white and Negro families.

Baltimore, Md., Wilmington, Del., Washington, D. C., and Wilmington, N. C. would be too small for boats to make any special stops, and in view of the fact that these products would probably be transported in refrigerated ships which would be making their return trip after taking citrus fruits into the Great Lakes, we have taken shipments to Florida as offering possible traffic to the St. Lawrence route. The estimated receipts from the tributary area in Florida of dairy products is placed at 14,997 short tons. Applying a 60 percent factor for the in-season movement to the total receipts in Florida, we obtain potential tonnage of 8,998 or 9,000 short tons. The total available traffic, (short tons) then, in export and coast-wise trade, (see table D-14, column 4, and page 5) would be as follows:

Dairy products	Short tons	Dairy products	Short tons
Exports of canned milk.....	4,000	Coastwise shipments to North Atlantic ports—Continued.	
Coastwise shipments to North Atlantic ports:		Poultry.....	58,000
Eggs.....	78,000	Canned milk.....	16,000
Butter.....	121,000	Florida.....	9,000
Cheese.....	28,000	Total.....	314,000

Section 4

ESTIMATE OF POTENTIAL SAVINGS ON AVAILABLE TRAFFIC

It was shown in the preceding section that 314,000 short tons of traffic would be available on the basis of 1928-37 averages in dairy products, which might possibly use the St. Lawrence route to the eastern coast. The next problem is to estimate the potential savings that may accrue to producers and/or consumers in transportation costs if this amount of traffic would actually use the St. Lawrence. The estimate of potential savings would be based, in this case also, upon existing rail rates as compared with different levels of Seaway rates that may be possible to establish for this trade.

In order to estimate as accurately as possible the potential savings, it will be necessary on the one hand to break down the figures of receipts of each commodity by points of origin and amounts, and secondly it will be necessary to examine present transportation costs from these specific points of origin to the principal eastern markets. For this purpose the commodities will be grouped differently than in the preceding analysis. The rail rates on eggs, butter, and poultry, which require refrigeration, are different from the rates on cheese; and, of course, canned milk products carry still another classification. Furthermore, the rates from individual points of origin to individual points of destination for each of these three classifications of commodities also vary. Hence, the in-season available traffic from particular States of origin to particular markets will be summarized, first for eggs, butter, and poultry, and then individually for cheese and canned milk. In table D-15 the average annual receipts during the period 1928-37 of eggs, butter, poultry, and cheese in the New York market from individual States in the tributary area are detailed. In this table total average annual receipts of each commodity from each State in the tributary area, as well as the proportion that is estimated to move during the open navigation season, are given. The percentages applied to obtain receipts during the open navigation season are the same as those given in table D-13. It must be observed that this is valid only upon the assumption that each State ships the same proportion during the open navigation season as the receipts of New York of the particular commodity during this season bears to the total annual receipts. Although this

may not be strictly true, as applied to each individual State, this method of calculating in-season movement of these products from specific points of origin will not result in any serious miscalculation in the final estimate of potential savings, since the savings from most of these places will be conservatively estimated at levels which are comparable for most of the points of origin. Furthermore, it is likely that New York receives a larger proportion of its summer requirements from the tributary area than in the winter, since this region reaches its peak of production in the summer.

Calculated on this basis, the in-season movement of eggs, butter, poultry, and cheese from Middle Western States to New York, as given in table D-15, shows that Iowa supplies the largest tonnage of the first three commodities to New York during the open navigation season, with 51,247 short tons. Minnesota is second, with 32,438 short tons. Illinois is third, with 25,492 short tons. The total for all the tributary States is 165,526 short tons. In cheese, Wisconsin is by far the largest single source, with Illinois second.

Similar tables D-16 and D-17, are presented for Boston and Philadelphia. Boston received a total of 51,387 short tons of eggs, butter, and poultry combined from the tributary area States. Minnesota is the largest supplier of these products to Boston, with 13,415 short tons; Illinois is second, with 9,536 short tons. The average season receipts of cheese in Boston are estimated at 4,926 short tons, most of it from Wisconsin. In the case of Philadelphia, average receipts of eggs, butter, and poultry from those same States during the open season amounted to 39,807 short tons. In this case again, Minnesota is the largest supplier, with 19,152 short tons, and Illinois second with 4,440 short tons. The average in-season receipts of cheese amounted to 7,070 short tons, again most of it shipped from Wisconsin. It is to be observed that the States bordering on the Great Lakes supply the larger portion of the total receipts of these products in New York, Boston, and Philadelphia.

The potential savings on the movement of these commodities from the respective points of origin to these three principal markets on the North Atlantic coast, of course, will depend upon the alternative rates that shippers may obtain via the seaway as compared with the present rail rates. In view of the fact that such large amounts of potential traffic are available, it will be assumed here that shipping services from such centers as Duluth, Milwaukee, Chicago, and Lake Erie points will be available, just as shipping services have been established between Florida and New York for the transportation of citrus fruits in shipload lots. The total estimate of nearly 300,000 short tons of in-season movement of butter, eggs, cheese, and dressed poultry, most of which comes principally from Minnesota, Wisconsin, Iowa, and Illinois, would require almost 100 boat trips carrying 3,000 short tons each, which would mean necessary shipping service almost every other day during the season of open navigation. As banana boats from the Caribbean and shiploads of citrus fruits from Florida could come into lake harbors with profitable cargo, these dairy products would make excellent return load for the refrigerated ships required for fresh fruit. As it was estimated that there would be nearly 200,000 short tons of incoming banana shipments from the Caribbean and 86,500 short tons of Florida citrus, there would be excellent opportunity for return cargo. The question of return cargoes for ships plying between designated points of origin and destination will be treated more fully in another part of this survey's reports. For the present purposes, we can assume that shipping will be available. The question, then, is at what rates ship lines might carry dairy products to the North Atlantic ports.

In treating this subject, we are again faced with the difficulty that there are no existing water rates on any route comparable to the St. Lawrence route which can be used for purposes of comparison. As this survey has attempted to proceed

upon the realistic basis of rate making for water carriers, which is not, as other writers have assumed, on cost basis or on a ton-mile basis, but essentially on the "what the traffic will bear" basis, considering all of the factors of competition in shipping and traffic, we must proceed to examine the possibilities of shipping rates from this point of view. It is not, of course, denied that the resultant rates or combination of rates on different commodities that may be carried by shipping lines must in the long run meet their total costs.

This method of establishing rates leads one to the determination of a rate which is essentially arbitrary and not necessarily duplicated in actual practice. There is a more rational approach not subject to the same disabilities. Study of comparative all-water and all-rail class rates between New York on the one hand and Florida, Gulf ports, and the West coast, on the other, indicates that there is a definite percentage relationship between all-water and all-rail rates which are uniformly the same for all classes. In the case of the distance between New York and Jacksonville, Florida, all-water class rates are kept at about two thirds of the all-rail rates. The same is true of all-water rates in relation to all-rail rates from New York to New Orleans. From New York to California the relationship of all-water rates to all-rail rates is between 71 and 73 percent. Of course, it is not true that this relationship is maintained in the case of individual commodity rates. However, when there is a deviation from this proportionate relationship of all-water and all-rail rates in specific commodities, it is usually brought about by the reduction of rail rates nearer to the level of the all-water rates. Since there is no competitive all-water route now from points on the Lakes to New York, we may take the present rail rates as the point of departure in establishing an all-water rate with a definite proportionate relationship to the all-rail rates. First, however, it should be pointed out that there are competitive lake-rail and rail-lake-rail routes through Duluth and Milwaukee via Buffalo, but with the exception of butter, available data indicate that relatively small tonnages of dairy products are moved over these routes. During the 10-year period 1930-39, for example, lakewise receipts of butter at Buffalo have averaged annually 79 percent of the total butter, eggs, cheese, and poultry received. Nevertheless, the competition of these routes must be recognized in developing the possible saving in transportation cost.

The distance between Duluth or Chicago and New York is comparable to the distance from New York to Jacksonville or New Orleans. As the relationship of the all-water and all-rail rates in the latter two cases is about two thirds, or between 66 and 67 percent of the all-rail rates, one might well adopt this proportion in arriving at all-water rates from lake ports to New York. However, in view of the fact that there is a considerable detour involved in the case of the St. Lawrence route—a detour which is only slightly longer than the trip around the Florida Keys to New Orleans—we may establish a ratio of 70 percent of all-water rates to all-rail rates.⁴ This, however, can be applied only in the case of ports located directly on the Great Lakes, since the relationship between rail-water rates and all-rail rates from points removed from the lakes would be somewhat different, because of the short distance of expensive rail transport involved in the combination rate. This matter will be taken up shortly.

First, then, let us establish probable all-water Seaway rates by reference to the existing all-rail rates. The rail rates to the three points here being studied, on eggs, butter, and poultry, are identical. Taking seven principal ports on the Great Lakes as base points, the rail rates to New York, Boston, and Philadelphia are given in table D-18. If we take 70 percent of the rail rates given in table

⁴ Executives of ship lines engaged in coastwise shipping have expressed the opinion to the director of the survey that they will be glad to carry dairy products between Duluth, Milwaukee, and Chicago, to North Atlantic ports at 65 or 70 percent of the all-rail rates, if the latter would remain stable.

D-18 as the probable Seaway rate, then we obtain all-water rates per hundred-weight as given in table D-19.

From Duluth to Boston, on the basis of the rates here established, the revenue per ton would be \$16.80. A boatload of 3,000 tons from Duluth to Boston, then, would yield \$50,400, and in addition would still offer a saving to the shipper of \$7.20 per ton, or a total of \$21,600. Similarly, a shipload from Chicago or Milwaukee to Boston of 3,000 tons would yield, at the rate of 57 cents per hundred-weight or \$11.40 per short ton, a total of \$34,200 of revenue and a saving to the shipper at the rate of \$4.80 a ton, or \$14,400.

Indeed, the savings would probably be greater than these, since eggs, butter, and poultry, being carried in refrigerated cars, must, in addition to the rates, meet the cost of icing on railroads. In order to have dry ice, of course, salt is required. The charges for ice and salt are indicated in table D-20. It will be noticed there that these charges vary generally between \$3.50 and \$4 per short ton. The charges for salt are, with one exception, 75 cents per hundred pounds. Of course, the amount of ice and salt needed per car of 20 or 30 tons will vary with distance and temperature. Hence, it is impossible to state how much saving there might be in icing charges. Assuming, however, that four tons of ice per car of 30 tons may be needed, for instance, between Minnesota and Boston during a summer trip, a cargo of 3,000 short tons would require 400 short tons of ice, which, at the rate of \$3.50 per short ton, would amount to \$1,400, not including additional charges for necessary salt. This would be an additional saving, since ships include refrigeration in the rates which yield such high revenues per trip as was shown above.

Before we calculate over-all potential savings on the indicated potential traffic, we must investigate possibilities in other rates. It may be asserted that taking 70 percent of the all-rail rates as a basis of setting all-water rates yields a divergence of rates between points in the same region, such as Cleveland and Toledo, Chicago, Milwaukee, and Green Bay, which is foreign to the practice of rate making among ship lines. Ship lines, it is well known, usually apply the same blanket rate in a given region, regardless of distances. On that basis, it may be claimed, for instance, that all rates east of the Straits of Mackinac and Sault Ste. Marie may carry the same blanket rates, and those west of that point in Lake Superior and Lake Michigan carry another set of blanket rates for all ports in those lakes. On this basis it is possible that uniform rates may be established in Lake Erie at 45 or 48 or even 50 cents per hundredweight; in Lake Michigan at anywhere between 50 and 60 cents per hundredweight; and in Lake Superior, anywhere between 60 and 70 cents per hundredweight. However, these tendencies toward uniformity will not materially affect the final calculations of savings, so that the 70 percent of all-rail rates, for purposes of this study, will be made the basis of calculating the over-all potential savings. On the basis of 70 percent of rail rates, the ship rates from Duluth to Philadelphia and New York are 80 cents per hundredweight, or \$16 per short ton, and to Boston 84 cents per hundredweight, or \$16.80 per short ton. These rates are considered exceedingly high. It is very likely that the rates will be nearer 60 cents per hundredweight, or \$12 per short ton. However, we shall estimate savings on the basis of ship rates established at 70 percent of rail rates.

Before giving the estimates of over-all potential rates, it is necessary to consider another situation where shipments of eggs, butter, and poultry may originate at points removed from the lakes, which would necessitate a rail haul to lake ports. In this situation, again, it is possible to apply an over-all standard of determining combination rail-water rates in relation to all-rail rates. A comparison of such combination rates between Chicago, Cleveland, Detroit, and Buffalo on the one hand, and West coast ports on the other shows certain definite relationships for each class rate. From Chicago, Illinois, to West coast points via New Orleans the

rail-water combination rate is between 88 percent in the case of class 1 commodities and 80 percent in the case of class 5 commodities, of the all-rail rates. From Cleveland the combination rail-water rate via New York is between 93 percent for class 1 and 90 percent for class 4, of the all-rail rates. From Buffalo the rail-water rate via New York varies between 91 percent of the class 1 rate and 89 percent in the case of class 4 commodities. In the matter of relative distances of rail-water combinations, the shipments from the interior of the tributary area to the Atlantic ports may be analagous to any one of the situations between Chicago, Cleveland, Detroit, and Buffalo, and the West coast. Hence, the proportion of rates may vary between 93 percent in the case of class 1 rates and 80 percent in the case of class 5 rates, as compared with all-rail rates. As eggs, butter, and poultry are generally classified as being fourth and fifth class, 88 percent of the all-rail rate would appear to be a very reasonable rate for combination rates from interior points. If such through rates are established, then 12 percent of the rail rates may be said to constitute the potential saving from any given interior point. If we apply this percentage to rates from such places as Columbus, Ohio; Evansville, Indiana; Eau Claire, Wisconsin; Minneapolis, Minnesota, we find that savings ranging from 9 to 14 cents per hundredweight may be realized. However, in many situations, where points quite removed from the lake shore are involved, 88 percent of the all-rail rate will result in a combination rate which is higher than if we added the local rail rate from interior point to lake shore to the water rate that was established by the method previously discussed from lake port to North Atlantic ports. To illustrate, in the case of Mason City, Iowa, the all-rail rate to Boston is \$1.14 per hundredweight. However, the all-water rate to Boston from Milwaukee, the lake port nearest Mason City, Iowa, was estimated at 57 cents, or 70 percent of the 81 cent all-rail rate. The local rail rate from Mason City to Milwaukee is 23 cents per hundred. The combination rate from Mason City to Boston may be estimated, then, as the sum of 57 cents and 23 cents, or 80 cents per hundredweight. This rate is 20 cents lower than the rate obtained by applying the 88 percent ratio to the all-rail rate of \$1.14 per hundredweight from Mason City, Iowa, to Boston.

This is a second method of estimating feasible combination rates to the Atlantic coast from points inland from the Great Lakes. It is simply the sum of the rail rate from the point of origin to the lake port plus a feasible water rate from that port to the point of destination. In this case, the feasible all-water rate from the lake port to the port of destination is calculated at 70 percent of the all-rail rate between these two ports. If this method is employed, in many cases the savings per unit would be higher than by taking 88 percent of all-rail rate from inland points to the seaboard. The savings on butter, eggs, and poultry that may be obtained by the application of these different methods of estimating all-water or rail-water combination rates are summarized in tables D-21 and D-22.

On the basis of table D-22, an average saving of 15 cents per hundredweight, or \$3 per short ton, would seem to be a fair estimate for the combined shipments from the interior points of the tributary area.

An approach similar to the one shown in tables D-18, D-19, and D-21 yields certain rates and savings on cheese from lake ports. From lake ports, a Seaway rate of 70 percent of rail rates would yield between 21 and 23 cents per 100 pounds from Milwaukee and Green Bay to Boston, New York, and Philadelphia. For points inland from the lakes, an examination of the rail rates and possible savings on the basis of the 88 percent and on the basis of combination local rail and water rates shows that savings may range anywhere from 8 to 35 cents per hundredweight, depending on the point of origin. If Wisconsin and Illinois are the principal sources of cheese received in New York, Boston, and Philadelphia, the cost of rail shipment from centers in those States as well as the savings on the alternate St. Lawrence route from those places would be controlling in the total

estimate. From Green Bay, the cost of transporting cheese to Boston is \$15.60 per short ton; to New York, it is \$15.20 per short ton, respectively; to Philadelphia, \$15.20 per short ton. From Chicago and Milwaukee to Boston it is \$15 per short ton; to New York, \$14.80 per short ton. The savings on the basis of 70 percent of these rates would amount, from Chicago and Milwaukee to Boston and New York to \$4.50 per short ton; from Green Bay, to \$4.68 per short ton; to Philadelphia, about 21 cents lower per short ton from each of those bases. Insofar as cheese is transported from the interior of those states, then, of course, the savings will be smaller, since rail haul would be involved. From Eau Claire, Wisconsin, to Boston, for instance, the rail rate on cheese is \$1.10 per hundredweight, or \$22 per short ton. Eighty-eight percent of this rate for a combination rail-water rate to Boston would be 97 cents, effective via Green Bay or Milwaukee. At this rate, there would be a saving of 13 cents per hundredweight. Similarly, from Manitowoc, Wis., the rate to Boston is 81 cents per hundredweight, or \$16.20 per short ton, and on the 88-percent basis, there would be a 9.72 or roughly a 10-cent saving per hundredweight. Savings of the same amount are indicated from Blue Island and Peoria, Ill. In view of all these factors, 15 cents per 100 pounds or \$3 per short ton as an average saving on the transportation of cheese to the eastern coast seems quite likely.

In the light of the preceding discussion, the following estimates of savings on the basis of the average in-season receipts of dairy products in New York, Boston, and Philadelphia from States in the tributary area are given:

Estimated savings on the transportation of eggs, butter, poultry, and cheese from tributary-area States to North Atlantic ports

Destination	Eggs, butter, and poultry			Cheese		Total estimated savings in dairy products
	Receipts in short tons	Estimated savings		Receipts in short tons	Estimated savings at \$3 per short ton	
		At \$3 per short ton	At \$4 per short ton			
New York.....	¹ 165, 526	² \$496, 578	³ \$662, 104	¹ 15, 914	² \$47, 742	\$544, 320 to 709, 846
Boston.....	¹ 51, 387	154, 161	205, 548	¹ 4, 926	14, 778	168, 939 to 220, 326
Philadelphia.....	¹ 39, 807	119, 421	159, 228	¹ 7, 070	21, 210	140, 631 to 180, 438
Total.....	256, 720	770, 160	1, 026, 880	27, 910	83, 730	\$683, 896 to 1, 110, 610
Adjusted for lake shipments....	200, 000	600, 000	800, 000	27, 910	83, 730	683, 730 to 883, 630

¹ See table D-15.

² See table D-16.

³ See table D-17.

As stated above, these estimated savings require modification in view of existing lake-rail rates to the Atlantic seaboard. The first step is to assume that the direct all-water rates via the Seaway could be no lower than the present lake-rail rates and that, therefore, no saving could be claimed. The maximum tonnage that would be affected by adoption of this assumption is, of course, the tonnage that now moves down the Lakes. During the 10-year period 1930-39 annual lakewise receipts of butter, eggs, and poultry at Buffalo averaged 68,800 tons. It would appear then that the above estimate of 256,720 tons would have to be reduced by 68,800. However, not all of the down-lake dairy-product traffic moves on to the seaboard. On the assumption that 80-85 percent does so move the deductible tonnage would be in the neighborhood of 56,720 leaving a balance of approximately 200,000 tons as possible Seaway traffic. At a saving of \$3 per ton the total would be \$600,000 and at \$4 per ton, \$800,000. Thus, the total saving on the basis of \$3 per ton and \$4 per ton, including that on cheese, would amount to between \$683,730 and \$883,730, respectively.

It was shown in the preceding section that the Northeastern region of the United States obtains a considerable amount of condensed and evaporated milk from Wisconsin, Illinois, Indiana, and Ohio. The amount of in-season traffic was estimated as 16,300 short tons. The relative rail rates on this product are considerably lower than those on poultry, eggs, butter, and cheese. The all-rail rates on condensed, evaporated, and powdered milk are given in table D-24. It appears from this table that from Milwaukee, Wis., and Chicago, Ill., it costs \$10.20 per short ton to Boston and New York, and \$9.40 per short ton to Baltimore. As this product is very compact and does not require any refrigeration, it is likely that an all-water rate can be established on the basis of 70 percent of the rail rates from lake ports. This would give a rate of almost 36 cents from Milwaukee, Wis., and Chicago, Ill., to Boston and New York, or a saving of 15 cents per hundredweight or \$3 per short ton. The rail rate from Cleveland to Boston is \$8.20 per ton, and to New York, \$7.80 per short ton. From Toledo to Boston the rate is \$8.80 per short ton, and to New York, \$8.20 per short ton. Seventy percent of these rates would be \$5.74 per short ton from Cleveland to Boston and New York, and slightly higher from Toledo to those points. At these levels, between \$2.50 and \$3 per short ton would be saved from these lake ports to North Atlantic ports. Considering the fact, however, that some of these canned products will be brought to lake ports by truck or by rail for shipping, entailing additional expense, the actual savings will probably be lower, on the average. For this reason, the savings on evaporated and condensed milk will be assumed to average around \$2 a ton. This would give an additional potential saving of \$32,600 on the transportation of condensed and evaporated milk to North Atlantic ports.

TABLE D-1

United States production of cheese¹ by specified States, 1935 and 1937

[Pounds]

State	1935			1937		
	United States total	American or cheddar	All other cheeses	United States total	American or cheddar	All other cheeses
Illinois.....	37,002,821	22,693,253	14,309,568	46,498,759	27,344,116	19,154,643
Indiana.....	25,765,284	19,800,577	5,964,707	26,925,940	22,942,969	3,982,871
Iowa.....	4,672,810	3,216,838	1,455,972	4,648,696	3,172,515	1,476,181
Kansas.....	9,743,987	(²)	9,743,987	8,855,445	6,973,651	1,881,794
Michigan.....	15,541,825	8,798,338	6,743,487	21,630,940	11,592,136	10,038,904
Minnesota.....	15,794,161	12,864,068	2,930,093	16,303,322	12,726,457	3,576,865
Missouri.....	13,315,997	(²)	13,315,997	14,133,868	10,429,514	3,704,354
Nebraska.....	3,044,953	1,724,621	1,320,332	2,758,087	1,548,528	1,209,559
North Dakota.....	(²)	(²)	(²)	(²)	(²)	(²)
Ohio.....	21,756,256	5,263,015	16,493,241	26,246,994	9,376,628	16,870,366
South Dakota.....	1,308,387	(²)	1,308,387	1,043,163	826,668	216,495
Wisconsin.....	360,031,141	275,699,214	84,331,927	313,137,287	236,448,695	76,688,592
All others.....	248,468,278	141,535,444	106,932,834	294,461,214	136,571,115	157,890,099
United States total.....	756,445,900	491,595,368	264,850,532	776,643,615	479,952,992	296,690,623

¹ Includes cottage, pot, and bakers' cheese.

² Not specifically shown.

SOURCE: Department of Commerce, *Biennial Census of Manufactures*, 1935, p. 74; 1937, p. 82.

If we assume that no more than \$3 per short ton is saved on shipments of all dairy products to Florida, the possible saving on this tonnage would be \$27,000. The combined estimated saving, then, on the basis of available open season traffic based on average 1929-38 figures, might be \$743,330 as a low estimate, and \$952,330 as a more probable figure. These estimates do not include any allowance for future increase of population, and for any increase in the per capita consump-

tion. Studies of the dietary habits of the population in the Southern States indicate that better education, higher wage levels, and lowering of the price of dairy products would certainly tend to increase consumption there. In view of the fact that population alone is expected to increase 10 to 12 percent in the next decade, a possible increase in the tonnage of available traffic above indicated by at least 30,000 short tons and of potential savings by \$90,000 would be a conservative expectation by 1950.

TABLE D-2

United States production of cheese¹ by specified States, 1935 and 1937, as percentages of total

State	1935	1937	State	1935	1937
United States, total.....	100.0	100.0	Missouri.....	1.8	1.8
Illinois.....	4.9	6.0	Nebraska.....	.4	.4
Indiana.....	3.4	3.5	North Dakota.....	(²)	(²)
Iowa.....	.6	.6	Ohio.....	2.9	3.4
Kansas.....	1.3	1.1	South Dakota.....	.2	.1
Michigan.....	2.0	2.8	Wisconsin.....	47.6	40.3
Minnesota.....	2.1	2.1	All others.....	32.8	37.9

¹ Includes cottage, pot, and bakers' cheese.

² Not specifically shown.

SOURCE: Department of Commerce, *Biennial Census of Manufactures*, 1935, p. 74; 1937, p. 82.

TABLE D-3

United States production of creamery butter in factories by specified States, 1927-37

[Thousands of pounds]

Year	United States, total	Illinois	Indiana	Iowa	Kansas	Michigan	Minnesota
1927.....	1,496,495	59,875	62,436	177,224	50,667	69,368	274,860
1928.....	1,487,049	62,894	60,409	196,068	55,756	65,803	271,345
1929.....	1,597,027	69,272	62,701	214,562	58,967	63,426	282,884
1930.....	1,595,231	65,281	63,249	216,058	56,919	65,926	282,540
1931.....	1,667,452	67,282	67,991	219,428	68,997	76,601	284,270
1932.....	1,694,132	70,433	75,507	219,531	74,587	78,609	281,659
1933.....	1,762,688	68,106	76,508	239,125	81,969	79,637	299,872
1934.....	1,694,708	71,927	77,662	238,313	79,248	76,438	276,786
1935.....	1,632,380	71,360	73,935	217,810	69,548	77,439	272,585
1936.....	1,629,407	67,640	67,112	208,926	62,802	82,162	289,830
1937.....	1,623,971	67,854	64,689	200,362	68,039	80,887	276,491

Year	Missouri	Nebraska	North Dakota	Ohio	South Dakota	Wisconsin	All others
1927.....	62,549	95,004	32,462	79,603	32,843	153,545	346,069
1928.....	69,201	96,472	30,889	75,681	34,853	137,483	330,225
1929.....	82,505	97,110	41,889	80,583	40,361	155,815	346,952
1930.....	77,939	85,623	41,032	78,972	40,406	171,644	349,642
1931.....	79,435	86,084	50,412	81,515	42,080	176,091	368,266
1932.....	81,702	85,660	49,336	81,140	39,700	170,399	385,869
1933.....	86,138	93,361	50,799	83,076	43,393	157,993	402,711
1934.....	84,747	91,384	41,968	80,997	38,948	161,942	375,948
1935.....	87,438	76,400	39,726	82,640	36,122	159,908	367,469
1936.....	74,214	72,842	43,575	79,256	38,741	171,400	370,907
1937.....	79,232	63,594	43,009	77,409	33,896	175,659	392,850

SOURCE: Department of Agriculture, *Yearbook of Agriculture*, 1931, 1933, 1935; *Agricultural Statistics*, 1936, 1937, 1939.

TABLE D-4

Distribution of United States production of condensed, evaporated, dried, or powdered milk and buttermilk, by specified States, 1937

State	Pounds	Per- cent of total	State	Pounds	Per- cent of total
Illinois.....	140,683,764	5.0	Wisconsin.....	814,613,946	28.7
Indiana.....	50,924,936	2.1	All other States.....	1,272,609,287	44.8
Iowa.....	19,463,968	0.7			
Kansas.....	38,768,841	1.4	Total United States bulk goods.....	2,837,140,610	100.0
Michigan.....	140,664,462	4.9	Total United States case goods ¹	2,004,823,947	
Minnesota.....	50,118,656	1.8			
Missouri.....	28,640,616	1.0	United States grand total.....	4,841,963,557	
Nebraska.....	10,454,085	0.4			
North Dakota.....	1,673,478	0.1			
Ohio.....	250,534,571	9.1			

¹ Distribution by States not available.

Source: Department of Commerce, *Census of Manufactures, 1937*, pt. I.

TABLE D-5

Number of chickens sold from farms, by specified States, 1927-39

[Thousands of chickens]

Year	United States total	Illinois	Indiana	Iowa	Kansas	Michigan	Minne- sota
1927.....	436,442	29,346	22,077	36,190	22,745	13,871	17,448
1928.....	434,742	28,224	19,949	33,524	22,655	13,857	17,610
1929.....	437,172	28,956	20,564	35,915	22,457	13,049	19,170
1930.....	489,001	28,505	21,507	44,085	28,252	12,884	21,697
1931.....	428,537	27,253	20,126	37,414	23,315	12,919	22,519
1932.....	418,280	27,194	20,858	34,645	22,091	12,693	21,773
1933.....	441,127	28,205	22,379	37,801	23,082	14,728	22,593
1934.....	409,990	26,961	20,375	36,271	22,884	12,061	20,063
1935.....	382,888	25,049	21,497	32,784	17,542	10,780	18,940
1936.....	428,759	27,627	22,735	35,233	18,988	12,257	22,674
1937.....	378,817	24,217	19,296	31,697	14,811	11,660	19,331
1938.....	378,873	23,899	19,440	31,088	15,130	10,979	19,347
1939.....	434,950	24,416	21,635	32,382	19,200	11,305	21,026

Year	Missouri	Neb- raska	North Dakota	Ohio	South Dakota	Wis- consin	All other
1927.....	27,838	15,123	3,367	24,710	9,151	13,391	201,176
1928.....	28,639	15,271	3,563	24,200	9,666	13,229	206,355
1929.....	25,728	16,823	4,233	24,527	10,143	14,031	201,576
1930.....	28,802	19,651	4,831	26,319	11,212	15,677	228,579
1931.....	23,696	18,683	4,078	22,240	10,447	15,410	190,338
1932.....	25,123	17,178	3,263	22,936	8,306	13,194	188,947
1933.....	25,019	19,437	3,770	24,653	9,802	14,319	195,339
1934.....	22,199	20,667	3,519	22,522	7,902	13,845	180,661
1935.....	16,791	15,901	2,416	22,977	5,765	14,317	178,138
1936.....	18,042	18,570	3,575	23,597	8,492	16,467	200,502
1937.....	12,966	14,967	2,140	21,484	5,565	12,039	188,624
1938.....	14,901	14,548	2,249	19,575	6,456	11,314	189,948
1939.....	17,494	18,661	2,801	21,321	8,937	11,658	224,114

Source: For the years 1927-36, Department of Agriculture, *Farm Production and Disposition, Chickens and Eggs, 1926-37*. For the year 1937, Department of Agriculture, *Farm Production and Disposition, Chickens and Eggs, 1937-38*. For the years 1938-39, Department of Agriculture, Agricultural Marketing Service, *Farm Production and Income, Chickens and Eggs, 1938-39*.

TABLE D-6

Number of eggs sold from farms, by specified States, 1927-39

[Millions of eggs]

Year	U. S. total	Illinois	Indiana	Iowa	Kansas	Michigan	Minnesota
1927	29,958	1,659	1,254	1,082	1,682	948	1,076
1928	30,268	1,624	1,233	2,016	1,666	945	1,117
1929	29,779	1,640	1,203	1,996	1,668	879	1,159
1930	30,613	1,659	1,219	2,216	1,656	927	1,247
1931	29,628	1,637	1,196	2,044	1,657	999	1,203
1932	27,415	1,480	1,092	1,811	1,396	1,038	1,093
1933	26,737	1,490	1,002	1,820	1,374	1,025	1,061
1934	26,058	1,425	991	1,843	1,254	990	1,066
1935	25,178	1,319	991	1,636	1,121	948	1,056
1936	25,630	1,311	1,033	1,644	975	936	1,083
1937	28,896	1,498	1,161	1,904	1,048	1,086	1,303
1938	27,962	1,468	1,127	1,852	1,086	991	1,348
1939	29,138	1,568	1,220	2,108	1,178	937	1,413

Year	Missouri	Nebraska	North Dakota	Ohio	South Dakota	Wisconsin	All other
1927	2,114	836	236	1,888	507	1,091	14,685
1928	1,993	877	243	1,828	553	1,107	15,034
1929	1,895	909	233	1,768	557	1,117	14,755
1930	1,988	982	242	1,849	620	1,133	14,875
1931	1,867	879	212	1,795	541	1,179	14,419
1932	1,670	736	152	1,738	401	1,097	13,741
1933	1,644	780	168	1,669	427	1,099	13,188
1934	1,380	765	159	1,644	360	1,229	12,947
1935	1,352	663	129	1,672	277	1,266	12,743
1936	1,223	637	110	1,735	284	1,311	13,348
1937	1,308	732	151	1,851	318	1,446	15,090
1938	1,298	738	138	1,661	342	1,396	14,417
1939	1,419	844	171	1,804	420	1,375	14,683

SOURCE: For years 1927-37: Department of Agriculture, *Farm Production and Disposition, Chickens and Eggs*, 1935-37. For years 1938 and 1939: Department of Agriculture, Agricultural Marketing Service, *Farm Production and Income, Chickens and Eggs*, 1938-39.

TABLE D-7

United States exports (domestic) of principal dairy products, 1930-31 to 1937-38

Year ended June 30—	Butter	Cheese	Milk, condensed	Milk, evaporated	Total	
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Short tons</i>
1930-31	2,293,000	1,733,000	22,934,000	56,052,000	83,012,000	41,506
1931-32	1,578,000	1,564,000	16,540,000	49,083,000	68,765,000	34,382
1932-33	1,386,000	1,346,000	6,247,000	33,666,000	42,745,000	21,372
1933-34	1,416,000	1,253,000	5,175,000	32,913,000	40,757,000	20,378
1934-35	761,000	1,344,000	7,881,000	39,549,000	49,535,000	24,767
1935-36	1,098,000	1,137,000	3,488,000	25,474,000	31,197,000	15,595
1936-37	840,000	1,076,000	3,334,000	22,395,000	27,645,000	13,822
1937-38	971,000	1,336,000	9,276,000	22,418,000	34,001,000	17,000

SOURCE: Department of Agriculture, *Agricultural Statistics*, 1939, p. 437, table 603.

TABLE D-8

Average annual exports of specified dairy products, 1928-37 (year ending June 30)

Commodity	Thou- sands of pounds	Short tons	Commodity	Thou- sands of pounds	Short tons
Butter.....	1,770	885	Eggs in the shell.....	6,019	3,010
Cheese.....	1,570	785	Total.....	66,418	33,210
Milk, condensed and evapor- ated.....	57,059	28,530			

SOURCE: Compiled from: Department of Agriculture, *Agricultural Statistics*, 1939, p. 433.

TABLE D-9

United States exports of evaporated milk, 1933-34 to 1937-38 (year ending June 30)

[Thousands of pounds]

Exports to —	1933-34	1934-35	1935-36	1936-37	1937-38
United Kingdom.....	1,038	351	363		1,272
Other Europe.....	72	106	116	34	18
Total, Europe.....	1,110	457	479	34	1,290
Panama.....	4,597	4,252	4,933	2,949	3,412
Mexico.....	907	1,114	753	1,147	1,300
Netherland West Indies.....	1,033	1,413	1,438	596	238
Cuba.....	287	243	108	116	791
Venezuela.....	118	156	205	231	300
Total, Central America.....	6,942	7,178	7,437	4,939	6,041
Phillipine Islands.....	16,920	22,125	9,847	11,308	10,115
Peru.....	830	1,528	1,116	511	469
Bermuda.....	341	302	242	256	74
Total, countries shown.....	26,143	31,590	19,121	17,048	17,989
Total United States exports of evaporated milk.....	32,913	39,549	25,474	22,395	22,418

SOURCE: Department of Agriculture, *Agricultural Statistics*, 1939, p. 437.

TABLE D-10

United States exports of condensed milk, 1933-34 to 1937-38 (year ending June 30)

[Thousands of pounds]

Exports to —	1933-34	1934-35	1935-36	1936-37	1937-38
Europe.....	5	14	12	37	175
Cuba.....	3	3	2	4	2,417
Mexico.....	219	205	15	5	9
Jamaica.....	1,077	845	624	16	4
Honduras.....	261	278	243	194	183
Costa Rica.....	115	68	87	108	194
Venezuela.....	133	88	37	190	397
Panama.....	168	136	316	220	80
Guatemala.....	39	52	107	52	58
Colombia.....	36	37	84	43	74
Total, Central America.....	2,051	1,712	1,515	832	3,416
Phillipine Islands.....	2,625	5,049	1,380	1,123	1,479
Union of South Africa.....	252	559		945	3,861
Total, countries shown.....	4,933	7,334	2,907	2,937	8,931
Total United States exports of condensed milk.....	5,175	7,881	3,488	3,334	9,276

SOURCE: Department of Agriculture, *Agricultural Statistics*, 1939, p. 437.

TABLE D-11

Gross receipts of dairy products in 3 principal eastern markets, annual average, 1928-37

[Short tons]

Product	New York	Boston	Philadelphia	Total
Eggs.....	194,382	39,813	42,426	276,621
Butter.....	130,493	41,084	42,405	213,982
Cheese.....	29,584	9,086	11,792	50,462
Poultry.....	101,421	27,175	16,534	145,130
Total.....	455,880	117,158	113,157	686,195

SOURCE: Compiled from Department of Agriculture, *Yearbook of Agriculture*, 1930 through 1935; *Agricultural Statistics*, 1936 through 1939.

TABLE D-12

Gross receipts¹ of dairy products in 3 principal eastern markets from the tributary area,² average 1928-37

[Short tons]

Product	New York	Boston	Philadelphia	Total
Eggs.....	93,554	28,632	20,454	142,640
Butter.....	120,887	37,568	38,227	196,682
Cheese.....	24,943	7,375	11,116	43,434
Poultry.....	64,072	20,514	10,641	95,227
Total.....	303,456	94,089	80,438	477,983

¹ Gross weight includes container and wrapper.

² Includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

SOURCE: Compiled from Department of Agriculture, *Yearbook of Agriculture*, 1930 through 1935; *Agricultural Statistics*, 1936 through 1939.

TABLE D-13

Percentage of gross annual average receipts during 1929-38¹ received during the open navigation season, May to November, inclusive

Product	New York	Boston	Philadelphia	Product	New York	Boston	Philadelphia
Eggs.....	54.4	55.9	56.2	Cheese.....	63.8	66.8	63.6
Butter.....	61.7	63.0	59.0	Poultry.....	62.5	57.1	54.1

¹ These averages have been computed for the period 1929-38. However, since they cover a 10-year interval it is assumed that the proportion of 1928-37 average during the 7-month period to the total would not differ greatly from the proportion of 1929-38 average to the total. Hence, these average percentages for the 1929-38 period were applied to the annual average of gross receipts for the period 1928-37.

SOURCE: Compiled from Department of Agriculture, *Yearbook of Agriculture*, 1930 through 1935; *Agricultural Statistics*, 1936 through 1939.

TABLE D-14

Gross receipts¹ of dairy products in 3 principal eastern markets from the tributary area² during the open navigation season, average 1928-37

[Short tons]

Product	New York	Boston	Phila- delphia	Total
Eggs.....	50,893	16,005	11,495	78,393
Butter.....	74,587	23,668	22,554	120,809
Cheese.....	15,914	4,927	7,070	27,911
Poultry.....	40,045	11,713	5,757	57,515
Total.....	181,439	56,313	46,876	284,628

¹ Gross weight includes container and wrapper.² Includes Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.SOURCE: Compiled from Department of Agriculture, *Yearbook of Agriculture*, 1930 through 1935, *Agricultural Statistics*, 1936 through 1939.

TABLE D-15

Estimated in-season receipts¹ of eggs, butter, poultry, and cheese at New York from tributary area States, annual average, 1928-37

[Short tons]

State of origin	Eggs		Butter		Poultry		Total		Cheese	
	Annual receipts	54.4 percent in season	Annual receipts	61.7 percent in season	Annual receipts	62.5 percent in season	Annual receipts	Seasonal receipts	Annual receipts	63.8 percent in season
Illinois.....	17,727	9,643	14,962	9,232	10,588	6,617	43,277	25,492	4,237	2,703
Indiana.....	10,430	5,674	2,440	1,505	4,645	2,903	17,515	10,082	606	386
Iowa.....	32,530	17,696	37,271	22,996	16,858	10,555	86,689	51,247	50	32
Kansas.....	6,516	3,545	4,275	2,638	8,996	5,622	19,787	11,805	(?)	(?)
Michigan.....	1,688	918	4,188	2,584	563	371	6,469	3,873	482	308
Minnesota.....	10,915	5,938	31,704	19,561	11,102	6,939	53,721	32,438	172	110
Nebraska.....	4,354	2,369	14,170	8,743	5,078	3,174	23,602	14,286	20	13
North Dakota.....	(?)	(?)	2,024	1,249	1,701	1,063	3,725	2,312	(?)	(?)
Ohio.....	7,106	3,866	3,086	1,904	1,386	866	11,578	6,636	400	255
South Dakota.....	(?)	(?)	662	408	2,569	1,606	3,231	2,014	(?)	(?)
Wisconsin.....	2,288	1,245	6,105	3,707	526	320	8,219	5,341	18,976	12,107
Total.....	93,554	50,894	120,887	74,587	64,072	40,045	278,513	165,526	24,943	15,914

¹ Gross weight includes container and wrapper.² Not separately shown.SOURCE: Annual receipts compiled from Department of Agriculture, *Yearbook of Agriculture*, 1930 through 1935; *Agricultural Statistics*, 1936 through 1939.

TABLE D-16

Estimated in-season receipts¹ of eggs, butter, poultry, and cheese at Boston from tributary area States, annual average, 1928-37

[Short tons]

State of origin	Eggs		Butter		Poultry		Total		Cheese	
	Annual receipts	55.9 percent in season	Annual receipts	63.0 percent in season	Annual receipts	57.1 percent in season	Annual receipts	Seasonal receipts	Annual receipts	66.8 percent in season
Illinois.....	4, 217	2, 357	7, 354	4, 633	4, 458	2, 546	16, 029	9, 536	556	371
Indiana.....	2, 618	1, 463	1, 322	833	1, 612	920	5, 552	3, 216	98	65
Iowa.....	7, 602	4, 250	3, 818	2, 405	4, 390	2, 507	15, 810	9, 162	(²)	(²)
Kansas.....	4, 690	2, 622	637	401	1, 809	1, 033	7, 136	4, 056	(²)	(²)
Michigan.....	977	546	631	398	252	144	1, 860	1, 088	124	83
Minnesota.....	4, 715	2, 636	13, 466	8, 484	4, 019	2, 295	22, 200	13, 416	(²)	(²)
Nebraska.....	2, 419	1, 352	2, 883	1, 816	1, 475	842	6, 777	4, 010	(²)	(²)
North Dakota.....	(²)	(²)	1, 958	1, 234	1, 391	794	3, 349	2, 028	(²)	(²)
Ohio.....	1, 394	779	1, 672	1, 053	105	60	3, 171	1, 892	22	15
South Dakota.....	(²)	(²)	1, 735	1, 093	886	506	2, 621	1, 599	(²)	(²)
Wisconsin.....	(²)	(²)	2, 092	1, 318	117	67	2, 209	1, 386	6, 575	4, 392
Total.....	28, 632	16, 005	37, 568	23, 668	20, 514	11, 714	86, 714	51, 387	7, 375	4, 926

¹ Gross weight includes container and wrapper.² Not specifically shown.

SOURCE: Annual receipts compiled from Department of Agriculture, Yearbook of Agriculture, 1930 through 1935; Agricultural Statistics, 1936 through 1939.

TABLE D-17

Estimated in-season receipts¹ of eggs, butter, poultry, and cheese at Philadelphia from tributary area States, annual average, 1928-37

[Short tons]

State of origin	Eggs		Butter		Poultry		Total		Cheese	
	Annual receipts	56.2 percent in season	Annual receipts	59.0 percent in season	Annual receipts	54.1 percent in season	Annual receipts	Seasonal receipts	Annual receipts	63.6 percent in season
Illinois.....	3, 576	2, 010	2, 946	1, 738	1, 280	692	7, 802	4, 440	1, 457	927
Indiana.....	930	523	813	480	655	354	2, 398	1, 357	36	23
Iowa.....	3, 889	2, 186	4, 036	2, 381	2, 780	1, 504	10, 705	6, 017	4	3
Kansas.....	2, 002	1, 125	217	128	1, 208	654	3, 427	1, 907	(²)	(²)
Michigan.....	1, 047	588	331	195	29	16	1, 407	799	195	124
Minnesota.....	5, 653	3, 177	24, 446	14, 423	2, 868	1, 552	32, 987	19, 152	169	107
Nebraska.....	834	469	2, 467	1, 456	879	476	4, 180	2, 401	(²)	(²)
North Dakota.....	(²)	(²)	90	53	456	247	546	300	(²)	(²)
Ohio.....	1, 392	782	585	345	132	71	2, 109	1, 198	24	15
South Dakota.....	(²)	(²)	217	128	246	133	463	261	(²)	(²)
Wisconsin.....	1, 131	636	2, 079	1, 227	108	58	3, 318	1, 921	9, 231	5, 871
Total.....	20, 454	11, 496	38, 227	22, 554	10, 641	5, 757	69, 322	39, 807	11, 116	7, 070

¹ Gross weight includes container and wrapper.² Not separately shown.

SOURCE: Annual receipts compiled from Department of Agriculture, Yearbook of Agriculture, 1930 through 1935; Agricultural Statistics, 1936 through 1939.

TABLE D-18

All-rail rates on butter, eggs, and poultry from Great Lakes ports to New York, Boston, and Philadelphia

[Cents per 100 pounds]

Point of origin	New York	Boston	Philadelphia	Point of origin	New York	Boston	Philadelphia
Cleveland.....	61	64	57	Milwaukee.....	80	81	80
Toledo.....	65	68	65	Green Bay.....	82	84	82
Detroit.....	65	68	65	Duluth.....	114	120	114
Chicago.....	80	81	77				

TABLE D-19

Estimated seaway rates on eggs, butter, and poultry from Great Lakes ports to New York, Boston, and Philadelphia, based on 70 percent of present all-rail rates

[Cents per 100 pounds]

Point of origin	New York	Boston	Philadelphia	Point of origin	New York	Boston	Philadelphia
Cleveland.....	43	45	40	Milwaukee.....	56	57	56
Toledo.....	46	48	46	Green Bay.....	57	59	57
Detroit.....	46	48	46	Duluth.....	80	84	80
Chicago.....	56	57	54				

TABLE D-20

Charges for ice and salt in the shipment of eggs, butter, cheese, and dressed poultry, by States

State	Ice per 2,000 pounds	Salt per 100 pounds	State	Ice per 2,000 pounds	Salt per 100 pounds
Illinois:			Minnesota.....	\$3.50	\$0.75
Joppa.....	\$4.50	\$0.75	Missouri.....	4.00	.75
Other points.....	4.00	.75	North Dakota.....	3.50	.75
Indiana:			South Dakota.....	3.50	.75
Jeffersonville.....	4.50	.75	Ohio.....	4.00	.75
Other points.....	4.00	.75	Maryland.....	4.00	.75
Iowa.....	4.00	.75	Pennsylvania.....	4.00	.75
Kansas.....	4.00	.75	Wisconsin.....	3.50	.75
Michigan:			New York.....	4.00	.75
Upper Peninsula.....	3.50	.75	Kentucky ¹	4.50	.75
Lower Peninsula.....	4.00	.75			

¹ Except Fulton, Henderson, Latonia, Louisville, Paducah, Russell, Stevens, Kentucky, which charges are \$4 and \$0.75.

TABLE D-21

Estimated savings¹ on butter, eggs, and poultry from Great Lakes ports to New York, Boston, and Philadelphia

[Cents per 100 pounds]

Point of origin	To New York	To Boston	To Philadelphia	Point of origin	To New York	To Boston	To Philadelphia
Cleveland.....	18	19	17	Milwaukee.....	24	24	24
Toledo.....	19	20	19	Green Bay.....	25	25	25
Detroit.....	19	20	19	Duluth.....	34	36	34
Chicago.....	24	24	23				

¹ Arithmetic difference between rates shown in table D-18 and D-19.

TABLE D-22

Estimated savings on butter, eggs, and poultry, on the basis of a feasible combination rate equal to 88 percent of the all-rail rate from interior points to New York, Boston, and Philadelphia

[Cents per 100 pounds]

Point of origin	New York		Boston		Philadelphia	
	All-rail rate	Saving	All-rail rate	Saving	All-rail rate	Saving
Columbus, Ohio.....	65	08	72	09	61	07
Evansville, Ind.....	84	10	88	11	80	10
Fort Wayne, Ind.....	72	09	74	09	68	08
Eau Claire, Wis.....	107	13	110	13	107	13
Manitowoc, Wis.....	80	10	81	10	80	10
Richland Center, Wis.....	98	12	101	12	96	12
Minneapolis, Minn.....	114	14	120	14	114	14
St. Paul, Minn.....	114	14	120	14	114	14
Moorehead, Minn.....	142	17	147	18	142	17
Blue Island, Ill.....	80	10	81	10	77	09
Peoria, Ill.....	85	10	87	10	82	10
Alma, Mich.....	74	09	75	09	74	09
Mason City, Iowa.....	110	13	114	14	106	13
Clinton, Iowa.....	88	11	90	11	84	10
Fargo, N. Dak.....	142	17	147	18	142	17
Bismarck, N. Dak.....	161	19	166	20	161	19
Watertown, N. Dak.....	136	16	141	17	134	16
Aberdeen, S. Dak.....	144	17	149	18	142	17
Omaha, Nebr.....	124	15	128	15	120	14
Hastings, Nebr.....	140	17	147	18	135	16
Topeka, Kans.....	124	15	131	15	119	14
Kansas City, Mo.....	119	14	126	15	114	14

NOTE.—On the basis of this tabulation, an average saving of between 15 and 20 cents per hundredweight, or \$3 to \$4 per short ton, would seem to be a fair estimate for the combined shipments from the interior points of the tributary area.

TABLE D-23

Direct all-rail rates, seaway rate on the basis of 70 percent of rail rates, and estimated Seaway savings on cheese from points on lake to New York, Boston, and Philadelphia

[Cents per 100 pounds]

Point of origin	To New York			To Boston			To Philadelphia		
	Rail rate	Seaway rate, 70 percent of rail	Seaway saving	Rail rate	Seaway rate, 70 percent of rail	Seaway saving	Rail rate	Seaway rate 70 percent of rail	Seaway saving
Cleveland.....	57	40	17	60	42	18	53	37	16
Toledo.....	60	42	18	64	45	19	60	42	18
Detroit.....	60	42	18	64	45	19	60	42	18
Chicago.....	74	52	22	75	53	22	70	49	21
Milwaukee.....	74	52	22	75	53	22	74	52	22
Green Bay.....	76	53	23	78	55	23	76	53	23
Duluth.....									

TABLE D-24

All-rail rates, carload lots, condensed, evaporated, and powdered milk

[Cents per 100 pounds]

From—	To—					
	Boston, Mass.	New York, N. Y.	Baltimore, Md.	Charleston, S. C.	Jacksonville, Fla.	Miami, Fla.
Chicago, Ill.....	51	51	47	87	92	117
Peoria, Ill.....	55	54	49	88	90	115
Indianapolis, Ind.....	50	47	43	78	85	110
Detroit, Mich.....	44	41	40	82	93	118
Northfield, Minn.....	66	64	62	91	95	119
St. Paul, Minn.....	66	64	62	93	97	121
St. Louis, Mo.....	58	55	51	85	86	111
Cleveland, Ohio.....	41	39	35	78	91	117
Hamilton, Ohio.....	49	46	39	75	83	107
Toledo, Ohio.....	44	41	40	78	90	116
Fondulac, Wis.....	54	53	51	81	86	110
Merrill, Wis.....	56	55	55	88	92	118
Milwaukee, Wis.....	51	51	47	90	96	120

Appendix E

GREEN COFFEE

Section 1

UNITED STATES IMPORTS AND CONSUMPTION OF GREEN COFFEE

The production of green coffee is confined principally to areas in North America (Mexico and Central America), South America, Africa, and Asia. South America, especially Brazil, predominates in world production. Table E-1 shows that South America accounts for approximately 80 percent of the world total.

As is the case of production, South America is outstandingly the world's leading exporter of coffee. The countries of Brazil, Colombia, Venezuela, and Ecuador account for more than 70 percent of the total moving in international export trade, as shown in table E-2.

Records of the United States Maritime Commission, as presented in table E-3, show that imports of green coffee into the United States during the period 1929-38 averaged 860,000 short tons annually, with 93 percent of the total originating in South America, Central America, Mexico, and the West Indies. The east coast of South America alone supplies approximately 62 percent of total imports. Principal United States ports of entry are New York, New Orleans, and San Francisco, in the order named, with lesser quantities being imported through several other ports along the Atlantic-Gulf-Pacific coastal rim. Customs districts of principal importation in 1937 were as follows: ¹

<i>Customs district</i>	<i>Short tons</i>
New York.....	427, 264
New Orleans.....	205, 869
San Francisco.....	79, 397
Massachusetts.....	32, 134
Galveston.....	27, 963
Los Angeles.....	27, 600
Maryland.....	11, 121
Total, 7 districts.....	811, 348
Grand total imports.....	848, 549
Percent 7 districts of grand total.....	95. 6

The value of green coffee imported into the United States has fluctuated but little since 1931. The annual average import value for the 5-year period 1931-35 was 8.7 cents per pound. In 1936, the value was 7.7 cents; in 1937, 8.9 cents; and in 1938, imports were valued at 6.9 cents per pound.

The United States consumes practically all of the coffee it imports. Net imports per capita in 1937 amounted to approximately 13 pounds of green coffee, equivalent to about 11 pounds of roasted coffee. Coffee is a commodity having extensive distribution in its processed state, and as it is consumed directly by the population, consumption in any particular area may be safely estimated in close proportion to the population of the area.

¹ Department of Commerce, *Foreign Commerce and Navigation of the United States, 1937.*

Section 2

SHIPMENTS OF COFFEE INTO THE GREAT LAKES
TRIBUTARY AREA

Green coffee is purchased in several different ways: F. o. b. country of origin, or New York, or New Orleans, appear to be the methods adopted by the larger importers. This group, and the companies marketing special brands, have warehousing facilities at ports properly situated for serving large sections of the country and, as different localities desire different tastes, much of the testing and blending is done at these ports, preparatory to forwarding the raw product to roasting and grinding plants in the hinterland. This is not to say that all coffee moves unroasted into the interior. It is believed that a sizable movement of roasted coffee reaches the inland sections from seaboard points. Roasting of coffee has not been dealt with specifically since the Biennial Census of Manufactures taken in 1931. At that time, the Bureau of the Census reported 917 establishments whose value of products manufactured totaled \$271,494,581. The amount of coffee actually roasted in 1931 was 1,233,494,343 pounds (617,000 short tons), with a value of \$249,514,274. The same data show plant location to be distributed rather generally throughout the country, with New York, California, Pennsylvania, Illinois, Texas, Ohio, Missouri, and Louisiana accounting for 505 establishments. It is believed that the 1931 data are generally representative of the present situation.

Important roasting points are located in the area adjacent to the Great Lakes, especially in the States of Minnesota (Duluth, Minneapolis, and St. Paul); Wisconsin (Milwaukee); Illinois (Chicago, Barrington, and Peoria); Ohio (Cincinnati, Cleveland, Toledo, and Dayton); and New York (Buffalo).

The position of the group of States, bordering on the Great Lakes, in the coffee roasting and grinding industry is revealed in table E-4. This table shows that, in 1931, the tributary area roasted nearly 30 percent of the coffee roasted in the country as a whole. The Chicago Industrial Area accounted for 12.6 percent.

Green coffee moves inland from New York to the Great Lakes region, all-rail and rail-lake, principally via the former, with the all-water route via the New York Barge Canal remotely competitive. Data are not available to show the extent of these movements statistically. From New Orleans, coffee also moves into the Great Lakes region. This movement is chiefly by rail, with much smaller tonnages moving barge-rail and all-barge via the Mississippi River system to points in Minnesota, Illinois, Ohio, and Missouri. A partial record of the tonnages moving from New Orleans by way of these routes to certain interior States, both bordering on and off the Great Lakes, during the 9-month period, January 1 to September 30, 1938, is shown in the following table:¹

State	Short tons, all-rail	Short tons, all-barge	Short tons, barge-rail	State	Short tons, all-rail	Short tons, all-barge	Short tons, barge-rail
Illinois.....	17, 743	2, 037	8, 689	Ohio.....	3, 205	2, 645	535
Indiana.....	975	35	756	Minnesota.....	4, 296	423	1, 477
Iowa.....	2, 964	249	389	Nebraska.....	1, 480	-----	2, 676
Missouri.....	20, 734	8, 853	142	Kansas.....	1, 419	-----	90
Wisconsin.....	2, 079	-----	414	South Dakota.....	90	-----	-----

Other data,² based on the calendar year 1933, show that 6,000 tons moved up the Mississippi from New Orleans on to the Illinois waterway, with 3,000 tons

¹ War Department, *Commercial Statistics, Water-Borne Commerce of the United States*.
² Interstate Commerce Commission, Docket 26712, exhibit 1287.

being received at Chicago; St. Louis received 20,000 tons by water; 7,500 tons moved into the Ohio River from the Mississippi; and 3,000 tons were received at Mississippi River points north of St. Louis. The San Francisco imports are principally for consumption in Pacific Coast territory.

Section 3

THE COST OF TRANSPORTATION AND POTENTIAL SAVINGS

The ocean rate on green coffee in bags from Brazil (Santos) and Venezuela to New York, and other ports within the North Atlantic range, as well as to New Orleans, was 50 cents per 100 pounds in August 1939. From Colombia and Ecuador the rates were higher. The Brazil rate to Montreal was 58 cents per 100 pounds; from Venezuela 55 cents; while from Colombia and Ecuador, the rates were also somewhat higher than the Brazil rate.

The rates from New York and New Orleans to Chicago, all-rail, the route over which the greater portion of the coffee moves, were 44 cents and 41 cents per 100 pounds, respectively, in the winter of 1939-40. By way of the water-rail routes into Chicago from coastal points, the rate from New York was 41 cents, and 34 cents from New Orleans. The all-barge rate to Chicago from New Orleans was 33 cents per 100 pounds. A compilation showing present rates to representative Great Lakes ports and to certain interior points, together with the supplemental cost of transportation by way of the proposed Great Lakes-St. Lawrence project, is presented in table E-5.

In this table the present cost of transportation from port of entry to inland points through various routes is given in cents per hundred pounds in the first column of figures. In the next column the supplemental cost of ocean rates in comparison with rates existing in August 1939 to New York and New Orleans is stated. The rate then from Brazil to New York or New Orleans was 50 cents per 100 pounds. The rate to Montreal was 58 cents. It is assumed that the Montreal rate will probably apply to Great Lakes ports. Thus, an 8-cent surcharge over the present rates to New York and New Orleans would be the added transportation cost of American imports of green coffee into Great Lakes ports. In addition to this surcharge, an allowance has been made for transportation inland from lake ports to points in Ohio, Indiana, Illinois, and Minnesota, which are at some small distance from the lake ports. These additional allowances are in some cases for truck; in other cases, for rail transportation. It is assumed that to important metropolitan centers where there may be return cargo, reasonable truck rates would be established from lake ports. For instance, from Erie to Pittsburgh a 20-cent truck rate was assumed. From Toledo, Ohio, to Cincinnati, Ohio, similarly, a 20-cent truck rate was considered. From Chicago to Indianapolis a 25-cent truck rate was allowed. All these figures are per 100 pounds of green coffee. These rates are quite liberal when one compares them with existing fifth-class rail rates, which, from Chicago to Indianapolis, are 28 cents. It is very probable that when the St. Lawrence is opened, the railroads will establish commodity rates on green coffee, which would be substantially lower than this 28 cents, so that the trucking allowances herein are amply conservative. Then, on the basis of the 8-cent surcharge on the ocean rate, plus the inward transportation cost, the net saving was calculated. This net saving was converted into equivalents per ton, the last column in table E-5.

The next step in the calculation of available tonnage and saving in cost of transportation was to estimate the consumption of green coffee in the tributary area, the proportion that might move during the open navigation season, and then by application of appropriate per-unit savings to estimate potential total saving on the movement of green coffee via the St. Lawrence. In order to calculate the consumption of green coffee in the tributary area, the average imports of green

coffee during the years 1929-38 inclusive, were taken. This figure was 860,688 short tons. Then the percentage of coffee roasted in certain industrial areas and States within the tributary area, as given in table E-4, was applied to this average figure of imports. The total for the tributary area designated in table E-4, namely, 29.9 percent of green coffee roasted in the country during 1931, when applied to this average import figure, gave a figure of 257,346 tons of green coffee. This, of course, is based upon the assumption that the ratio of coffee roasting in these areas during 1931 is representative of the importation of green coffee during the course of the decade in question. This method was considered better than the usual method employed in estimating the tributary area portion of coffee imports, namely, application of per capita consumption of roasted coffee to the population in the tributary area. It is superior in that it concerns principally the requirements of the coffee-roasting industry and escapes the error introduced in the other method of computation where consumers following their peculiar tastes might be purchasing certain brands of coffee roasted in centers outside the tributary area.

The allocation of imports of coffee on the basis adopted in this report to the various industrial areas and States in the Great Lakes region is given in the first column of table E-6. An allowance must be made, however, for the proportion of imports that may move into the area during the open season. For this purpose, an examination was made of the seasonality of green coffee imports during the years 1936, 1937, and 1938. On the basis of the average monthly imports during those years, it appears that a little over 51 percent of green coffee has been imported in the United States during those 3 years in the 7 months, May to November, inclusive. Without considering the possibility that with the opening of the St. Lawrence there may be a tendency for the coffee-roasting industry to take advantage of savings in transportation costs and import a larger percentage of their green coffee requirements during the open navigation season, this 51-percent factor was applied to the total annual import figures. The result is that 131,246 short tons of coffee would be potential traffic for the St. Lawrence. This, to repeat, is on the basis of 1929-38 average annual imports as allocated to the tributary area on the basis of 1931 census figures of the coffee-roasting industry. The appropriate unit savings as applicable to each industrial area and State were applied to the corresponding tonnages.

In selecting the unit savings from table E-5, care was taken to obtain the most reasonable figure. Where there is only one route in use at the present time, such as rail from New York, the unit saving used was the one given in the last column of table E-5. On the other hand, where more than one route was available, such as, for example, at Chicago, the rate of saving calculated on the basis of the route that was considered to be most nearly competitive was used as the average saving per unit. Chicago, for instance, might obtain its coffee through any one of five different routes; namely, rail or rail-lake combined from New York, and rail-barge, rail, or all-barge from New Orleans. The savings by these different routes vary all the way from \$7.20 on all-rail from New York to \$5 per ton on all-barge from New Orleans. The most competitive route in the summertime would be rail-lake from New York, which would cost 41 cents per 100 pounds or \$8.20 per ton. On this basis, the saving when the Seaway is available would be \$6.60. This same saving would also apply in comparison with all-rail transport from New Orleans. However, since some small amount of coffee is transported from New Orleans by barge-rail and by barge, on which the savings are respectively \$5.20 and \$5 (there were more than 10,000 tons moved by these routes in 1938), instead of the \$6.60 saving, a flat \$6 was applied to the total open-season importation in the Chicago area. For the balance of Illinois, a much lower rate of saving was taken; namely, \$3 per ton. This was done to allow a sufficient differential for any possible cost of inland transportation from Chicago to other points in Illinois. This was considered to be fair, particularly in view of the rates of savings

indicated in such places as Barrington and Peoria, Ill., as shown in table E-5, where the savings in transportation costs via the St. Lawrence might be anywhere between \$1 and \$4.60, depending on whether the alternative routes are all-barge from New Orleans, the lowest-cost competitive route, or all-rail from New York. Calculated in this manner, the total potential saving on the importation of green coffee during the season of open navigation appears to be in the neighborhood of \$612,000, as shown in table E-6. This figure is based on average consumption during the 10 years 1929 to 1938. It allows only 51 percent of total imports into the tributary area as potential traffic during the open navigation season.

Some allowance must be made for three factors which will affect the potential tonnage and potential saving when the Seaway becomes a fact in the future. First, with the growth of population, consumption, and therefore importation of green coffee, will increase. In the second place, with substantial saving in transportation costs available during the open season of navigation, it is very likely that the proportion of total requirements imported during the summer and fall months will increase to more than 51 percent. Finally, when the Great Lakes ports become importing centers, the railroads are likely to establish commodity rates on green coffee which will be lower than the fifth-class rates, and correspondingly, competing trucking companies would lower their rates. This last item cannot now be estimated. Some allowance, however, may be made for the first two possibilities. By 1950, medium estimates of population indicate that there will be an increase of some 12 percent over 1940. As per capita consumption of coffee has remained fairly stable during the past many years, at around 11 pounds of roasted coffee or the equivalent of 13 pounds of green coffee, it would be expected that the middle western coffee-roasting industry would participate equally in this increased consumption. Hence, one may assume a 12-percent increase in the tonnage considered to be potential. When applied to the imports of the tributary area during the open season, or 131,246 tons, a 12-percent increase would indicate an additional tonnage of 15,720, or a total tonnage of about 147,000 tons. Again, upon the assumption that each area would participate equally in the growth of the market, the total potential saving might be increased by 12 percent to \$685,000.

If the roasters of green coffee in the tributary area make a practice of importing a larger percentage of their requirements during the open navigation season, then, of course, the potential tonnage and the saving would increase correspondingly. For instance, if they imported 61 percent rather than 51 percent of their requirements during the 7 months of open navigation, the tonnage might be increased to 175,000 tons and the saving would increase by \$130,000, or a total saving of approximately \$815,000.

TABLE E-1

World production of green coffee, averages 1925-29, 1930-34, and annual, 1935 and 1936

[Short tons]

Producing countries	Average 1925-29	Average 1930-34	1935	1936
Brazil.....	1,323,683	1,425,085	1,372,998	1,712,304
Colombia.....	165,700	213,101	252,384	264,000
Venezuela.....	60,152	53,500	61,100	72,600
Ecuador.....	7,405	8,963	7,920	7,920
Total, South America.....	1,556,940	1,700,649	1,694,402	2,056,824
Total, all other principal countries.....	369,257	406,731	487,938	465,268
Total, all countries.....	1,926,197	2,107,380	2,182,340	2,512,092
Percent South America of total production.....	80.8	80.7	77.6	81.9

Source: New York Coffee and Sugar Exchange, Inc., New York, N. Y.

TABLE E-2

International export trade in green coffee, averages 1925-29, 1930-34, and annual, 1935 and 1936

[Short tons]

Exporting countries	Average 1925-29	Average 1930-34	1935	1936
Brazil.....	932,696	987,860	1,013,815	938,211
Colombia.....	162,077	209,039	249,263	260,727
Venezuela.....	59,109	60,463	59,137	67,858
Ecuador.....	7,169	10,401	13,790	15,212
Total, South America.....	1,161,051	1,267,763	1,336,005	1,282,008
Total, including all other principal exporting countries.....	1,510,026	1,662,736	1,741,359	1,780,863
Percent South America of total exporting countries.....	76.9	76.2	76.7	72.0

SOURCE: Department of Agriculture, *Agricultural Statistics, 1938*, p. 424.

TABLE E-3

United States imports of green coffee by regions, 1929-38

[Short tons] ¹

Year	Total	West Indies	Mexico	Central America	North coast South America	East coast South America	West coast South America	All other
1929.....	772,332	14,943	19,715	86,929	127,345	479,447	20,961	22,992
1930.....	840,745	13,177	22,730	96,239	132,139	533,178	26,800	16,482
1931.....	896,758	11,324	21,489	69,583	122,933	611,642	38,754	21,033
1932.....	776,244	17,144	13,649	92,458	123,487	456,581	29,044	43,881
1933.....	834,637	20,550	34,514	107,356	112,864	524,172	22,468	12,713
1934.....	829,848	14,392	28,573	103,289	106,068	518,312	26,407	32,807
1935.....	895,643	14,213	21,990	149,588	107,832	560,432	24,484	17,104
1936.....	918,763	29,959	36,951	155,488	103,621	525,965	30,792	35,987
1937.....	886,255	32,197	25,638	190,128	119,590	446,439	27,214	45,049
1938.....	955,655	² 35,351	25,510	57,984	² 217,318	556,164	24,376	35,952
Average 1929-38...	860,688	20,625	25,076	110,904	127,320	521,233	27,130	28,400

¹ Original figures were stated in cargo tons. Conversion factor: 1.12 short tons in 1 cargo ton.² Estimated.

SOURCE: Maritime Commission.

TABLE E-4

Coffee roasting and grinding in the Great Lakes tributary area, 1931

	Number of establishments	Coffee roasted and ground		
		Pounds	Value	Percent of United States based on quantity
Chicago-Indiana area.....	48	155,170,000	\$31,189,250	12.6
Balance of Illinois.....	11	6,268,696	1,190,694	.5
Indianapolis area.....	7	4,548,000	873,299	.4
Balance of Indiana.....	8	4,040,756	779,951	.3
Detroit area.....	20	14,103,000	3,243,682	1.1
Balance of Michigan.....	7	9,395,511	2,159,820	.8
Minneapolis-St. Paul.....	16	18,791,000	4,491,252	1.5
Balance of Minnesota.....	4	6,807,489	1,643,684	.6
Cleveland area.....	10	21,349,000	3,992,224	1.7
Cincinnati area ¹	13	22,683,000	4,241,738	1.8
Toledo.....	9	32,023,000	5,988,336	2.6
Balance of Ohio.....	15	2,766,117	509,889	.2
Milwaukee.....	10	13,435,000	1,746,598	1.1
Balance of Wisconsin.....	6	4,450,840	882,072	.4
Buffalo area.....	7	8,360,000	1,596,890	.7
Rochester area.....	5	9,536,000	1,821,452	.8
Pittsburgh.....	16	34,777,000	5,938,433	2.8
Total above areas.....	210	368,504,409	71,989,264	
Total United States.....	917	1,233,494,343	249,514,274	
Percent of areas to United States.....		29.9	28.9	29.9

¹ Includes 2 counties in Kentucky.

SOURCE: *Census of Manufactures, 1931.*

NOTE: The percentage of value of products for the coffee and spice, roasting and grinding industry for each area to the total value of products for the United States was applied to the total value of coffee roasted to obtain value of coffee in each area. The relation between value of coffee roasted and value of all products was very consistent throughout the States.

Quantity was obtained by dividing the value of coffee roasted by the average price per pound for the States within which the areas lie.

TABLE E-5

*Indicated savings on the transportation of green coffee
via the St. Lawrence Seaway*

[Cents per 100 pounds]

Destination	Present cost			Additional cost via St. Lawrence		Indicated saving	
	Port of entry	Route	Rate	Shipline surcharge over ocean rate of 60¢	Inland truck (t) or rail (r) rate	Cents per 100 pounds	Per short ton
Rochester, N. Y.	New York	Rail	28	8		20	\$4.00
Buffalo, N. Y.	do.	do.	30	8		22	4.40
Pittsburgh, Pa.	do.	do.	31	8	20 t	3	.60
Cleveland, Ohio	do.	do.	33	8		25	5.00
Akron, Ohio	do.	do.	33	8	15 r	10	2.00
Toledo, Ohio	do.	do.	34	8		26	5.20
Cincinnati, Ohio	New Orleans	Barge	28	8	20 t		
Do.	do.	Rail	35	8	20 t	7	1.40
Do.	New York	do.	39	8	20 t	11	2.20
Detroit, Mich	do.	do.	32	8		24	4.80
Indianapolis	do.	do.	41	8	25 t	8	1.60
Do.	New Orleans	do.	41	8	25 t	8	1.60
Chicago, Ill.	New York	do.	44	8		36	7.20
Do.	do.	Rail-lake	41	8		33	6.60
Do.	New Orleans	Rail	41	8		33	6.60
Do.	do.	Barge-rail	34	8		26	5.20
Do.	do.	Barge	33	8		25	5.00
Barrington, Ill	New York	Rail	45	8	14 r	23	4.60
Do.	New Orleans	do.	41	8	14 r	19	3.80
Do.	do.	Barge-rail	34	8	14 r	12	2.40
Peoria, Ill.	New York	Rail	48	8	20 t	20	4.00
Do.	New Orleans	do.	41	8	20 t	13	2.60
Do.	do.	Barge	33	8	20 t	5	1.00
Milwaukee, Wis	New York	Rail	44	8		36	7.20
Do.	do.	Rail-lake	41	8		33	6.60
Do.	New Orleans	Rail	43	8		35	7.00
Duluth, Minn.	New York	do.	66	8		58	11.60
Do.	do.	Rail-lake	48	8		40	8.00
Do.	New Orleans	Rail	60	8		52	10.40
Do.	do.	Barge-rail	53	8		45	9.00
Minneapolis-St. Paul	New York	Rail	66	8	20 t	38	7.60
Do.	do.	Rail-lake	56	8	20 t	28	5.60
Do.	New Orleans	Rail	49	8	20 t	21	4.20
Do.	do.	Barge	43	8	20 t	15	3.00

TABLE E-6

*Potential tonnage and savings in transportation costs on importation
of green coffee into the tributary area*

Area	Estimated imports (short tons)	Imports in open season (short tons)	Saving per ton	Total saving
Chicago Industrial Area	108,447	55,308	\$6.00	\$331,848
Balance of Illinois	4,303	2,195	3.00	6,585
Indianapolis area	3,443	1,756	1.60	2,810
Balance of Indiana	2,582	1,317	1.60	2,107
Detroit area	9,468	4,828	4.80	23,174
Balance of Michigan	6,885	3,511	3.00	10,533
Minneapolis-St. Paul	12,910	6,584	4.20	27,653
Balance of Minnesota	5,164	2,634	8.00	21,072
Cleveland area	14,632	7,462	5.00	37,310
Cincinnati area	15,492	7,901	1.40	11,061
Toledo area	22,378	11,413	5.20	59,348
Balance of Ohio	1,721	878	2.00	1,756
Milwaukee, Wis	9,468	4,828	6.60	31,865
Balance of Wisconsin	3,443	1,756	5.60	9,834
Buffalo area	6,025	3,073	4.40	13,521
Rochester area	6,886	3,511	4.00	14,088
Pittsburgh area	24,099	12,291	.60	7,375
Total	257,346	131,246		611,940

Appendix F

THE CITRUS INDUSTRY

INTRODUCTION

In this report an attempt will be made to evaluate the effect of the proposed St. Lawrence Seaway upon the cost of transporting citrus products to the tributary area of the Great Lakes. In this study, as in others dealing with individual commodities, the basic calculations are made on the basis of production and consumption figures of the recent past, and the transportation costs of the year 1940. In the concluding section an effort is made to indicate possible trends in the future.

The report is presented in two chapters, dealing with fresh citrus and canned citrus. Principal attention is given to the influence of the St. Lawrence upon the citrus industry in Florida. Shipments of citrus products from California and Texas now move by rail, and this practice is expected to continue even after the construction of the Seaway.

Section 1

PRODUCTION AND SHIPMENTS OF CITRUS FRUITS

There has been a very significant increase in production of citrus fruits in the United States in recent years. The total production exceeded 133,000,000 boxes of oranges, grapefruit and lemons in 1938, as compared with about 96,000,000 boxes in 1934.¹ Of the 1938 total, Florida produced 75,000,000 boxes of oranges and grapefruit, or approximately two-fifths of the total United States production.² Production of citrus fruits including lemons again was on a high level for the 1939 season, with a total of 122,437,000 boxes, of which Florida produced 43,600,000 boxes. For the same season, Florida commercial canneries utilized 1,187,544 boxes of oranges and 8,481,053 boxes of grapefruit. Total imports of grapefruit and oranges for the three seasons, 1936-38, averaged 4,632,893 pounds, or 2,316 short tons.³

Table F-1 shows shipments of citrus fruits in boxes from the three principal domestic producing areas: California, Florida, and Texas, for the 10 seasons, 1929-30 to 1938-39, inclusive.

This table does not include shipments of lemons, which are not produced in appreciable amounts in Florida. It does appear from the table that, in the past few years, shipments from Florida have increased greatly and now constitute more than half of the total shipment of oranges, grapefruit, and tangerines.

Even as production and shipments have increased during the decade of the thirties, the price per box and the total annual value of the crop has steadily declined. The average price of oranges per box, in 1929, was \$3.66. In 1932, it had gone down to 96 cents. From this, the average price per box increased to \$1.86 in 1936; but in 1937 and 1938, the average price declined to 97 cents and 86 cents, respectively. As a result, the annual value of the orange crop

¹ The average weight of a box varies between 70 pounds (California oranges) and 90 pounds (Florida oranges).

² Department of Agriculture, *Agricultural Statistics*, 1939, p. 182, and 1040, p. 210.

³ Department of Commerce, *Fresh Fruits*, 1938.

went down from \$119,356,000 in 1929 to \$49,215,000 in 1932. After rising to \$100,202,000 in 1936, the value of oranges declined to \$71,505,000 in 1937, and \$65,180,000 in 1938.

Grapefruit growers fared a similar fate. In 1929, the value per box of grapefruit was \$2.26; in 1938, only 35 cents. Correspondingly, the total value of grapefruit crop in 1929 was \$25,212,000; in 1938, only \$13,948,000.⁴

Section 2

TRANSPORTATION COST ON FRESH CITRUS FRUITS

In a report of the Federal Trade Commission,⁵ published in June 1937, pursuant to the direction of Congress, a study was made of the distribution of fresh fruits and vegetables, in which costs for shipments of oranges and grapefruit are analyzed. The study covers the period from October 1935 to November 1936, inclusive, a complete season. The study shows all factors involved in costs of distribution from production origins to terminal marketing centers, including expense of transportation.

To illustrate transportation costs, the two largest cities in the United States—New York and Chicago—were selected. During the period above named, information was obtained for 357,007 standard boxes of Florida oranges sold in New York City. It was found that freight and other transit costs amounted to 18.75 percent of the wholesale value per box of all oranges sold. For Florida oranges sold in Chicago, data were collected on the sale of 63,795 standard boxes; freight and other transit costs amounted to 28.27 percent of the wholesale value. It will thus be seen that freight and other transit costs from Florida to Chicago amount to 9.52 percent more of the wholesale value than in New York.

For grapefruit sold in New York City, information was obtained on 265,011 standard boxes. On all shipments sold, freight and other transit costs amounted to 23.79 percent of the wholesale value. On shipments of 31,164 standard boxes to Chicago, freight and other transit costs amounted to 36.59 percent of the wholesale value. Thus, freight and other transit costs amounted to 12.8 percent more for grapefruit sold in Chicago than in New York.

The reason why transportation costs absorb so much more of the wholesale dollar spent on citrus fruits in Chicago than in New York is found in the relatively high rail rates to Chicago as compared with rail rates to New York. For instance, from Lake Wales, Fla., to New York, a distance of 1,159 miles, the rate is 66.5 cents per 100 pounds in carload lots; whereas, to Chicago, approximately 100 miles farther, the rate is 95 cents. This large difference is essentially due to the competitive influence of all-water transportation, which is always present and easily accessible from any part of Florida to the North Atlantic coast. The same influence accounts for the fact that the rail rate from Lake Wales to Boston is 80 cents, as compared with 95 cents to Chicago, even though Boston is farther than Chicago by nearly 160 miles. The comparative rail rates on fresh citrus from Jacksonville, Fort Pierce, and Lake Wales, Fla., to consuming centers is given in detail in table F-2.

A further indication of comparative costliness of rail transportation as against water is revealed in the relative distances that may be traveled for the same expenditure of money. It was stated above that the rail rate from Lake Wales, Fla., to Boston, Mass., a distance of nearly 1,400 miles, is 80 cents per 100 pounds.

⁴ Department of Agriculture, *Agricultural Statistics*, 1940, pp. 208-9.

⁵ Federal Trade Commission, *Agricultural Income Inquiry, part II, Fruits, Vegetables, and Grapes*, 1937, pp. 240, 247, 267, 277.

For the same rate at times in 1939, the Canadian National Steamship Lines carried a 90-pound box of citrus fruits from British West Indies to Montreal. The distances from various West Indies points to Montreal by water are over twice the rail distance between Lake Wales and Boston.

The following three points are established, therefore, from the foregoing facts: The Middle West pays a much higher percent of its expenditures on citrus fruits in cost of transportation; for comparable distances, where there is threat of competition by water transport, the rail rates are lower; and for a given amount of expenditure on transportation, citrus fruit can often be transported more than twice as far by water as by rail.

The need for cheaper transportation for the Middle West, particularly in view of the increasing acreage devoted to citrus plantings and the growing annual production, is definitely indicated. It would appear that cheaper methods of transportation would benefit both consumer and producer.

The present marketing condition and the need of new distribution areas are clearly set forth in a letter of Mr. Marvin H. Walker, secretary-manager of the Florida Citrus Producers Trade Association, under date of February 22, 1940. Mr. Walker wrote:

The problem of distributing a larger portion of the citrus crops in the Central States is one of the most important facing this industry. If the development of the St. Lawrence Waterway would make possible lower transportation costs to interior marketing areas, if only for a part of our shipping season, it would be of benefit to the fruit growers of this state.

Cheaper transportation could serve not only the millions of consumers on the United States side of the Great Lakes, but also those on the Canadian side. The population in the tributary area of the Great Lakes which may benefit by cheaper transportation costs on fresh citrus fruits numbers about 22,000,000 in the United States alone. This is a very conservative figure because it includes only the population of the counties immediately adjacent to the Great Lakes in the States of New York, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin, and Minnesota, and the total population of Michigan. In addition to this, the population of certain cities, such as Akron and Youngstown, Ohio; Indianapolis, Ind.; Rochester and Syracuse, N. Y., are included because the rates via the Seaway are expected to be lower than applicable all-rail rates. Detailed figures of population are given in table F-8. On the Canadian side, about 33 percent of the Dominion's population live in the tributary area, or, to be conservative, about 3,400,000 people.

Section 3

CONSUMPTION OF CITRUS FRUITS IN GREAT LAKES AREA

How much citrus fruit is the American and Canadian population, living in the tributary area of the Great Lakes, likely to consume; and how much of this could be considered potential traffic on the proposed St. Lawrence Seaway?

Annual per capita consumption of fresh grapefruit and oranges in the United States for the 10 seasons, 1929-30 to 1938-39, is shown in table F-3.

This table shows the annual per capita consumption of oranges, lemons, and grapefruit, on a very conservative basis. Consumption of California and Arizona oranges has been calculated on the basis of 70 pounds per box, and Florida and others at 90 pounds per box. Grapefruit consumption has been estimated on the basis of 60 pounds to the box for California and Arizona products, and 80 pounds to the box for Florida and Texas grapefruits. Both oranges and grapefruit were adjusted by a waste factor of 13 percent.

Of course, per-capita consumption of citrus fruits is a function of price. The demand for this product is elastic. One can expect that with lower transportation cost, lower price will result and consumption will increase. To take the consumption figures for the 1937-38 and 1938-39 seasons, both periods of large domestic production and lower prices would not be overoptimistic, particularly in view of the upward trend of production since 1929. On the other hand, average per capita consumption is perhaps weighted by the larger share consumed in the producing areas and on the coastal plains within reach of cheap transportation. To be conservative, therefore, one may take a per capita consumption of 30 pounds of oranges and 10 pounds of grapefruit as an annual quota of the Midwestern consumer in order to estimate total potential market in the tributary area.

Although habits of consumption in Canada must differ at present with regard to this fruit, particularly where the price factor militates against a liberal portion of this product in the ordinary budget, it could be assumed that, with prices on the Canadian side comparable with those on the United States side of the Lakes, Canadians will react the same way, marketwise, as the Americans. Assuming the same percapita consumption on both sides, 30 pounds a year, total demand for oranges by the 22 million Americans and approximately 3.4 million Canadians in this area would be at least 762,000,000 pounds. On grapefruit, the estimated total consumption on both sides of the Lakes may be estimated at 254,000,000 pounds, at the rate of 10 pounds per capita. This gives a total annual consumption in the tributary area of 1,016,000,000 pounds, or 508,000 short tons.

This figure applies, of course, to both Great Lakes Canada and the United States tributary area. It is a very conservative estimate, since in 1939 the United States exported 4,436,925 boxes of 90 pounds each to Canada, or nearly 200,000 tons. Allocating 33 percent of this to the Canadian population within reach of the Great Lakes would give 66,000 tons of citrus fruits exported from the United States to Great Lakes Canada. Our calculation is further validated by the elimination of other sources of supply for Canada. For, in the whole year of 1939, the Canadian Steamship Lines, which has frequent scheduled sailings to the British West Indies, brought back to St. John, New Brunswick, Halifax, Nova Scotia, and Montreal, Quebec, a total of 83,987 boxes of citrus fruits of 90 pounds per box, or a mere 3,780 short tons.

It is safe to assume, then, that 66,000 short tons of citrus fruit to 3,400,000 people on the Canadian side of the Lakes, and 880,000,000 pounds, or 444,000 short tons, to the 22,000,000 people on the United States side, are conservative estimates. Both of these markets would be almost 100 percent available to American producers.

The estimated consumption in Great Lakes Canada and the tributary area on the United States side is on the basis of their respective populations and per capita consumptions, given in table F-4.

Section 4

ESTIMATED POTENTIAL TRAFFIC AND SAVINGS VIA THE ST. LAWRENCE SEAWAY

With the estimates of total consumption of grapefruit and oranges in the tributary area of the Great Lakes, it is now possible to calculate the potential open-season movement of shipments from Florida. This task presents two problems: First, it is necessary to estimate the proportion of the total shipments of citrus which move into the tributary area during the open season on the Great

Lakes; and second, it is necessary to estimate the probable proportion of this movement which may be supplied from Florida.

An examination of the weekly shipments of citrus fruits over a period of years, as given in the *Market News Service on Fruits and Vegetables*,⁶ indicates that about 36 percent of shipments take place between April 15 and November 30. The reason for this small proportion of shipments during the open season is that citrus is a fall and winter crop and that in the summer months of July and August there is only a small amount of shipments. By applying this 36 percent factor to total estimated consumption on both sides of the Great Lakes, as given in table F-4, it is possible to determine the open-season movement of grapefruit and oranges into the tributary area. The resultant figures are given in table F-5, which shows that 36,720,000 pounds of oranges and 12,240,000 pounds of grapefruit would be shipped to Great Lakes Canada during the open season, and 237,600,000 pounds of oranges and 79,200,000 pounds of grapefruit to the tributary area in the United States.

The next problem is to determine how much of this open-season citrus fruit may come from Florida and how much from other sources of production. For this purpose, grapefruit and oranges must be separately treated, since the principal competitive sources of production are different in each case. In the shipment of oranges, Florida and California are the principal competitors. For grapefruit, Florida and Texas are the principal competitors. A test study of shipments of oranges, including tangerines, from Florida and California, and of grapefruit from Florida and Texas, indicates that in the 10 seasons from 1928-29, 38.5 percent of some 457,000,000 boxes of oranges shipped, including a small amount of tangerines, came from Florida, and 61.5 percent from California. In the case of grapefruit, of a total of 120,000,000 boxes shipped, 73 percent came from Florida and 27 percent from Texas. These calculations are presented in table F-6. These figures, in fact, underestimate the importance of Florida as a producing center since the trend has been definitely toward an increase in the supply of citrus fruits grown and shipped from Florida. Consequently, 38.5 percent is a definite understatement.

Applying these proportions of shipments from Florida to the estimated open-season consumption of grapefruit and oranges, as given in table F-5, it is possible to obtain the estimated amounts of consumption of Florida citrus in the tributary area. The results of these calculations are given in table F-7.

It appears from this table that, on the basis of the 1928-29 to 1938-39 proportion of shipments from Florida to the Middle West, 91,476,000 pounds of oranges and 57,895,000 pounds of grapefruit, or a total of 149,371,000 pounds of citrus fruit, would be shipped annually from Florida to the United States tributary area. On a similar basis, 14,137,000 pounds of oranges and 8,947,000 pounds of grapefruit, or a total of 23,084,000 pounds of citrus fruit, would go from Florida to Canadian consumers in the Great Lakes area. As the estimated population residing within reach of Great Lakes transportation facilities on the Canadian side is 3,400,000 people, and on the United States side, 22,000,000 people, these figures indicate a consumption during the open season of about 7 pounds per capita, oranges and grapefruit combined.

The next problem is to determine the extent of potential savings on the transportation of Florida citrus to the Great Lakes area, which would be achieved if the St. Lawrence Seaway were constructed. This problem must first be analyzed in terms of what the potential savings might be if the Seaway were now available

⁶ Issued annually by the Department of Agriculture and the Florida State Marketing Bureau, Jacksonville, Fla.

for such shipments of citrus fruits. Later, probable future tendencies as of the time when the Seaway may actually be completed will be considered.

In order to estimate potential savings in terms of present conditions, it is necessary to obtain a more detailed allocation of consumption of Florida citrus by smaller territorial subdivisions in the Great Lakes area. This obligation is imposed because transportation rates now existing between Florida and the Great Lakes vary between different points. In order to determine potential savings we must, therefore, know in greater detail the quantity of consumption at specified points near the Lakes, and the rail rates now applicable thereto. There are no statistics available on the amount of citrus consumption by smaller geographic or political subdivisions. To overcome this difficulty, it has been arbitrarily assumed that the amount of shipments of Florida citrus into the Great Lakes area is evenly distributed in all the major population centers, and that the per capita consumption does not vary greatly between Duluth, Minneapolis, Chicago, Detroit, Cleveland, and other points adjacent to the Lakes. With this assumption, it is easy to apply the per capita consumption of Florida citrus to population by specified areas.

The population of trading areas, and by counties, is given in *Atlas of Wholesale Grocery Trading Areas*.⁷ The populations of those areas which are considered to be within reach of Great Lakes ports for the shipment of Florida citrus as determined by a comparison between rail rates and Seaway rates are specifically tabulated in table F-8.

The foregoing calculation of citrus consumption shows that approximately 150,000,000 pounds of both oranges and grapefruit are consumed on the United States side of the Lakes by an estimated number of 22,000,000 people. This is at the rate of about 7 pounds of Florida citrus per capita during the open season.

Applying to these population figures, 7 pounds per capita consumption of Florida oranges and grapefruit, we obtain the total consumption of Florida citrus by the population of those trading areas.

The next step in this procedure is to determine the savings that could be effected if we had the St. Lawrence Seaway, at the present time, in comparison with existing rail rates to the focal points of those trading areas. These rail rates are from Lake Wales, Fla., which is at the center of production of Florida citrus, to the principal trading centers given in table F-8.

In the next column is given the probable Seaway rate, which is estimated at 72 cents per 100 pounds to all Great Lakes ports, with the exception of Duluth, where the rate is estimated at 77 cents from Lake Wales, Fla. The 72-cent rate is comparable with 48 cents from Lake Wales to New York. Both rates include 12 cents for trucking from Lake Wales to Jacksonville, Fla. It is believed that in view of the availability of return cargo, particularly in dairy products, this 72 cents per 100 pounds is quite adequate. In calculating the unit savings, allowance has been made for trucking charges to points in the Great Lakes area inland from the lake shore. Generally, it was assumed that trading within a 50-mile radius would not require an additional charge for trucking because store owners would come to the market center to obtain provisions on specified days of the week in their own trucks. However, for points further removed, an allowance of 10 or 15 cents for trucking was made. On the basis of probable Seaway rates so established, savings on shipments of Florida citrus to these trading centers were calculated as shown in table F-8.

The total savings on the basis of 1930 population in the United States area and 7 pounds per capita consumption during the open season is thus estimated to be about \$358,000 per season. This figure does not include any shipments of citrus

⁷Department of Commerce, Market Research Series No. 19.

by water either from California or from Texas. Neither does it include the savings on shipments of canned citrus which will be calculated separately in a subsequent section.

The savings on transportation costs to Great Lakes Canada could not be calculated in the same detailed fashion. The work involved in obtaining population figures by parishes and cost of transportation, at present, to a multitude of terminating points would entail an amount of work which would not be repaid by the results. For this reason, an extremely conservative estimate of savings is made by comparing present rail rates to Montreal with the proposed Seaway rate. The rail rate from Lake Wales, Fla., to Montreal, Canada, is 111.5 cents per 100 pounds. Rates to most points in Great Lakes Canada would certainly be greater. Disregarding this discrepancy, we have taken 39 cents per 100 pounds as the average saving on the consumption of 23,084,000 pounds of fresh Florida citrus in Great Lakes Canada during the open season. The resultant saving is \$90,027 per year. The saving on shipments of fresh citrus from Florida during the open season to Great Lakes Canada and the United States tributary area would be \$358,000 plus \$90,027, or a total of \$448,000.

This result is understated as of 1940, since it is based upon 1930 population figures. We know that a normal increase of population has taken place during the past decade, and will continue to take place during the succeeding decades. The medium estimate of population for the United States tributary area in question in 1950 is in the neighborhood of 25,300,000, or an increase of over 3¼ million, as compared with 1930. Without assuming any change in per capita consumption of Florida citrus, this should mean an additional consumption of 22,750,000 pounds, or at an average saving of 2 mills per pound—an additional saving of \$45,500. As population and per capita consumption grows, the additional savings will, of course, be greater. Supplementing this with the increasing consumption of Florida citrus by a growing population in Great Lakes Canada, it is safe to assume that there would be a saving of between \$500,000 and \$600,000 a year in transportation of Florida citrus to the Great Lakes area, when the Seaway is completed.

The distribution of this benefit between consumers and producers is hard to trace. If competition reduces the price of the fresh citrus fruit, the consumer would, of course, benefit. However, the broadening of the market geographically, and by reaching more and more marginal consumers, will certainly facilitate marketing at favorable prices. The new markets thus opened will provide a cushion on citrus prices, which are notoriously affected by variations in supply.

There seems to be little in the marketing arrangements now in use which would militate against the use of the St. Lawrence Seaway by the shippers. Being a commodity of very wide consumption, fresh citrus, as other fresh fruits, has easy access to the marketing channels which are a part of the commercial life of every large community. The only factor that needs to give any serious concern is the effect of the longer time required in shipping through the St. Lawrence as compared with the rail and truck routes now employed. As against this factor, Florida citrus shippers have advanced the following advantages of the Seaway route which, in their opinion, counteracts the disadvantages of the longer route:⁸ First, the shippers maintain citrus fruit would arrive in better condition by boat than by rail, due to less road shock and less percentage of decay. This has been their experience in the shipment of citrus fruit by boat to North Atlantic ports. In the second place, the more even distribution of citrus unloads in the different Great Lakes harbors will prevent congestion and glutted markets at North Atlantic ports. In the third place, by eliminating

⁸ *Economic Survey for Port of Canaveral, Florida, Shippers Reports, February 1939.*

long truck hauls or local rail freight charges, direct shipments to lake ports would reduce the cost of transportation and hence help broaden the market for fresh citrus, which is a growing industry.

Will there be ship lines which would find this business profitable during the open season? At the present time, four ship lines handle citrus fruit between Florida and North Atlantic ports. These are the Clyde-Mallory Lines, the Bull Steamship Co., Merchants and Miners Transportation Co., and Refrigerated Steamship Lines. These lines have been carrying an increasing proportion of shipments of citrus from Florida in the past several years. For instance, in the 1931-32 season, shipments by water amounted to the equivalent of 4,656 cars as against direct rail movements to Baltimore, Md., of 17,691 cars. A year later, in 1932-33, water and rail shipments were practically equal, at around 13,900 cars each. In the 1934-35 season, shipments from Florida to New York were equal to 1,425 cars by rail and 14,565 cars by water. From 1935 through the 1938 season, the proportion of rail to water transport varied between 17 and 25 percent. This has been the trend in spite of the fact that rail rates are practically equal to water rates. The increasing use of water transportation would seem to indicate that shippers and boat lines find it profitable, in spite of the slower time involved.

The factor that would seem to be controlling in the extending of the services of the Great Lakes is whether there would be profitable return cargo from the Great Lakes ports to the South Atlantic States. Such return cargo will certainly be available as shown by other studies of the Survey—in dairy products (butter, eggs, cheese, and poultry), grains, machinery, and automobiles. This conclusion is further emphasized in view of the fact that some way-traffic between Great Lakes harbors and North Atlantic ports of call must also be available. The conclusion is warranted, therefore, that the St. Lawrence Seaway would be utilized by the shippers of Florida citrus fruits, and would be of benefit both to shippers and consumers.

Section 5

PRODUCTION OF CANNED CITRUS FRUITS AND JUICES

Production of canned citrus fruit and juice, a comparatively new industry, has become an important factor, in recent years, to both growers and consumers because of the increased volume. Price reductions and improved quality of products, being easier to handle and less seasonable in shipping requirements, seem to have acquired an important place in the largely increased production.

Statistics of national production of canned citrus products are limited to a comparatively few years; however, these data show a very significant increase in output for both of the principal producing areas, Florida and Texas. The table below shows national production for the last 4 seasons, largely consisting of grapefruit hearts and juice; it also includes a small amount of canned citrus from Puerto Rico.

Production statistics of Florida's canned citrus, available for the past 10 seasons, are shown in table F-10, and indicate a striking upward trend, ranging from 1,528,224 cases in the season of 1929-30, to 11,277,638 cases in the 1938-39 season. This table likewise shows the number of boxes of fresh citrus fruit used per season for canning purposes, ranging from 1,676,437 boxes in the first season shown, to 9,656,059 boxes in the last season; thus showing that a substantial proportion of Florida's citrus production reaches the consumer in a canned rather than a fresh state.

Unlike shipments of fresh fruit, canned citrus products require little, if any, refrigeration, only temperature control with adequate ventilation being generally

utilized in shipments to markets. Production of canned citrus takes place at approximately the same time as that of fresh; however, it may be stored at or adjacent to points of production, or at consumption points if transportation savings justify, for a few months awaiting favorable markets. The element of time in deliveries to markets is not so important as that for fresh fruit, thus allowing for a more regular flow of shipments.

The Florida Canners Association embraces within its membership practically all of the canners within that State, headquarters being located in Tampa, with canning plants located in the various sections of the citrus-producing area. The association generally supplies information to its members on marketing, grading, packaging, transportation, and other trade matters. Very recently, Florida canners have begun to produce quite an important byproduct in canning processes in the shape of cattle feed, it being said by State agricultural authorities to have approximately the same feeding quality as beet pulp. At present, this byproduct is being entirely utilized by the State livestock industry.

Section 6

ESTIMATED TONNAGE AND SAVINGS ON THE TRANSPORTATION OF CANNED CITRUS VIA THE ST. LAWRENCE SEAWAY

By applying the method which was used in estimating the amount of consumption and potential traffic on fresh citrus to the canned citrus industry, it is possible to disclose approximately the amount of traffic and savings that might be expected in the transportation of this canned product. The consumption of canned citrus, just as of fresh citrus products, has been increasing considerably over the past decade. This increase has been so pronounced that it is definitely a trend encouraged by continued education of consumers on the one hand and price reductions on the other. The average per-capita consumption of canned grapefruit has increased from 1.33 pounds in the 1934-35 season to 3.13 pounds in the 1938-39 season. One could well take 3 pounds per capita as a probable long-run consumption factor. However, in view of the fact that this is only a recent trend, and also because 5 months of the season the Great Lakes will not be open to traffic, it is justified to take 2 pounds per capita as the amount of canned grapefruit that may be shipped via the St. Lawrence during the open season. If this rate is applied to the population of the tributary area, as was considered in the previous analysis, of fresh citrus, where there were about 22,000,000 people, on the basis of 1930 census population figures, we obtain approximately 44,000,000 pounds of canned Florida grapefruit. A detailed comparison of the present rail rates and possible future rates via the Seaway indicates substantial potential savings to each of the trading areas in the Middle West which are considered tributary to the Great Lakes. The estimated consumption in season and the savings per pound, as well as total savings for each of the trading areas, are calculated in table F-11. This shows that the potential savings will be in the neighborhood of \$91,000 on shipments of canned grapefruit from Florida. This potential saving is calculated by comparing rail rates in effect in the spring of 1940 with potential St. Lawrence Seaway all-water rates, including allowance of 13 cents per hundred pounds for trucking from Lake Wales to ship-side at Fort Pierce, Fla., and 40 cents for the water haul from Fort Pierce to Great Lakes ports, or a total of 53 cents. This 53-cent rate compares with 38 cents per hundred pounds from Lake Wales to New York, including 13 cents for trucking from Lake Wales to Fort Pierce, and 25 cents by water from Fort Pierce to New York. In the estimation of unit savings, allowance was also made for trucking from lake port to final trading centers, wherever such trading centers were considerably removed from the lake ports.

The saving of nearly \$91,000 on this traffic is, therefore, very conservatively estimated, as it is based upon 1930 population figures and upon a consumption rate of 2 pounds per capita, making allowance at the same time for trucking from Lake Wales to ship-side in Florida, and from ship-side to trading centers in the tributary area, and a 15-cent increase for transportation into the Great Lakes over the rates now in effect from Florida to New York.

If we assume that per capita consumption on the Canadian side of the Great Lakes will be approximately the same as on the American side, then there will be an additional potential traffic of 6,800,000 pounds, considering the population of Great Lakes Canada equal to 3,400,000 people. Even if the average saving per pound on transportation costs were no more than on the United States side of the Lakes, namely, 2 mills, then the total savings on this Canadian trade should be about \$13,600. If the saving on the Canadian side is considered to be 3 mills per pound, then the savings on this trade can be estimated at around \$24,000 a year.

An over-all saving of at least \$110,000 on the shipment of Florida grapefruit to both United States and Canadian areas tributary to the Great Lakes would not be considered an overstatement. With expected increase of population, 1950-60, by approximately 3¼ million people on the United States side as compared with 1930, and a probable increase of slightly more than 1 million in Great Lakes Canada over 1931 figures, one must assume a possible potential traffic of about 9,700,000 pounds more than the preceding estimates, and a possible potential saving in transportation cost of at least \$19,400, or more likely \$29,000 on this increased future consumption due to increased population. Without considering any increase in the rate of per capita consumption, therefore, this would mean a total saving on the shipment of canned grapefruit as of the time the Seaway may become available of from \$130,000 to \$140,000.

Table F-1 recapitulates the estimated potential traffic and savings in both fresh and canned citrus from Florida. This shows that as of the time the Seaway may be available, the total tonnage of Florida citrus, both fresh and canned, that may be expected to pass through is estimated at 131,475 short tons, which could provide a potential saving of \$687,700. These are based on present cost of transportation and present rates of per capita consumption.

TABLE F-1

Citrus shipments from three principal producing States, seasons 1929-30 to 1938-39

[Boxes]

Season	Florida ¹				California ² (oranges)	Texas ³ (grapefruit)
	Oranges	Grapefruit	Tangerines	Total		
1929-30-----	7,664,040	5,850,720	637,920	14,152,680	19,196,066	1,530,000
1930-31-----	15,736,610	12,178,590	1,916,615	29,831,815	32,728,752	1,135,000
1931-32-----	10,834,176	8,446,080	1,785,984	21,066,240	31,771,415	2,480,000
1932-33-----	13,464,485	7,912,105	1,749,445	23,126,035	31,151,717	1,385,000
1933-34-----	14,511,496	7,509,501	1,856,247	23,877,244	25,711,851	1,055,352
1934-35-----	14,010,560	8,696,684	1,675,848	24,383,092	38,818,521	1,983,024
1935-36-----	14,236,916	6,943,826	1,855,539	23,036,281	30,414,598	2,069,268
1936-37-----	17,190,976	10,802,103	2,781,773	30,774,852	19,450,000	6,589,668
1937-38-----	21,679,591	7,877,787	2,027,559	31,584,937	30,170,000	6,655,383
1938-39-----	27,422,640	11,679,200	3,071,287	42,173,127	*21,808,710	7,487,130

¹ Includes rail, boat, and truck shipments.

² 1929-30 through 1937-38 furnished by the California Fruit Growers Exchange and represents rail and boat shipments.

³ 1933-34 through 1937-38 are rail, boat, and truck shipments. Figures for prior seasons indicate production.

⁴ As of Aug. 19, 1939.

SOURCE: Department of Agriculture, and the Florida State Marketing Bureau, Jacksonville, Fla., *Market News Service on Fruits and Vegetables*.

TABLE F-2

All-rail rates on fresh citrus fruits¹ from Florida to North Atlantic and Great Lakes points

[Cents per 100 pounds²]

Destination	Points of origin			Destination	Points of origin		
	Jacksonville, Fla.	Fort Pierce, Fla.	Lake Wales, Fla.		Jacksonville, Fla.	Fort Pierce, Fla.	Lake Wales, Fla.
Akron, Ohio.....	78	99	95	Milwaukee, Wis.....	83	103	99
Boston, Mass.....	64½	70	80	Minneapolis, Minn.....	99	118	113
Chicago, Ill.....	80	100	95	New York, N. Y.....	51	56½	66½
Cleveland, Ohio.....	79	99	95	Omaha, Nebr.....	93	112	108
Columbus, Ohio.....	71	91	87	Pittsburgh, Pa.....	75	97	92
Des Moines, Iowa.....	88	107	103	Peoria, Ill.....	78	98	92
Detroit, Mich.....	81	100	96	Rochester, N. Y.....	82	103	100
Duluth, Minn.....	102	122	118	South Bend, Ind.....	79	98	92
Fort Wayne, Ind.....	76	95	89	Springfield, Ill.....	75	95	90
Grand Rapids, Mich.....	83	102	97	St. Paul, Minn.....	97	118	112
Indianapolis, Ind.....	71	90	86	Toledo, Ohio.....	78	97	92
Kansas City, Mo.....	86	105	101	Wheeling, W. Va.....	75	97	92
Kalamazoo, Mich.....	80	99	95				

¹ Does not apply to cold pack in packages.

² In carload lots.

Tariff Authority: Miller, I. C. C. 1828.

TABLE F-3

Estimated per capita consumption of citrus fruits, 1929-30 to 1938-39

[Pounds]

Year	Oranges	Grapefruit	Lemons	Total	Year	Oranges	Grapefruit	Lemons	Total
1929-30.....	15.9	5.6	4.0	25.5	1934-35.....	31.1	8.2	5.6	44.9
1930-31.....	27.9	8.7	4.4	41.0	1935-36.....	24.5	7.2	3.8	35.5
1931-32.....	24.7	7.4	4.2	36.3	1936-37.....	27.7	11.4	3.9	43.0
1932-33.....	25.5	6.5	3.6	35.6	1937-38.....	35.7	10.8	4.7	51.2
1933-34.....	23.6	6.0	3.9	33.5	1938-39.....	38.7	15.8	5.3	59.8

SOURCE: Department of Agriculture, Division of Program Development and Coordination, May 1, 1940.

TABLE F-4

Estimated consumption of citrus fruits in Great Lakes Canada, and United States tributary area

Region	Population	Orange consumption		Grapefruit consumption	
		Per capita	Total	Per capita	Total
Great Lakes, Canada.....	Thousands 3,400	Pounds 30	1,000 pounds 102,000	Pounds 10	1,000 pounds 34,000
Tributary area, United States.....	22,000	30	660,000	10	220,000
Total.....	25,400		762,000		254,000

TABLE F-5

The estimated consumption of grapefruit and oranges in Great Lakes Canada, and United States tributary area during the open season
[Thousands of pounds]

Region	Total citrus consumption		36 percent shipped in open season	
	Oranges	Grapefruit	Oranges	Grapefruit
Great Lakes, Canada.....	102,000	84,000	36,720	12,240
Tributary area, United States.....	660,000	220,000	237,600	79,200
Total.....	762,000	254,000	274,320	91,440

TABLE F-6

Origin of citrus fruit shipments in United States, with amounts and percentages originating in California, Florida, and Texas, total, seasons 1928-29 to 1938-39

	Oranges	Grapefruit		Oranges	Grapefruit
	<i>Boxes</i>	<i>Boxes</i>		<i>Percentages</i>	<i>Percentages</i>
From Florida ¹	176,109,707	87,896,596	From Florida ¹	38.51	73.10
From California.....	281,221,630	32,369,825	From California.....	61.49	-----
From Texas.....	-----	-----	From Texas.....	-----	26.90
Total shipments.....	457,331,337	120,266,421			

¹ Orange shipments from Florida include tangerines.

SOURCE: Florida Citrus Exchange, Tampa, Fla., Statistical Department, *Statistical Bulletin, Season 1938-39*, p. 16.

TABLE F-7

Estimated consumption of Florida citrus during open season

[Thousands of pounds]

Region	Oranges	Grapefruit	Total
Great Lakes, Canada.....	14,137	8,947	23,084
Tributary area, United States.....	91,476	57,895	149,371
Total.....	106,613	66,842	172,455

TABLE F-8

Estimated consumption and potential savings on the transportation of fresh Florida citrus into Great Lakes area during open season

Trading area	Population 1930	Estimated consumption in open season	Rail rate from Lake Wales, Fla.	Sea-way rate	Allowance for trucking	Indicated savings	Total potential savings
		Pounds	Cents per 100 lbs.	Cents per 100 lbs.	Cents per 100 lbs.	Cents per 100 lbs.	
Plattsburg-Ogdensburg, N. Y.	217, 300	1, 521, 100	106	72		84	\$5, 172
Syracuse, N. Y.	541, 285	3, 788, 995	100	72		28	10, 609
Rochester, N. Y.	607, 543	4, 252, 801	100	72		28	11, 908
Buffalo, N. Y.	1, 364, 753	9, 553, 271	101	72		29	27, 705
Erie, Pa.	238, 257	1, 667, 799	99	72		27	4, 503
Cleveland, Akron, Canton, and Mansfield:							
Cleveland and adjacent territory ¹	1, 478, 243	10, 347, 701	95	72		23	23, 800
Summit County (Akron)	344, 131	2, 408, 917	95	72	10	13	3, 132
Stark County (Canton)	221, 784	1, 552, 488	93	72	10	11	1, 708
Mahoning County (Youngstown)	239, 142	1, 652, 994	96	72	10	14	2, 314
Areas tributary to above ²	711, 018	4, 977, 126	95	72	10	13	6, 470
Toledo-Lima, Ohio	943, 451	6, 604, 157	92	72		20	13, 208
Chicago and environs ³	4, 838, 516	33, 869, 612	95	72		23	77, 900
Area tributary to Chicago, Rockford, and Joliet ⁴	749, 418	5, 245, 926	95	72	10	13	6, 820
Detroit, Hamtramck, Pontiac, Ann Arbor, Jackson, Mich.	2, 621, 920	18, 353, 440	96	72		24	44, 048
Kalamazoo, Mich.	325, 518	2, 278, 626	95	72		23	5, 241
Flint, Mich.	279, 506	1, 956, 542	99	72	10	17	3, 326
Saginaw-Bay City, Mich.	450, 754	3, 155, 278	100	72		28	8, 855
Grand Rapids-Muskegon, Mich.	641, 663	4, 491, 641	97	72		25	11, 229
Marquette, Mich.	185, 238	1, 296, 696	122	72		50	6, 487
Hancock-Houghton-Ironwood, Mich.	127, 013	889, 091	124	72		52	4, 623
Milwaukee, Wis.	1, 734, 022	12, 138, 154	99	72		27	32, 773
Green Bay, Wis.	370, 184	2, 591, 288	112	72		41	10, 624
Duluth, Minnesota-Superior, Wis.	705, 068	4, 935, 478	118	77		41	20, 235
Minneapolis-St. Paul, Minn.	1, 974, 467	13, 821, 269	113	77	15	11	15, 209
Total	21, 907, 194	153, 350, 358					357, 873

¹ Includes the following counties: Cuyahoga, Lorain, Lake, Ashtabula, Erie and Geauga Counties.

² Includes the following counties: Ashland, Carroll, Columbiana, Coshocton, Crawford, Holmes, Huron, Knox, Marion, Medina, Marrow, Portage, Seneca, Trumbull, Tuscarawas, Wayne, Wyandot.

³ Includes the following counties: Cook, Lake, DuPage, Will, Kane, Kendall, Grundy, Kankakee, Ill., Lake, Porter, and LaPorte, Ind.

⁴ Includes the following counties: Boone, Bureau, Carroll, De Kalb, Ford, Henry, Iroquois, La Salle, Lee, Livingston, McHenry, McLean, Ogle, Putnam, Stephenson, Whiteside, Winnebago, Ill., Jasper, Newton, Pulaski, and Starke, Ind.

SOURCE: Population data Department of Commerce, *Atlas of Wholesale Grocery Trading Areas*, Market Research Series No. 19.

TABLE F-9

National production of canned grapefruit and grapefruit juice[Thousands of cases ¹]

Producing area	Type of product	1935-36	1936-37	1937-38	1938-39
Florida.....	Hearts.....	2, 150	3, 972	3, 335	4, 033
	Juice.....	1, 808	3, 710	3, 139	4, 916
Texas.....	Hearts.....	22	129	104	105
	Juice.....	540	2, 024	4, 700	4, 200
Puerto Rico.....	Hearts.....	239	179	216	90
	Juice.....	44	190	101	None

¹ Cases of 24 cans.² All sizes.SOURCE: American Institute of Food Distribution, Inc., Graybar Bldg., New York City, *Food Markets*.

TABLE F-10

Florida canned citrus production, 1929-39[Cases ¹]

Seasons	Grapefruit juice	Grapefruit segments	Orange juice	Total cases	Boxes used
1929-30.....	173, 934	1, 316, 738	37, 552	1, 528, 224	1, 676, 437
1930-31.....	412, 066	2, 712, 489	61, 110	3, 185, 665	2, 954, 058
1931-32.....	247, 652	907, 323	36, 362	1, 191, 337	966, 533
1932-33.....	727, 803	2, 182, 597	37, 258	2, 947, 658	2, 644, 115
1933-34.....	610, 115	2, 184, 577	57, 678	2, 852, 370	2, 424, 908
1934-35.....	2, 236, 726	3, 588, 042	240, 967	6, 065, 735	5, 781, 933
1935-36.....	1, 758, 497	2, 251, 775	162, 452	4, 322, 876	3, 856, 068
1936-37.....	3, 918, 604	4, 057, 672	498, 206	8, 333, 399	7, 273, 090
1937-38.....	3, 370, 002	3, 419, 226	806, 183	8, 260, 441	7, 160, 452
1938-39.....	5, 502, 102	4, 105, 775	926, 278	11, 377, 638	9, 656, 059

¹ Cases of 24 cans, No. 2 size.² Includes 65,194 cases citrus salad, and 84,958 cases combination orange and grapefruit juice.³ Includes 87,758 cases citrus salad, and 271,599 cases combination orange and grapefruit juice.⁴ Includes 84,271 cases citrus salad, 547,329 cases combination orange and grapefruit juice, and 33,430 cases orange segments.⁵ Includes 130,562 cases citrus salad, 699,295 cases combination juice, and 13,626 cases orange segments. Does not include 688,188 cases grapefruit canned for Federal Surplus Commodities Corporation, for relief purposes.Source: Florida Citrus Exchange, Tampa, Florida, Statistical Department, *Statistical Bulletin, Season 1938-39*.

TABLE F-11

Estimated consumption and potential savings on the transportation of Florida canned citrus into Great Lakes area during open season

Trading area	Population 1930	Estimated consumption in season	Rail rate from Lake Wales, Fla.	Seaway rate	Allowance for trucking	Indicated savings	Total potential savings
			Cents per 100 pounds	Cents per 100 pounds	Cents per 100 pounds	Cents per 100 pounds	
Plattsburg-Ogdensburg, N. Y.-----	217, 300	Pounds 434, 000	83	53	-----	30	\$1, 304
Syracuse, N. Y.-----	541, 285	1, 082, 570	79	53	-----	26	2, 815
Rochester, N. Y.-----	607, 543	1, 215, 086	81	53	-----	28	3, 402
Buffalo, N. Y.-----	1, 364, 753	2, 729, 506	82	53	-----	29	7, 916
Erie, Pa.-----	238, 257	476, 514	90	53	-----	37	1, 783
Cleveland, Akron, Canton, and Mansfield:							
Cleveland and adjacent territory ¹	1, 478, 243	2, 956, 486	73	53	-----	20	5, 913
Summit County (Akron)-----	344, 131	688, 262	73	53	10	10	688
Stark County (Canton)-----	221, 784	443, 568	81	53	10	18	798
Mahoning County (Youngstown)	236, 142	472, 284	83	53	10	20	946
Areas tributary to above ²	711, 018	1, 422, 036	73	53	10	10	1, 422
Toledo-Lima, Ohio-----	943, 451	1, 886, 902	73	53	-----	20	3, 774
Chicago and environs ³	4, 838, 516	9, 677, 032	61	53	-----	8	7, 742
Area tributary to Chicago, Rockford, and Joliet ⁴	749, 418	1, 498, 836	71	53	10	8	1, 199
Detroit, Hamtramck, Pontiac, Ann Arbor, Jackson, Mich.-----	2, 621, 920	5, 243, 840	73	53	-----	20	10, 488
Kalamazoo, Mich.-----	325, 518	651, 036	81	53	-----	28	1, 823
Flint, Mich.-----	279, 506	559, 012	84	53	10	21	1, 174
Saginaw-Bay City, Mich.-----	450, 754	901, 508	85	53	-----	32	2, 885
Grand Rapids-Muskegon, Mich.-----	641, 663	1, 283, 326	84	53	-----	31	3, 978
Marquette, Mich.-----	185, 238	370, 476	104	53	-----	51	1, 989
Hancock-Houghton-Ironwood, Mich.-----	127, 013	254, 026	107	53	-----	54	1, 372
Milwaukee, Wis.-----	1, 734, 022	3, 468, 044	72	53	-----	19	6, 589
Green Bay, Wis.-----	370, 184	740, 368	96	53	-----	43	3, 184
Duluth, Minn., Superior, Wis.-----	705, 068	1, 410, 136	116	53	-----	63	8, 884
Minneapolis-St. Paul, Minn.-----	1, 974, 467	3, 948, 934	91	53	15	23	9, 083
Total-----	21, 907, 194	43, 814, 388					91, 030

¹ Includes the following counties: Cuyahoga, Lorain, Lake, Ashtabula, Erie, and Geauga.
² Includes the following counties: Ashland, Carroll, Columbiana, Coshocton, Crawford, Holmes Huron, Knox, Marion, Medina, Marrow, Portage, Seneca, Trumbull Tuscarawas, Wayne, Wyandot.
³ Includes the following counties: Cook, Lake, Du Page, Will, Kane, Kendall, Grundy, Kankakee, Ill.; Lake, Porter, and La Porte, Ind.
⁴ Includes the following counties: Boone, Bureau, Carroll, De Kalb, Ford, Henry, Iroquois, La Salle, Lee, Livingston, McHenry, McLean, Ogle, Putnam, Stephenson, Whiteside, and Winnebago, Ill.; Jasper, Newton, Pulaski, and Starke, Ind.

SOURCE: Department of Commerce, *Atlas of Wholesale Grocery Trading Areas*, Market Research Series No. 19.

TABLE F-12

Estimated consumption and potential saving on fresh and canned citrus moving into United States and Canadian markets via the St. Lawrence Seaway 1930 and estimated increase for 1950

Destination and type of fruit	Estimated consumption	Potential saving	Destination and type of fruit	Estimated Increase 1950	
				Consumption	Potential saving
United States tributary area (1930 population):			United States tributary area (1950 population):		
Fresh citrus-----	Pounds 150, 000, 000	\$358, 000	Fresh citrus-----	Pounds 22, 750, 000	\$45, 500
Canned citrus-----	44, 000, 000	91, 000	Canned citrus-----	6, 500, 000	13, 000
Great Lakes, Canada (1931 population):			Great Lakes, Canada (1951 population):		
Fresh citrus-----	23, 000, 000	90, 000	Fresh citrus-----	7, 700, 000	15, 400
Canned citrus-----	6, 800, 000	20, 400	Canned citrus-----	2, 200, 000	4, 400
Total 1930-----	223, 800, 000	559, 400	Total increase 1950-----	39, 150, 000	78, 300
Total 1950-----	282, 950, 000	637, 700			

Appendix G

BANANAS

Section 1

IMPORTS AND CONSUMPTION OF BANANAS IN THE UNITED STATES

The United States is the largest consumer of bananas, and practically all of its consumption requirements are imported. Average imports into the United States during the decade 1928-37 were 1,976,397 short tons. During the course of two decades since 1919, imports of bananas have increased gradually from 1,294,760 short tons in the earlier year to a peak of 2,330,540 short tons in 1937. Since 1935, the average annual imports have been above 1,999,000 short tons.

The principal countries from which the United States obtains its requirements of bananas are those of Central America. Mexico and Honduras are the largest exporters of bananas to the United States, between them accounting for 45 percent of the total imports in 1939. Guatemala and Panama, Cuba and Costa Rica are also main sources of banana imports. Jamaica used to be a very substantial exporter of bananas to the United States, but since 1933 has lost its position of importance as a source of this product. The imports of bananas into the United States by countries of origin are given in table G-1.

The principal ports of entry of bananas into the United States, on the Atlantic and Gulf coasts, are, in the order of magnitude: New Orleans, New York, Philadelphia, Baltimore, and Boston. The average annual imports through New Orleans during the years 1928-37 were 596,000 short tons. Through New York, over the same period, the average annual imports were 538,000 short tons. Philadelphia acted as port of entry for 174,000 short tons, and Boston for 130,000 short tons over the same period. The imports of bananas by customs districts are presented in table G-2. It is fair to conclude from these facts that the Great Lakes tributary area obtains its quota of bananas through these ports, but principally through New Orleans and New York.

The annual per capita consumption of bananas compares with the consumption of oranges, both being approximately 20 pounds. The following averages¹ by 5-year periods of per capita consumption of bananas indicate the slight variations, as a result of changing economic conditions: 1919-23, 17.2 pounds; 1924-28, 21.9 pounds; 1929-33, 18.3 pounds; 1934-38, 20.7 pounds. It will be noticed that during the depression years, 1929-33, there was a reduction of only 16.4 percent from the high record over 1924-28.

A more detailed study of consumption of bananas by regions indicates that in the North Atlantic States, white families consumed, during 1935-36, an average of 25 pounds per year. On the Pacific coast, white families consumed only 18 pounds per year. In the East South Central States, the average consumption

¹ Department of Agriculture, *Agricultural Outlook*, 1940, section, *Fruit Outlook*, p. 4.

per capita among white families was 22 pounds. In the East North Central States, the corresponding figure was 27 pounds.³

On the basis of these figures, a conservative assumption of per capita consumption in the Great Lakes region might be 20 pounds.

Section 2

COST OF TRANSPORTING BANANAS INTO THE UNITED STATES

Bananas are transported from sources of origin to ports of entry in the United States mainly by boats owned or under lease to fruit companies which own their own plantations in the Central American countries. Most of the banana requirements of the United States are supplied by two such companies.

Since the major portion of banana imports into the United States is brought from Central American points by ships owned or operated by the plantation owners, there are no quotations on freight rates from Central America to United States ports. The cost of transportation to the fruit companies in their own boats is the only basis of comparison. These costs are estimated to be at about 56 cents per hundred pounds from Central American countries to Baltimore, Philadelphia, New York, and New Orleans. This includes also the cost of refrigeration and ventilation in the boats.

From seaport to the interior of the country, bananas are transported principally by rail, also under refrigeration, during the summer months. Without considering the cost of transshipment from ship to train, the rail rates on bananas to the interior of the country are very substantial, as shown in table G-3.

From New York City to Oswego, N. Y., it would cost 52 cents per hundred pounds; to Cleveland 74 cents; to Detroit 81 cents; to Chicago 92 cents; and to Minneapolis \$1.21. These costs, of course, are reflected on the prices of bananas to the general consumer.

Table G-3 shows all-rail rates from the principal ports of entry for imports of bananas—namely, Baltimore, New York, and New Orleans—to trading centers in the tributary area of the Great Lakes. Bananas carry specific commodity rates which are lower than the third-class rates to which this commodity would normally belong. During the summer, bananas sometimes carry charges for refrigeration in addition to these rates. In 1940 the average cost per short ton for ice was between 4 and 5 dollars.

As bananas are carried principally by railroad to interior points, the calculation of savings on any future transportation of bananas via the St. Lawrence must be based on a comparison between railroad rates, as shown in table G-3 and the additional charge that the shipping companies specializing in bananas would impose to carry their load to the Great Lakes in comparison with their present cost to New Orleans, Baltimore, and New York. As 56 cents per hundredweight was the average cost of transportation quoted by one of the fruit companies to New Orleans, Baltimore, and New York from Central American points, without regard to distance, we should have to make certain assumptions as to the additional cost into the Great Lakes. Since the steamship companies carrying bananas also own their plantations, the real point at issue is, for what additional revenue on the sale of bananas would these companies agree to take their cargoes into the Great Lakes. This additional charge, of course, must be equal to, if not greater than, the incremental cost of going into the lake region. On the other hand, the fruit markets in the Great Lakes ports would be expected to pay for

³ Department of Agriculture, *Diets of Families of Employed Wage Earners and Clerical Workers in the Cities, 1939*, Bulletin 507, p. 30.

bananas, at the most, the New York, Baltimore, or New Orleans price plus rail transportation into the Great Lakes. There is a wide margin of saving which would be the subject of division between seller and purchaser through the ordinary process of bargaining.

As the exact bargain between the seller and purchaser in the fruit markets is not known, it is possible only to make certain assumptions and to calculate potential savings accordingly. Three general assumptions are here made: The first is that the companies may be satisfied with a participation in the savings on rail rates to the extent of 20 cents per hundred pounds; the second assumption is that they would be satisfied with 30 cents per hundred pounds; and finally, it was assumed that they might be satisfied with 40 cents per hundred pounds. In addition to the division of the savings between the fruit companies and the local middlemen and retailers, allowance must be made for transportation of bananas from lake ports to inland points in the tributary area.

On these assumptions, indicated savings are tabulated in table G-4 for a number of trading areas which are located on or near the Great Lakes. These trading areas were selected for their proximity to lake ports. They are, as a whole, within easy trucking distance of such ports. The present rates over which savings under the given assumptions were calculated were the lowest rail rates from one or the other of the three principal ports of entry. It need hardly be stated that actual conditions in any given year or in any particular month in a year, or, indeed, in the case of a particular boatload, may and certainly will differ from the conditions presented in table G-4. The savings in relation to then-existing rail rates may be below the lowest level of 20 cents or anywhere between 20 and 40 cents, or even above 40 cents per hundred pounds. The particular assumptions are here used in order to indicate the possible range of the total savings that may accrue to consumers of bananas.

In order to calculate a total amount of potential savings under the present assumptions, one must know the consumption of bananas in the respective areas. It was previously stated that the average consumption of bananas is approximately 20 pounds per capita. A case study made by the United States Department of Agriculture indicates that actually, in the East North Central States, which nominally would include the principal States in the tributary area, the average consumption of bananas was 27 pounds per capita over a period. The sample used in this study covered the period December 1934 to February 1937.³ However, for the sake of conservatism, a 20-pound per capita consumption was assumed in our calculations. By applying this per capita consumption to the 1930 population figures for the trading areas selected in our study, the total consumption of bananas in the tributary area is obtained, which amounts to 502,000,000 pounds, or 251,000 short tons. This would not be the total potential traffic, because of the seasonality of navigation on the Great Lakes. An examination of the monthly imports of bananas into the United States during 1936, 1937, and 1938, indicates that nearly 65 percent of total banana imports came into the country during the months of May to November, inclusive. By taking 65 percent of the total annual consumption on a 20-pound per capita basis, the in-season consumption amounts to 326,300,000 pounds, which equals more than 163,000 short tons.

As the calculations of savings via the St. Lawrence under the assumptions applied in this study result in different figures for each trading area, the population and the total consumption of bananas in each trading area were separately calculated, and the savings under the three assumptions on the 65 percent of the total annual consumption were applied. The results are given in table G-4. Under

³ U. S. Department of Agriculture, *Diets of Families of Employed Wage Earners and Clerical Workers in the Cities, 1939*, Bulletin 507, p. 30.

the first assumption of savings—namely, present rail rates minus 20-cent surcharge of the fruit companies to go into the Great Lakes, and in cases where the trading area is further removed from the lake shore, making also an allowance for trucking charges—the total potential savings appear to be \$1,849,000. Under the second assumptions, where the shipping companies make a surcharge of 30 cents per hundred pounds to go into the Lakes, allowing also for trucking charges, the potential savings might be \$1,523,000. Under the third set of assumptions, where the shipping company might make a 40-cent surcharge, allowing again for trucking costs from lake ports, the potential savings might be as much as \$1,196,000.

These figures are obtained on the basis of 1930 population and a very conservative average consumption figure of 20 pounds per capita. The population of the trading areas in 1950 is expected to be, by the most conservative estimates, about $3\frac{1}{4}$ or 4 million more than the 1930 figures. Under the first assumption, where the shipping companies make an additional charge of 20 cents per hundred pounds to go into the Great Lakes, the average saving on all shipments to the tributary area amounts to about 56.6 cents per 100 pounds. Three and a half millions of additional people at an average of 20 pounds per capita would consume approximately 70 million pounds of bananas, which, added to 326,300,000 pounds, would give a total of 396,300,000 pounds or in-season potential movement of bananas, or 198,150 short tons. The saving on the additional 70 million pounds adds 56.6 cents per 100 pounds, or an additional \$397,000, or a total of \$2,246,000 potential savings. Under the second assumption, where the shippers may make a surcharge of 30 cents per pound, the average saving on the total in-season movement is 46.7 cents per 100 pounds. Applying this to the additional consumption of 70 million pounds, we obtain a further saving on the basis of the second assumption of \$327,000, which, added to \$1,523,000, gives \$1,850,000. On the basis of the third assumption, where the fruit company may charge as much as 40 cents per hundred pounds over the New York or New Orleans price, the average savings amount to about 36.7 cents per 100 pounds, which would give, on the additional consumption of 70 million pounds, a further potential saving of \$257,000, which, added to \$1,196,000, gives \$1,453,000 of potential savings. These calculations, of course, do not include consumption due to changes in consumer's habits, nor do they include any allowance for the increasing consumption that may result directly from lowering of price of bananas as a result of the Seaway.

TABLE G-1
Imports of bananas into the United States by countries of origin, 1919-39

[Short tons]

Year	Total	Honduras	Mexico	Panama	Guatemala	Jamaica	Cuba	Costa Rica	Nicaragua	Colombia	All other countries
1919.....	1,294,760	397,586	6,139	171,466	85,576	239,985	53,054	142,118	29,677	143,323	25,836
1920.....	1,376,186	402,095	25,494	159,563	127,203	248,624	59,396	189,078	46,857	93,771	24,105
1921.....	1,517,803	461,063	50,004	139,181	153,475	301,559	62,096	139,963	67,594	123,033	19,835
1922.....	1,578,288	510,464	25,872	128,288	157,458	373,280	63,311	129,666	91,122	77,194	21,633
1923.....	1,538,563	407,940	73,447	157,969	155,083	323,200	79,695	109,086	119,202	86,652	26,289
1924.....	1,658,442	459,401	106,650	180,703	193,405	350,481	59,838	101,177	96,169	87,323	23,295
1925.....	1,941,920	520,439	113,419	198,757	202,140	441,578	94,343	134,963	105,377	76,830	54,074
1926.....	1,968,790	453,857	160,707	158,840	214,015	486,698	100,847	188,154	87,656	82,748	35,268
1927.....	2,135,332	571,297	200,233	166,052	227,609	528,668	100,052	184,550	81,533	57,094	19,274
1928.....	2,250,770	786,994	193,417	170,179	218,787	417,746	107,709	162,131	118,920	56,678	18,209
1929.....	2,279,696	793,669	199,517	166,443	254,088	380,569	133,032	144,412	139,618	53,687	14,661
1930.....	2,195,581	771,766	227,686	166,642	177,751	417,516	141,096	112,979	128,528	43,167	8,450
1931.....	1,954,879	742,989	180,754	172,023	143,174	361,041	107,177	116,963	91,728	31,143	7,887
1932.....	1,731,001	640,789	159,215	159,103	115,024	167,200	127,769	141,397	118,896	93,301	8,307
1933.....	1,386,471	450,598	230,682	170,932	109,090	9,628	83,857	122,145	120,132	76,110	13,297
1934.....	1,668,774	510,110	300,508	200,105	126,108	25,675	182,877	93,463	82,965	87,779	59,184
1935.....	1,925,672	393,576	432,132	241,189	191,935	44,699	201,877	101,605	103,398	139,998	75,263
1936.....	2,040,585	385,537	544,412	241,164	234,953	1,330	215,289	118,089	73,100	126,973	99,738
1937.....	2,330,540	335,359	586,794	252,835	310,585	2,982	298,675	173,177	87,540	161,404	121,189
1938.....	2,073,503	346,109	542,411	222,343	321,126	353	147,930	142,583	72,877	131,298	146,473
1939.....	1,999,482	413,702	486,973	203,364	335,587	32	167,649	101,524	60,614	72,724	157,313
Average, 1928-37.....	1,976,397	581,139	305,512	194,061	188,150	182,839	169,936	128,636	106,482	87,024	42,618

NOTE.—Conversion factor: 1 short ton equals 28.5714 bunches.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States*.

TABLE G-2

United States imports of bananas, by customs districts, 1919-38

[Thousands of short tons]

Year	Massachusetts	New York	Philadelphia	Maryland	New Orleans	All other	Total
1919.....	60	321	102	61	644	107	1,295
1920.....	72	313	110	84	703	94	1,376
1921.....	63	401	121	89	696	121	1,518
1922.....	99	410	142	105	734	88	1,578
1923.....	81	490	122	81	666	109	1,539
1924.....	97	526	168	91	670	107	1,659
1925.....	129	604	171	122	768	148	1,942
1926.....	127	574	193	98	781	196	1,969
1927.....	125	673	172	109	778	278	2,135
1928.....	126	664	174	120	788	379	2,261
1929.....	122	663	189	120	809	377	2,280
1930.....	122	670	190	120	653	441	2,196
1931.....	130	610	169	118	571	357	1,955
1932.....	221	451	159	96	443	361	1,731
1933.....	115	403	126	60	399	284	1,387
1934.....	94	448	161	100	445	421	1,669
1935.....	114	513	187	125	553	434	1,926
1936.....	120	477	206	133	595	510	2,041
1937.....	140	483	179	173	704	651	2,330
1938.....	117	432	168	138	493	726	2,074
Average 1928-37.....	130	538	174	117	596	422	1,977

NOTE.—Conversion factor: 1 short ton equals 28.57 bunches.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1919-38*.

TABLE G-3

All-rail rates on bananas in carload lots

[Cents per 100 pounds]

To—	From—			To—	From—		
	Balti- more	New York	New Orleans		Balti- more	New York	New Orleans
Plattsburg, N. Y.....	68	65	-----	Detroit, Mich.....	78	81	91
Ogdensburg, N. Y.....	65	62	-----	Hamtramck, Mich.....	78	81	91
Syracuse, N. Y.....	52	52	-----	Pontiac, Mich.....	82	85	91
Rochester, N. Y.....	52	52	112	Ann Arbor, Mich.....	88	91	91
Buffalo, N. Y.....	60	60	105	Jackson, Mich.....	88	91	91
Oswego, N. Y.....	52	52	156	Kalamazoo, Mich.....	89	92	91
Erie, Pa.....	59	62	195	Flint, Mich.....	88	91	99
New Castle, Pa.....	67	70	105	Saginaw, Mich.....	88	91	99
Pittsburgh, Pa.....	59	62	105	Bay City, Mich.....	88	91	99
Cleveland, Ohio.....	71	74	96	Grand Rapids, Mich.....	89	92	91
Akron, Ohio.....	71	74	96	Muskegon, Mich.....	89	92	91
Canton, Ohio.....	71	74	96	Marquette, Mich.....	146	149	114
Mansfield, Ohio.....	76	79	96	Hancock, Mich.....	158	161	117
Youngstown, Ohio.....	67	70	105	Houghton, Mich.....	158	161	117
Toledo, Ohio.....	78	81	91	Ironwood, Mich.....	118	121	114
Lima, Ohio.....	80	83	91	Milwaukee, Wis.....	89	92	95
South Bend, Ind.....	89	92	91	Green Bay, Wis.....	89	92	103
Chicago, Ill.....	89	92	87	Duluth, Minn.....	118	121	122
Rockford, Ill.....	104	107	91	Superior, Wis.....	118	121	122
Joliet, Ill.....	89	92	87	Minneapolis, Minn.....	118	121	117
				St. Paul, Minn.....	118	121	117

SOURCE: P. R. R., I. C. C. 2179; Curlett, I. C. C. A-647; D. L. & W., I. C. C. 23906; N. Y. C., I. C. C. 16981.

TABLE G-4

Estimated consumption and potential savings on the transportation of bananas into Great Lakes area during open season

Trading area	Population, 1930	Estimated consumption (20 pounds per capita)	In-season consumption (65 percent of total)	Indicated potential savings ¹					
				A		B		C	
				Cents per 100 pounds	Total	Cents per 100 pounds	Total	Cents per 100 pounds	Total
Plattsburg-Ogdensburg, N. Y.	217,300	4,346,000	2,824,800	44	\$12,430	34	\$9,605	24	\$6,780
Syracuse, N. Y.	541,285	10,825,700	7,036,705	32	22,517	22	15,481	12	8,444
Rochester, N. Y.	607,543	12,150,860	7,898,059	32	25,274	22	17,376	12	9,478
Buffalo, N. Y.	1,364,753	27,295,060	17,741,789	40	70,907	30	58,225	20	35,484
Erie, Pa.	235,257	4,705,140	3,067,341	39	12,080	29	8,982	19	5,885
New Castle, Pa.	378,921	7,598,420	4,933,973	37	18,274	27	13,335	17	8,396
Pittsburgh, Pa.	2,376,504	47,530,080	30,894,552	24	74,147	14	48,252	4	12,358
Cleveland, Akron, Canton, and Mansfield:									
Cleveland and adjacent territory ²	1,478,243	29,564,860	19,217,159	51	98,008	41	78,700	31	59,573
Summit County (Akron)	344,131	6,882,620	4,473,703	41	18,242	31	18,868	21	9,395
Stark County (Canton)	221,784	4,435,680	2,883,192	41	11,821	31	8,939	21	6,055
Richland County (Mansfield)	65,002	1,300,040	845,028	46	3,887	36	3,042	26	2,197
Mahoning County (Youngstown)	236,142	4,722,840	3,069,846	32	9,824	22	6,754	12	3,684
Areas tributary to above ³	711,015	14,220,360	9,243,234	36	35,276	26	24,032	16	14,789
Toledo-Lima, Ohio	943,451	18,869,020	12,264,863	59	72,308	49	60,098	39	47,833
South Bend, Ind.	370,977	7,419,540	4,822,701	59	28,454	49	23,031	39	18,809
Chicago and environs ⁴	4,838,516	96,770,320	62,900,708	69	434,015	59	371,114	49	308,213
Areas tributary to Chicago, ⁵ Rockford, and Joliet	749,418	14,988,360	9,742,434	36	54,558	46	44,815	36	35,073
Detroit, Hamtramck, Pontiac, Ann Arbor, Jackson, Mich.	2,621,920	52,438,400	34,084,960	53	180,650	43	146,565	33	112,480
Kalamazoo, Mich.	325,518	6,510,360	4,231,734	69	29,199	59	24,907	49	20,736
Flint, Mich.	279,506	5,590,120	3,633,878	68	21,075	48	17,441	38	13,808
Saginaw-Bay City, Mich.	450,754	9,015,080	5,859,802	68	39,847	58	33,387	48	28,127
Grand Rapids-Muskegon, Mich.	641,663	12,833,260	8,341,610	68	59,723	58	48,381	48	40,040
Marquette, Mich.	185,238	3,704,760	2,408,004	94	29,638	84	20,238	74	17,820
Hancock-Houghton-Ironwood, Mich.	127,013	2,540,260	1,651,160	36	14,200	26	12,540	16	10,898
Milwaukee, Wis.	1,734,022	34,680,440	22,542,286	60	158,542	50	132,960	40	110,457
Green Bay, Wis.	370,184	7,403,680	4,812,392	60	23,248	50	28,393	40	23,531
Duluth, Minn.-Superior, Wis.	705,068	14,101,360	9,165,884	93	85,243	83	76,077	73	66,911
Minneapolis-St. Paul, Minn.	1,974,467	39,489,340	25,668,071	82	210,478	72	184,810	62	159,142
Total	25,100,498	502,009,060	326,294,774		1,849,036		1,522,785		1,196,446

¹Basis A calculated on assumption that shippers would be satisfied with 20-cent surcharge for going into Great Lakes; B, 30 cents; C, 40 cents, plus trucking allowances.

²Includes these counties: Cuyahoga, Lorain, Lake, Ashtabula, Erie, and Geauga.

³Includes: Ashland, Carroll, Columbiana, Coshocton, Crawford, Holmes, Huron, Knox, Marion, Medina, Marrow, Portage, Seneca, Trumbull, Tuscarawas, Wayne, Wyandot.

⁴Includes: Cook, Lake, Du Page, Will, Kane, Kendall, Grundy, Kankakee, Ill.; Lake-Porter and La Porte, Ind.

⁵Includes: Boone, Bureau, Carroll, De Kalb, Ford, Henry, Ingham, La Salle, Lee, Livingston, McHenry, McLean, Ogle, Putnam, Stephenson, Whiteside, Winnebago, Ill.; Jasper, Newton, Pulaski, and Starke, Ind.

Appendix H

ALCOHOLIC WINES AND DISTILLED LIQUORS

Section 1

IMPORTS AND CONSUMPTION IN THE TRIBUTARY AREA

Since the repeal of prohibition, the United States has imported during the years 1934-38 an average of about 3,500,000 gallons of wines. Of these, slightly over 3,000,000 gallons were classified as still wines and less than 447,000 gallons as champagne and all other sparkling wines. Over these years, the total imports of still and sparkling wines remained fairly stable. During the same period, the United States imported an average of 11,500,000 proof gallons of distilled liquors.¹ About 86 percent of this amount, or 9,900,000 proof gallons, was whiskey. Brandy, the next largest item, was imported to the extent of about 610,000 proof gallons; cordials, liqueurs, and other spirits accounted for about 432,000 proof gallons. Table H-1 presents United States imports of alcoholic wines and distilled liquors by types for the years 1934 to 1938.

The greater proportion of our imports of wines come from the Mediterranean countries—France, Italy, and Spain (table H-2). France was the most important source of shipments into this country, averaging almost 1,300,000 gallons for the years 1934-38. Italy for the same years exported to the United States an average of 1,000,000 gallons; Spain, 500,000 gallons; while from Germany, another important source, average imports amounted to 175,000 gallons. Among the countries grouped as "All other" is Japan, from which the United States imported sake, the total for which, however, is insignificant.

In table H-3 are shown United States imports of distilled liquors by principal countries. Canada and the United Kingdom rival each other as principal sources of liquors imported into the United States, Canada having shipped us an average of 4,930,000 proof gallons from 1934-38, and the United Kingdom having sent us an average of 4,880,000 proof gallons for the same period. Average United States imports from Cuba amounted to 334,000 proof gallons, of which rum was the major item, and from France the United States imported about 732,000 proof gallons, of which brandy constituted the major part.

Among the commodities studied in this Survey, wines and liquors are unique in that the imports by customs districts are an approximation of the actual consumption of imported wines and liquors by regions. This is due to the practice followed by the trade of keeping its products in bond as long as possible in order to postpone the payment of the heavy duty. Thus, wines and liquors which may be imported via New York, placed there for a while in warehouses and then shipped to St. Louis, would be credited to the St. Louis customs district when they were withdrawn from the bonded warehouse. Conversely, the figures of imports by

¹ Proof gallon is a standard of measurement consisting of 1 wine gallon of 231 cubic inches, of which one-half the volume is alcohol.

customs districts give little indication of the spots at which wines and liquors enter the country. Indeed, much of the liquors credited to customs districts not on the coasts moved into the interior from New York by rail in bond.

With this in mind, it is possible to estimate the potential tonnage in wines and liquors for the St. Lawrence Seaway by studying imports of wines and liquors, excluding rum, by customs districts, and obtaining the percent of total United States imports received at each customs district and applying that percent to the 1934-38 annual average, excluding rum and excluding imports from Canada. Rum has been omitted from this study because it comes mainly from Cuba and the other Caribbean states, and would be subject to an independent rate study. Canada has been omitted because presumably most of the shipments from Canada came across the Great Lakes and would be unaffected by the proposed Seaway development. By eliminating from consideration rum and Canadian liquor, then, we should have an estimated consumption for the tributary area of imported wines and liquors that come almost entirely from Europe.

Table H-4 presents 1934-38 annual averages of the imports of wines and liquors for the customs districts tributary to the Great Lakes. The Chicago and Indiana customs districts are the largest consuming areas. Chicago in this period received an average of 1,367,000 proof gallons of distilled liquors and 170,000 gallons of wine. Indiana received for this period 1,237,000 proof gallons of distilled liquors and 17,000 gallons of wine. The total imports, excluding rum, for the selected 12 customs districts are 3,953,000 proof gallons of distilled liquors and 323,000 gallons of wines. In order to gain a common unit, these figures may be converted to pounds, using the conversion factor, 7.7821 pounds to a gallon of 100-proof of distilled liquors and 8.5 pounds per gallon of wine. The net weight of wines and liquors for the tributary area is 33,514,000 pounds or 28.9 percent of the country's total imports of wines and liquors, excluding rum. Chicago received approximately 36 percent of the total for the area—12,000,000 pounds and Indiana, 9,700,000 pounds, or 29 percent of the total.

Table H-5 gives the United States imports of wines and liquors, excluding rum, from all countries other than Canada. The 1934-38 average was, for distilled liquors, 6,099,000 proof gallons, and for wines, 3,483,000 gallons. Converting the average for 1934-38 to net weight, as above, we have for distilled liquors, 47,464,000 pounds, and for wines, 29,604,000 pounds, or a total for both wines and distilled liquors of 77,068,000 pounds. Applying the percentage, which imports of the 12 customs districts are of the United States total, obtained in table H-4 to this total weight, we have an estimated consumption in the tributary area of wines and liquors, excluding rum, imported from countries other than Canada, of 22,272,587 pounds, as shown in table H-6. Applying the 75 by seasonal percentage, we obtain potential tonnage for the tributary area of 16,700,000 pounds, of which 6,000,000 pounds went to Chicago and 4,900,000 pounds to Indiana.

A study of imports by months shows that in the years 1936-38 in terms of the total annual imports, 56.65 percent of distilled liquors were received during the months May to November, and 53.77 percent of the wines during these months.³ However, it must be borne in mind that the customs district figures are based mainly upon withdrawals from bonded warehouses. They give an indication of the consumption of imported wines and liquors during those months but not of the time of physical transportation. Consumption of both wines and liquors is at its height at the months immediately preceding and during the holiday season, but the wines and liquors must be imported previous to that time in order to be on

³ Based on compilations from the Department of Commerce, Bureau of Foreign and Domestic Commerce, *Monthly Summary of Foreign Commerce of the United States, 1936-38.*

hand when the increased demand begins. Therefore, on an estimate of the trade, 75 percent may be taken as the proportion of liquor and wines actually brought into the country during the months of the open season of navigation—May to November. Application of this percentage to the imports as shown in table H-6 gives the estimated in-season movement of 16,700,000 pounds.

Distilled liquors are imported into this country mainly in bottles. The most typical way of packing them is in wooden boxes of 12 bottles, one-fifth of a gallon each, which have a gross weight of 44 pounds and a net weight of 19 pounds.² Imported wines, of course, are almost wholly high-priced and shipped in blottles. The average case used by the United States Tariff Commission in its calculations contains 2.4 gallons, and a gross weight of 50 pounds, if made of wood, or 40 pounds, if made of fibre. The net weight of 2.4 gallons at 8.5 pounds to the gallon is 20.40 pounds. Thus, in order to obtain the transportation weight, which includes bottle, wrapper, and case, as well as effective contents, as shown in table H-6, it is necessary to double the net weight. This gives a gross weight of wines and liquors brought into the tributary area during the open season of navigation of 33,408,000 pounds. Chicago received 12,138,000 pounds and Indiana 9,710,000 pounds.

To reach an estimate of the transportation savings that might be due to the construction of the proposed Seaway, we have in table H-7 withdrawn from the potential tonnage the receipts by water at lake ports of beverages imported from overseas direct by water through the present St. Lawrence canals. This step reduces the estimated savings somewhat, in that the amounts subtracted from potential tonnage include all beverages, and that they were subtracted from the in-season consumption figure for points on or near the lakes and no allowance was made for amounts that might have been reshipped to the hinterland.

During 1936-38, Milwaukee received from overseas by water an average of 704,000 pounds of beverages, gross weight. Since this amount was greater than the estimated consumption, 578,000 pounds, of Wisconsin, the balance was applied to Minnesota.

In this fashion we have in table H-7 estimated arrivals by rail of liquors and wines imported from abroad. The total for the tributary area is 30,136,000 pounds and for Chicago 10,148,000 pounds. Michigan is estimated to have received by rail 3,722,800 pounds and Minnesota 900,000 pounds. Wisconsin, however, is estimated to have received all its imported liquors by water.

Section 2

POTENTIAL TRAFFIC AND SAVINGS IN TRANSPORTATION COSTS VIA THE ST. LAWRENCE SEAWAY

The actual ocean rate for still wines from Bordeaux and Le Havre to Atlantic ports before the war was 90 cents per 100 pounds. The Fjell Line, just prior to September 1939 carried still wines by direct water route to Chicago for at least as low as 95 cents per 100 pounds. The ocean rate in effect during the summer of 1939 on distilled liquors in bottles from the United Kingdom to North Atlantic ports was \$1.17 per 100 pounds. The Fjell Line has been carrying distilled liquors to Chicago at \$1.18. Considering the practice of the shipping trade and the increased efficiency and speed that will be brought about by the use of larger ships and faster passage, we can expect the rates to the Great Lakes ports to be at least as low as those applied by the Fjell Line.

² Tariff Commission, *Commodity Packaging Data*.

Thus the unit savings on wines and liquors may be estimated as the difference between the rail rate to the point of destination from New York and from the nearest lake port. This simplifies the problem somewhat, inasmuch as the import rail rates, unlike the ocean rates, are the same for both wines and liquors. New York has been taken as the typical port through which wines and liquors pass because reports from the industry indicate that most of imported wines and liquors now moving into the tributary area travel all-rail from New York.

Table H-8 shows the indicated differential per unit in the cost of transportation via the St. Lawrence Waterway as compared with the present method via New York. The indicated savings per 100 pounds are greatest for shipments to Milwaukee, in which case the rail rate is, from New York, 73 cents. Chicago has an indicated savings of 71 cents per 100 pounds. Pittsburgh, Pa., with a rail rate of 46 cents from New York and 31 cents from Cleveland, has an indicated savings of 15 cents per 100 pounds.

Applying these indicated differentials to the respective tonnages, we have in table H-9 estimated savings on wines and distilled liquors imported into the Great Lakes area totaling \$145,000, of which shipments into Chicago account for \$72,000 and those into Indiana, \$27,000. This is the possible saving on a total of 15,000 tons of distilled wines and liquor estimated to have moved annually by rail to the tributary area during the years 1934-38 (exclusive of rum and Canadian shipments).

TABLE H-1

United States imports of alcoholic wines, and distilled liquors by types, 1934-38

Year	Wines (gallons)			Liquors (proof gallons)					
	Champagne and other sparkling wines	Still wines	Total, wines	Brandy	Gin	Rum	Whisky	Cordials, liqueurs, other spirits, and compounds	Total, distilled liquors
1934.....	395,412	3,462,704	3,858,116	556,086	153,198	315,824	5,624,483	583,915	7,233,506
1935.....	277,287	2,493,529	2,770,816	444,338	60,468	482,497	5,847,208	227,283	7,061,794
1936.....	502,299	3,133,677	3,635,976	645,845	69,890	554,836	13,376,539	505,736	15,151,646
1937.....	576,858	3,240,336	3,817,194	738,423	70,364	510,094	14,364,102	504,665	16,187,648
1938.....	482,678	2,946,679	3,429,357	665,568	62,301	395,040	10,320,866	339,357	11,783,162
Average, 1934-38.....	446,907	3,055,385	3,502,292	610,052	83,244	451,658	9,906,403	432,191	11,483,549

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1934-38.*

TABLE H-2

United States imports¹ of wines, by principal countries, 1934-38

[Gallons]

Year	France	Germany	Italy	Spain	All other countries	Total
1934.....	1,264,088	272,300	993,390	479,681	848,657	3,858,116
1935.....	924,894	146,002	780,993	398,110	520,817	2,770,816
1936.....	1,344,071	163,971	1,015,993	540,657	571,284	3,635,976
1937.....	1,494,135	171,708	1,204,340	564,047	382,964	3,817,194
1938.....	1,376,026	120,579	1,116,422	502,289	314,041	3,429,357
Average, 1934-38.....	1,280,642	174,912	1,022,228	496,957	527,568	3,502,292

¹ Imports for consumption.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1934-38.*

TABLE H-3

United States imports¹ of distilled liquors, by principal countries, 1934-38
[Proof gallons]

Year	France	United Kingdom	Canada	Cuba	All other countries	Total
1934.....	720, 587	2, 297, 052	3, 143, 850	352, 871	719, 146	7, 233, 506
1935.....	528, 987	2, 531, 345	3, 185, 937	412, 902	403, 737	7, 062, 908
1936.....	754, 256	5, 985, 458	7, 375, 635	386, 594	649, 703	15, 151, 646
1937.....	866, 431	6, 847, 708	7, 402, 805	319, 598	751, 108	16, 187, 648
1938.....	788, 671	6, 719, 401	3, 655, 862	196, 575	522, 643	11, 783, 152
Average, 1934-38.....	731, 786	4, 876, 193	4, 932, 818	333, 708	609, 267	11, 483, 772

¹ Imports for consumption.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1934-1938.*

TABLE H-4

United States imports of wines and distilled liquors (excluding rum),
by customs districts, annual average—1934-38

Customs district	Volume		Weight		Total distilled liquors and wines	
	Distilled liquors	Wines	Distilled liquors	Wines	Pounds	Percent
	<i>Proof gallons</i>	<i>Gallons</i>	<i>Pounds¹ net weight</i>	<i>Pounds¹ net weight</i>	<i>Pounds¹ net weight</i>	
St. Lawrence.....	1, 751	76	13, 526	646	14, 272	(²)
Rochester.....	120, 818	15, 698	940, 218	133, 433	1, 073, 651	0.9
Buffalo.....	57, 449	9, 910	447, 074	84, 235	531, 309	.5
Pittsburgh.....	233, 504	4, 113	1, 817, 151	34, 961	1, 852, 112	1.6
Minnesota.....	138, 284	15, 378	1, 076, 140	130, 713	1, 206, 853	1.0
Wisconsin.....	53, 780	16, 379	418, 521	139, 222	557, 743	.5
Michigan.....	465, 222	28, 668	3, 628, 186	243, 651	3, 871, 847	3.3
Chicago.....	1, 307, 350	169, 565	10, 640, 854	1, 441, 303	12, 082, 157	10.4
Indiana.....	1, 236, 902	16, 562	9, 625, 695	140, 777	9, 766, 472	8.5
Ohio.....	170, 486	26, 686	1, 326, 739	226, 831	1, 553, 570	1.3
Iowa.....	2, 211	57	17, 206	17, 691	17, 691	(²)
St. Louis.....	104, 417	20, 300	812, 584	173, 815	985, 999	.9
Total 12 customs districts.....	3, 953, 174	323, 480	30, 763, 994	2, 749, 582	33, 513, 576	28.9
United States total.....	11, 031, 891	3, 502, 292	85, 851, 279	29, 769, 482	115, 620, 761	100.0

¹ One gallon of 100-proof spirits is equal to 7.7821 pounds. The weight of a gallon of wine varies from 8.22 pounds to 8.81 pounds; an average of 8.5 was used as a conversion factor.

² Less than one-half of 1 percent.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States.*

TABLE H-5

United States imports of wines and liquors (excluding rum), from all
countries other than Canada

Year	Distilled liquors	Wines
	<i>Proof gallons</i>	<i>Gallons</i>
1934.....	3, 773, 927	3, 781, 879
1935.....	3, 393, 446	2, 757, 086
1936.....	7, 221, 253	3, 628, 573
1937.....	8, 274, 754	3, 817, 085
1938.....	7, 832, 250	3, 429, 357
Average, 1934-38.....	¹ 6, 099, 126	² 3, 482, 796

¹ 47,464,008 pounds (basis: 7.7821 pounds per gallon).

² 29,603,766 pounds (basis: 8.500 pounds per gallon).

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States.*

TABLE H-6

Estimated consumption in the tributary area of wines and liquors (excluding rum), imported from countries other than Canada

Customs district	Percent ¹	Annual consumption net weight (in tributary area)	Estimated movement, May-November (75% of annual consumption)	Customs district	Percent	Annual consumption net weight (in tributary area)	Estimated movement, May-November (75% of annual consumption)
		Pounds	Pounds			Pounds	Pounds
St. Lawrence.....	(²)			Indiana.....	8.4	6,473,693	4,855,269
Rochester.....	0.9	693,610	520,208	Ohio.....	1.3	1,001,881	751,411
Buffalo.....	5	385,339	289,004	Iowa.....	(³)		
Pittsburgh.....	1.6	1,233,084	924,813	St. Louis.....	.9	693,610	520,207
Minnesota.....	1.0	770,678	578,009	Total, customs districts of the tributary area.....	28.9	22,272,587	16,704,440
Wisconsin.....	5	385,339	289,004	Total, United States.....	100.0	77,067,774	57,800,831
Michigan.....	3.3	2,543,237	1,907,428				
Chicago.....	10.5	8,062,116	6,069,087				

¹ See table H-4, last column.

² Less than one-half of 1 percent.

TABLE H-7

Estimated receipts in the tributary area by rail of imported wine and distilled liquors (excluding rum), from countries other than Canada

[Pounds]

Customs district	Total estimated in-season movement of wines and liquors ¹		Receipts by water of beverages imported from overseas	Estimated in-season arrivals of wines and liquors by rail ⁴
	Net weight	Gross weight ²	Gross weight ³	Gross weight
St. Lawrence.....				
Rochester.....	520,200	1,040,400		1,040,400
Buffalo.....	289,000	578,000		578,000
Pittsburgh.....	924,800	1,849,600		1,849,600
Minnesota.....	578,000	1,156,000	⁵ 258,000	900,000
Wisconsin.....	289,000	578,000	⁵ 578,000	
Michigan.....	1,907,400	3,814,800	92,000	3,722,800
Chicago.....	6,069,000	12,138,000	1,990,000	10,148,000
Indiana.....	4,855,200	9,710,400		9,710,400
Ohio.....	751,400	1,502,800	356,000	1,146,800
Iowa.....				
St. Louis.....	520,000	1,040,000		1,040,000
Total.....	16,704,000	33,408,000	3,272,000	20,136,000

¹ 75 percent of estimated annual consumption, based on 5-year average, 1934-38.

² Twice net weight, to allow for weight of glass bottles and packing.

³ All beverages; based on 3-year averages, 1936-38.

⁴ Difference, column 2 minus column 3.

⁵ Receipts by water of beverages imported from overseas at Duluth, plus balance of receipts at Milwaukee. See footnote 6.

⁶ Milwaukee received 704,000 pounds. The balance over the 578,000 pounds estimated as consumed by Wisconsin is credited to Minnesota.

TABLE H-8

Indicated differential of transportation cost on alcoholic liquors, in bottles

Point of destination	Rail rates			Indicated differential Cents per 100 pounds
	From New York	From nearest lake port		
	Cents per 100 pounds	Port	Cents per 100 pounds	
Rochester, N. Y.....	52			52
Buffalo, N. Y.....	55			55
Pittsburgh, Pa.....	46	Cleveland.....	31	15
St. Paul, Minn.....	96	Chicago.....	39	57
Milwaukee, Wis.....	73			73
Detroit, Mich.....	59			59
Chicago, Ill.....	71			71
Indianapolis, Ind.....	65	Toledo.....	37	28
Cleveland, Ohio.....	52			52
Cincinnati, Ohio.....	59	Toledo.....	35	24
Des Moines, Iowa.....	90	Chicago.....	45	45
St. Louis, Mo.....	77	do.....	51	26

TABLE H-9

Estimated savings in alcoholic beverages

Customs district	Representative point	Potential tonnage	Indicated differential	Estimated savings
		100 pounds	Cents per 100 pounds	
Rochester.....	Rochester.....	10,404	52	\$5,410
Buffalo.....	Buffalo.....	5,780	55	3,179
Pittsburgh.....	Pittsburgh.....	18,496	15	2,774
Minnesota.....	St. Paul.....	9,000	57	5,130
Wisconsin.....	Milwaukee.....		73	
Michigan.....	Detroit.....	37,228	59	21,965
Chicago.....	Chicago.....	101,480	71	72,051
Indiana.....	Indianapolis.....	97,104	28	27,189
Ohio.....	Cleveland.....	5,734	52	2,982
Do.....	Cincinnati.....	5,734	24	1,376
St. Louis.....	St. Louis.....	10,400	26	2,704
Total, tributary area.....		301,360		144,760

Appendix I

CRUDE RUBBER

Section 1

UNITED STATES EXPORTS AND IMPORTS OF CRUDE RUBBER

The United States is dependent upon foreign countries for the entire supply of crude rubber, a recognized strategic raw material. At the present time, most of the crude rubber supply of the world comes from plantations in the middle eastern possessions of Great Britain, Netherlands, and France, and from plantations in Thailand (Siam).

World crude rubber production, in recent years, has averaged 1,000,000 long tons annually. Exports of crude rubber by producing areas are shown in table I-1.

The only export movement of crude rubber from the United States has been a reexport of 5,000 to 36,000 long tons per year. This traffic is of no importance in a study of the Great Lakes-St. Lawrence Waterway.

Table I-2 sets forth gross imports, reexports, and net retention of crude rubber for the years 1919-38. United States gross imports of crude rubber have increased steadily from 45,000 long tons in 1910 to 253,681 in 1920, and 565,087 in 1929. In 1937, imports reached 600,476 long tons. The average annual gross imports for the 10-year period 1928-37 were 484,659 long tons. By deducting reexports, the net retention of crude rubber imports in the United States may be computed. The average annual net retention for the same 10-year period is 462,484 long tons.

According to United States Maritime Commission statistics of United States, water borne imports of crude rubber for the years 1922-38 indicate that 80 percent of the imports come directly from the East Indies and additional regions, and 11 percent more from eastern, southern, and western Asia. Thus, 91 percent of crude rubber imports originate in Asia for direct shipment to the United States. The small remaining balance is derived from indirect receipts of crude rubber through Europe, and direct shipments from Africa, Central America, and South America.

Section 2

CONSUMPTION OF CRUDE RUBBER IN THE GREAT LAKES TRIBUTARY AREA

Statistics of the Rubber Manufacturers' Association indicate that over 70 percent of crude rubber consumed in the United States enters into the manufacture of automobile tires and tire sundries. Mechanical rubber goods account for somewhat less than 10 percent of crude rubber consumed, and a wide range of rubber manufacturing industries consume the balance.

Data on crude-rubber consumption in the United States do not agree with net retention statistics set forth in table I-2.

The discrepancies are due to the varying amounts of rubber inventories within the United States as a result of trade conditions. For the purpose of this study, however, net retention data are more accurate since they measure the tonnage of crude rubber actually shipped to this country, regardless of variations in production schedules of rubber-goods manufacturers. The proportions of crude rubber consumed according to States, on the other hand, will provide an accurate measure of the distribution by States of net retention of crude-rubber imports.

Crude-rubber consumption by States is set forth in table I-3, for the years 1925, 1928, 1935, and 1937, and the percentage consumed in States tributary to the Great Lakes is shown.¹

It will be noted that one-half of the estimated consumption of Pennsylvania and New York has been assigned to the tributary area. This allocation is justified on the basis of comparative transportation costs to important rubber manufacturing points in the western section of these States, e. g., Jeannette, Pa., and Buffalo, N. Y.

Table I-3 indicates that States and sections of States contiguous to the Great Lakes account for about 65.4 percent of crude-rubber consumption. Taking, therefore, 65.4 percent of the average annual net retention during 1928-37, of approximately 462,484 long tons of crude rubber imported into the United States, we find 302,464 long tons to have been consumed in the tributary area.

The process of decentralization in the rubber manufacturing industry has already reduced the consumption of crude rubber in such production centers as Akron, Ohio. Much of this industrial migration has been in the direction of Michigan, Indiana, Tennessee, and the States of the Atlantic and Pacific Coasts. One factor in this shift is the cost of shipping finished products to local consuming markets. However, rubber manufacturing plants in the tributary area continue to supply practically all of the original equipment tires and tubes mounted on automobiles, the production of which is concentrated in the same territory. For this reason, production of rubber tires for original equipment probably will undergo no more extensive decentralization than the automobile manufacturing (assembly) industry.

Section 3

MARKETING AND TRANSPORTATION OF CRUDE RUBBER

The central trading point for rubber in the Middle East is Singapore, with various cities in Malaya, Netherland Indies, Ceylon, and elsewhere, as subsidiary centers. British control of rubber production has made London the point at which most large plantations maintain selling organizations for negotiating contracts on rubber. New York is the center of the distributing trade in the United States. Whether physical rubber actually passes through these points or not, they will doubtless remain the headquarters for contractual arrangements in rubber trading.

Crude rubber dealers in New York probably account for one-half of total imports. Acting as merchant importers, they supply manufacturers and assemble, package, and ship given quantities of special grades of rubber in accordance with contractual requirements.

¹ The tributary area is defined as that territory to which crude rubber may be shipped via the St. Lawrence route at transportation costs the same as, or lower than, via existing routes. As set forth in table I-4, the tributary area embraces chief consuming points in the States of Ohio, Illinois, Indiana, Kentucky, Michigan, Minnesota, Wisconsin, western Pennsylvania, and New York.

Practically all of the remaining half of crude rubber imports is handled direct by four manufacturing companies that operate their own rubber plantations and branch purchasing offices abroad. Finally, some rubber is purchased in European markets—London, in particular.

The future volume of ocean tonnage may be increased by changes in the form in which rubber is marketed. Until 20 years ago, nearly all rubber contained impurities that added materially to weight. Nowadays the plantation output is chiefly marketed in dry sheets, blankets, and crepes, with negligible volume of impurities. About 15 years ago, a trade in liquid latex began, and now the dry weight of rubber imported in various forms of liquid latex, concentrated latex, etc., amounts to about 4 percent of the total *dry* net weight of our gross imports (possibly 6 percent of the *wet* gross weight of gross imports). Latex imports are likely to constitute a larger percentage of future total imports, but methods of preparing and shipping latex must be perfected to reduce the amount of moisture in ocean freight to smaller proportions than at present. Liquid latex is imported in bulk in tank steamers and a substantial part in drums.

Rubber for the tributary area has always entered the United States at Atlantic ports, except during the World War when large entries were made at northern United States and Canadian west coast ports and were shipped by rail across country. New York is the outstanding port of actual entry for the tributary area, having accounted for 90 percent of the total in 1938. Boston, Baltimore, Philadelphia, and New Orleans take care of practically all of the balance.

Some years ago, the New York Barge Canal was used to a considerable extent for rubber shipments to midwest manufacturers. Likewise, before rail rates were reduced, Akron tire manufacturers used motor trucks to haul tires to New York and rubber on the return trip. This activity ended with the lowering of rail freight rates, and the New York Barge Canal traffic ceased almost entirely, though it is still used occasionally.

At present, rubber moves largely by rail. Carriage from New York to Akron is divided between the Pennsylvania, Baltimore & Ohio, and Erie Railroads. The New York Central carries most of the rubber for Michigan. Other lines also participate in this traffic but these lines are the outstanding carriers of crude rubber, although the proportion of each is not known. If an ocean steamer service from the Middle East to ports on the Great Lakes were available with lower through rates than by other routes, the proverbial quickness of the rubber industry to take advantage of any opportunity for definite savings would operate.

In this connection, the comment of one large New York crude rubber importer is significant. This importer states that "almost without exception, our customers in the Great Lakes district favor other than standard trunk line routings. Generally, on crude rubber, there is an advantage of from 2 to 5 cents per 100 pounds on canal, lake, and differential rail routings. Difference in time of delivery is not usually an important factor to the larger rubber consumers." A cheaper route is afforded via the Central Vermont Railroad and Canadian National Railways on shipments to Detroit, Mich., and points west of Detroit. The New York Barge Canal and the Great Lakes also afford cheaper means of transportation. As stated, however, the bulk of crude rubber consumed in the tributary area now moves all-rail from North Atlantic United States ports and principally from New York. The cheaper differential routes at present available apparently do not offer sufficient economy in transportation cost to divert a sizeable volume of traffic from the all-rail route.

Section 4

POTENTIAL TRAFFIC AND SAVINGS VIA THE ST. LAWRENCE SEAWAY

The average annual consumption of crude rubber, in the tributary area on the basis of the years 1928-37, was found to be 302,464 long tons. The share of this consumption, which is likely to move over the waterway, would be influenced principally by (1) season of open navigation, and (2) retentive power of present routes, chiefly through New York.

At the present time, crude rubber is imported during each month of the year, with the fall and winter months showing somewhat of a bulge. Representatives of the crude rubber trade, who were contacted during this survey, state that while 50 to 60 percent of rubber receipts arrive during the open season of navigation on the Great Lakes, roughly from May 1 to December 1, a much larger share would be imported during this period if adequate savings could be realized by direct water shipment via the St. Lawrence.

The factor of the retentive power of present routes, regardless of transportation savings, is difficult to measure. It is understood that New York rubber dealers would continue the assembly, packaging, and shipping of special grades of crude rubber. The volume of rubber bought on this basis is known to be a small portion of the total. It is estimated that four companies alone handle about one-half of crude rubber imports direct.

Another factor to be considered is the practice of the railroads (and one coast-wise shipping line) to grant long-term storage of crude rubber at North Atlantic ports. Under the railroad and steamship tariffs, crude rubber may be stored for a period of 12 months prior to shipment to final point of consumption, at charges ranging between 1 cent and 2 cents per 100 pounds. This service, if continued and if not afforded at Great Lakes ports, may induce rubber dealers to store some portion of their traffic at North Atlantic seaports, awaiting opportunities to locate certain classes of customers.

An allowance of 10 percent of the annual tonnage for that share which may be retained by present routes would therefore appear to be reasonable. However, it is to be recognized that the bulk of crude rubber purchases moves direct to large consuming centers, as far as the tributary area is concerned. The balance of 90 percent of crude rubber consumption in the tributary area, or approximately 272,218 short tons, could be considered as traffic potential to the St. Lawrence Waterway.

Assuming that 55 percent of the shipments of crude rubber are received during the season of open navigation, the potential traffic available for the St. Lawrence on the basis of average imports during 1928-37, would be 149,719 long tons.

The next question to be considered is the probable unit savings in transportation costs of crude rubber when shipped via the St. Lawrence to lake ports, as compared with present ocean rates.

The rate on crude rubber in August 1939 was 67 cents per 100 pounds from Singapore, Thailand, and Ceylon, to Gulf and North Atlantic ports. The distance from Singapore to New York is 10,209 nautical miles. From Liberia, West Africa, to New York, the rate was 63 cents per 100 pounds. The distance from Freetown, nearest port to Liberia, to New York is 3,782 nautical miles. This illustrates again that there is no relationship between distance traveled and rates, so far as ocean shipping is concerned. The availability of return cargo and the geographical position of ports in relation to established trade routes which affect

the competitive situation between shipping lines, are the more important considerations in the establishments of rates.

From New York, the principal port of entry for crude rubber, to the centers of consumption in the Middle West, the rail rates are as follows:

From New York to—	Cents per 100 pounds
Buffalo, N. Y.-----	36
Jeannette, Pa.-----	38
Cleveland, Ohio-----	43
Akron, Ohio-----	43
Dayton, Ohio-----	48
Detroit, Mich-----	49
Muncie, Ind-----	52
Chicago, Ill-----	54

Any savings that may be effected in the transportation of crude rubber direct to lake ports will be a saving on the cost of continental transportation in the United States from New York to these points. The principal consideration, therefore, is to determine at what ocean rates crude rubber may be transported directly to lake ports.

One possible hypothesis is that crude rubber may be transported into Cleveland, for instance, at the same rate as it is now carried to New York. If crude rubber can be transported for 4 additional cents per 100 pounds from Singapore to New York, as compared with Liberia, when the difference in distance is over 6,400 miles, the assumption that crude rubber may be carried right into the Great Lakes for the same rate, where less than 1,500 miles additional travel would be involved, may be considered reasonable; particularly in view of the fact that rates covering all Atlantic and Gulf ports from Montreal to Houston, Tex., are often identical.

On this assumption of blanketing New York rates into the Great Lakes, at 67 cents, importers of crude rubber would save all of the rail costs; namely, 43 cents per 100 pounds to Cleveland, 36 cents per 100 pounds to Buffalo, 49 cents per 100 pounds to Detroit, and 54 cents per 100 pounds to Chicago. Where inland transportation is involved, for instance, from Cleveland to Akron, the savings will be the New York-to-Akron rate minus the cost of transporting from lake port to point of consumption. In the case of Akron, one would expect that there would be very substantial traffic both ways; consequently, rubber could be carried by trucks on contract rates. Since the distance is so short between the two points, one could expect a rate as low as 15 cents per 100 pounds between Cleveland and Akron, which, in fact, is the present rail rate. This rate may be even as low as 10 cents per 100 pounds on trucks. The savings to Akron, therefore, may be considered to be between 28 and 33 cents per 100 pounds when shipments are received via the St. Lawrence and Cleveland.

To Dayton, Ohio, and Jeannette, Pa., the savings, after allowing for rail transport from Toledo, Ohio, and Erie, Pa., respectively, would be 22 cents per 100 pounds to Dayton and 13 cents per 100 pounds to Jeannette.

Another possible assumption is that a rate higher than the effective rate to New York might be required in order to induce shippers to go into the Great Lakes; this upon the assumption that going to the lakes involves a detour, or perhaps even transshipment at some port such as Halifax or Montreal, in case the round-the-world services which operate between New York and Far Eastern points may not wish to take up 2 additional weeks to make calls in the lakes. Upon this assumption, therefore, the savings above-mentioned might be 10 cents lower to each place.

On the two bases of calculating savings on crude rubber shipments via the St. Lawrence to lake ports, allowing also for rail transportation from lake ports to interior points, the unit savings would be as indicated in table I-4.

No transportation reductions may be realized to a point as far south as St. Louis, Mo., due to low shipping costs on the Mississippi River route from New Orleans. For this reason, Missouri is excluded from the tributary area.

Table I-3 indicates that the State of Ohio accounted for 63.4 percent of the rubber consumed in the entire tributary area during 1937. Akron, Ohio, is recognized as the center of the rubber tire manufacturing industry. With no data available as to consumption of crude rubber among the several manufacturing centers in Ohio, Akron is taken as representative of transportation reductions that may be realized by shipping crude rubber for that State via the St. Lawrence Seaway.

Another territorial grouping in Table I-3 is indicated as "Michigan, Minnesota, and Wisconsin" and accounts now for about 25 percent of rubber consumed in the tributary area during 1937. Due principally to the expansion of rubber tire manufacturing in Detroit, this State grouping has shown marked increase in rubber consumption. Again, as in the case of Ohio, it is impossible to separate these statistics as among production centers, or even as among the three States comprising the group. Since Detroit, Mich., is outstanding as a consumption center, the transportation reduction applicable at Detroit is taken as representative of potential savings on rubber consumed in the three States. This procedure is further justified in that savings in transportation costs available on the relatively small volume of crude rubber consumed in the States of Minnesota and Wisconsin would closely approximate those applicable at Detroit.

The small remaining balance of somewhat less than 10 percent is distributed among a number of States.

According to census classification, Indiana and Kentucky, together, show an increase in consumption; and the bulk of this tonnage goes to such manufacturing centers as Mishawaka and Muncie, Ind. Pennsylvania, with consuming industries in Jeannette, Pa., and Conshohocken, Pa.; New York State at Buffalo and Long Island; and Illinois, comprise the balance of the tributary area.

The 1937 distribution of consumption is applied to the average imports of 1928-37, in order to apply the unit savings in transportation costs that are indicated in the previous discussion. This is done because 1937 figures give effect to the decentralization movement which has been taking place in the tire manufacturing industry. The potential savings appear, then, to be about \$1,094,445. This is based on past import figures, 1937 distribution of consumption by areas, August 1939 ocean rates in effect blanketed into the Great Lakes, and rail rates in effect in the winter of 1939. If a 10-cents-per-100-pounds surcharge becomes necessary, the savings would be \$335,370 less, or \$759,075.

Based upon known trends in the crude rubber trade, including growth in the use of synthetic rubber and of reclaimed rubber, United States consumption by 1950 may run to 650,000 tons per year.

Taking into consideration the decentralization movement in the rubber manufacturing industry by the year 1950, the tributary area will probably account for 59 percent of national consumption. An estimate of potential tonnage movements and savings for the year 1950, based upon savings of \$1,094,445 on a potential tonnage of 149,719 long tons, based on 1928-37 average import figures (or an average of \$7.31 per long ton) would be \$1,387,700 on future potential tonnage of 190,000 long tons.

Estimated savings in transportation costs for crude rubber moving via the St. Lawrence Waterway—1950

	<i>Long tons</i>
United States consumption-----	650,000
Consumed in tributary area—59 percent-----	383,500
Balance available after deducting 10 percent retained by present routes-----	345,150
Share available during open season of navigation— 55 percent-----	189,832
Total potential savings at present average saving of \$7.31 per long ton-----	\$1,387,671

TABLE I-1

World exports of crude rubber by regions, 1929-38

[Long tons]

Year	Middle east regulated areas	Philippines and Oceania	Liberia and other Africa	Latin America
1929-----	838,100	900	6,300	22,600
1930-----	804,700	1,200	4,900	15,300
1931-----	783,400	900	3,500	12,200
1932-----	699,400	800	2,000	6,500
1933-----	839,900	1,200	2,200	10,100
1934-----	1,004,700	1,500	3,400	9,500
1935-----	853,400	1,500	6,100	12,700
1936-----	832,000	1,600	8,400	15,900
1937-----	1,107,100	1,600	11,400	19,700
1938-----	862,945	1,971	11,929	18,095

SOURCE: Department of Commerce, *Statistical Bulletin of International Rubber Regulation Committee*

TABLE I-2

United States foreign trade in crude rubber, 1919-38

[Long tons]

Year	Gross imports	Reex-ports	Net retention	Year	Gross imports	Reex-ports	Net retention
1919-----	240,690	2,283	238,407	1929-----	565,087	36,485	528,602
1920-----	253,681	4,160	249,521	1930-----	487,628	30,205	457,423
1921-----	185,452	5,716	179,736	1931-----	501,788	25,609	476,179
1922-----	301,203	4,809	296,394	1932-----	414,668	20,937	393,731
1923-----	310,518	8,772	301,746	1933-----	418,902	20,576	398,326
1924-----	329,412	10,309	319,103	1934-----	463,018	23,856	439,162
1925-----	400,423	14,827	385,596	1935-----	487,146	11,390	455,756
1926-----	417,643	17,671	399,972	1936-----	488,145	12,582	475,563
1927-----	431,246	27,775	403,471	1937-----	600,476	7,948	592,528
1928-----	439,731	32,159	407,572	1938-----	411,982	5,652	406,330
				Average 1929-37-----	484,669	22,175	462,494

SOURCE: Department of Commerce, Trade Promotion Series 181, *Rubber Statistics*, pp. 48, 50.

TABLE I-3

United States crude rubber consumption by States, specified years

[Long tons]

Area	1925	1928	1935	1937
Ohio.....	198,222	242,100	249,821	220,186
Illinois.....	¹ 1,036	4,320	5,239	6,516
Indiana and Kentucky.....	(¹)	8,860	13,454	16,407
Michigan, Minnesota, and Wisconsin.....	² 17,721	39,150	60,953	87,774
Pennsylvania (one-half of State consumption).....	4,676	5,530	6,236	9,347
New York (one-half of State consumption).....	3,032	5,695	3,848	6,883
Tributary area total	224,687	305,675	339,551	347,112
California.....	(¹)	18,650	35,988	59,322
Massachusetts.....	² 15,625	40,160	34,167	36,166
Pennsylvania (one-half of State consumption).....	4,676	5,530	6,235	9,346
New Jersey.....	25,657	15,850	14,006	16,200
Connecticut.....	2,122	14,000	12,666	15,655
New York (one-half of State consumption).....	3,031	5,695	3,847	6,883
Rhode Island.....	3,168	5,540	4,099	5,699
Missouri.....	(¹)	2,670	2,252	3,411
Other States.....	108,664	21,210	15,735	31,296
Nontributary area total	162,942	129,325	129,907	183,978
Total consumption	387,629	435,000	469,458	531,091
Percentage consumed in tributary area.....	57.96	70.27	72.33	65.36

¹ Wholly included under "Other States."² Incomplete, partly under "Other States."

SOURCE: Department of Commerce, Rubber Information and Census Reports.

TABLE I-4

Potential savings on transportation of crude rubber

Point of destination	Savings based on New York rates applied to lake ports		Savings based on a 10-cent surcharge over New York rate applied to lake ports	
	Per 100 pounds	Per long ton	Per 100 pounds	Per long ton
Buffalo, N. Y.....	\$0.36	\$3.06	\$0.26	\$5.82
Cleveland, Ohio.....	.43	9.63	.33	7.39
Akron, Ohio.....	.28	6.27	.16	4.03
Dayton, Ohio.....	.22	4.93	.12	2.69
Detroit, Mich.....	.49	10.98	.39	8.74
Chicago, Ill.....	.54	12.10	.41	9.86
Jeannette, Pa.....	.13	2.91	.03	.67

Appendix J

TIN-CONSUMING INDUSTRIES

Section 1

UNITED STATES PRODUCTION, CONSUMPTION, AND IMPORTATION OF TIN

This study undertakes to appraise the effect of the proposed St. Lawrence Seaway on the industries that consume primary tin, as distinct from secondary or recovered tin. The average apparent consumption of tin in the United States for the years 1928-37 was 66,501 long tons. The figures showing apparent consumption in table J-1 do not take into account fluctuations in dealer and consumer stocks, information on which is not always available. Over a long period, they do, however, give an indication of the amount of tin used in this country.

In contrast to this quantity of consumption, the production of primary tin in the United States has never been more than 170 long tons. In the years 1928-37 it has averaged 42.1 long tons. Almost the entire production is in Alaska. South Dakota, the most important producing State, has not had, since 1927, an output greater than 2 long tons. Its largest production since 1919 was 6 tons, in 1920. Production of all other States has not been greater than 3.6 tons since 1919. Usually the production is nil, or less than one-tenth of a ton (table J-2).

Table J-3 gives potential production of tin in the United States, at assumed index prices, according to estimates made by the Bureau of Mines. Although many speculative elements enter into these estimates, they do indicate the magnitude of what might be expected. In the third year at \$1 per pound, Alaska and domestic sources may produce an estimated maximum of 3,000 long tons; at 50 cents per pound, the maximum estimated production would be only 310 long tons.

As is shown in table J-4 the highest price per pound for tin in New York since 1928 was 75 cents in (September) 1939. The yearly average price has ranged from 22.01 cents in 1932 to 54.24 cents in 1937. Beginning with 1934 to 1939 the average price has ranged between 42.26 and 54.24 cents per pound. Even with prices raised to three times their present levels, the United States, it is estimated, would be able to produce a maximum of only about 5 percent of the Nation's requirements.

Therefore, to satisfy almost the entire needs of the domestic industry, the United States has had to resort to imports. Table J-5 presents United States imports of tin by principal countries. The average imports for the years 1928 to 1937 were 151,860,000 pounds or 67,794 long tons. In that period the lowest imports were for 1932—77,995,000 pounds or 34,819 long tons. The largest imports, in 1937, were 197,377,000 pounds, or 88,115 long tons. Over this period about 75 percent came from the Far East, especially British Malaya, which supplied 67 percent of total United States imports. The other important sources of imports in the Far East were China, Netherlands Indies and Hong Kong. Over the same period Germany, the Netherlands and the United Kingdom sent us approximately 24 percent. The imports from Bolivia were nil from 1928 to

and including 1935. During the 3 years 1936-38 an average of 139,600 pounds, or 62 long tons, has been received from this country. The largest amount of direct shipments came in 1937 when 251,000 pounds were obtained from Bolivia.

These small receipts from Bolivia can be explained by the practice of shipping Bolivian ore to Europe, especially the United Kingdom, where it is smelted. The smelted product is then shipped back to the United States and appears as imports from the United Kingdom. In the years 1928-37, the United States imported an average of only 113 long tons of ore, of which 31 tons came from Bolivia, 32 from Canada and 50 from all other countries.¹

That the sources of United States imports are likely to remain either in Bolivia or the Eastern countries which now contribute the greater proportion of our requirements is indicated by table J-6, which shows the total production of the major tin-producing countries.

Bolivia produced in each year during 1925-29 an average of over 37,000 long tons and in 1934-38 an average of 24,500 long tons. In the latter period its production represented 15.5 percent of the world output. The Malay States produced an average of 56,800 long tons in 1925-29 and 53,500 long tons in 1934-38. In 1934-38 the production was 33.7 percent of the world production. The Netherlands Indies for the same periods produced an average of 33,300 and 26,100 long tons. The total production of Far Eastern countries averaged in both periods 108,000 long tons.

Section 2

THE RELATION OF NATIONAL DEFENSE TO THE FUTURE MOVEMENT OF IMPORTED TIN

Before going on to an analysis of the movement of tin into the tributary area and the possible savings in transportation costs that might result from the proposed St. Lawrence Seaway, the possible alterations that national defense needs may cause in the present methods of obtaining and shipping the metal must be considered. Tin is one of the vitally strategic materials. It is important to this country not only because of its great use in the canned-food industry but also for its essential utility to industry in general. Especially is it important in the manufacture of bearings for automobiles, airplanes, and ships, not to speak of other industrial machinery and apparatus. At the same time, the lack of domestic commercial deposits and the distance of foreign sources of supply, especially those in the Far East, make this country particularly vulnerable to blockade with respect to tin.

Various proposals have been made to reduce the vulnerability of the Nation in time of emergency: Accumulation of stock-pile reserves; stimulation of production; construction of smelters to handle ore imported from Bolivia; development of substitutes; and lastly, construction of smelters in Bolivia. Without trying to evaluate the advantage and disadvantages of these various methods in relation to the national security, we may look at them from the point of view of their possible effect upon the movement of tin into the Great Lakes area. It seems certain that to increase domestic production is impracticable. If smelters were developed in Bolivia the relation of source of supply to the Great Lakes consuming area would be little changed. There still would be a long ocean haul, which from the Panama Canal onward would be identical with the present haul from the Far East, and the points of consumption would remain quite as they are. If reserve stock piles were gathered in this country, the result would also have little effect on the

¹ Compiled from Department of Commerce, *Foreign Commerce and Navigation of the United States*.

present methods of moving tin. The reserves would probably be concentrated near the points of consumption. There is some possibility of their being held at interior points which would be less vulnerable to attack from the outside. In that case, the Great Lakes area might well find its receipts of tin increased. The development of smelters within the country to refine imported ore would change the problem of estimating potential tonnage; the route traveled by tin ore would be controlled by the location of American smelters. It probably can be assumed that these smelters would be near deep water in order to take advantage of cheap water transportation. On the other hand, smelters might be located inland from the coasts in order to render attack by an outside power more difficult. The desirability of combining water transportation and inland location would seem to point to the Mississippi valley and the Great Lakes area as the most favorable locations for such smelters. However, in the absence of any certainty as to which solution may be adopted to meet emergency requirements this study will be based on the past movements of tin from the Far East and Bolivia to the United States.

Section 3

POTENTIAL TRAFFIC AND INDICATED SAVINGS IN TIN MOVING OVER THE ST. LAWRENCE SEAWAY

Estimates of the potential tonnage in tin that might move over the St. Lawrence Seaway and the savings that might accrue therefrom calls for a study, first, of the consumption of tin in the Great Lakes area, and, second, of the transportation rates involved. Since figures are not available as to the actual consumption of tin by States, we must resort to estimating consumption by first finding the amounts of tin consumed by the important tin-consuming industries and then apportioning the amount consumed by each industry to the States in the Great Lakes area. Table J-7 shows the consumption of primary tin by industries, average for the years 1935-37, and an estimate of the consumption of imported tin.

The tin-plate and terneplate industry consumed 33,740 long tons of primary tin, or 51.4 percent of the total. Solder, babbitt, and bronze, and the other nonferrous-metal alloys together consumed 20,900 long tons, or 31.8 percent of the total. The average imports of tin from 1928 to 1937 were 151,860,000 pounds.³ Applying the percentages of consumption of primary tin to this 10-year average of imports, we have for tin plate and terneplate an estimated consumption of imported tin of 78,056,000 pounds and for the nonferrous-metal-alloys industry a total of 48,291,405 pounds.

Tin plate is iron or steel sheets which have been thinly coated with tin by being dipped in a molten bath of that metal. Terneplate are sheets of iron or steel coated with a lead-tin alloy containing about 85 percent lead and 15 percent tin. Tin plate is used primarily in the manufacture of containers for foods and other substances. Terneplate is used for many purposes in which there is no danger of poisoning from lead; for example, in the fabrication of roofing and the manufacture of automobile gasoline tanks.

The Temporary National Economic Committee has made a study of the shipments of tin plate during the years 1936, 1937, and 1938. Table J-8 shows the shipments of tin plate from the producing districts of Chicago, Youngstown, Pittsburgh-North Ohio River, and Canton-Mansfield. The figures of the Temporary National Economic Committee for the country as a whole cover the following percentages of 1937 capacity:⁴

³ Compiled from Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-38* (see table 5).

⁴ Temporary National Economic Committee, Questionnaire Form A. *Shipments to Consuming States.*

	<i>Percent</i>
1936.....	83.2
1937.....	89.1
1938.....	89.1

Although the Pittsburgh-North Ohio River steel-producing district embraces almost the entire western half of Pennsylvania, as well as the four northernmost counties of West Virginia and the two western counties of Maryland, the tin-producing capacity of that area is concentrated in the counties of Allegheny, Washington, and Beaver, Pa.

Application of the percentages of total shipments of tin plate from these tin-producing districts to estimated total consumption of imported tin by the tin plate and terneplate industry gives an estimated consumption of imported tin by that industry within the tributary area (table J-9). Thus, the Chicago area in the years 1936-38 shipped 20.1 percent of the total United States shipments of tin plate and is assumed to have consumed 20.1 percent of the total imported tin consumed by the tin plate and terneplate industry, or 15,689,000 pounds. The Pittsburgh-North Ohio River district shipped 49.7 percent of the total United States shipments in those years, and assuming the same percentage consumption of tin, it is estimated to have consumed 38,794,000 pounds. The total tributary area during the same period is thus estimated to have consumed 82.8 percent or 64,630,000 pounds of tin destined for use in the tin plate industry. The imports of tin during the years 1936-38 for the months of May through November, the open season of navigation on the St. Lawrence, averaged 56 percent of total annual imports. This percentage applied to the estimated consumption in the tributary area yields potential movement for the Chicago district, 8,786,000 pounds; for the Pittsburgh-North Ohio River district, 21,725,000 pounds; for the total tributary area, 36,193,000 pounds, during the open season.

As will be explained later, the unit savings in transportation costs on shipments via the proposed St. Lawrence are likely to vary according to the point of origin of the tin imports. In order to simplify the application of the unit savings to the tonnage, the estimated consumption of imported tin by steel producing districts may be further broken down by the region of origin. This step can satisfactorily be accomplished by two groups, Europe and all other countries. In the years 1928-37 the United States received 24 percent of its imports from Europe and 76 percent from other sources.

The tributary area as a whole is estimated in this way to have imported in the months of May through November, 8,614,000 pounds from Europe and 27,579,000 pounds from other regions.

Several of the tin-consuming industries can be grouped under the nonferrous-metal alloys industry. There are no recent data for allocating the tin consumption of the tin and terneplate industry to individual States. Table J-10 gives the quantities of tin consumed by these industries in tributary area States in 1929, and the percentages to total United States consumption of those same industries. Applying the 1929 consumption percentages to the estimated annual consumption of imported tin by these industries, 48,291,000 pounds (see table J-7), the annual consumption of imported tin by them in these States is obtained. Michigan, which took 36.2 percent of the total tin consumed by the nonferrous metal alloys industry in 1929, is estimated to have consumed 17,481,000 pounds of tin a year for this purpose. Illinois, which took 7.9 percent in 1929, is estimated to have consumed 3,815,000 pounds of imported tin. The total for the tributary area, or 49.2 percent, is estimated at 23,759,000 pounds. Taking 56 percent, the proportion imported during the open season of navigation, we have an estimated potential tonnage that might move through the St. Lawrence Seaway during the open season

of navigation for the use of the nonferrous metal alloys industry as follows: 9,790,000 pounds to Michigan; 2,136,000 pounds to Illinois; and 13,305,000 pounds to the total tributary area as a whole.

The consumption in season of imported tin is allocated between Europe and other countries as was done in the case of the imports consumed by the tin and terneplate industry. The tributary area as an entity thus is estimated to have received 3,167,000 pounds from Europe and 10,139,000 pounds from other countries during the open season of navigation.

To estimate possible savings on tin shipped over the St. Lawrence Seaway, we must consider not only the tin consumed in the area but also the rates of transportation applicable to it, which, in turn, involves a comparison of the feasible rates via the Seaway with the present rates. As can be seen in table J-11, almost 95 percent of the tin imported into the United States moves through the port of New York. The ocean rates on tin, as of August 15, 1939, from Singapore to Montreal and to United States ports in the North and South Atlantic and the Gulf, was \$25 per long ton, or \$1.11 per hundred pounds as shown in table J-12. From the United Kingdom to the same ports the rate was \$8.28 per long ton or 37 cents per 100 pounds.

In order to make a more exact analysis of the inland rates, representative points must be selected for each of the tin and terneplate producing districts for which tonnage has been estimated and likewise for each State for which consumption by the nonferrous metal alloys industry has been estimated.

The points chosen as typical for each of the steel producing districts concerned are, for the Chicago district, South Chicago; for the Youngstown district, Youngstown; for the Pittsburgh and North Ohio River district, Pittsburgh; and for the Canton and Mansfield district, Mansfield. The indicated savings, as shown in table J-14 are 57 cents per hundred pounds at Chicago, 20 cents per hundred pounds at Youngstown, 12 cents per hundred pounds at Pittsburgh and 24 cents per hundred pounds at Mansfield.

In the choice of typical points of destination for the nonferrous metal alloys industry the Census figures, whenever available, on the cost of the materials in the nonferrous metal products in industrial areas within the States concerned, were taken as a guide.

On this basis, Chicago, with slightly less than 68 percent of the State's total consumption of materials in the nonferrous metal alloys industry in 1937, is taken as typical for Illinois. Indianapolis, although it consumed only 7.9 percent of the State's total, was taken as representative of Indiana, first, because no data are available on the other industrial areas, and second, because of its central location. Detroit, which used 84 percent of Michigan's total is taken as typical of the State. Minneapolis used 100 percent of Minnesota's total. Cleveland took 56.3 percent, Cincinnati 17.3 percent and Toledo 15.9 percent of Ohio's total. Since to have taken Cleveland alone would have given perhaps undue advantage to the Seaway in the calculation of rates, the tonnage of the State was allocated 50 percent to Cleveland, 25 percent to Cincinnati, and 25 percent to Toledo. No data are available on the consumption of materials by the nonferrous metal alloys industry in Wisconsin; Milwaukee was used as typical because of its general industrial importance.

In table J-12, the possible unit savings on tin imports are estimated for the typical points in the Great Lakes area, on shipments originating in Singapore and in the United Kingdom. The savings from Singapore may be taken as typical of those on shipments from non-European countries since among the countries from which the United States draws its tin the Far East and especially British Malaya predominate. The rates from the United Kingdom, Germany, and the

Netherlands, the three important European sources, would be approximately the same, so that the United Kingdom may be used as typical for a study of the rates from European countries.

In view of the practice of the ship operators it is not unlikely that the ocean rate from the United Kingdom to Great Lakes ports will be about equal to the rate from the United Kingdom to North Atlantic ports. On shipments from such points as Singapore, the ship operator probably will require greater revenue to offset the additional costs involved in entering the Great Lakes. Therefore, for a feasible rate from the United Kingdom to the Great Lakes, the rate to New York may be used, whereas for a feasible rate from Singapore a differential of \$2 per short ton may be added.

Thus, we have for shipments from Singapore to Chicago an actual rate of \$1.69 per 100 pounds composed of 57 cents rail rate from New York to Chicago plus \$1.12 ocean rate from Singapore to New York. The feasible rate from the same point to Chicago is estimated at \$1.22 and the indicated savings at 47 cents. The indicated savings on shipments from Singapore to points shown range from 2 cents per 100 pounds on shipments to Pittsburgh to 48 cents on shipments to Milwaukee. On shipments from the United Kingdom savings range between 12 cents per 100 pounds on those going to Pittsburgh, and 58 cents on those going to Milwaukee.

In table J-13 the unit savings are applied to the potential tonnage of tin imported into the Great Lakes area for use in the tin and terneplate industry. The total savings amount to \$60,000. Of this amount \$43,400 is estimated for shipments to Chicago and \$9,500 for shipments to Pittsburgh.

Table J-14 presents the estimated savings on tin imported for consumption by the nonferrous metal alloys industry which total \$53,400. Of this amount, \$38,300 accrue to Detroit and \$10,500 to Chicago.

For both the tin and the terneplate industry and the nonferrous metal alloys industry, the potential tonnage amounts to 49,498,000 pounds and the estimated savings at \$113,400.

Factors other than rates must be considered in the choice of a mode of transportation for tin. In a commodity valued at 50 or 60 cents per pound, or \$1,000 or \$1,200 per short ton, the capital involved and fluctuations in price become important.

The savings calculated must then be considered as tentative. If the estimated consumption by the two tin-using industries that have been analyzed were to take advantage of the lower rates of transportation via the St. Lawrence, the savings estimated would be realized. If that tonnage upon which savings are estimated as only 12 cents per 100 pounds or less is eliminated, all the shipments estimated to Pittsburgh and those from Singapore to the Youngstown steel-producing district and Indianapolis and Cincinnati would be withdrawn. The effect of this step would be to reduce the total tonnage of 49,498,000 pounds by 26,140,000 pounds, leaving 23,358,000 pounds. The total savings of \$113,400 likewise would thus be reduced by \$13,900 to \$99,600. The average savings on the remaining tonnage would be about 43 cents per 100 pounds.

These figures of potential tonnage and estimated savings make no allowance for the consumption by industries other than tin plate and terneplate and the nonferrous-metal alloys industry. For example, the collapsible tubes industry consumed 5.4 percent and other industries 11.4 percent.⁴ However, it must be assumed on the basis of the general industrial importance of the area that a fair amount of the tonnage would be moving into the Great Lakes area.

The size of future requirements of tin in the area tributary to the Great Lakes may be indicated by the trend of the total consumption of tin and by shifts in

⁴ See table 7.

relative consumption by the important tin-consuming industries. The 5-year averages of the apparent tin consumption of the United States^a are:

	<i>Long tons</i>
1911-15.....	48,000
1916-20.....	65,000
1921-25.....	63,000
1926-30.....	77,000
1931-35.....	52,000

For the 3 years 1936-38 the average apparent consumption was 71,000.

Although there has been a considerable pick-up in consumption since the period 1911-15, the post-war figures have followed more or less the rise and fall of general business activity.

In the last decade there have been pronounced changes in the proportions consumed by different industries. Table J-1 shows the percentages consumed by each industry in the years for which such data are available. From the years 1927 and 1928 to the years 1936 and 1937 tin plate and terneplate has increased its consumption from about 36 percent to over 50 percent. Tin plate goes almost directly into consumer channels in the form of containers for food and other perishable goods which usually keep a rather steady level in depression times, while some of the other tin-consuming industries are capital-goods industries which usually decline heavily in depression. That the shift among the consuming industries is not due entirely to this fact, is indicated by the high rank of tin plate in 1937, a year of high general business activity. The nonferrous-metal alloys industry, as a whole, increased its consumption as a percent of total tin consumed, from roughly 75 percent to about 85 percent.

It has been shown that both the tin plate and the nonferrous-metal alloys industry are heavily concentrated in the Great Lakes area. Although it would be difficult to forecast with any degree of accuracy the consumption of the tributary area, it does appear that if the present trends within the tin-consuming industries continue, the tributary area will certainly partake in any general expansion of tin consumption which may come about as a result of general industrial growth.

TABLE J-1

Apparent consumption of primary tin in the United States, 1928-38

Year	Apparent consumption	Year	Apparent consumption
	<i>Long tons</i>		<i>Long tons</i>
1928.....	76,353	1935.....	61,966
1929.....	85,197	1936.....	75,643
1930.....	78,501	1937.....	87,802
1931.....	64,403	1938.....	49,494
1932.....	33,702		
1933.....	62,677	Average, 1928-37.....	66,501
1934.....	38,770		

SOURCE: Department of the Interior, *Minerals Yearbook*, 1939, p. 680.

^a Department of Interior, *Minerals Yearbook*, 1939, p. 680.

TABLE J-2

United States mine production of tin (content of ore), by States, 1919-38

[Long tons]

Year	Alaska	South Dakota	Other States ¹	Total
1928.....	36.6	1.8	3.6	42.0
1929.....	34.5	.2	.3	35.0
1930.....	13.1	.2	1.7	15.0
1931.....	3.6	.1	.....	3.7
1932.....	.....	.4	.....	.4
1933.....	2.6	.1	.....	2.7
1934.....	8.0	.2	.....	8.2
1935.....	44.1	.4	.....	44.5
1936.....	101.0	(?)	.....	101.0
1937.....	166.0	.8	1.6	168.4
1938.....	* 108.0	1.0	.....	* 109.0
Average, 1928-37.....	41.0	.4	.7	42.1

¹ California, North Carolina, South Carolina, Texas, and Wyoming.² Less than 0.1 ton.³ Subject to revision.SOURCE: Department of Interior, *Minerals Yearbook*, 1939, p. 679.

TABLE J-3

Potential production of tin in the United States at assumed index prices of \$0.50 and \$1 per pound

Assumed index price	Potential production (long tons)		
	Alaskan placers	Domestic lodes	Total
\$0.50 per pound:			
First year.....	150-300	0-10	150-310
Second year.....	150-300	0-10	150-310
Third year.....	150-300	0-10	150-310
\$1 per pound:			
First year.....	250-500	10-50	260-550
Second year.....	500-1,000	200-500	700-1,500
Third year.....	1,000-2,000	500-1,000	1,500-3,000

SOURCE: Department of the Interior, *Minerals Yearbook*, 1939, p. 676.

TABLE J-4

Spot prices of Straits tin at New York

[Cents per pound]

Year	Highest	Lowest	Average	Year	Highest	Lowest	Average
1928.....	57.75	45.75	50.46	1934.....	56.65	50.00	52.16
1929.....	50.38	38.38	45.19	1935.....	54.00	45.75	50.39
1930.....	39.75	23.75	31.70	1936.....	53.50	40.50	46.42
1931.....	27.50	20.60	24.46	1937.....	66.63	41.00	54.24
1932.....	25.63	18.35	22.01	1938.....	46.75	35.00	42.26
1933.....	55.80	21.80	39.12	1939.....	75.00	45.00	50.20

SOURCE: *Statistical Bulletin of the International Tin Research and Development Council*, Statistical Office, The Hague, February 1940, p. 11.

TABLE J-5

United States imports¹ of tin,² by principal countries, 1928-38

[Thousands of pounds]

Country	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Germany.....	4,030	1,267	193	1,905	393	3,397	2,116	1,994	358	-----	45
Netherlands.....	16,023	16,849	16,518	4,497	6,004	7,174	1,826	4,419	10,044	5,481	4,963
United Kingdom.....	27,322	36,948	27,215	17,361	12,198	46,825	18,966	34,897	18,904	16,137	7,363
Total, European countries.....	47,375	55,064	43,926	23,763	18,595	57,396	22,908	41,310	29,306	21,618	12,371
British Malaya.....	117,133	130,411	124,857	111,420	48,797	70,831	55,617	83,348	121,792	149,427	82,147
China.....	112	816	111	292	1,066	4,481	3,269	5,425	2,306	10,007	4,668
Netherlands Indies.....	756	607	422	1,997	1,174	2,864	3,857	5,584	6,134	9,194	6,936
Hong Kong.....	4,868	6,918	10,987	9,399	7,562	4,440	3,123	6,802	7,961	4,632	2,697
Total, Far East.....	122,869	138,752	136,377	123,108	58,569	82,616	65,866	101,159	138,193	173,260	96,448
Bolivia.....	-----	-----	-----	-----	-----	-----	-----	-----	112	251	56
All other.....	4,409	1,349	541	1,113	801	754	794	1,469	-----	-----	2,451
Grand total.....	174,653	195,165	180,844	147,984	77,995	140,766	89,568	143,938	170,305	197,376	111,326

¹ General imports through 1933; imports for consumption thereafter.² Consisting of bars, blocks, pigs, grain or granulated.SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-38*.

TABLE J-6

Average annual world production of tin (content of ore), 1925-29 and 1934-38, by countries

Country	Average, 1925-29		Average, 1934-38		Country	Average, 1925-29		Average, 1934-38	
	Long tons	Percent of total	Long tons	Percent of total		Long tons	Percent of total	Long tons	Percent of total
Burma.....	2,228	2.7	4,229	2.7	Bolivia ¹	37,169	15.5	24,506	15.5
China ¹	7,085	6.4	10,213	6.4	Nigeria.....	8,319	5.0	7,877	5.0
Indo-China.....	691	.9	1,395	.9	Portugal.....	625	.5	794	.5
Malay States, total	56,837	33.7	53,496	33.7	All others.....	8,576	10.9	17,359	10.9
Netherlands Indies.....	33,266	18.5	20,143	18.5	Grand total.....	163,000	100.0	158,540	100.0
Siam.....	8,204	7.9	12,528	7.9					
Total, Far East.....	108,311	68.1	108,004	68.1					

¹ Exports.SOURCE: Department of the Interior, *Minerals Yearbook, 1939*, p. 688.

TABLE J-7

United States estimated consumption of imported tin, by industry, 1928-37

Industry	Consumption of primary tin, annual average 1935-37		Estimated consumption of imported tin	
	Long tons	Percent of total	Annual	Seasonal (66%)
Tin plate and terneplate.....	33,740	51.4	<i>Pounds</i> 78,055,920	<i>Pounds</i> 43,711,315
Solder.....	11,276	17.1	25,968,020	14,542,091
Babbitt.....	4,413	6.7	10,174,604	5,697,778
Bronze.....	3,320	5.1	7,744,848	4,337,115
Type metal.....	213	.3	455,579	255,124
Galvanizing.....	878	1.3	1,974,177	1,105,539
Miscellaneous alloys.....	440	.7	1,063,018	595,290
White metal.....	360	.6	911,159	510,249
Total nonferrous metal alloys.....	20,900	31.8	48,291,405	27,043,186
Collapsible tubes.....	3,558	5.4	8,200,428	4,592,240
All other industries.....	7,498	11.4	17,312,014	9,694,728
Grand total.....	65,696	100.0	151,859,767	85,041,469

SOURCE: Consumption of primary tin, annual average, 1935-37, Department of the Interior, *Minerals Yearbook*, 1939 p. 361. Total consumption of United States imports, annual average, 1928-37, Department of Commerce, *Foreign Commerce and Navigation of the United States*, 1928-37.

TABLE J-8

Shipments of tin plate from producing districts

[Short tons]

Year	Chicago ¹	Youngstown ²	Pittsburgh, ³ North Ohio River	Canton, ⁴ Mansfield	All other	Total
1936.....	359,233	(0)	1,209,644	12,179	340,671	1,885,727
1937.....	481,846	487,576	1,086,067	17,850	435,963	2,509,302
1938.....	306,305	225,318	545,136	836	240,540	1,324,135
Average 1936-38.....	382,461	237,631	946,949	10,288	329,059	1,906,388
Percent of total.....	20.1	12.5	49.7	0.5	17.2	100.0

¹ Chicago-Illinois: Cook, Du Page, Lake, Kane, and Will Counties. Wisconsin: Kenosha, Racine, and Milwaukee Counties. Indiana: Lake County.

² Ohio: Trumbull, Mahoning, and Columbia Counties. Pennsylvania: Crawford, Mercer, and Lawrence Counties.

³ Pennsylvania: McKean, Elk, Cameron, Clearfield, Jefferson, Clarion, Butler, Armstrong, Bedford, Blair, Venango Indiana (County), Cambria, Beaver, Allegheny, Westmoreland, Somerset, Washington, Green, Fayette, Forest, and Warren Counties. Maryland: Allegany and Garrett Counties. West Virginia: Preston, Monongalia, Marion, and Wetzel Counties.

⁴ Ohio: Guernsey, Muskingum, Stark, Carroll, Wayne, Ashland, Richland, Harrison, Tuscarawas, Coshocton, and Holmes Counties.

⁵ Included with Pittsburgh, North Ohio River.

SOURCE: Temporary National Economic Committees—Questionnaire Form A. *Shipments to Consuming States*.

TABLE J-9

Estimated consumption of imported tin by the tin and terneplate industry in the tributary area

Steel producing district	Percent of total	Annual	Seasonal, 56 percent		
			Total	From Europe, 23.8 percent	From other countries, 76.2 percent
Chicago ¹	20.1	Pounds 15,689,240	Pounds 8,785,974	Pounds 2,091,062	Pounds 6,694,912
Youngstown ²	12.5	9,756,990	5,463,914	1,300,412	4,163,502
Pittsburgh, North Ohio River ³	49.7	38,793,792	21,724,524	5,170,436	16,554,088
Canton, Mansfield ⁴.....	.5	390,280	218,557	52,017	166,540
Total tributary area.....	82.8	64,630,302	36,192,969	8,613,927	27,579,042
Total United States.....	100.0	78,055,920			

¹ Chicago-Illinois: Cook, Du Page, Lake, Kane, and Will Counties. Wisconsin: Kenosha, Racine, and Milwaukee Counties. Indiana: Lake County.

² Ohio: Trumbull, Mahoning, and Columbiana Counties. Pennsylvania: Crawford, Mercer, and Lawrence Counties.

³ Pennsylvania: McKean, Elk, Cameron, Clearfield, Jefferson, Clarion, Butler, Armstrong, Bedford, Blair, Venango, Indiana, Cambria, Beaver, Allegheny, Westmoreland, Somerset, Washington, Green, Fayette, Forest, and Warren Counties. Maryland: Allegany and Garrett Counties. West Virginia: Preston, Monongalia, Marion, and Wetzel Counties.

⁴ Ohio: Guernsey, Muskingum, Stark, Carroll, Wayne, Ashland, Richland, Harrison, Tuscarawas, Coshocton, and Holmes Counties.

⁵ Based on computations made in table J-8.

SOURCE: Percentages based on figures from Temporary National Economic Committee—Questionnaire Form A, *Shipments to Consuming States* (average 1936-38).

TABLE J-10

Potential tonnage of imported tin consumed in nonferrous metal alloys and products (not including aluminum products), by States

State ¹	Consumption of tin, 1929		Estimated consumption of imported tin (pounds)			
	Pounds	Percent of United States total	Annual	Seasonal (56 percent)		
				Total	From Europe (23.8 percent)	From other countries (76.2 percent)
Illinois.....	1,789,517	7.9	3,815,021	2,136,412	508,466	1,627,946
Indiana.....	55,998	.2	96,533	54,086	12,872	41,214
Michigan.....	8,236,754	36.2	17,481,489	9,789,634	2,329,934	7,459,700
Minnesota.....	47,430	.2	96,533	54,086	12,872	41,214
Ohio.....	940,575	4.1	1,979,948	1,108,771	263,887	844,884
Wisconsin.....	134,113	.6	289,748	162,259	38,618	123,641
Total tributary area.....	11,204,387	49.2	23,759,372	13,305,248	3,166,649	10,138,599
Total United States.....	22,728,103	100.0	48,291,405	27,043,187	6,436,279	20,606,908

¹ Iowa not shown separately.

SOURCE: Consumption of tin, 1929, U. S. Department of Commerce, *Census of Manufactures, 1929*, vol. II, p. 1076. Total United States estimated consumption of imported tin by the nonferrous-metal alloys and products (not including aluminum products), table J-7, column 4.

TABLE J-11

United States imports¹ of tin,² by principal customs districts, 1927-38

[Pounds]

Year	Total	New York	All other
1927.....	159,357,110	149,377,837	9,979,273
1928.....	174,653,760	166,514,866	8,138,894
1929.....	195,165,173	186,506,366	8,658,807
1930.....	180,844,329	173,279,474	7,564,855
1931.....	147,984,192	141,520,592	6,463,600
1932.....	77,995,310	73,977,151	4,018,159
1933.....	140,766,210	130,413,096	10,353,114
1934.....	89,568,499	81,420,528	8,147,971
1935.....	143,938,130	134,351,513	9,586,617
1936.....	170,305,359	160,243,881	10,061,478
1937.....	197,376,708	183,662,374	13,714,334
1938.....	111,326,139	103,577,179	7,748,960
Average, 1928-37.....	151,859,767	143,188,964	8,670,783

¹ General imports through 1933, imports for consumption thereafter.

² Consisting of bars, blocks, pigs, grain or granulated.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-38.*

TABLE J-12

Indicated unit savings on tin imported from Singapore and from the United Kingdom to representative points in the Great Lakes area

[Cents per 100 pounds]

Representative points	Present rate via New York					Feasible rate via St. Lawrence					Indicated savings	
	Rail	Ocean		Total		Rail	Ocean		Total			
		From Singapore	From United Kingdom	From Singapore	From United Kingdom		From Singapore	From United Kingdom	From Singapore	From United Kingdom	From Singapore	From United Kingdom
Chicago, Ill.....	57	112	37	169	94	122	37	122	37	47	57	
Youngstown, Ohio.....	39	112	37	151	76	119	122	37	141	56	10	
Pittsburgh, Pa.....	37	112	37	149	74	125	122	37	147	62	2	
Mansfield, Ohio.....	44	112	37	156	81	120	122	37	142	57	14	
Indianapolis, Ind.....	52	112	37	164	89	134	122	37	156	71	8	
Detroit, Mich.....	47	112	37	159	84	122	37	122	37	37	47	
St. Paul, Minn.....	84	112	37	196	121	48	122	37	170	85	26	
Cleveland, Ohio.....	42	112	37	154	79	122	37	122	37	37	42	
Cincinnati, Ohio.....	48	112	37	160	85	130	122	37	152	67	8	
Toledo, Ohio.....	47	112	37	159	84	122	37	122	37	37	47	
Milwaukee, Wis.....	58	112	37	170	95	122	37	122	37	48	58	

¹ From Cleveland.

² From Duluth.

TABLE J-13

Estimated savings on tin imports consumed in the tin and terneplate industry

Steel producing district ¹	Estimated seasonal consumption (pounds)			Indicated unit differential (cents per 100 pounds)		Estimated total savings		
	Total	From Europe	From other countries	From United Kingdom	From Singapore	From Europe	From other countries	Total
Chicago.....	8,785,974	2,091,062	6,694,912	57	47	\$11,919	\$31,466	\$43,385
Youngstown.....	5,463,914	1,300,412	4,163,502	20	10	2,601	4,164	6,765
Pittsburgh, North Ohio River.....	21,724,524	5,170,436	16,554,088	12	2	6,205	3,311	9,516
Canton, Mansfield.....	218,557	52,017	166,540	24	14	125	233	358
Total tributary area.....	36,192,969	8,613,927	27,579,042	-----	-----	20,850	39,174	60,024

¹ For counties in the districts included, see table J-9.

TABLE J-14

Estimated savings on tin imports consumed in the nonferrous metal alloys and products (not including aluminum products), by States

Representative point and State	Estimated seasonal consumption ¹ (pounds)			Indicated unit differential (cents per 100 pounds)		Total estimated savings		
	Total	From Europe	From other countries	From United Kingdom	From Singapore	From Europe	From other countries	Total
Chicago, Ill.....	2,136,412	508,466	1,627,946	57	47	\$2,898	\$7,651	\$10,549
Indianapolis, Ind.....	54,086	12,872	41,214	18	8	23	33	56
Detroit, Mich.....	9,789,634	2,329,934	7,459,700	47	37	10,951	27,601	38,552
St. Paul, Minn.....	54,086	12,872	41,214	36	26	46	107	153
Cleveland, Ohio.....	554,385	131,943	422,442	42	32	554	1,352	1,906
Cincinnati, Ohio.....	277,193	65,972	211,221	18	8	119	169	288
Toledo, Ohio.....	277,193	65,972	211,221	47	37	310	782	1,092
Milwaukee, Wis.....	162,259	38,618	123,641	58	48	224	593	817
Total tributary area.....	13,305,248	3,166,649	10,138,599	-----	-----	15,125	38,288	53,413

¹ See table J-10.

TABLE J-15

United States consumption of primary tin by industry, for selected years, percentages

Industry	1927	1928	1930	1935	1936	1937
Tin plate and terneplate.....	35.96	36.38	42.40	49.17	50.01	54.31
Solder.....	19.94	18.66	17.43	17.41	17.69	16.49
Babbitt.....	11.14	10.96	8.31	6.56	7.43	6.17
Bronze.....	6.84	5.81	5.35	4.81	5.22	5.09
Type metal.....	.66	.55	.34	.30	.37	.30
Galvanizing.....	(¹)	(¹)	(¹)	1.10	1.48	1.37
Miscellaneous alloys.....	.82	.85	.47	.75	.61	.66
White metal.....	1.25	1.08	1.71	.62	.53	.51
Total nonferrous metal alloys.....	76.61	74.29	76.01	80.72	83.34	84.90
Collapsible tubes.....	3.97	3.85	5.84	6.34	5.21	4.90
All other industries.....	19.42	21.86	18.15	12.94	11.45	10.20
Grand total.....	100.00	100.00	100.00	100.00	100.00	100.00

¹ Not shown separately.

Source: Department of Commerce, *Mineral Resources of the United States*, Part 1, 1931, p. 34; Department of the Interior, *Minerals Yearbook*, 1939, p. 681.

Appendix K

NATIVE SULFUR

INTRODUCTION

This study attempts to evaluate the economic effects of the proposed St. Lawrence Seaway upon the native sulfur industry and upon the industries that consume the product. Sulfur plays an indispensable role in American industry, especially through its most important derivative, sulfuric acid. The latter is needed in the manufacture of fertilizers, illuminating gas, soap, artificial leather, many medicinals, cleansers, shoe blacking, and dyestuffs. Modern construction and mining operations, as well as modern warfare, require its use in explosives. For the processes of electroplating and electro-deposition, sulfuric acid enters the manufacture of tin cans, galvanized iron, and chromium surfaces. It is used in the cleansing of wool, processing of cotton, purifying and manufacture of gasoline and other petroleum products. In industrial chemistry, it is a cheap and powerful tool in disintegration and synthesis.¹ It is not surprising, therefore, that the output of the sulfuric acid industry is considered a representative index of general industrial production, and that the apparent consumption of sulfur follows closely the rise and fall of the index of production of the Federal Reserve Board.

Sulfur is derived mainly from three sources: From the mining of natural sulfur, from burning pyrites, and, as a byproduct, in the purification of manufactured fuel gases. The latter method has been little used in the United States, but is receiving increased interest in other countries. Pyrites are a common mineral of a pale brass yellow color and brilliant metallic luster, crystalline in isometric form. In coal it frequently forms bands and nodules known as "brasses." An extremely important variety is that which bears more or less copper, sometimes silver and gold, and not infrequently associated with lead and zinc sulphides. Sulfur is obtained from pyrites either by distilling it in iron or fire-clay tubular retorts, whereby one-third of the sulfur is obtained in the distillate, or by a modification of the Sicilian process, described below.

Natural sulfur is mined in two ways. In Sicily an open pit method calls for the use of a large labor force. The ore is then melted in kilns by fire set on part of it, or by external heating. Further purification is effected by distillation from large iron pots. In the United States the Frasch method, first perfected in 1903, requires heavy expenditures of capital and relatively small amounts of labor. In the Frasch process, four concentric pipes, having diameters of 1, 3, 6, and 10 inches, are sunk in a bore hole. Superheated water is forced down the 3-inch pipe to melt the sulfur. Compressed air is driven down the center pipe and causes the mixture of water and molten sulfur to rise in the outer pipes. The mixture, run off into settling tanks, yields sulfur, 98 percent pure.²

The discovery of the Frasch process brought a sharp shift from pyrites to natural sulfur as the primary source of sulfuric acid in the United States. The

¹ See Theodore J. Krepes, *The Economics of the Sulfuric Acid Industry*, Stanford University Press, 1938 pp. 1-2.

² Krepes, *ibid.*, pp. 92-97.

process is cheap in itself and near tide-water, so that ocean transportation to the eastern seaboard is available. The shift was greatly hastened by the first World War which brought a large demand for sulfuric acid for explosives and fertilizer at a time when foreign sources of pyrites were cut off.

Since the beginning of the first World War, sulfur burners have generally been installed in place of pyrites furnaces, although, of the small number of pyrites plants operating, several are of large capacity.

Section 1

PRODUCTION AND EXPORTS OF SULFUR

The first plant in the United States to use the Frasch process for the extraction of native sulfur was established in Louisiana. Texas has now advanced to first position; in the 8-year period, 1925-32 inclusive, Texas produced over 99 percent of the country's total output and, in recent years, has been producing about 85 percent. Most of the remainder still comes from Louisiana, whose renewed production since 1933 accounts for Texas' drop in relative position;³ small amounts are detained from surface deposits in Western States.

For the country as a whole, production of native sulfur since 1900 has shown a marked, if irregular, growth. The 5-year average of 1922-26 was 1,677,000 long tons. In the period of 1925-29, the average reached 1,951,000 long tons and, in 1930-34 it declined to 1,681,000 long tons. The 10-year average for 1927-36 was 1,851,000 long tons. In 1937 and 1938 production amounted to 2,742,000 tons and 2,393,000 tons, respectively.

Of the 1938 United States total, Texas produced 2,059,000 long tons, or 86 percent, and Louisiana 328,000 long tons, or 13 percent. California and Utah, the only other States producing native sulfur, together had an output of less than 1 percent.⁴

Sulfur, as such, is not mined in the tributary area of the Great Lakes; however, according to the Chemical Division, Bureau of Foreign and Domestic Commerce, the region offers prospects of being a fairly important source of sulfur obtained either as a byproduct of smelting and coal-cleaning operations, or from the treatment of pyrites.

At present the output of the region is small. In 1938, two coal operators in Illinois produced pyrites (coal brasses) recovered as a byproduct in coal-cleaning operations. In Wisconsin, one company makes pyrites concentrate at Cuba City. Production of sulfur other than native sulfur is limited by the low cost of the Texas and Louisiana product.

In 1909, Italy was the world's chief producer of native sulfur but, although world production has expanded materially during the past 30 years, Italy's annual contribution was less in 1938 than in 1909. Meanwhile, production in the United States has grown so rapidly that, in 1938, as can be seen from table K-1, the United States accounted for three-fourths of the world's production.

This study is not concerned with the exports of sulfur except those moving to Canada, generally our largest customer. In the 10 years of 1928-37, the United States exported to Canada an average of 150,000 long tons, or 26 percent of this country's total exports of sulfur.⁵ In 1938, exports to Canada declined to 85,000

³ Department of Interior, *Minerals Yearbook*, 1934, p. 914.

⁴ *Minerals Yearbook*, 1939; pp. 1247-8.

⁵ Based on figures in Bureau of Foreign and Domestic Commerce and Navigation for the years 1934-36; and in the *Minerals Yearbook* for the years 1937-38.

long tons from the preceding year's figure of 197,000 long tons. In percentage, of total United States exports of sulfur, Canada received only 14.4 percent in 1938, as compared with 28.6 in 1937.

The importance of the United States exports to Canada in the economy of the Dominion is demonstrated by the fact that from 1934 to 1938 the United States has supplied each year at least 99.7 percent of the Dominion's total imports of sulfur.

In the 10-year period of 1928-37, the United States imported for consumption an average of only 1,928 long tons, and in that small trade the tributary area is of no importance.

Section 2

CONSUMPTION OF SULFUR IN THE UNITED STATES

For the years 1934-38, the average consumption of sulfur in the United States was 1,333,000 long tons. Table K-2 gives the average consumption by industries during those 5 years.

In 1938, the apparent sulfur consumption of the United States exceeded 1,040,234 long tons; the rest of the world consumed 1,600,000 long tons.

There are no figures available on sulfur consumption in the tributary area. The Chemical Division of the Bureau of Foreign and Domestic Commerce estimates that the area⁶ uses perhaps 17 percent of the United States consumption, or not over 250,000 long tons. Of this amount, it estimates 75 percent or 188,000 long tons is consumed by the chemical and fertilizer industries; and 25 percent, or 62,000 long tons, by the pulp paper and miscellaneous industries.

For the tributary area composed of Michigan, Illinois, Wisconsin, Ohio, and part of New York, the consumption of sulfur is estimated at 274,000 long tons. This estimate is reached by the following method. The sulfur consumed by each industry is allotted to the individual State on the basis of the raw materials consumed, as reported by the Census of Manufactures. For the chemicals industries, the recent census data that were used for estimating the distribution of the industry by States, was for the "Chemicals not elsewhere classified" group. The greater proportion of sulfur used in chemicals is first made into sulfuric acid. The value of production for sale of the sulfuric acid industries subgroup in 1937 amounted to only \$42,000,000 out of a total for the "Chemicals not elsewhere classified" group of \$933,000,000⁷ or 4.5 percent. The Census of Manufactures for 1937 does not show the distribution by States; therefore, it was necessary to go back to 1929, the most recent year for which census data by States for the sulfuric acid industry were published.

Table K-3 shows the percentage of the sulfur-consuming industries estimated to be in the tributary area States. Table K-4 applies the percent obtained in the preceding table K-3 to the average (1934-38) consumption of sulfur by the industry in the United States. The result is the estimated consumption of sulfur by that industry in the State.

For example, the fertilizer industry in 1937 consumed in Michigan 1.29 percent of all the raw materials it consumed in the entire country. Assuming, then, that it consumed in Michigan 1.29 percent of the 277,000 long tons of sulfur it consumed in the entire country, or 3,578 long tons. For the State of New York, the figure used was based upon one-half the raw materials consumed in the State for each industry. This arbitrarily chosen percentage may seem high, but it must be remembered that near the Lakes there is a concentration of the sulfur-consuming industries.

⁶ Including the following States: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, and Wisconsin.

⁷ Department of Commerce, *Census of Manufactures, 1937*, pp. 646-648.

Section 3

CONSUMPTION OF SULFUR IN CANADA AND THE PROVINCE OF ONTARIO

Almost all the sulfur consumed in Canada comes from the United States. Sulfur consumed in Ontario is likely to be tributary to the St. Lawrence Seaway. Any savings in transportation costs on sulfur exported to Canada would vitally affect the industry in the United States even though that industry is located as far away from the Great Lakes as Louisiana and Texas.

There are no figures available for the consumption of sulfur in the Province of Ontario. An allocation may be made by a method similar to that used in estimating the consumption in the tributary area on the American side, although the data are not quite as complete.

The dominant sulfur consuming industry of Canada is the pulp and paper industry. In the decade 1928-37 it used an average of 126,000 long tons of sulfur a year. On the basis of distribution of "Pulpwood used in the manufacture of pulp" in Canada, 27.9 percent of the Dominion's pulp and paper industry, is located in the Province of Ontario.⁸ Applying this percentage to the annual average consumption of sulfur during 1928-37 (126,000 long tons), the sulfur consumed by the pulp and paper industry in Ontario amounted to 35,148 long tons.

The second largest sulfur-consuming industry of Canada is the chemicals and allied products industry. Since the industry is so large and so heterogeneous that to allocate the consumption of sulfur on the basis of the distribution of the whole industry might lead to serious errors. Within this large group the sulfur consumption is heavily concentrated in the manufacture of acids, alkalies, and salts. Therefore, the geographic allocation of the consumption of sulfur for the entire industry may be more accurately based upon the distribution of the subgroup, acids, alkalies and salts. In this manner an estimate of Canadian consumption of sulfur by the chemicals and allied industries, on the basis of annual averages, 1928-36, is obtained. This is 15,924 long tons for the Dominion. The distribution of "cost at works of materials consumed by the acids, alkalies, and salts industry" in the Province of Ontario (average, 1934-36) is 67.8 percent,⁹ and an estimated consumption of sulfur in the chemicals and allied industries in Ontario, therefore, is 10,796 long tons. The third most important sulfur-consuming industry in Canada is the rubber industry which uses annually about 1,000 long tons. Neglecting the rubber and other minor sulfur-consuming industries, the estimated total consumption of sulfur by the two major users in Ontario is 51,072 long tons annually, or 29,792 long tons during the open season of navigation.

Section 4

MARKETING CHANNELS

Sulfur as obtained in Texas and Louisiana by the Frasch process is 99 percent pure. The primary sulfur producers sell in bulk and ship in car lots or in vessels, including barges. Sales are ordinarily made direct to consumers. It is possible that some domestic sulfur consumers are supplied with quantities in excess of their

⁸ Canada, Dominion Bureau of Statistics, the *Pulp and Paper Industry*, 1928-29, 1930-31, 1932-33, 1934 and 1935.

⁹ *Ibid.*, *Chemicals and Allied Products*, 1928-36.

immediate needs in order to take advantage of the transportation economies in large shipments. Under such conditions the sulfur may be stored by the seller in a pile at the consumer's plant and periodic payments may be arranged, based upon quantities used.

At present the Sulfur Export Corporation handles the sulfur sold abroad by the Texas Gulf Sulfur Co. and the Freeport Sulfur Co., America's two largest sulfur producers. The Sulfur Export Corporation owns no oceangoing steamers and no foreign or domestic sulfur-processing or sulfur-consuming plants. Like the producers, it ships in bulk and has on occasions carried stock piles at strategic points in Europe.

From the point of view of the proposed St. Lawrence Seaway, sulfur offers an example of a commodity whose physical nature and marketing channels are ideally suited to shipments in large bulk and over a seasonally open waterway. In the event of material savings in transportation costs, sulfur could well be shipped during the season of open navigation to be stored for winter use.

Section 5

POTENTIAL TRAFFIC AND ESTIMATED SAVINGS

The figures on how much domestic sulfur moves by all-rail are not available. A great proportion of the shipments move by rail from Hoskins to Freeport, and from New Gulf and Boling to Galveston, Texas, and from these ports coastwise by ocean vessel. In the years 1934-38 the movement of sulfur by water up the Mississippi River above St. Louis and up the Ohio averaged 64,000 long tons. Of this amount, 27,700 long tons went up the Ohio; and 36,300 long tons proceeded further up the Mississippi. Of the latter, 35,100 passed into the Illinois Waterway. The movement as far as Chicago can be traced in the years 1934 (20,401 long tons), 1935 (25,541 long tons), and 1938 (8,937 long tons).¹⁰

During the years 1934-38, the New York State Barge Canal carried in bound from New York City an average of 183,448 long tons of sulfur. Sulfur is sometimes shipped inland from New York by rail when the rail rate drops slightly below the barge rates. Though sulfur is known to move over the present St. Lawrence system into the Great Lakes, the volume is not determinable.

Thus, excluding the St. Lawrence traffic, an average of over 247,000 long tons moved by water into the Great Lakes area and territory immediately adjoining it during the years 1934-38. This compares closely with our estimate that the consumption of the region is 274,000 long tons, and indicates that sulfur is now shipped into the area almost entirely by water or combination water with a short rail haul.

Exports to Ontario seem to move mainly by ocean to Montreal and thence by rail to points in eastern Ontario and by river and lake vessel to the head of the Lakes.

Apparently the all-rail rate needs to be within only a few cents per long ton of the rail-ocean-barge rate for the traffic destined for the Great Lakes area to move by rail. Nevertheless, it may be said that factors other than rates play a less important part in the choice of routes for sulfur than for many another commodity. One producer estimates that a difference of approximately 75 cents per long ton would cause a shift of his traffic to the St. Lawrence Seaway.

Because fertilizer sales are made chiefly in the spring, there is a lull in consumption of sulfur for superphosphate manufacturing in the summer and early

¹⁰ Annual Report of the Chief of Engineers, U. S. Army, *Commercial Statistics of Water-borne Commerce of the United States*, pt. II, 1934, 1935, and 1938.

fall. In general, however, consumers of sulfur operate on a fairly even 12-month basis and sulfur is ideally adapted, by its very physical and chemical qualities as well as by its marketing channels and practices, to storage in large quantities at the point of consumption. Therefore, if the savings for transportation are great enough, it is not too rash to say that all the sulfur consumed in the tributary area may be moved via the Seaway during the season of open navigation, to be stored until used.

Table K-5 gives the indicated unit savings and table K-6 the estimated total savings upon the amount of sulfur estimated to be consumed in the tributary area. The savings indicated there are on the basis of feasible rates via the St. Lawrence of 26 cents per 100 pounds.

It is composed of the rail rate from Boling to Galveston (7 cents), plus the ocean rate to Montreal (15½ cents), plus a 3¼-cent differential. The producing centers of sulfur in Texas are grouped closely together in the counties of Brazoria, Wharton and Fort Bend. In 1938 Boling Dome was the largest of the producing operations.¹¹ Galveston is the most important shipping port. For this reason the rail rate from Boling to Galveston was taken as typical of the average. The present all-rail rate from Texas producing points to the representative consuming points are shown for comparison in table K-5. However, in reaching an estimate of savings only the combination rate, rail-ocean-berge or rail-ocean-berge-rail, was used. The combination rate in all cases was cheaper than the all-rail except for Milwaukee, which has an all-rail rate of 9 cents and a combination rate of 10 cents. Thus to Chicago the proposed Seaway rate is 26 cents, the all-rail rate 30 cents, the combination via the Mississippi barge system 29 cents and the present St. Lawrence rate 30 cents. Compared with the combination rate via the Mississippi, the Seaway rate offers, then, a differential of 3 cents. These indicated savings amount on the average to about 5 cents per 100 pounds, or \$1.58 per long ton.

On this basis, indicated savings on the annual tonnage of 306,000 short tons would be slightly over \$317,000. If only a season of 7 months is considered, the indicated savings would be about \$185,000.

In the calculations of tables K-5 and K-6, for the sake of simplicity usually one point was taken as representative of the State and the savings were calculated as if all the tonnage moved to that one point. The points were chosen as being the greatest concentration in the State of the sulfur consuming industries, on the basis of scanty information. They are, for the most part, on the lake shore, which location, of course, increases the indicated savings, but as a whole these industries tend to have a large concentration along the Lakes so that such an assumption seems more nearly realistic than taking an interior point. In the case of Michigan, Detroit was balanced by an interior point, Midland, which was known specifically to have consumed a fair quantity of sulfur. For Ohio, it was difficult to find a single representative point, but the three points taken—Cleveland, Akron and Cincinnati—balanced each other fairly well as far as distance from the Lakes is concerned. In those cases where more than one representative point for a State was taken, the total tonnage for the State was divided equally among the points.

The sulfur shipped into the Great Lakes area is assumed to have come entirely from Texas for two reasons: First, Texas has in the past produced 99 percent of the country's total production and of late years has been producing 85 percent; secondly, the two largest companies indicated that their shipments into the area are from Texas alone.

Although consumption of American sulfur in Ontario has been estimated at 51,000 long tons, because of the lack of data on rates no estimate is made of savings

¹¹ *Minerals Yearbook* 1939, pp. 1243 and 1247.

in transportation costs. Any savings which might be realized on direct shipments to Canadian points of consumption should be added to the indicated savings on sulfur shipped to American points. If this saving is no more than the saving per ton on shipments to American points in the tributary area (\$1.58 per long ton) then the saving on exports to Canada may be as much as \$34,499 on the basis of 7 months shipments and \$59,141 if 12 months supply is shipped in during the open season of navigation.

TABLE K-1

Estimated world production of native sulfur

	Thousands of long tons			Thousands of long tons	
	1909	1938		1909	1938
United States.....	275	2,395	Other countries.....	9	260
Italy.....	430	370			
Japan.....	36	175	Total.....	750	3,200

TABLE K-2

Average consumption of sulfur in the United States by industries, 1934-38

Industry	Thousands of long tons	Percent of total ¹	Industry	Thousands of long tons	Percent of total ¹
Chemicals.....	590	44.25	Paint and varnish.....	44	3.30
Fertilizer.....	277	20.82	Food products.....	5	.36
Pulp and paper.....	223	16.75	Miscellaneous.....	67	5.04
Explosives.....	51	3.84			
Dyes and coal-tar products.....	42	3.12	Total.....	1,333	100.00
Rubber.....	34	2.52			

¹ The percentages are based upon the unrounded figures and therefore differ by one- to four-hundredths, from percents calculated upon the accompanying rounded figures.

SOURCE: Compiled from data in *Minerals Yearbook*, 1939, p. 1245.

TABLE K-3

Estimated percentage of the sulfur-consuming industries in the tributary area, 1937

[Percent]

Industry	Basis of allocation	Michigan	New York ¹	Illinois	Wisconsin	Ohio	Total for tributary area
Chemicals.....	Production of sulfuric acid industry, quantity, 1929 ¹ .	2.50	1.15	9.45	0.40	7.31	20.81
Fertilizer.....	Consumption of raw materials.	1.29	1.87	2.42	.76	6.10	12.44
Pulp and paper ²	do.....	8.50	5.84	2.42	10.73	6.64	34.13
Explosives ³	do.....			7.69			7.69
Dyes and coal-tar products ⁴	do.....		3.24	.81			4.05
Rubber ⁵	Rubber consumed.....		.89	1.38		45.83	48.10
Paints and varnish ⁶	Consumption of raw materials.	8.76	5.79	15.22	2.54	9.73	42.04

¹ For New York, only one-half the total figures for the State were taken.

² Distribution of production for 1929 was used, as data for 1937 showed no break-down by States. Michigan, New York, and Wisconsin percentages are estimates, the production figure for these States being grouped together.

³ Includes pulp and paper but not converted paper products.

⁴ Does not include ammunition or fireworks.

⁵ Tanning materials, natural dyestuffs, mordants, and assistants, and sizes.

⁶ Covers 2 years, 1937 and 1938.

⁷ Paints, pigments, and varnishes.

SOURCE: Computed from data of *Census of Manufactures*, 1937, for all industry groups, except chemicals.

TABLE K-4

Estimated consumption of sulfur within the tributary area, by industries and by States

[Long tons]

Consuming industry	Michigan	New York †	Illinois	Wisconsin	Ohio	Total sulfur consumed in tributary area	Total sulfur consumed in United States, 1934-38 average ‡
Chemicals.....	14,740	6,780	55,717	2,358	43,100	122,695	589,600
Fertilizer.....	3,578	5,187	6,713	2,108	16,922	34,508	277,400
Pulp and paper.....	18,972	13,035	5,401	23,949	14,820	76,177	223,200
Explosives.....			3,938			3,938	51,200
Dyes and coal tar.....		1,348	337			1,685	41,600
Rubber.....		299	464		15,399	16,162	33,600
Paints and varnishes.....	3,854	2,548	6,697	1,118	4,281	18,498	44,000
Total.....	41,144	29,197	79,267	29,533	94,522	273,663	‡ 1,332,600
Total, 100-pound units...	921,626	654,013	1,775,581	661,539	2,117,293	6,130,051	29,850,240

† Arbitrarily one-half New York's sulfur-consuming industries were assumed to be within the tributary area.

‡ Based on table: *Sulfur consumed in the United States, 1934-38, by uses, in long tons.* Department of the Interior, *Minerals Yearbook, 1939*, p. 1245.

§ Includes 5,000 long tons of food products and 67,000 long tons of miscellaneous products.

NOTE.—For State percentage applied to the United States total sulfur consumed, 1934-38 average, in each consuming industry, see table K-3.

TABLE K-5

Indicated differential on cost of transportation of sulfur transported via the St. Lawrence Seaway

[Cents per 100 pounds]

State	Representative point	Actual rates, all-rail direct or total water and rail, via New York, Montreal, or New Orleans	Feasible rates via the St. Lawrence Waterway on basis of present ocean-rail rate to Montreal, plus 3½ cents	Indicated differential
Michigan.....	Detroit.....	‡ 41	‡ 26	15
	do.....	‡ 34	‡ 26	8
	Midland.....	‡ 50	‡ 29	21
New York.....	do.....	‡ 37	‡ 29	8
	Buffalo.....	‡ 57	‡ 26	31
	do.....	‡ 32	‡ 26	6
Illinois.....	Chicago.....	‡ 30	‡ 26	4
	do.....	‡ 29	‡ 26	3
	do.....	‡ 30	‡ 26	4
Wisconsin.....	Milwaukee.....	‡ 35	‡ 26	9
	do.....	‡ 36	‡ 26	10
	Cleveland.....	‡ 41	‡ 26	15
Ohio.....	do.....	‡ 32	‡ 26	6
	Akron.....	‡ 53	‡ 38	15
	do.....	‡ 44	‡ 38	6
	Cincinnati.....	‡ 45	‡ 49	

† All rail.

‡ Rail to Gulf port, ocean to New York, barge inland.

§ Includes rail haul from Bay City.

¶ Rail to Gulf port, ocean to New York, barge inland, plus rail from lake port.

‡ Rail to Gulf, ocean to New Orleans, inland by Mississippi River.

§ All water via St. Lawrence River.

¶ Includes rail from Cleveland.

‡ Cincinnati left out because of charter sulfur rate via Mississippi River, which was not available but assumed to be less than all rail.

§ Includes rail from Toledo.

TABLE K-6

Estimated savings on crude sulfur shipped via the St. Lawrence Seaway

State	Representative points	Estimated available traffic		Indicated differential ¹	Estimated savings	
		Total for State	Total for State divided among representative points		On basis of 12-month tonnage	On basis of 7-month tonnage ²
		<i>Units of 100 lb.</i>	<i>Units of 100 lb.</i>	<i>Cents per 100 lb.</i>		
Michigan.....	{ Detroit.....	921,626	460,813	8	\$36,865	\$21,505
	{ Midland.....		460,813	8	36,865	21,505
New York.....	{ Buffalo.....	654,013	654,013	6	39,241	22,891
Illinois.....	{ Chicago.....	1,775,581	1,775,581	3	53,267	31,701
Wisconsin.....	{ Milwaukee.....	661,539	661,539	10	66,154	38,590
Ohio.....	{ Cleveland.....	2,117,292	705,764	6	42,346	24,702
	{ Akron.....		705,764	6	42,346	24,702
	{ Cincinnati.....		705,764	6	42,346	24,702
Total.....		6,130,051	6,130,051		317,084	184,966

¹ Based on comparison of rates via the proposed St. Lawrence Waterway with rates via combination rail to Gulf, ocean vessel to New York or New Orleans, and barge inland to Great Lakes.

² 7/12 or 0.58333 applied as seasonal factor to figures on 12-month basis.

Appendix L

VEGETABLE FATS AND OILS AND VEGETABLE OIL SEEDS

Section 1

UNITED STATES IMPORTS OF VEGETABLE FATS AND OILS

An extensive study of the individual vegetable oils and fats and the seeds from which they are derived would awaken, probably more than any other study, a sense of the integration of world commerce. Tung oil, derived from the Chinese tung tree, comes to this country to be used in the manufacture of varnishes, enamels, and floor coverings. Olive oil from Italy, Spain, France, and Greece, is used on salads, in cooking and in packing food products. From western Africa and the Netherlands Indies, comes palm oil to be used in the making of vegetable shortenings, soaps, and to play an important role in the tin plate industry. Sesame comes primarily from China or India; the seed is transported first to the Netherlands, Denmark and Belgium, where it is ground, and then the oil comes to our shores to be used in lard compounds, vegetable shortenings, and salad oils.

Despite the fact that the United States produced from domestic materials for the years 1928-37 an average of 1,891 million pounds of vegetable oils (table L-1), there were imported during the same period an average of over 1 billion pounds of vegetable oils. Some of the oils imported into the United States are of seeds not produced at all in this country, such as perilla and castor oils. Others are of seeds produced in small quantities at costs and qualities that cannot compete with those of foreign sources. Still others are generally produced in quantities insufficient for the domestic demand because either the oils are produced only as a byproduct, or because more profitable uses for the raw material are available.

The production of cottonseed oil, for example, is limited by the production of cotton. Corn oil is a byproduct of the manufacture of starch, syrup, and sugar. The production of peanut oil is limited because the peanut producers have a more profitable market with the manufacturers of confectionery.

Some of the oils have special usages in which substitution is difficult. In other cases substitution is feasible only by other imported oils. For example coconut, palm-kernel and barbassu oils, which enter into the manufacture of soap and foods, can be substituted if need be, one for the other.

Table L-2 shows the average imports for the years 1935-39 by kinds of oils. In that period, coconut oil imports amounted to 343 million pounds, palm oil imports to 321 million pounds, each roughly 25 percent of the total imports for the period. Cottonseed oil, crude and refined, was imported to the amount of 119 million pounds, or about 9 percent of the total imports.

Table L-3 presents imports of vegetable oils from the Far East, Europe, Africa, and Brazil. The average imports from the Far East for the years 1928-37 were

670 million pounds. Of these, the largest portion—324 million pounds, or 29.8 percent of total United States imports came from the Philippines.¹ The Netherlands Indies and China contributed 135 million pounds each, or 12.4 percent of the United States total. Japan accounted for 56 million pounds, or 5.2 percent. From Europe the United States received about one-third as much oil as from the Orient; namely, 228 million pounds. The largest European sources were Italy, with 63 million pounds; the Netherlands, 43 million pounds; and Spain, 35 million pounds. Africa contributed 112 million pounds, of which the greatest part came from western countries such as the Belgian Congo and Nigeria.

Imports by customs districts as an annual average, 1928-37, are present in table L-4. In the years 1928-37, the average imports of vegetable oils received at New York amounted to about 54 percent of the United States total. Boston, the second largest of the Atlantic ports in this respect, received only about 10 percent and Philadelphia less than half as much. New Orleans and San Francisco received, respectively, 12.5 percent and 9.3 percent.

Section 2

CONSUMPTION OF VEGETABLE OILS IN THE TRIBUTARY AREA

Transportation savings on the potential tonnage of vegetable fats and oils via the proposed St. Lawrence Seaway would depend upon the consumption of the area and the relation of the proposed rates via the Seaway to present rates along routes now used. To determine the consumption of vegetable oils and fats within the area, the consumption of imported fats and oils to the various consuming industries must first be allocated. The proportion apportioned to each industry can then be allotted to the respective States.

In tables L-5 and L-6 the first of these steps is carried out. Table L-5 gives the average annual factory consumption during the years 1935-39 of vegetable fats and oils by classes of products, both for the total and for the total excluding corn oil, cottonseed oil, soybean oil, and linseed oil, which are largely produced domestically. The respective percentages consumed in the manufacture of each class of product are also given. Table L-6 applies the percentage obtained in table L-5 to the average imports of vegetable oils during the period 1928-37. The resulting figure for each class of product is the estimated consumption of imported vegetable fats and oils in the manufacture of that product. Corn, cottonseed, soybean, and linseed oils were excluded in obtaining the percentage ratios of consumption because, although these oils are imported, they are produced in great quantities from domestic seeds, and including them in figures of total United States consumption would tend to give too much weight to their importance among the imported vegetable oils. The oils that remain, then, are those which are mainly imported. They include peanut, coconut, olive (including olive foots), palm-kernel, palm, barbasu, rapeseed, linseed, tung, perilla, castor, sesame, and some minor oils. On this basis, of the total average annual imports of vegetable oils in the years 1928-37, shortening is estimated to have consumed 20 percent, or 221 million pounds; soap, 38 percent, or 415 million pounds; paints and varnishes, 10.4 percent, or 113 million pounds; and oleo-margarine, 9.5 percent, or 104 million pounds.

Table L-7 presents the basis upon which each consuming industry's share of the imported oils is allotted to the respective States in the tributary area. Since there are no figures on total consumption of vegetable oils by States or on the

¹ The figures for the individual countries given in this paragraph were compiled from the Department of Commerce, *Foreign Commerce and Navigation of the United States, 1919-38*.

consumption by each industry by States, we have resorted to other methods of apportionment, derived from data in the *Census of Manufactures*. In accordance with the policy of the Bureau of Census not to issue any figures which might disclose the operations of any company, the published data for none of these industries is complete, either for value of production, number of wage earners, or cost of materials. In each case that basis of allocation was used which struck the most satisfactory balance between recency and completeness. For oleomargarine, production in pounds for the years 1932-38 was available. Shortening, however, offered no break-down by States except Census figures covering 1929 production in pounds. Soap and paint and varnish had data covering the wage earners by States for 1935 and 1937, and the average of those 2 years was used as the basis of allocation. For printing inks, cost of materials for the same years was used. No data are available for the allocation of linoleum and oilcloth, or of "other edible products," the miscellaneous products and loss. The location of plants, however, indicates that the linoleum and oilcloth industry is concentrated on the Atlantic coast.

This method of estimating consumption in the tributary area is, of course, very rough. It is, however, the best method available. It should be noted that an estimate based upon this method is very likely to err on the side of understatement. There is no allocation possible for any of the States for the item "Other edible products," which factories are estimated to have consumed over 85 million pounds of imported vegetable fats and oils, see table L-6, or for "Loss, including oils from foots," in which consumption was estimated at 64 million pounds, or "Miscellaneous products," with an estimated consumption of 67 million pounds. The total estimated consumption of these three groups of industries is 216 million pounds, or 20 percent of total estimated consumption of imported vegetable fats and oils. Similarly, understatement of the consumption of the tributary area is increased by the fact that in the census data, for each of the industries certain States of the Great Lakes area were grouped in "All other." The grouping of States in "All other" by the census does not necessarily indicate that the States thus grouped are less important than the States shown separately. All States are shown separately by the census except where there is danger that the figures might disclose the operations of an individual concern. It often happens, then, that an important producing State is thrown in with "All other States" merely because most of its production is by one or two very large companies.

Applying the percentages of table L-7 to the total estimated consumption of imported vegetable fats and oils for each of the consuming industries, as in table L-8, the estimated consumption of imported vegetable fats and oils for each State is obtained. Thus, since Illinois in 1929 produced 10.7 percent of the shortening, it was assumed that it consumed the same percentage of the imported vegetable fats and oils consumed by the shortening industry, or 23,681,000 pounds.¹ The total consumption of imported vegetable fats and oils in Illinois for the specified consuming industries is, in this manner, estimated at 125,000,000 pounds. In Ohio the total consumption of imported vegetable fats and oils for the same period is estimated at 95,192,000 pounds; in Indiana, at 48,093,000 pounds. Total consumption of imported vegetable oils and fats for the tributary area for the five specified industries in table L-8 is thus estimated at 390,848,000 pounds.

In the years 1936-38 the imports of vegetable fats and oils during the months May through November amounted to 57 percent of the total. Applying this percentage to the estimated annual consumption of the States in the tributary area, the estimated tonnage potential to the St. Lawrence Waterway would be,

¹ Table L-6, $221,319,000 \times 0.107$ (from table 7) = 23,681,000 pounds.

for Illinois, 71,000,000 pounds; for Ohio, 54,000,000 pounds; for Indiana 27,000,000 pounds; and the total for the tributary area, 222,000,000 pounds, or 111,000 short tons. The figures for the tributary area include the estimated consumption of New York and Pennsylvania. Only part of these States are tributary to the Seaway. If the estimated consumption of New York and Pennsylvania is eliminated, the total consumption of vegetable oils and fats for the tributary area remains 170,000,000 pounds or 85,000 short tons.

Section 3

ESTIMATED POTENTIAL SAVINGS VIA ST. LAWRENCE

Vegetable oils are shipped in drums, but mostly as ballast in the ballast tanks. If oil or some other liquid cargo is not available, water must be used. This practice results in low rates. The ocean freight rates naturally vary according to the country of origin. From Japan to United States ports and Canada, the rates in effect as of August 15, 1939, were \$14 per short ton. From the Philippines, rates in effect as of the same date were \$10.72 per short ton; from Holland, the United Kingdom and France, \$6.35; and from Germany, \$6.80. If it is assumed that the rates into the Great Lakes ports via the St. Lawrence Seaway would be the same as the rates to Montreal and New York, any differential for or against the Seaway can be obtained by a comparison of the inland rate to the point of destination from the seaboard port of entry and the rail rate from the nearest lake port to the same point.

For shipments from Brazil and the Far East the ship operator may require additional revenue. If a reasonable surcharge of 10 cents per 100 pounds or \$2 per short ton is given to the ocean rate to North Atlantic ports on shipments from those areas, the result will be the same as reducing the unit savings by the same amount.

Vegetable oils generally move inland from the ports by rail. New York is the most important port of entry on the Atlantic seaboard. Rate comparisons may be based on existing rail rates from New York and New Orleans.

Table L-9 presents estimated transportation savings on imported vegetable fats and oils via the St. Lawrence Seaway on the first assumption. For each State one city was taken as a representative point, except for Ohio. Because no data is available as to the concentration of the vegetable oil consuming industries by cities or by industrial areas, these points were chosen on the basis of a study of the distribution of the large firms in the tributary area States, as shown in Thomas' Register of American Manufacturers.¹ In all the States except Ohio, concentration was quite obvious. In Ohio, Cincinnati and Cleveland seemed equally important. On this basis, therefore, the estimated consumption for Ohio was divided between these two cities. For Indianapolis, Des Moines, and Cincinnati the present rates from New Orleans were used; for Detroit and Cleveland the rates from New York were used. To Chicago, Minneapolis, and Milwaukee the rates from New Orleans are lower than the rates from New York. Considering the dominant position of New York as a port of entry, it is reasonable to expect that a part of the shipments to these three points are from New York. Therefore on the assumption that part of the shipments come from New York and part from New Orleans, the present rates shown in table L-9 for Chicago, Minneapolis, and Milwaukee are about the midpoint between the rates from New Orleans and the rates from New York.

¹ Thomas' Register of American Manufacturers, 30th edition, 1940, Thomas Publishing Co., New York.

Comparing the present rail rate from the seaboard as thus determined with the rail rate from the nearest lake port to the point of destination, estimated savings appear for shipments from points other than Brazil and the Far East (table L-9). They range from 8 cents per 100 pounds on shipments to Indianapolis to 40.5 cents per 100 pounds on shipments to Chicago and Milwaukee. If a surcharge of 10 cents per 100 pounds is added to the ocean rate from Brazil and from the Far East, the savings per 100 pounds on shipments from those countries can be calculated by reducing the unit savings obtained for shipments from other countries by 10 cents. Thus from Brazil and from the Far East the savings range from 13 cents per 100 pounds on shipments to Des Moines, Iowa, to 30.5 on shipments to Chicago or Milwaukee. On this basis, on shipments to Indianapolis and Cincinnati from Brazil and the Far East no savings appear feasible.

Applying these savings to the in-season tonnage already estimated, the possible savings on vegetable oils are obtained as in table L-10. For the tributary area as a whole they are \$387,000, for Illinois \$244,000 and for Ohio \$90,000. These calculations do not include savings that might accrue to Nebraska or to those parts of New York and Pennsylvania that could benefit from the proposed St. Lawrence development.

In this survey of the potential tonnage of vegetable oils and oil seeds we have made no effort to calculate the tonnage and savings that might take place on the domestic movement of cottonseed oil. There is, however, a possibility that some movement of the commodity may take place. Following the general procedure here adopted there is indicated an estimated consumption of cottonseed in the tributary area of 203,685,000 pounds annually, or 118,137,000 pounds during the open season of navigation. Illinois accounts for 151,735,000 pounds annually, or 88,000,000 pounds during the open season of navigation. Production of cottonseed oil is well distributed throughout the Southeastern and Southwestern States and within each of the producing States. The States of Texas, North Carolina, South Carolina, and Georgia together, in 1937, produced according to value of products 42.2 percent of the national total of cottonseed oil, cake and meal. Texas alone produced 21.6 percent of the total in the same year. Other important producing States are Mississippi, Arkansas, Alabama, Louisiana, and Tennessee. Within each State production centers are so well scattered that it would be very difficult to make comparison of rates and an estimate of the exact movement. But certainly points close to the Coast in the State of Texas and the South Atlantic States are in a position to benefit from a possible savings in transportation costs, to Great Lakes ports. This has not been calculated because of inherent difficulties of analysis.

Section 4

POTENTIAL TRAFFIC AND SAVINGS IN IMPORTED OIL SEEDS

In addition to the vegetable oils and fats imported as such, the United States takes from other countries considerable amounts of seeds from which oils are derived. In 1937 the imports of oil seeds attained a figure of 2,425,000,000 pounds, which surpassed even the 1929 figure of 2,161,000,000 pounds. The annual average over the period 1928-37 was 1,698,000,000 pounds. Table L-11 gives the imports of oil seeds by groups of countries. The 1928-37 annual average of imports from Argentina, Brazil, and Uruguay together amounted to 896,000,000 pounds, or about 53 percent of the United States total. Argentina alone accounted for 825,000,000 pounds, or over 48 percent. The Far East accounted on an annual average during the same period for 709,000,000 pounds, or about 42 percent of the United States total imports of oil seeds. Among the Far Eastern countries, the Philippine Islands were particularly important, sending us in these years annually

an average of 353,500,000 pounds, or over 21 percent. Other important sources were British India, with annual average imports for the period 1928-37 of 118,000,000 pounds or about 7 percent, and China, which supplied an average of 62,000,000 pounds, or 3.6 percent. Canada also shipped annually an average of 43,000,000 pounds over this period and the Netherlands, 7,000,000 pounds.⁴

The largest quantity of the individual seeds imported into the United States for the years 1934-38 was flaxseed, which accounted for an average in that period of 1,013,000,000 pounds, or 56 percent of total imports. Almost all of this flaxseed comes from Argentina. Copra imports over the period 1934-38 averaged 453,524,000 pounds, or just over 25 percent of all oil seeds imported. Copra is the dried broken meat of the cocoanut, and is the source of cocoanut oil and of the joint product cocoanut cake or meat. The United States imports of copra come almost entirely from the Philippine Islands, though the Netherlands Indies is the most important world source. Castor beans were imported, to the amount of 119,000,000 pounds annually during the same period, or approximately 7 percent of the total United States imports of oil seeds. Castor beans come mostly from Brazil and smaller proportions from British India and Kwantung. Besides its use as a medicine, castor oil has technical uses, principally in the textile and leather industries and for lubricating high-speed motors and engines, for which purpose it is considered strategic material. Table L-12 shows United States imports of principal oil seeds by kinds, averaged for the period 1928-37.

An estimate of the potential traffic in oil seeds over the proposed St. Lawrence Seaway can be made based upon the estimated consumption of the area and a comparison of the rates via the present modes of transportation with those estimated as feasible via the St. Lawrence. To obtain an estimate of the consumption in the tributary area we may apply the percentages of materials consumed in the "Oils not elsewhere classified" industry. The "Oils not elsewhere classified" industry embraces establishments engaged primarily in the production of both enamel oils and crude oils. It does not include the production of cottonseed, linseed, and essential oils, nor does it include lard and the native fats and oleos produced by meat-packing concerns primarily engaged in the production of meats. In the absence of data strictly limited to imported vegetable seeds, it should serve as an indication of the distribution of the vegetable oils crushing industry.

In order to arrive at a rough estimate the 1928-37 average imports of oil seeds have been distributed (less imports of flaxseed), according to the percentage distribution of the materials consumed in the "oils not elsewhere classified" industry. Flaxseed is omitted because the areas west of the Great Lakes, particularly Minnesota, North Dakota, and South Dakota, are large producers of flaxseed and supply most of the requirements of the tributary area. Indeed the imports of flaxseed into the North Atlantic coastal regions seem to be primarily to fill deficits of domestic flaxseed production in certain years. It appears that the great increase in production of flaxseed in these States is destined to preclude future imports into the North Atlantic coastal areas and perhaps sharply cut down flaxseed imports generally.

Serious incompleteness of data is encountered in the method followed in allocating the consumption of imported oilseeds to the States of the Great Lakes tributary area. First, the census data are not available for Ohio, Indiana, Wisconsin, and Michigan despite the fact that there are two establishments in Indiana, one in Ohio, and three in both Wisconsin and Michigan. Second, there is no way of apportioning the consumption of New York and Pennsylvania, which together

⁴ Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37.*

are estimated to have consumed 10.5 percent of the United States total, or 81,000,000 pounds. Only the potential tonnage that might arise from the consumption of Illinois and Iowa can be estimated.

The 1928-37 annual average of United States imports of oil seeds, except flaxseed, from countries other than Canada, was 768,581,000 pounds. Illinois, which in 1937 consumed 13.0 percent of the value of materials consumed in the "Oils, not elsewhere classified industry", is estimated to have consumed annually 99,916,000 pounds of imported oil seeds. Likewise, Iowa is estimated to have consumed 2.4 percent or 18,446,000 pounds.

A study of the imports by months of oil seeds shows that if flaxseeds are excluded, about 53 percent entered in the open months of navigation over the St. Lawrence. Modifying the tonnage for Illinois and Iowa by this percentage, there results an estimate of the tonnage available for shipment over the St. Lawrence of 52,955,000 pounds for Illinois and 9,776,000 pounds for Iowa.

The ocean rates to the North Atlantic ports for the year 1939 vary for different kinds of seeds. From Japan, they range from 55 cents per 100 pounds for castor beans, flaxseed, sesame, rapeseed, and hempseed, to 70 cents per 100 pounds for copra. From the Philippine Islands the rate on copra is 49 cents per 100 pounds. From the Argentine castor beans were taken at 36 and rapeseed at 40 cents per 100 pounds. From Brazil the rate on castor beans is 36 cents. From the Netherlands the rates range from 33 cents per 100 pounds on rapeseed and poppy seed to 65 cents per 100 pounds on castor beans.

About 60 percent of the cost of materials consumed in Illinois by the "Oils not elsewhere classified" industry in 1937, was consumed in the Chicago Industrial Area. For the purpose of calculating savings Chicago then may be taken as a typical point for Illinois. For Iowa, Des Moines may be used. The import rail rate from New York to Chicago for copra is 45 cents per 100 pounds and for castor beans 57 cents per 100 pounds. The import rail rates on copra to Des Moines are 74 cents per 100 pounds from New York and 40 cents from Chicago, which gives a differential of 34 cents per 100 pounds. The import rail rates on castor beans to Des Moines are 84 cents per 100 pounds, and from Chicago 45 cents per 100 pounds, leaving a differential of 39 cents per 100 pounds. Copra beans and castor beans are the two most important oil seeds imported into this country. For the purposes of this survey a differential in favor of the Seaway may be assumed at a mid-point between the differential for each of these seeds. For shipments to Chicago we would then have an average of about 51 cents per 100 pounds and for shipments to Des Moines, 36 cents per 100 pounds. Applying these savings to the in-season tonnage estimated respectively for Illinois and Iowa, savings are estimated to amount to \$270,000 for Illinois, \$35,000 for Iowa, and a total for the two of \$305,000.

These savings are based upon the hypothesis that the ocean rate would be the same to the Great Lakes as to the North Atlantic ports. Most of the shipments originate in the Far East and such a condition of comparative rates may well come to exist. However, in order to allow for greater revenue for the ship operator on his longer run, a surcharge of 10 cents per 100 pounds or \$2 per short ton may be added to the ocean rate. This surcharge would have the effect of reducing the unit savings by 10 cents per 100 pounds. Taking into account such a reduction, the estimated savings would be \$217,000 on the shipments to Chicago, and \$25,000 on the shipments to Des Moines. The total savings for States of Illinois and Iowa then, would be \$242,000.

The above savings are estimated on oil seeds, exclusive of flaxseed. They furthermore do not include those States for which census data for estimating consumption were unavailable, namely Ohio, Indiana, Wisconsin, and Michigan,

or for which it was impossible to determine what portion of the State's consumption could be considered tributary to the St. Lawrence, namely New York and Pennsylvania.

In summary then, following are the potential tonnage and estimated savings on vegetable oils and fats and oil seeds, table L-13.

TABLE L-1
Production and apparent disappearance of vegetable oils, 1928-37

[Millions of pounds]

Year	Production from domestic materials ¹	Apparent disappearance		
		Oils produced from domestic raw materials ²	Oils mainly imported or produced from imported materials ³	Total
1928.....	2,042	2,085	1,488	3,573
1929.....	2,067	2,071	1,819	3,890
1930.....	2,030	2,004	1,602	3,606
1931.....	1,949	1,836	1,402	3,238
1932.....	1,922	1,592	1,249	2,841
1933.....	1,764	1,655	1,386	3,041
1934.....	1,534	1,850	1,476	3,326
1935.....	1,612	(⁴)	(⁴)	3,817
1936.....	1,847	(⁴)	(⁴)	3,957
1937.....	2,148	(⁴)	(⁴)	4,266
Average, 1928-37.....	1,891	(⁴)	(⁴)	3,556

¹ Production of the following oils: Corn, cottonseed, linseed, olive, peanut, and soybean.

² Includes the apparent disappearance of the following oils produced from domestic raw materials: Corn, cottonseed, linseed, olive, peanut, and soybean.

³ Includes the apparent disappearance of the following oils, mainly imported or produced from imported materials: Corn, castor, coconut, hempseed, kapok, linseed, mustard, olive, palm, palm-kernel, peanut oil, perilla, rape, sesame, soybean, sunflower, teaseed, tung, and vegetable tallow.

⁴ Data not available.

SOURCE: Department of Agriculture, *Agricultural Outlook Charts*, 1940, p. 1 (October 1939) *Fats, Oils and Oilseeds*. For "Apparent disappearance," 1927-34, Department of Agriculture, Statistical Bulletin No. 59, *Fats, Oils, and Oleaginous Raw Materials—Production, Prices, Trade, Disappearance in the United States, 1912-1935* (May 1937), tables 6 and 7, pp. 10 and 11. 1935-38, Department of Agriculture, *The Fats and Oils Situation*, July 1939, pp. 12-15.

TABLE L-2
Imports for consumption of vegetable fats and oils, average 1935-39

Kinds of oil	Quantity	Kinds of oil	Quantity
	<i>1,000 pounds</i>		<i>1,000 pounds</i>
Coconut oil.....	342,715	Sunflower seed oil.....	12,388
Palm oil.....	321,044	Soybean oil.....	11,914
Tung oil.....	123,189	Glycerine, crude.....	11,411
Cottonseed oil:		Glycerine, refined.....	2,758
Crude.....	12,992	Palm kernel oil.....	6,285
Refined.....	106,069	Vegetable wax, n. e. s.....	6,112
Perilla oil.....	63,385	Vegetable tallow.....	2,799
Olive oil.....	62,811	Linseed oil.....	713
Peanut oil.....	41,412	Sunflower seed oil, inedible.....	265
Palm kernel oil.....	38,289	Other edible oils.....	21,578
Rapeseed oil.....	28,857	Other inedible olive oils.....	10,681
Olive oil sulphured.....	24,767	Other inedible vegetable oils.....	35,746
Corn oil.....	24,710		
Carnauba wax.....	13,114	Total.....	1,326,034

SOURCE: Department of Commerce, *Animal and Vegetable Fats and Oils*, 1935-39, pp. 20-21.

TABLE L-3

United States imports of vegetable oils, expressed, edible and inedible, 1928-38¹
[Thousands of pounds]

Year	Total	Far East ²	Europe ³	Africa ⁴	Brazil	All other
1928.....	819, 971	449, 613	218, 068	26, 415	6, 068	119, 807
1929.....	1, 156, 946	623, 359	306, 203	176, 010	7, 063	44, 311
1930.....	1, 017, 467	568, 340	227, 732	184, 275	7, 415	29, 704
1931.....	901, 260	522, 164	191, 319	157, 883	7, 389	22, 605
1932.....	741, 189	457, 432	137, 142	96, 497	6, 169	43, 949
1933.....	965, 149	641, 043	160, 676	97, 546	7, 720	58, 164
1934.....	802, 866	565, 786	138, 763	47, 344	8, 014	42, 959
1935.....	1, 472, 776	895, 310	349, 481	104, 644	26, 914	96, 427
1936.....	1, 394, 881	982, 992	215, 286	88, 672	63, 173	54, 768
1937.....	1, 629, 906	996, 295	331, 950	138, 257	63, 983	99, 421
1938.....	1, 067, 426	782, 260	107, 791	41, 097	70, 640	65, 638
Average, 1928-37.....	1, 090, 241	670, 233	227, 662	111, 754	19, 391	61, 201

¹ General imports through 1933, imports for consumption thereafter.

² Includes Philippine Islands, Netherlands Indies, China, Japan and Kwantung.

³ Includes Greece, Italy, Germany, Netherlands, United Kingdom, France and Spain.

⁴ Includes Belgian Congo, Nigeria and Egypt.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-38.*

TABLE L-4

United States imports¹ of expressed vegetable oils, edible and inedible, by principal customs districts, annual average 1928-37

Customs district	Short tons ²	Customs district	Short tons
New York.....	293, 976	San Francisco.....	50, 500
Boston ³	51, 757	Washington.....	9, 897
Philadelphia.....	24, 679	All others.....	41, 035
Baltimore ⁴	4, 989		
New Orleans.....	68, 285	Total United States.....	545, 121

¹ General imports through 1933, imports for consumption thereafter.

² Previous to 1937 all oils listed in gallons were converted into tons by the conversion factor of 7½ pounds to the gallon.

³ Listed as Massachusetts.

⁴ Listed as Maryland.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37.*

TABLE L-5

Factory consumption of primary animal and vegetable fats and oils by classes of products, average, 1935-39

Class of product	Consumption of oils		
	Total amount	Total, excluding corn oil, cottonseed oil, soybean oil, and linseed oil	
	1,000 pounds	1,000 pounds	Percent
Shortening.....	1, 392, 359	265, 613	20. 3
Oleomargarine.....	281, 341	124, 268	9. 5
Other edible products.....	369, 550	101, 782	7. 8
Soap.....	513, 616	498, 138	38. 1
Paint and varnish.....	390, 397	135, 220	10. 4
Linoleum and oilcloth.....	79, 453	19, 027	1. 5
Printing inks.....	21, 108	4, 163	. 3
Miscellaneous products.....	100, 333	80, 664	6. 2
Loss (including oil in foots).....	205, 102	77, 075	5. 9
Total.....	3, 853, 259	1, 305, 940	100. 0

SOURCE: Department of Commerce, *Animal and Vegetable Fats and Oils, Production, Consumption, Imports, Exports and Stock*, p. 26, table 8, quarterly for calendar years 1935-39.

TABLE L-6

Distribution of imported vegetable fats and oils according to usage, 1928-37

Used in production of—	Percent distribution	Amount (thousands of pounds)	Used in production of—	Percent distribution	Amount (thousands of pounds)
Shortening.....	20.3	221,319	Printing inks.....	0.3	3,271
Oleomargarine.....	9.5	103,573	Miscellaneous products.....	6.2	67,595
Other edible products.....	7.8	85,039	Loss (including oil in foats).....	5.9	64,324
Soap.....	38.1	415,381			
Paint and varnish.....	10.4	113,385			
Linoleum and oilcloth.....	1.5	16,364	Total.....	100.0	1,090,241

SOURCE: From table L-4. Percentages based on computations from Department of Commerce, *Animal and Vegetable Fats and Oils, Production, Consumption, Imports, Exports and Stocks*, quarterly for calendar years 1935-39, pp. 26-28 (average 1935-39)

TABLE L-7

Allocation of vegetable fats and oils consumed in tributary area by States

Industry and basis of allocation	Percent of total												
	Illinois	Indiana	Iowa	Michigan	Minnesota	Nebraska	New York	Ohio	Pennsylvania	Wisconsin	Total tributary area	All other States	Total
Shortening (production, 1929).....	10.7	0.1	0.3	(¹)	(¹)	0.6	(¹)	(¹)	(²)	(¹)	11.7	88.3	100.0
Oleomargarine (production, average 1932-38).....	35.1	8.3	---	4.4	0.3	* 1.1	---	19.4	---	---	67.6	32.4	100.0
Soap (wage earners, average 1935 and 1937).....	11.4	8.8	1.5	.1	.3	(¹)	11.8	15.5	4.5	0.2	54.1	45.9	100.0
Paint and varnish (wage earners, average 1935 and 1937).....	15.1	2.4	.1	8.6	.9	.1	12.4	9.3	8.3	2.6	59.8	40.2	100.0
Printing inks (cost of materials, average 1935 and 1937).....	21.2	(¹)	(¹)	5.5	(¹)	---	28.6	5.2	11.7	1.6	73.8	26.2	100.0

¹ Included in "Other States."² Less than 1/2 of 1 percent.³ No production after 1933.SOURCE: Department of Commerce, *Census of Manufactures, 1929, 1933, 1935, 1937.*

TABLE L-8

Estimated consumption of imported vegetable fats and oils in the tributary area

[Thousands of pounds]

State	Consuming industry					Total estimated consumption of the State	
	Shortening	Oleomargarine	Soap	Paints and varnish	Printing inks	Annual	Seasonal, 57 percent
Illinois.....	23,681	36,354	47,353	17,122	693	125,202	71,365
Indiana.....	221	8,597	36,554	2,721	---	48,093	27,413
Iowa.....	664	---	6,231	113	---	7,008	3,094
Michigan.....	---	4,557	415	9,761	180	14,903	8,495
Minnesota.....	---	311	1,246	1,020	---	2,577	1,469
Nebraska.....	1,323	104	---	113	---	1,545	881
New York.....	---	---	49,015	14,060	936	64,011	36,486
Ohio.....	---	20,093	64,384	10,545	170	95,192	54,259
Pennsylvania.....	---	---	18,692	9,411	383	28,486	16,237
Wisconsin.....	---	---	831	2,948	52	3,831	2,184
Total for tributary area.....	25,894	70,015	224,721	67,804	2,414	390,848	222,783
All other States.....	195,425	33,558	190,660	45,581	857	466,081	265,666
Total United States.....	221,319	103,573	415,381	113,385	3,271	856,929	488,449

SOURCE: See table L-6.

TABLE L-9

Indicated unit savings on imported vegetable fats and oils via St. Lawrence Seaway

[Cents per hundred pounds]

Representative city	Rail rate		Indicated differential on basis of—	
	From sea-board	From nearest lake port	Blanketed ocean rate	Surcharge of 10 cents per 100 pounds
Chicago, Ill.....	1 40.5	-----	40.5	30.5
Indianapolis, Ind.....	1 36.0	1 28.0	8.0	-----
Des Moines, Iowa.....	1 53.0	1 30.0	23.0	13.0
Detroit, Mich.....	1 36.5	-----	36.5	26.5
Minneapolis, Minn.....	1 61.5	1 33.0	28.5	18.5
Cincinnati, Ohio.....	1 33.5	1 25.0	8.5	-----
Cleveland, Ohio.....	1 36.5	-----	36.5	26.5
Milwaukee, Wis.....	1 40.5	-----	40.5	30.5

1 Midpoint between 42 cents from New York and 39 cents from New Orleans.

2 From New Orleans.

3 From Chicago.

4 From New York.

5 Midpoint between 65 cents from New York and 58 cents from New Orleans.

6 From Duluth.

7 From Toledo.

TABLE L-10

Estimated transportation savings on available traffic in imported vegetable fats and oils via the St. Lawrence Seaway

Representative city	Estimated tonnage modified by 57 percent seasonal factor			Indicated unit savings		Estimated savings		
	Total	From Far East and Brazil	From other countries	From Far East and Brazil	From other countries	From Far East and Brazil	From other countries	Total
				<i>Cents per 100 pounds</i>	<i>Cents per 100 pounds</i>			
Chicago, Ill.....	1,000 pounds 71,365	1,000 pounds 44,960	1,000 pounds 26,405	30.5	40.5	\$137,128	\$106,940	\$244,068
Indianapolis, Ind.....	27,413	17,270	10,143	-----	8.0	-----	8,114	8,114
Des Moines, Iowa.....	3,994	2,676	1,478	13.0	23.0	3,479	3,399	6,878
Detroit, Mich.....	3,495	5,692	3,143	26.5	36.5	15,083	11,471	26,554
Minneapolis, Minn.....	1,469	925	544	18.5	28.5	1,711	1,550	3,261
Cincinnati, Ohio.....	27,129	17,061	10,038	-----	8.5	-----	8,532	8,532
Cleveland, Ohio.....	27,130	17,062	10,038	26.5	36.5	45,294	36,639	81,933
Milwaukee, Wis.....	2,184	1,376	808	30.5	40.5	4,197	3,272	7,469
Total for tributary area.	169,179	106,583	62,596	-----	-----	206,892	179,917	386,809

TABLE L-11

United States imports¹ of oil seeds by groups of principal countries, 1928-38

[Pounds]

Year	Argentina, Brazil and Uruguay	Far East ²	Canada	Nether- lands	All others	Total
1928	844,499,149	643,649,498	145,938,369	11,883,934	21,777,860	1,667,748,810
1929	1,308,251,988	770,004,724	59,985,097	8,154,743	14,587,698	2,160,984,250
1930	676,658,004	722,491,802	51,541,940	7,804,127	48,389,170	1,505,885,043
1931	758,739,885	677,783,553	68,315,031	8,809,192	55,668,057	1,569,315,718
1932	432,369,795	548,433,110	29,693,469	7,116,457	37,633,869	1,055,236,700
1933	685,736,108	896,795,022	21,931,331	6,374,801	22,768,606	1,633,605,863
1934	531,725,771	760,889,006	19,012,887	4,074,344	47,381,993	1,363,084,001
1935	997,697,162	818,418,913	4,593,112	3,752,114	72,867,915	1,897,329,216
1936	957,318,321	671,893,702	30,626,866	8,121,094	31,354,382	1,699,314,365
1937	1,704,699,674	581,268,034	812,875	5,884,241	72,698,330	2,425,363,154
1938	1,026,287,569	530,939,975	1,946,383	9,430,661	29,012,721	1,597,617,309
Average, 1928-37	895,668,585	709,162,736	43,245,098	7,197,505	42,512,788	1,697,786,712

¹ General imports through 1933; imports for consumption thereafter.² Includes Philippine Islands, China, Kwantung, British India, Netherlands Indies, Japan, British Oceania, French Oceania, British Malaya and Australia.SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-38.*

TABLE L-12

United States imports of oil seeds by types

[Thousands of pounds]

Type	Average 1934-38	Average 1928-37	Type	Average 1934-38	Average 1928-37
Castor beans	118,969	119,915	Rapeseed	16,406	9,723
Copra	453,524	499,513	Poppy seed	7,793	7,017
Flaxseed	1,013,488	1,928,675	All others	85,751	52,851
Sesame seed	60,879	58,300			
Palm nuts and palm nut kernels	39,731	21,793	Total	1,796,542	1,697,787

¹ Conversion factor used: 56 pounds per bushel.SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1937-38.*

TABLE L-13

Summary of potential tonnage and estimated savings on vegetable oils and oil seeds

Item	Potential tonnage	Estimated savings
Vegetable oils and fats	1,000 pounds	
Oil seeds	169,000	\$387,000
	63,000	242,000
Total	232,000	629,000

NOTE.—These figures do not, it must be remembered, include any shipments of fats and oils to western New York and Pennsylvania, nor any shipments of oil seeds to Ohio, Indiana, Wisconsin, and Michigan. Furthermore, no effort has been made to estimate the potential coastwise movement of cottonseed oil.

Appendix M

MACHINERY

INTRODUCTION

Machinery represents a complex segment of industry and to permit a clear discussion from the standpoint of the St. Lawrence Seaway, some logical subdivision must be made.

Machinery can be grouped very broadly into producer goods and consumer goods. This grouping, however, does not correspond to rate classifications on transportation lines. For purposes of this study, therefore, machinery for use by the consumer directly, as well as machinery used in further production have been regrouped into the following broad classes:

(1) *Agricultural machinery*, including tractors, implements of cultivation and harvesting and other farm equipment.

(2) *Industrial machinery*, including such power-generating equipment as electric, steam, and internal-combustion motors and engines; generators, transformers, electric-distribution apparatus; machines used in roadmaking, construction, conveying, dredging, mining, drilling, pumping, refining, metalworking, printing, textile and other industries; and machinery parts, and equipment therefor.

(3) *Business machines*, including such appliances as accounting and calculating machines, duplicating machines, cash registers, typewriters, and many other appliances used in the conduct of business.

(4) *Household equipment*, including such large items as electric refrigerators, washing machines, ironers and dryers, sewing machines, vacuum cleaners, and electric ranges; also such small items as electric fans, grills, toasters, percolators, roasters, curling irons, flatirons, and similar items.

(5) *Miscellaneous machinery*, such as batteries, radios and other signal and communication devices, therapeutic equipment, electrical wiring and fixtures, lightning arrestors, etc.

Section 1

UNITED STATES PRODUCTION AND EXPORTS OF MACHINERY

The machinery industry, not including transportation equipment,¹ in 1937 ranked fifth in a group of 16 industrial classes as to the cost of materials and value of products. It ranked third as to the average number of wage earners and wages paid. In value added by manufacture it ranked first. In 1937 the average number of wage earners employed in the manufacture of machinery was 956,000, or about 11 percent of the total employed in manufacturing industries. These workers were paid a total of \$1,376,000,000 or about 14 percent of the total paid by all manufacturing industry. The materials used in the manufacture of machinery cost \$2,424,000,000, or almost 8 percent of the United States total. The products of this industrial group were valued at \$5,892,000,000² or close to 10 percent of the

¹ Group 13, as defined in the *Census of Manufactures, 1937*, pt. 1, p. 22, table 4.

² *Ibid.* This figure includes the value of machine-shop products and machine-tool accessories which are not considered as machinery in this study; also the value of accessory products of machine industries and miscellaneous items produced by manufacturers not classified as machinery producers.

United States total. The value added by manufacture in the group totaled \$3,467,000,000, or nearly 14 percent of the United States total.

As shown in table M-1, industrial machinery comprises nearly one-half of the value of all machinery produced in the United States. Miscellaneous machinery not otherwise specified accounts for 31 percent of the total. These two leading classes, while revealing an increase in value in 1937 in comparison with 1927, show a decline in proportionate share of the total.

Both agricultural and household machines, while relatively less important classes, have gained in both value and proportionate position. The smallest group, business machinery, shows little change in its relative importance as between 1927 and 1937.

During the industrial expansion of the United States, the center of machinery manufacturing moved west from New England to the States surrounding the Great Lakes. As a result of this migration, today more than 62 percent of all machinery manufactured in this country is produced within an area bounded by Syracuse, Rochester, Buffalo, Pittsburgh, Cincinnati, St. Louis, Des Moines, and Minneapolis.³ From the standpoint of the St. Lawrence Seaway, the machinery industry is therefore particularly significant.

As divided among the several classes of machinery, it will be observed from table M-4 that between 95 and 96 percent of the value of both agricultural and household machinery produced in the United States in 1937 came from factories located in the tributary area. For industrial machinery, the figure was 58 percent; for business machinery, 56 percent; and for miscellaneous classes, 46 percent.

Markets for American machinery are world-wide; concentration varies with each commodity: Business machines go to large centers of population, agricultural machines to crop-producing areas of the world; industrial machinery finds its way to isolated parts of the world to make possible the recovery of natural resources, and to manufacturing areas where machines transform these resources for man's use; consumer goods, such as household equipment, likewise have world-wide distribution, with concentration in countries with comparatively high standards of living.

The value of exports of machinery from the United States during the decade 1927-37 reached a total of more than 617 million dollars for the single year 1929, and dropped as low as 133 million dollars in 1933.⁴ In 1937, the value of total machinery exports reached 480 million dollars. Average exports, alternate years 1927-37, amounted to \$376,350,000.

Industrial machinery is the most important class participating in the export trade. Industrial machinery exports have contributed more than 54 percent of the value of all machinery exports during the past decade, and even during the depression period this class suffered slight diminution in relative importance.

Agricultural machinery in 1937, while in second position among the several machinery classes in the export trade, indicates a decline in relative position. Miscellaneous types of machinery have displayed a growth in relative importance and the same is true of household machinery, although the last named is of minor importance among the export classes. Business machinery, which is also of smaller importance in its participation in the total export machinery trade, exhibits a somewhat erratic picture with a percent varying between 8 and 12 during the past decade.

Export trade provides a substantial share of the market for machinery of each class. Table M-3 indicates that 20 percent of the business machinery produced in the United States was shipped to foreign markets in 1937. Agricultural

³ See table M-4.

⁴ See table M-2.

machinery depended upon foreign buyers for over 13 percent of the market. More than 11 percent of the value of industrial machinery produced in the United States in 1937 was sold abroad. For household and miscellaneous classes of machinery, the share of each is somewhat greater than 5 percent. The average percentage, alternate years 1927-37, of exports to production of the several classes of machinery reveals 25.55 percent of business machinery, 19.21 percent of agricultural, 12.25 percent of industrial, 5.82 for household and 5.06 for the miscellaneous class.

Relative to total domestic production, exports in agricultural machinery in 1937 reveal a decided drop in importance as compared with 1927. Business machinery has likewise declined in this same ratio, while household machinery exhibits an increase in the importance of the export market, as does the miscellaneous class of machinery. Relative exports of industrial machinery remained virtually unchanged.

In terms of participation in the total machinery export trade of the United States in 1937, it will be observed from table M-3 that industrial machinery contributed more than 57 percent of this value; agricultural machinery, over 15 percent; miscellaneous machinery, less than 15 percent; business machinery, nearly 8 percent; and household machinery, less than 5 percent.

Section 2

TOTAL PRODUCTION AND EXPORT OF MACHINERY FROM THE TRIBUTARY AREA

In order to estimate exports of machinery from the tributary area⁵ without undertaking exhaustive inquiries of every establishment within the area, a fairly close approximation is obtained for each class by applying the ratios of exports to production for the United States as given in table M-3 to production in the Great Lakes tributary area shown in table M-4.⁶

Applying these export ratios for 1937 for the United States as a whole to production within the Great Lakes tributary area, it is estimated that in 1937 there was exported agricultural machinery worth \$71,986,000 from the area, industrial machinery worth \$160,353,000, business machinery valued at \$21,071,000, household equipment, \$22,350,000, and miscellaneous machinery, \$32,521,000. Applying the average ratio of exports to production, alternate years 1927-37,⁷ to the estimated 1927-37 average value of production of each class of machinery in the tributary area,⁸ average exports from that area are indicated as follows:

Class of machinery	Average ratio 1927-37, export to production	Estimated value of exports from tributary area
Agricultural	19.21	\$65,050,300
Industrial	12.25	119,672,900
Business	25.55	19,012,670
Household	5.82	14,125,530
Miscellaneous	5.06	25,448,830
Total		243,310,230

⁵ The tributary area is defined as that territory to which machinery may be shipped via the St. Lawrence route at transportation costs the same as, or lower than, via existing routes. The tributary area embraces chief producing points in the states of Ohio, Illinois, Indiana, Michigan, Minnesota, Wisconsin, and western Pennsylvania and New York.

⁶ There are certain items of machinery which are largely produced outside the tributary area, but, these items are not large enough in total value in relation to the total value of all machinery production to distort the result appreciably.

⁷ Table M-3.

⁸ Tables M-1 and M-4.

Machinery, as a class, represents relatively high unit value and therefore, in common with commodities of high value, generally requires rapid transportation to market. A prime reason for speedy shipment is that interest on capital invested in machinery en route to destination may be an important cost factor. Insurance charges in transit are other cost items influencing the means of transportation used.

Not all of the several classes of machinery are affected alike in this regard, but, in general, the time factor is predominant in the transportation of machinery. High-valued machinery can afford high transportation charges, as long as these costs are compensated by savings in interest on investment and insurance charges. In foreign trade, this factor is more significant than in domestic trade, because the wide expanse of ocean spreading between our shores and all foreign markets (except those contiguous to this country) defeats the possibility of speedy transportation. In domestic trade, on the other hand, a wide variety of routes and shipping media are generally available from which may be selected the most expeditious route.

Machinery, moreover, requires protection from the elements and from rough handling. Extra handling of machinery increases the need for more expensive packing to forestall damage in transit. The routing that reduces the cost of packing and the hazards of damage will strongly influence the movement of machinery, and will tend to offset savings in transportation cost, or in time, offered by other routings.

Recognizing these general forces, their influence will be outlined on the marketing of the several classes of machinery into which this analysis is divided. In view of this consideration, and the difficulty of further particularizing the study, only agricultural and industrial machinery are studied here in detail. These two items cover almost 76 percent of total exports.

Section 3

PRODUCTION AND EXPORT OF AGRICULTURAL MACHINERY FROM THE TRIBUTARY AREA

The value of agricultural machinery produced in the Great Lakes tributary area in 1937 is estimated to have been \$539,625,000, or 95 percent of total United States production.⁹

According to a method previously discussed,¹⁰ the value of exports of agricultural machinery from the tributary area in 1937 was \$71,986,000; on the basis of biennial averages 1927-37, exports of agricultural machinery from this area averaged \$65,050,300.¹¹ The principal markets abroad other than Mexico and Canada have been South America, Australia, South Africa, the United Kingdom, and Scandinavia.

For most classes of agricultural implements and machinery, including tractors, New York is the leading port of export, accounting for over 50 percent of exports of certain classes, with New Orleans and, in some instances, Baltimore, also of marked importance. In the case of ploughs, for example, out of an export value in 1937 of \$2,883,000 New York accounted for 55 percent; New Orleans, 18 percent. In combines or reaper-threshers, exported in 1937 to a value of \$2,000,000, New Orleans accounted for 43 percent, New York 27 percent, and Baltimore, 17 percent. In drills and seeders, with a value in excess of \$1,000,000, New York participated to the extent of 45 percent, Baltimore 30 percent, and New Orleans

⁹ Table M-4.

¹⁰ See p. 9.

¹¹ See p. 11.

10 percent. In the customs classification of "other" cultivation implements and parts valued at \$2,750,000, New York handled 48 percent of the exports, New Orleans, 23 percent.¹³

In tractors, New York is the outstanding port of export, the principal types of tracklaying tractors and wheel tractors accounting for nearly 44 percent in 1937, while New Orleans exports accounted for almost 13 percent.

Agricultural machinery exports moving during the open season¹⁴ of navigation constitute slightly less than 66 percent of annual shipments, while tractors exported during the same period account for about 62 percent of a year's total.¹⁴ Altogether, exports of farm equipment from the Great Lakes tributary area during the open season of navigation—May 1 to December 1—was about \$41,150,000 in 1937.¹⁵

In converting export value of machinery into weight units of 100 pounds each, factors were derived from figures given in the Census of Manufactures. The average export value per pound for each product making up the agricultural machinery group, when applied against declared export values, resulted in an estimate of 2,031,266 one-hundred-pound units of tractors and 538,676 one-hundred-pound units of other agricultural machinery exported to countries other than Canada and Mexico during the year 1937. Of these figures 1,246,791 units or 62,339 tons and 323,529 units or 16,176 tons, respectively, or a total of 89,515 tons, came from the Great Lakes area during the period May 1 to December 1, 1937.¹⁶ An average export movement from the tributary area for the period 1927-37, on a weight basis, cannot be determined due to absence of detail as between tractors and other agricultural machinery. These figures do not include packaging.

Section 4

POTENTIAL SAVING ON TRANSPORTATION OF AGRICULTURAL MACHINERY EXPORTED VIA THE ST. LAWRENCE SEAWAY

Aggregate savings will, of course, depend upon the number of units shipped by way of the St. Lawrence, and upon the particular points in the tributary area at which traffic may be diverted to the St. Lawrence. Expressions of opinion from officials of the more important agricultural machinery companies indicate that where time is not a factor, shipments would be routed by way of the St. Lawrence if any savings are shown over present complete costs. It has been determined, moreover, that for agricultural machinery, time is not as great a consideration in competing abroad as it is with other types of machinery. The average increase in time in reaching foreign markets by way of the St. Lawrence is not great enough to present this as a serious obstacle in the way of potential traffic.

With savings varying from zero up to 61 cents per unit as against the cheapest alternative route, via New Orleans, it is estimated from the location of the many companies and the distribution among the several ports of export, that an average minimum saving of 25 cents per 100-pound unit would be conservative. From

¹³ Department of Commerce, *Foreign Commerce and Navigation of the United States*.

¹⁴ May 1 to December 1 for the Great Lakes-St. Lawrence route.

¹⁵ Based on statements of manufacturers and checked against statistics in *Monthly Summary of Foreign Commerce of the United States, 1937*.

¹⁶ Equals estimated annual value of exports from tributary area (p. 12) reduced to open-season movement of total annual exports (64 percent).

¹⁷ Great Lakes proportion of exports: Tractors, 99 percent; other agricultural machinery, 91 percent; open-season shipments, 62 percent for tractors, 63 percent for agricultural machinery other than tractors.

this, aggregate savings to manufacturers of tractors on an in-seasonal movement of 1,246,791 units of 100 pounds would have been in the neighborhood of \$311,698 in 1937 and savings to implement manufacturers on an in-seasonal movement of 323,529 units would have been \$80,882. The total estimated savings amount to \$392,580.

In fact, however, New York is the principal port of shipment for most agricultural implements. Furthermore, most of the agricultural implements produced in the tributary area are produced in Illinois and Wisconsin. In 1937, the value of agricultural machinery produced in Illinois and Wisconsin was over 403 million dollars, or nearly 75.5 percent of the total production of agricultural machinery in the tributary area of 535 million dollars. Hence, the savings on transportation costs from Chicago and Milwaukee would be more representative of the average. From these sources, savings over the St. Lawrence route as compared to shipment by rail to New York would be 45 cents. This rate of savings may therefore be taken as representative, even though savings from certain places such as Duluth may range as high as 96 cents, and from other places, such as Burlington, Iowa, as low as 3 cents a hundredweight. At a unit saving of 45 cents per 100 pounds, or \$9 per short ton, total saving on exports of tractors may amount to \$561,056, and on agricultural machinery, other than tractors, \$145,588—a total of \$706,644. Actual savings, as of 1937, in all probability would have been near this higher figure.

This saving is on the basis of a lake-ocean rate which is identical with the rates from New York and Montreal. However, if we allow an additional charge of \$2 a ton for cargo picked up at Chicago or Milwaukee over Montreal rates, the unit savings would be reduced by that amount and the total savings on exports of agricultural machinery would still be \$550,000.

This estimate is based upon net weight, and does not allow for the weight of packaging, which is usually a substantial item. If no crating is used because of direct delivery to ship's hold, then the saving in cost of packing is an additional advantage.

In arriving at these estimates of potential savings in transportation costs, no allowance has been made for the share of the export movement of agricultural implements that may be retained on present routes. As discussed heretofore, marketing considerations are such that the entire open-season export movement of a given commodity may not flow through the St. Lawrence Seaway en route to foreign markets. However, in the normal course of events, movement between factory and branch can be scheduled, and advantage can be taken of cheaper routes, even though a longer time is spent in transit. There are, of course, periods when agricultural machinery leaves the factories in great quantities, and speed must be paramount in getting it into the hands of farmers in time for spring planting or fall harvesting. It is a quirk peculiar to this industry that such a procedure has developed, for it has obvious drawbacks. The increasing tendency to store products near the markets, rather than at the factory, may influence a change in the present marketing procedure of agricultural implements.

Since it is believed that businessmen generally will follow a course designed to achieve the greatest possible economies, in order to place them in a favorable competitive position, it would appear more than likely that the bulk of these indicated transportation savings would actually be realized. The better and more frequent the ocean services from the Great Lakes ports, the greater would be the possibility of agricultural machinery items moving via that route.

A study of ocean freight rates on a group of commodities such as agricultural machinery involves many a complexity. To begin with, the rates vary, of course, according to the destination and the time. Often they are not published. When

they are published, there may be a distinction between contract rates and non-contract rates. Noncontract rates are for the general shipper, contract rates are for the shipper who enters into some arrangement that gives the ship operator all or a certain portion of the shipper's total business or a minimum quantity of business or that enables the ship operator in some way to keep more level his rate of operation or to plan his operations better. Even when a rate has been chosen as typical for a given moment between certain ports, it still is not directly usable for our purposes, because in this report as much as possible rates are quoted in terms of cents per 100 pounds, whereas most ocean rates on machinery are quoted in terms of dollars per ton weight or measurement. For example, the rate on agricultural implements to United Kingdom in August 1939 was \$6.80 per ton w/m. This applies only to a ton of 40 cubic feet. The basis actually used, either weight or measurement, will be that one which gives the ship operator the greater revenue. Thus, the actual rate in cents per 100 pounds will depend greatly upon the relative compactness of the specific piece of machinery shipped. If the piece is compact, its rate will be determined purely on the basis of its weight. If it is not compact, then its rate will be determined by the space it occupied. Therefore, the rates in this report have all been converted where necessary on the basis of typical density data supplied by the United States Department of Commerce, or contained in the United States Tariff Commission compilation of *Commodity Packaging Data* (December 1937).

In table M-5 are presented typical out-bound ocean rates in effect as of August 15, 1939, from United States North Atlantic ports to the more important export markets of United States agricultural machinery, excepting Soviet Russia. No rates are available for shipments to Russia. It will be observed that the rate per 100 pounds was in all cases higher if based upon space than upon weight. The rate based upon weight, then, has no actual significance, because the ship owner would ask from the shipper the rate based upon space. On unboxed tractors the rates based upon space to the points selected range from 47 cents per 100 pounds to the Union of South Africa, to \$1.37 per hundred pounds on shipments to Hong Kong and Manila. The rate to Australia was 74 cents, and to the River Plate countries 70 cents per 100 pounds. To the United Kingdom the rate was 53 cents and to Scandinavia 63 cents.

If the proposed St. Lawrence Seaway were built it is likely that the rates to such points as Scandinavia and the United Kingdom from the Great Lakes ports would approach the ocean rates in effect from New York and Montreal. Such a close relationship can be expected because of the "blanketing" practice of ocean ratemaking. On the other hand, rates to such areas as South Africa, Australia, China, the Philippines, and Argentina from Great Lakes ports can be expected to be somewhat higher, in order to induce the ship operator to extend a voyage the additional number of days past New York and Montreal into the Great Lakes area. Exactly how much cannot, of course, be determined. If the ocean rate from New York and Montreal were blanketed to Chicago and Milwaukee, the savings would be the equivalent of the difference between the rail rate to New York and the rail rate to the Lakes port from inland points of origin. The savings may first be estimated on this basis and then an allowance made for an increase in the New York or Montreal ocean rates of \$2 per short ton, or 10 cents per 100 pounds. Such a surcharge on the ocean rate will be the equivalent to reducing the feasible unit savings by \$2 per short ton, or 10 cents per 100 pounds.

If the blanketing principle holds, it will be seen from table M-6 that indicated transportation savings on agricultural machinery moving via the St. Lawrence route will range up to 61 cents per 100 pounds, under existing charges applicable on cheapest alternative routes. As compared with railroad rates from originating

points to New York for export, rather than via the cheapest available export route (rail-barge to New Orleans) the indicated transportation savings are as high as 96 cents per 100 pounds.

Section 5

PRODUCTION AND EXPORT OF INDUSTRIAL MACHINERY FROM THE TRIBUTARY AREA

The value of industrial machinery produced in the Great Lakes tributary area in 1937 is estimated to have been \$1,360,073,000 or 58.4 percent of total United States production.¹⁷ According to a method previously discussed,¹⁸ the value of exports of industrial machinery from the tributary area in 1937, based upon 11.79 percent of the total production that is exported, amounted to \$160,353,000. On the basis of biennial averages, 1927-37, this figure would be \$119,672,900.¹⁹

The principal foreign markets for industrial machinery other than Canada and Mexico have been the United Kingdom, Japan, U. S. S. R., France, Netherlands Indies, South America, Philippine Islands, and the Union of South Africa.²⁰ These markets are reached chiefly through Atlantic coast ports, although ports on the Gulf and Pacific seaboard are also used when conditions of cost and service warrant.

For all major classes of industrial machinery, New York is the outstanding port of export, comprising from 42 to 85 percent of the totals of most leading classes. Excavators, including power shovels, exported in 1937 to a value of \$4,563,000, moved through New York to the extent of 42 percent, and the balance moved principally through Michigan ports and Buffalo, Baltimore, and San Antonio. In mining and quarrying machinery—ore crushing and sorting machinery—valued at \$4,207,000, New York accounted for 56 percent, with the balance divided principally among Michigan ports, New Orleans, and San Francisco. The customs classification of "other" mining and quarrying machinery, valued at \$8,578,000, showed New York as participating to the extent of 46 percent; San Francisco, 15 percent; New Orleans, 10 percent; and Michigan ports, 7 percent.

For dredging machinery, valued at \$2,537,000, New York accounted for 56 percent; petroleum and gas-well-drilling machinery valued at \$18,513,000, New York handled 65 percent; engine lathes, with a value of \$3,649,000, showed New York with 85 percent; cotton-textile machinery, with a value of \$2,105,000, was exported through New York to the extent of 65 percent, and "other" industrial machinery and parts with a value of \$20,312,000, utilized New York for 53 percent of this amount, with Michigan ports and Buffalo of lesser importance.

Industrial machinery moving for export during the open season on the Great Lakes, extending from approximately May 1 to December 1 each year, constitutes 62 percent of an entire year's traffic.²¹ Taking 62 percent of \$160,353,000 or an estimate of \$99,419,000 for the year 1937, the annual average 1927-37 would amount to \$74,197,000.

Aggregate savings will depend upon the indicated transportation reductions and the number of units shipped by way of the St. Lawrence. In a manner similar to that employed for agricultural machinery, average value per pound has been obtained for each of the many products in the industrial machinery group.

¹⁷ Table 4.

¹⁸ Cf. p. 9.

¹⁹ Cf. p. 11.

²⁰ Department of Commerce, *Foreign Commerce and Navigation of the United States*.

²¹ Based on statements of manufacturers and checked against statistics in *Monthly Summary of Foreign Commerce of the United States*, 1937.

With a total value of \$99,419,000 shipped abroad from the Great Lakes area between May 1 and December 1, 1937, the quantity of industrial machinery exported, not including that to Canada and Mexico, is estimated to have been about 2,100,719 units of 100 pounds. Midwest manufacturers of industrial machinery are closely concentrated along the Great Lakes. The following tabulation gives the break-down of the total value of industrial machinery produced in 1937 in the tributary area by States and industrial areas:

State or area	Value (millions of dollars †)	Percent of total	State or area	Value (millions of dollars †)	Percent of total
Ohio.....	400	29.4	Rochester, N. Y.....	26	1.9
Indiana.....	113	8.3	Buffalo, N. Y.....	34	2.5
Michigan.....	131	9.6	Pittsburgh, Pa.....	94	6.9
Illinois.....	261	19.2	Total value of industrial machinery produced in 1937 in the tributary area.....	1,360	100.0
Wisconsin.....	164	12.1			
Iowa.....	22	1.6			
Minnesota.....	28	2.1			
Missouri.....	72	5.3			
Syracuse, N. Y.....	15	1.1			

† Census Bureau special compilation.

Ohio, with 29.4 percent of the total of \$1,360,000,000 is the largest producer in this group. Cleveland and Cincinnati are major centers of production of industrial machinery. Illinois, with 19.2 percent is second in importance, and Wisconsin is third with 12.1 percent. These three States account for 825 millions out of total value of production in the area, or 60 percent of 1,360 million dollars. Michigan and Indiana bring the figure to 1,071 millions or 78 percent of the total in the area. The States immediately adjoining the lakes predominate in production of industrial machinery.

In order to come closer to a figure of probable saving, the potential tonnage of 105,000 short tons must be distributed to their source of origin, since savings from each locality will differ according to distance from seaport and lakeport, and the water rates applicable to such ports. A convenient distribution of this export trade is on the same basis as the proportion of value of production of each State and area to the total value of production in the tributary region as a whole. On this basis we obtain the following allocation:

State or area	Percent of total value produced in tributary area	Allocated export trade		State or area	Percent of total value produced in tributary area	Allocated export trade	
		Hundreds of pounds	Short tons			Hundreds of pounds	Short tons
Ohio.....	29.4	614,000	30,700	Missouri.....	5.3	111,000	5,550
Indiana.....	8.3	174,000	8,700	Syracuse, N. Y.....	1.1	23,000	1,150
Michigan.....	9.6	196,000	9,800	Rochester, N. Y.....	1.9	40,000	2,000
Illinois.....	19.2	410,000	20,500	Buffalo, N. Y.....	2.5	53,000	2,650
Wisconsin.....	12.1	256,000	12,800	Pittsburgh, Pa.....	6.9	145,000	7,250
Iowa.....	1.6	34,000	1,700	Total.....	100.0	2,100,000	105,000
Minnesota.....	2.1	44,000	2,200				

† Total estimated exports of industrial machinery from the Great Lakes area during open season does not include exports to Canada and Mexico.

Section 6

SHIPPING COSTS AND POSSIBLE RATE REDUCTIONS ON INDUSTRIAL MACHINERY

The next problem is to designate the probable unit saving for each principal center of production. Ocean rates on industrial machinery present much the same complexity as those on agricultural machinery. They have an additional factor in that certain large companies, notably oil-mining companies, have arrangements with steamship lines, whereby the lines agree to take any and all traffic sent by the company to a given country to be used by its own principals. Such arrangements for example were in effect in August 1937 to Venezuela and provided a flat rate per short ton of \$9.

Table M-7 shows selected rates on industrial machinery in effect as August 15, 1939. As in the case of agricultural machinery, the rates are shown in cents per 100-pound unit, upon both weight and space bases, although except for the rate on well-drilling machinery to Venezuela and mining and ore-crushing machinery to Argentina, only the rate based upon measurement has actual significance. The groups of machinery are among the most important of industrial machinery exports. The countries shown were among those most important in 1937 for export of the respective classifications. The densities in pounds per cubic foot are based upon typical weights and space measurements as supplied by the United States Tariff Commission.²³ It will be noted that the density for the items shown range from 20 pounds per cubic foot for excavators and attachments to 70 pounds per cubic foot for mining and ore-crushing machinery.

The rates for industrial machinery run very much higher than the rates on agricultural machinery to the same countries. For textile machinery the rate per 100 pounds was \$1.36 to United Kingdom and \$1.63 to Colombia. A printing press could be shipped to the United Kingdom at \$1.23. Well drilling machinery could go to Venezuela under a special arrangement at 45 cents and to the Netherland Indies at \$1.77 per 100 pounds on the basis of space. Mining and ore-crushing machinery to the Argentine could be shipped at 72 cents per 100 pounds on the basis of weight. Power-driven and other metalworking machinery could be sent to United Kingdom and Japan at \$1.38 and to the Union of South Africa at \$1.16, respectively, per 100 pounds on the basis of space. A model 100 excavator and attachments could go to the United Kingdom at \$1.88 per 100 pounds, to the Argentine at \$2.00 and to Colombia at \$2.26—all on the basis of space.

In the discussion of ocean rates and feasible St. Lawrence rates on agricultural machinery it was brought out that to the United Kingdom the rate from the Great Lakes ports can be expected to approximate the rate from New York and Montreal, whereas from other regions such as the Far East, South Africa and South America, the rates can be expected to be somewhat higher. As in the case of agricultural machinery, the potential savings will be evaluated first on the basis of blanketing the ocean rate to the Great Lakes ports, i. e., giving them the same rate as Montreal and New York, and second, on the basis of a surcharge of \$2 per short ton or 10 cents per hundred pounds. Because of the higher water rates in industrial machinery, the savings will also be investigated upon the basis of a surcharge of \$4 per short ton, or 20 cents per 200 pounds. The savings that will eventually be realized on shipments made via the St. Lawrence will probably be between those based upon the two extremes of a blanketed rate or a \$4 surcharge.

If the same ocean rates apply from Chicago and Ohio ports as from Montreal and New York, the costs of transportation will be lowered by the equivalent of

²³ *Commodity Packing Data*, December 1937.

the difference between the rail haul to New York as opposed to the Lakes ports.

At this point the peculiarities of existing rail rates on industrial machinery or capital goods must be described. Rail rates on capital goods are generally based upon class rates. Less than carload lots usually take second class rates; carloads take in most cases 40 percent of first class rates. The rate classification which specific kinds of capital goods take are as follows:

Rail rate classification of capital goods

Type of capital goods	Classification	
	Less than carload	Carload
Bottling machinery.....	First.....	40 percent of first.
Cereal and flour-mill machinery.....	First and second.....	Third or 40 percent of first.
Dairy machinery.....	do.....	Fourth.
Air compressor.....	do.....	40 percent of first.
Crushers, breakers, grinders.....	Third.....	Do.
Elevators, conveyors, or escalators.....	First, second, and third.....	Do.
Engines, steam or internal-combustion.....	Second.....	Do.
Filtering machines.....	do.....	Do.
Steam or power trip hammers.....	do.....	Do.
Icemaking machinery.....	Second or third.....	Do.
Rolling-mill machinery.....	.....	37½ percent of first.
Commercial laundry machinery.....	First or second.....	40 percent of first.
Drilling machinery.....	Second.....	Do.
Mining machinery.....	do.....	Do.
Oil-mill machinery.....	First, second, or third.....	Do.
Paper-mill machinery.....	First, second, or fourth.....	Fifth.
Power-transmission machinery.....	First, second, third, or fourth.....	Fifth or 40 percent of first.
Printing presses.....	First or second.....	40 percent of first.
Pumps.....	Second.....	Fifth or 40 percent of first.
Screening machines.....	do.....	40 percent of first.
Separators.....	do.....	Do.
Textile machines.....	Third.....	Do.
Windmills.....	do.....	Do.
Generators, motors, switchboards, combinations.....	Second.....	Do.
Miscellaneous machinery:		
Batteries:		
Dry.....	Third.....	Do.
Storage.....	Second.....	Do.
Switchboards.....	First.....	Do.
X-ray machines.....	do.....	Do.
Shoe machinery.....	Second.....	Do.
Grading and roadmaking implements.....	Third.....	Do.
Blowers, ventilation machinery.....	Second or third.....	Do.

Less-than-carload rates on industrial machinery being generally second-class rates are about 85 percent of the first-class rates; carload rates are 40 percent of the first-class rate. The savings on shipments in less-than-carload lots, then, will be much higher than those on carload lots.

Table M-8 shows the indicated unit savings on industrial machinery. The choice of a representative point for States such as Ohio, Michigan, and Illinois requires the exercise of judgment based upon a study of the general distribution of manufactures within the State. For Ohio, the most representative points are Cleveland, Cincinnati, Columbus, and Toledo, with savings on a blanketing basis ranging for less-than-carload, from 44 cents per 100 pounds from Cincinnati and Columbus to \$1.15 per 100 pounds from Toledo. A saving on the blanketing basis typical of the State can be taken at 75 cents, which gives some weight to the larger concentration of production near the Lakes. For Michigan, Detroit, and Grand Rapids with a savings of \$1.15 and 65 cents per 100 pounds, respectively, are important among the producing centers. As a typical rate, 90 cents per 100 pounds is the authentic average of the two. The savings from

selected producing centers of Illinois, based upon the rail rate to New Orleans compared with that to Chicago, range from 65 cents per 100 pounds from Springfield to \$1.31 from Chicago. Because of Chicago's dominance 83 cents per 100 pounds appears to be representative of the State. In the case of Indiana, the Indianapolis rate may be taken as representative both because of the central location of the city and its importance as a producing center. Likewise, Milwaukee's predominance in Wisconsin makes it a logical selection as a typical point for the State despite its lake-shore position. The savings on a blanketing basis, then, for Indianapolis and Wisconsin are 56 cents and 137 cents, respectively. For the industrial areas the savings range from 37 cents per 100 pounds on shipments from Pittsburgh to 93 cents from Buffalo.

If the ship operator obtains a rate from the Great Lakes ports equal to the ocean rate from Montreal and New York, the typical savings will be reduced a corresponding amount. If allowance is made for a 20-cent surcharge, the unit savings vary from 17 cents on less-than-carload shipments from Pittsburgh to \$1.17 on less-than-carload shipments from Milwaukee.

On carload shipments the representative unit savings, the basis of a blanketed ocean basis, range from 17 cents per 100 pounds on shipments from the Rochester industrial area to 64 cents on shipments from Wisconsin. If a surcharge of 20 cents is added to the ocean rate on shipments from the Great Lakes, there would be no savings from Rochester and from Pittsburgh, and only 1 cent from Syracuse. For the other areas they range from 4 cents per 100 pounds from Indiana to 44 cents from Wisconsin. From Ohio the savings on a blanketing basis are 36 cents and on the basis of a 20-cent surcharge 16 cents per 100 pounds. For Illinois, they range from 44 cents on a blanketing basis to 24 cents if the 20-cent surcharge is considered.

In table M-9 the indicated unit savings are applied to the tonnage of the respective areas, under two pairs of assumptions. The first pair is, one, that the entire tonnage moved in less-than-carload lots and, two, that it moved in carload lots. The second pair of assumptions is, that the ship operator asked, one, for a 10 cents surcharge, and two, for a 20 cents surcharge. Under these assumptions the savings range from \$1,364,000 if the shipments were made in less-than-carload lots at a surcharge of 10 cents, to under \$376,000 if the shipments were made in carload lots at a surcharge of 20 cents. These figures do not include the exports estimated to have moved from Iowa and Minnesota, which were small, or from Missouri on which the savings were too small to warrant consideration. Among the States included, the estimated savings vary from \$399,000 to \$98,000 on shipments from Ohio and from \$325,000 to \$113,000 on shipments from Wisconsin. On exports from Illinois, the savings estimated range from \$299,000 to \$98,000.

In general, industrial machinery moves under greater urgency than agricultural machinery. Upon its delivery may hinge the beginning or completion of a major piece of construction or the opening or speeding up of production of a much larger unit of machinery. Because generally it is a more or less special job, storage at the point of consumption is usually out of the question. How great a factor the need of speed and certainty in delivery may be in determining the routing of the mass of machinery cannot, of course, be determined. It is likely, however, that the savings as calculated above for carload shipments at an ocean surcharge of 20 cents per 100 pounds are so low that they make an allowance for those shipments that will continue to be made via coastal ports.

From statements of manufactures, it appears that in 1937 domestic shipments of industrial machines from the Great Lakes areas to the four major Pacific coast ports of the west coast, during the 7 months of open navigation of the St. Lawrence, were somewhere below 1,000,000 units or 50,000 short tons. Some of the shipments to the Pacific coast might be expected to move via the St. Lawrence, especially

those originating in industrial areas on the Lakes shore. However, considering the length of haul via the Seaway as compared with all-rail route in the light of the importance of speed and promptness of delivery of this type of machinery no estimate has been made of the savings involved.

Section 7

EXPORTS OF BUSINESS MACHINES, HOUSEHOLD MACHINES, AND MISCELLANEOUS MACHINERY

Together exports of agricultural and industrial machinery amounted to 72.56 percent of the United States total exports of machinery, biennial average 1927-37. The extensive study given these two groups suffice to show that machinery is a potential source of traffic for the Seaway of considerable volume whose transportation via the St. Lawrence would result in great savings in distribution costs. The exports of the three remaining groups amount to 27.44 percent as a biennial average 1927-37. On page 11 it was estimated that \$58,600,000 worth of these groups were exported from the tributary area. In 1937, the principal markets, other than Canada and Mexico of these types of machinery were: For business machines, the United Kingdom, France, Brazil, Argentina, Sweden, Belgium, and Australia; for household equipment, the United Kingdom, France, the Union of South Africa, Australia, Argentina, Brazil, and Cuba. For radio apparatus, batteries, telephone and telegraph apparatus, and incandescent lamps, the major markets, excepting Canada and Mexico, were the United Kingdom, the Union of South Africa, Argentina, Brazil, Colombia, Cuba, the Philippine Islands, British Malaya, Australia, and British India.

No estimate has been made of the volume of tonnage that the in-seasonal movement of these three groups might represent nor what savings might be realized. The miscellaneous group is from its very nature difficult to analyze. Business machinery, because of its compactness and high value can absorb heavy transportation charges easily; on the other hand in some cases the elimination of certain handling might make the St. Lawrence attractive. The fact that the machines are considerably standardized and manufacturers of business machinery have representatives and warehouses abroad might make it possible for them to take advantage of a cheaper form of transportation. This may be especially true on shipments to the United Kingdom, France, Sweden, Belgium, and other European countries. Household machinery because of the rapid changes in design, due especially to style variations, now moves in small lots. Nevertheless, the attractiveness of the St. Lawrence route is shown by the fact that certain items of household equipment are already being shipped by direct all-water carrier from the Great Lakes to Europe at a considerable saving, derived in a large measure, from the reduced cost of packing. By personal supervision of the stowing of refrigerators in the vessel, it is possible for the manufacturer to use domestic packing, saving approximately \$1.50 a unit. This is without regard to any savings in transportation charges.

If only agricultural and industrial machinery are considered, the estimates of potential traffic and savings are as follows:

	<i>Minimum</i>	<i>Maximum</i>
Agricultural machinery-----	\$393, 000	\$707, 000
Industrial machinery-----	376, 000	1, 364, 000
Total-----	769, 000	2, 071, 000

The range is from \$769,000 to \$2,071,000. This estimate does not include the weight of packaging or crating. The addition of the tare to the net weight would increase the estimated savings. Nor does this estimate make allowance for any reductions in the cost of packing that might be made possible by direct delivery to the ships.

TABLE M-1
Value of United States production of machinery, 1927-37

Year	Total machinery	Agricultural machinery	Industrial machinery	Business machinery	Household machinery	Miscellaneous n. o. s. machinery
Thousands of dollars						
1927	4,132,382	362,263	2,085,753	170,629	239,618	1,274,119
1929	4,967,057	606,622	2,436,536	183,350	295,790	1,444,759
1931	2,677,607	214,390	1,138,737	84,889	222,154	1,017,437
1933	1,646,633	46,335	635,745	55,495	88,183	820,875
1935	2,765,429	331,999	1,411,400	117,860	271,749	622,421
1937	4,776,084	564,778	2,328,697	183,077	402,113	1,297,419
Biennial average, 1927-37	3,492,532	354,398	1,672,811	132,550	253,268	1,079,605
Percentage distribution						
1927	100.00	8.77	50.47	4.13	5.80	30.83
1929	100.00	12.21	49.05	3.69	5.96	29.09
1931	100.00	8.01	42.53	3.17	8.30	37.99
1933	100.00	2.81	38.61	3.37	5.36	49.85
1935	100.00	12.05	51.22	4.28	9.86	22.59
1937	100.00	11.83	48.76	3.83	8.42	27.16
Biennial average, 1927-37	100.00	10.15	47.89	3.80	7.25	30.91

SOURCE: Production figures represent value of machinery manufactured in the United States. *Census of Manufactures.*

TABLE M-2
Value of United States exports of machinery, 1927-37

Year	Total machinery	Agricultural machinery	Industrial machinery	Business machinery	Household machinery	Miscellaneous n. o. s. machinery
Thousands of dollars						
1927	439,955	90,747	243,248	44,094	9,470	52,396
1929	617,749	140,801	324,114	53,754	22,931	76,149
1931	319,572	57,403	176,866	24,932	12,210	48,111
1933	133,469	12,216	68,637	15,769	6,310	30,537
1935	266,909	32,039	142,589	27,039	14,138	51,104
1937	480,448	75,331	274,501	37,523	23,341	69,752
Biennial average 1927-37	376,350	68,089	204,993	33,860	14,733	54,675
Percentage distribution						
1927	100.00	20.63	55.29	10.02	2.15	11.91
1929	100.00	22.79	52.47	8.70	3.71	12.33
1931	100.00	17.98	55.34	7.82	3.82	15.06
1933	100.00	9.15	51.43	11.81	4.73	22.88
1935	100.00	12.00	53.42	10.13	5.30	19.15
1937	100.00	15.68	57.13	7.81	4.86	14.52
Biennial average 1927-37	100.00	18.09	54.47	9.00	3.91	14.53

SOURCE: Export figures represent value of domestic machinery exported from the United States, from *Foreign Commerce and Navigation of the United States.*

TABLE M-3

Relative ratio of machinery exports, by classes, to total production and exports, 1927-37

Class of machinery	1927			1937			Average exports, alternate years, 1927-37		
	Value (thousands of dollars)	Percent of U. S. production	Percent of U. S. exports	Value (thousands of dollars)	Percent of U. S. production	Percent of U. S. exports	Value (thousands of dollars)	Percent of U. S. production	Percent of U. S. exports
Agricultural.....	80,747	25.05	20.63	75,331	13.34	15.68	68,089	19.21	18.09
Industrial.....	243,248	11.66	55.29	274,501	11.79	57.13	204,993	12.25	54.47
Business.....	44,094	25.84	10.02	37,523	20.50	7.81	33,860	25.55	9.00
Household.....	9,470	3.95	2.15	23,341	5.80	4.86	14,733	5.82	3.91
Miscellaneous.....	52,396	4.11	11.91	69,752	5.38	14.52	54,675	5.06	14.53
Total.....	439,955	10.64	100.00	480,448	10.06	100.00	376,350	10.78	100.00

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States*, alternate years, 1927-37.

TABLE M-4

Production of machinery in the United States and the tributary area, 1937

Classes of machinery	Value of production in United States	Value of production in tributary area ¹	Percent of production in tributary area to U. S. total production
Agricultural.....	\$564,778,000	\$539,625,000	95.55
Industrial.....	2,328,697,000	1,360,073,000	58.40
Business.....	183,077,000	102,785,000	56.14
Household.....	402,113,000	385,349,000	95.83
Miscellaneous.....	1,297,419,000	604,474,000	46.59
Total.....	\$4,776,084,000	\$2,992,306,000	62.65

¹ Tributary area includes the States of Ohio, Indiana, Michigan, Illinois, Wisconsin, Iowa, Minnesota, Missouri, and the industrial areas of Syracuse, Rochester, Buffalo, and Pittsburgh.

² Value of production of agricultural machinery in the New York counties of Genesee and Ontario are included to avoid disclosures of individual establishments.

³ Does not include \$601,654,000 of machine shop products and machine tool accessories not regarded as machinery but included in the machinery group by the Bureau of the Census.

⁴ Does not include \$334,777,000 of machine shop products and machine tool accessories not regarded as machinery but included in the machinery group by the Bureau of the Census.

SOURCE: Special tabulation by the Census Bureau.

TABLE M-5

Typical out-bound ocean rates on boxed tractors and agricultural machinery from United States, North Atlantic ports to selected countries as of Aug. 15, 1939

Country	Tractors				Agricultural machinery ²			
	Rate ¹ w/m	Density	Rate per 100 pounds on basis of—		Rate ¹ w/m	Density	Rate per 100 pounds on basis of—	
			Weight	Space			Weight	Space
		Lb. per cu. ft.	Cents	Cents		Lb. per cu. ft.	Cents	Cents
South Africa.....	\$6.00	32	27	47	\$6.00	16	27	1.85
Not boxed ³	8.00	32	36	63	8.00	16	36	1.74
Australia.....	9.50	32	42	74	9.50	16	42	1.34
Hongkong and Manila.....	17.50	32	78	137	13.50	16	60	1.90
South America.....	9.00	32	40	70	9.00	16	30	1.27
United Kingdom.....	6.80	32	30	53	6.80	16	30	.96
Scandinavia.....	8.00	32	40	63	8.00	16	36	1.13

Density— $\frac{\text{gross weight}}{\text{cubic volume}}$

¹ Rates based on long tons (2,240) or 40 cubic feet.

² Includes binder, combine (with gas engine), mower and thresher.

³ Not boxed.

SOURCE: Tariff Commission Commodity Packing Data, December 1937.

TABLE M-6

Agricultural machinery exports, transportation rates and savings for representative points, on theory of equality of ocean rates, Great Lakes ports and Atlantic-Gulf ports

[Cents per 100 pounds]

Origin points	Present export carload rate to seaboard	Present rate to nearest lake port	Indicated transpor- tation reductions
Cleveland, Ohio.....	(29 Baltimore ¹ 32 New York ¹		29 32
Cincinnati, Ohio.....	(31 New Orleans ² 39 New York ¹	32 Toledo ¹ 32 Toledo ¹	7
Springfield, Ill.....	(32 New Orleans ² 51 New York ¹	32 Chicago ¹ 32 Chicago ¹	19 3
Burlington, Iowa.....	(32 New Orleans ² 53 New York ¹	29 Chicago ¹	24
Minneapolis, Minn.....	54 New Orleans ²	40 Duluth ¹	14
St. Paul, Minn.....	96 New York ¹	40 Duluth ¹	56
Duluth, Minn.....	(61 New Orleans ² 96 New York ¹		61 96
Chicago, Ill.....	(32 New Orleans ² 45 New York ¹		32 45
Milwaukee, Wis.....	(52 New Orleans ² 45 New York ¹		52 45

¹ All-rail.

² Rail-barge.

TABLE M-7

*Typical out-bound ocean rates on industrial machinery from United States
North Atlantic ports to selected countries as of Aug. 15, 1937*

Type of machinery and country of destination	Rate W/M	Density	Rate per 100 pounds on basis of—	
			Weight	Space
Textile machinery: ¹		Lb. per cu. ft.		
United Kingdom.....	ST \$15	28	\$0.75	\$1.36
Colombia.....	ST 18	28	.90	1.63
Printing press with motor:				
United Kingdom.....	ST 15	31	.75	1.23
Well-drilling machinery: ²				
Netherlands Indies.....	ST 20	28	1.00	1.77
Venezuela ³	9		.45	
Mining and ore crushing machinery: ⁴				
Argentina.....	LT 16	70	.72	.60
Power driven and other metal working machinery: ⁵				
United Kingdom.....	16	33	.80	1.23
Japan.....	ST 18	33	.90	1.38
Union of South Africa.....	15	33	.67	1.16
Model 100 excavator and attachments:				
United Kingdom.....	LT 15	20	.67	1.88
Argentina.....	LT 16	20	.71	2.00
Colombia.....	LT 18	20	.80	2.26

ST=2,000 pounds.

LT=2,240 pounds.

Density= $\frac{\text{gross weight}}{\text{cubic volume}}$ ¹ Includes—braiding machine, carding machine, knitting machine, spinner machine, and loom.² Includes—drilling engine, swivel, and rotary hoist.³ Special rate for over-all contract covering all shipments of any type of a company from New York to Maracaibo, Venezuela.⁴ Includes—hub section of spider, low head vibrating screen.⁵ Includes—screw machine, grinder, lathe, milling machine.SOURCE: Weight and measurement classification. Tariff Commission, *Commodity Packing Data*, December 1937.

TABLE M-8
Estimated savings on industrial machinery exports
 [Cents per 100 pounds]

State and representative point	Less than carload ¹					Carload ²				
	Rail rate		Unit savings based upon a Seaway rate equal to ocean rate from Montreal and New York.			Rail rate		Unit savings based upon a Seaway rate equal to ocean rate from Montreal and New York.		
	To New York	To lake port	Blan-keted	With sur-charge of—		To New York	To lake port	Blan-keted	With sur-charge of—	
				10 cents	20 cents				10 cents	20 cents
Ohio:										
Cleveland.....	99		99			48		48		
Cincinnati.....	112	68	44			54	32	22		
Columbus.....	102	58	44			50	27	23		
Toledo.....	115		115			54		54		
Representative of State.....			75	65	55			36	26	16
Indiana: Indianapolis (representative of State).....	123	67	56	46	36	56	32	24	14	04
Michigan:										
Detroit.....	115		115			54		54		
Grand Rapids.....	128	63	65			62	30	32		
Representative of State.....			90	80	70			44	34	24
Illinois:										
Chicago.....	131		131			62		62		
Freeport.....	145	54	85			65	26	39		
Peoria.....	131	62	69			62	29	33		
Springfield.....	131	66	65			62	31	31		
Representative of State.....			83	73	63			44	34	24
Wisconsin: Milwaukee (representative of State).....	137		137	127	117	64		64	54	44
New York:										
Syracuse.....	78	34	44	34	24	37	16	21	11	01
Rochester.....	88	46	42	32	22	39	22	17	07	
Buffalo.....	93		93	83	73	44		44	34	24
Pennsylvania: Pittsburgh.....	97	60	37	27	17	46	28	18	08	

¹ Class 2 rates, generally apply on less-than-carload lots of industrial machinery. ² To New Orleans, La.
³ Carload lots of industrial machinery usually take rates 40 percent of class 1. ⁴ Via Oswego.

TABLE M-9
Estimated savings on industrial machinery exported to countries other than Canada

State	Estimated exports	Less than carload ¹				Carload lots ²			
		Unit savings based upon a surcharge of—		Estimated savings based upon a surcharge of—		Unit savings based upon a surcharge of—		Estimated savings based upon a surcharge of—	
		10 cents	20 cents	10 cents	20 cents	10 cents	20 cents	10 cents	20 cents
		Ct. per 100 lb.	Ct. per 100 lb.			Ct. per 100 lb.	Ct. per 100 lb.		
Ohio.....	100 lb.								
.....	614,000	65	55	\$399,100	\$337,700	26	16	\$159,640	\$98,240
Indiana ³	174,000	46	36	80,040	62,640	14	04	24,360	6,960
Michigan.....	196,000	80	70	156,800	137,200	34	24	66,640	47,040
Illinois ⁴	410,000	73	63	299,300	253,300	34	24	139,400	98,400
Wisconsin ⁵	258,000	127	117	325,120	299,520	54	44	138,240	112,640
Syracuse, N. Y.....	23,000	34	24	7,820	5,520	11	1	2,530	230
Rochester, N. Y.....	40,000	32	22	12,800	8,800	7		2,800	
Buffalo, N. Y.....	53,000	83	73	43,990	38,690	34	24	18,020	12,720
Pittsburgh, Pa.....	145,000	27	17	39,150	24,650	8		11,600	
Total above States and districts.....	1,911,000			1,364,120	1,173,020			563,230	376,230

¹ Less than carload lots of industrial machinery usually move at class 2 rates.
² Carload lots of industrial machinery usually move on rates 40 percent of class 1 rates.
³ To New Orleans, La. ⁴ Via Oswego, N. Y. ⁵ Does not include Iowa, Minnesota, and Missouri.

Appendix N

IRON ORE, IRON AND STEEL PRODUCTS

INTRODUCTION

Iron and steel may be considered one of the most basic industries of the national economy of the United States. Not only is the industry in and of itself important among our industrial groups, but from it stem other industries of great magnitude. Indeed, of the 16 major groupings of the Biennial Census of Manufactures, 3 may be gathered into one heading, Iron and Steel and Related Products, for machinery and transportation equipment to a great extent may be considered as iron and steel in a further processed stage of manufacture.

As shown in table N-1, in 1937 these three groups of industries employed 32 percent of the wage earners in manufacturing industries in the United States. The workers of this industry received almost 40 percent of the wages paid all manufacturing wage earners in the country. As respects cost of materials, these groups of industries consumed about 30 percent of the national total. The value of products of these industries amounted to almost 32 percent; the value added by manufacture to nearly 35 percent of the United States total.

Restricting out attention to the group called iron and steel and their products, not including machinery, it will be seen that in 1937 this industrial group employed an average number of wage earners of 1,166,000, or 13.6 percent of the total employed in United States manufacturing industries. The industry paid in the form of wages \$1,661,000,000, or 16.4 percent of the total wages paid by United States industrial concerns. Cost of materials for the industry amounted to \$4,048,000,000, or 11.4 percent of the United States total. The value of products of the group was \$7,480,000,000, or 12.3 percent of the total of all United States manufacturing industries. The value added by manufacture in this industry was 13.6 percent of the United States total, or in actual figures \$3,433,000,000. The industry ranks first as to wages paid, second as to the number of wage earners and value of products and value added by manufacture, and fourth as to the cost of materials.

The iron and steel industry is of especially great importance to the Great Lakes area. As shown in table N-2, of the United States total annual average production of iron ore in the years 1928-37, 84.8 percent, or 36,317,000 long tons, were produced in the Great Lakes area. Coal is the second most important raw material consumed in the manufacture of iron and steel. In the year 1937 of the United States total production of 445,531,000 long tons of bituminous coal, the Great Lakes area produced 182,075,000 long tons, or about 40.9 percent.

In the years 1928-37, the United States as a whole produced a yearly average of 25,249,000 long tons of pig iron. Of this amount, 19,006,000, or 75.3 percent, was produced in the Great Lakes region.

Of the total steel ingot capacity of the United States in 1935, 70,983,000 long tons, the Great Lakes area contained 53,438,000, or about 75.3 percent. Most of the further processing of steel, either cold- or hot-rolled, takes place close to the point of ingot production, so that roughly 70 percent or more of the finished or

semifinished steel capacity of the United States is concentrated in the Great Lakes area. Not only are the States of this area important from the point of view of the production of iron and steel materials and products, but in them are also great concentrations of the important steel consuming industries, especially machinery, automobiles and railroad equipment. In the year 1936, according to a special compilation of the United States Tariff Commission, about 42 percent of the finished iron and steel products of the United States were consumed in the Great Lakes area, excluding New York and Pennsylvania. These two States consumed respectively 12 percent and 6 percent, a good part of which consumption no doubt took place in the Great Lakes area. (See table N-2.)

Because of the unusual importance of the iron and steel industry to the Great Lakes area, the impact of the proposed St. Lawrence Seaway upon the industry will be studied as regards imports, exports, and domestic movements, not only of the finished products, but also of iron ore, pig iron, and scrap iron.

Section 1

IRON ORE

The most important steel-producing region of the United States is found in five States bordering the Great Lakes area; in the western part of New York, and Pennsylvania, and the State of Ohio, and the northern sections of Indiana and Illinois. Here coal from Illinois and the Appalachian fields meets iron ore from Minnesota, Wisconsin, and Michigan mines. Enormous quantities of ore move south and east in specially built lake carriers from the head of the lakes to the lower part of Lake Michigan and to Lake Erie. This ore is consumed at points like Chicago, Cleveland, or Buffalo, and shipped to interior points such as Pittsburgh and Youngstown. On the backhaul, coal is moved into the Northwest.

Imports.

In an appraisal of the effects of the proposed St. Lawrence Seaway on iron ore, one of the problems to be probed is the likelihood of imports into the Great Lakes area. Present United States imports are relatively small. They come mainly from Chile and Cuba, where the Bethlehem Steel Corporation has mining interests, whence they are brought to the company's plants in Baltimore and Philadelphia. The utilization of foreign ores at these plants springs primarily from the cheaper water transportation from the foreign mines, compared with the lake-rail haul from the Lake Superior region. Receipts of iron ore from countries other than Chile and Cuba are often due to the need of a special grade of ore to be mixed with domestic ores to make a particular type of steel. In 1937, for example, at least 116,000 long tons were received at Buffalo from Norway and Sweden.¹ In general, the Lake Superior ores are today unchallenged in the Great Lakes steel centers.

The question of the effect of the St. Lawrence development on the imports of iron ore can be best studied, first, as a short-term problem, and, second, as a long-term problem.

As a short-term problem there are adequate reserves in the Great Lakes area to meet the needs of the steel industry for at least 20 years. Table N-3 shows the estimated actual iron-ore reserves of the Lake Superior district, during the years 1920-38. There is considerable fluctuation due to new discoveries, but in general the actual reserves have been depleted from about 1,541,000,000 long tons to 1,374,000,000 long tons from 1920 to 1938. The average annual shipment of the Lake Superior region in the years 1928-37 was 36,806,000 long tons.² At

¹ Lake Superior Iron Ore Association, *Lake Superior Iron Ores*, 1938, p. 336.

² Lake Carriers Association, *Annual Report*, 1938, p. 144.

that rate of shipment it would take about 40 years to consume the present estimated actual reserves of 1,400,000,000 long tons. There are, of course, great cyclical fluctuations in the production of iron ore. Since 1920 production of iron ore in the Lake Superior region has dropped as low as 3,589,000 long tons in 1932 and attained the extreme figure of 66,157,000 long tons in 1929.³ If production were to be maintained at the unlikely level equal to the maximum yearly production since 1920, the present actual reserves would last about 20 years.

Not only are the supplies in the Great Lakes region adequate, but the costs of mining and transportation are low. Much of the production of the region comes from open-pit mines, which are cheaper to operate than underground mines. In 1938 the open-pit method in the Lake Superior region yielded 55 percent of the national output. The average costs of production in Minnesota, the most important of the ore-producing States, ranged in the years 1933-37 from \$1.079 to \$1.14 per long ton.⁴ These estimates of costs are based on returns to the Bureau of Mines from mining companies. That the costs may, in truth, be overstated was indicated by an incident in the investigation of the steel industry conducted by the Department of Justice. In reply to a questionnaire dated December 14, 1937, Butler Brothers reported average costs in all of its open-pit mines for the period 1925-38 as \$2.0979, ranging as low as \$1.8014 and as high as \$3.3292. In a letter to Patrick Butler dated September 15, 1936, Emmett Butler said: "Of course, as I have often stated, our iron ore, after we have passed the million-ton mark, only costs us about \$1.50 to produce, and when I say \$1.50, I mean all costs, including taxes and royalties."

The Lake Superior region is favored also by the extremely low cost of transportation from mine to blast furnace. To points on the Lakes, such as Chicago and Cleveland, the rail and lake rate from the Mesabi range was \$1.85 per long ton. To the Pittsburgh and the Valleys districts, the rail-lake-rail rates were respectively \$3.15 and \$2.82 per long ton.⁵ From Tunisia to the North Atlantic ports, the ocean rate in 1939 was \$2.33 and from the Soviet Union in Europe, \$2.88.

A factor other than costs involved in the question of the amount of imports of iron ore that might be expected to move into the Great Lakes area, is the integration of the United States steel industry and the interlocked relationship of mines, steel companies and transportation agencies in the Great Lakes area. Between 85 and 90 percent of the ore shipped from the Lake Superior district is delivered to steel companies which own or lease the mines. Likewise a large proportion of the carriers and other facilities on the lakes is under the direct or indirect control of the great steel corporations or their agents. Mining and shipping interests of the steel companies represent large investments that they will not readily abandon.

Closely connected with the factor of interlocked relationship of mines, lake carriers and steel companies is the element of price. From 1929 to 1936 there was no change in the base prices of Lake Superior ores at Lake Erie ports. During the years 1937-38 prices were generally stable at a somewhat higher level. For Bessemer ores, old range, they were \$5.25 per long ton, for Bessemer-Mesabi ores they were \$5.10. The prices for non-Bessemer ores were \$5.10 per long ton for old range, \$4.95 for Mesabi and \$4.85 per long ton for high phosphorous.⁶ These prices are base prices of nominal significance on most shipments. Penalties and premiums are paid for variations in silicate, phosphorous, and other chemical elements, as well as percent of iron content. Most of the sales are made to companies that either own, control, or have a close relationship to the mining company.

³ Lake Superior Iron Ore Association, *Lake Superior Iron Ores*, 1938, p. 308.

⁴ Department of the Interior, *Minerals Yearbook*, 1939, p. 552.

⁵ *Op. cit.* Compiled from *Lake Superior Iron Ores*, 1938, pp. 323-5.

⁶ *Ibid.*, p. 322.

There are indications that ore mining operations have not been unprofitable. According to the financial statements of the Cleveland Cliff Iron Co., their ore department's average return on investment during the 10-year period, 1929-38, was 9.5 percent. Despite the depression, they incurred a loss in only one year, 1932, and returns ranged in other years from 4.3 percent in 1933 to 22.2 percent in 1937. Over the same period the average return on investment in the Lake Superior and Ishpening Railroad Co. averaged 11.2 percent, with losses in only 2 years and returns as high as 26.8 percent in 1937. Again, during the same period, the average return on the lake transportation department of the Cleveland Cliff Iron Co. was 21.1, with no loss in any year, and returns as high as 33.8 percent in 1937.

Although comparable figures for other companies are not at hand, it may be mentioned that in the 3 years, 1930, 1936, and 1937 the ratio of net income, before Federal income tax, to net sales and gross revenues for United States Steel's ore mining companies, was roughly 16.0, 11.3, and 21.2 percent, respectively, while the ratio on the total of all its companies was only 8.3, 5.6, and 10.2 percent. Differences in fixed investment may account for some of this discrepancy, but it seems possible that a difference so substantial is associated with higher average returns in ore mining.

It must be concluded that considering the integration of mining, transportation, and steel companies, the low cost, high quality, and ample reserves of the Great Lakes ore, the low costs of transportation and flexibility that the steel companies have in reducing the price of iron ore at lower lake ports, that no great volume of iron ore is likely to be needed or imported into the Great Lakes area in the next 20 years or so.

There will no doubt be small amounts imported for special purposes, like the 116,000 long tons that arrived at Buffalo from Norway and Sweden in 1937.¹ A most important effect that the proposed Seaway may have, however, is in moderating the price of ore at the consuming points. This effect will be especially important for the independent steel company that controls no ore sources.

In trying to appraise the effect of the proposed St. Lawrence development upon imports of iron ore from the long-term viewpoint, the question of depletion of the Lake Superior reserves becomes critical. The actual reserves will last under the present rate of extraction, for over 20 years. Behind the actual reserves are untold "possible" reserves. The term "possible" reserves is used for ore that is not proven but the existence of which is indicated by the formation, and by the presence of low-grade ore that cannot be moved or used under present conditions and methods. Many ores that a few years ago were not considered as available can now be beneficiated and used, and in the future new methods of beneficiation will probably be discovered that will make ores available that now are uneconomic. One estimate places these "possible" reserves in the Lake Superior district at 72,000,000,000 long tons,² about 43.0 percent of the "possible" reserves of the world. What technological changes may be brought about in 20 years no one can say. Such changes may enable the United States to utilize the possible reserves without mixture of foreign ores.

Nevertheless, from the viewpoint of so vast an industry representing such tremendous investments, and of such great importance to the national economic power and well-being, 20 years is but a brief period. It is possible that by the end of that period the state of technology may be such and the depletion of the better ores of the Lake Superior region may be so great as to make it highly desirable, if not necessary, to bring foreign ores to be mixed with the Great Lakes ores in order to

¹ *Op. cit. Lake Superior Iron Ores*, 1938, p. 336.

² Olin B. Kuhn, in *Engineering and Mining Journal*, July 17, 1926, p. 90.

maintain satisfactory types and quality of steel. In the face of such a prospect, by no means impossible, the St. Lawrence Seaway stands as a form of insurance: Through it the Great Lakes producers will be able to bring in the foreign ores for mixing with the domestic ores which will enable them to insure their investments in plant and transportation at their present locations.

Coastwise Movement.

Large amounts of foreign ore are consumed along the Atlantic coast, especially at Sparrows Point, Md.

There is also a movement of some magnitude from the Lake Superior region to points east of the Alleghenies. Between 1913 and 1920 these shipments ranged annually from 458,140 long tons to over 4,086,153 long tons. Since the beginning of the twenties, however, there has been a considerable drop in the tonnage shipped to the East, both in terms of actual amounts and as percent of the total shipments. This decrease was due to the utilization of foreign ores. Still, the shipments from Lake Superior points east of the Alleghenies reached over 1,177,498 long tons in 1929, and 1,467,000 long tons in 1937, and the average shipments in the years 1928-37 were 324,102 long tons.⁹ If it is assumed that a direct shipment from the head of the lakes to Baltimore or Philadelphia were to save only 20 percent on the present rail rate from the lakes to Baltimore, the through water rate would be \$3.68 per long ton and the unit savings \$0.40 per long ton.¹⁰ Applying these savings to the average annual tonnage, namely 324,102 long tons, that moved in the years 1928-37, a total estimated savings of about \$130,000 would result in ore shipments to the east coast. Whether in view of the lowered transportation costs the movement of ore from the Lake Superior region to Sparrows Point would be increased at the expense of the importation of foreign ores, is a question complicated by the facts that the Bethlehem Steel Corporation has heavy investments in Chile and Cuba and the costs of production and of transportation from those points are unknown. Although steel plants and iron foundries along the Atlantic coast tend to use scrap iron and steel as their primary material, there is a certain amount of ore smelted at other North Atlantic coastal points by smaller pig iron producers. These producers would perhaps be in position to benefit from lower transportation rates that would make the Lake Superior ore available to them.

Exports.

The effect of the proposed St. Lawrence development upon exports of iron ore may be examined under three headings:

- (1) Will it affect the present market in the Canadian Great Lakes area by introducing foreign competition?
- (2) Will it lower costs of transportation on shipments to any other part of Canada?
- (3) Will it bring about savings in transportation and greater exports to countries other than to Canada?

In the years 1928-37 the exports of United States iron ore to Canada were 99.3 percent of the total United States exports of iron ore.¹¹ Most of the iron ore exported to Canada is consumed in the great industrial areas of Ontario. The effect of the St. Lawrence upon that market will parallel closely the effect upon the United States steel centers near the Great Lakes. There is a certain degree of

⁹ The Lake Superior Iron Ore Association, letter to N. R. Daniellian, Director, St. Lawrence Survey, October 4, 1940.

¹⁰ *Op. cit.* Based upon rates in *Lake Superior Iron Ores*, 1939, pp. 323-5.

¹¹ Compiled from data obtained from Department of Commerce, *Foreign Commerce and Navigation of the United States*, 1928-37.

inter-relation of Canadian steel companies and United States mines, although the relationship is not so complete as that found between the mines and United States steel companies. For example, the Steel Co. of Canada, Ltd., one of the largest Ontario producers of steel and pig iron, owns mines in the Lake Superior district, which are managed and operated by others.¹³ Since there is no tariff on iron ore imported into Canada, and no subsidy for production of pig iron from Canadian ores, other conditions are identical with those described for the United States market.

The conclusions are, first, that in the short-run there will be little imports into Ontario of other than United States ore, but that there may be a moderating influence upon the price of ore at the blast furnace, and second, that in the long-run the utilization of United States ores may be aided by the ability of the Canadian steel mills to bring in other ores to be mixed with them.

On the basis of the cost of materials consumed in 1935, the primary iron and steel manufacture in Canada is distributed as follows: 65.7 percent in the Province of Ontario and 2.8 percent in the Province of Quebec.¹³ If United States exports of iron ore to Canada are allocated on the basis of this division, Quebec would have received an annual average of 60,400 long tons during the decade 1928-37. However, it seems that in the years 1935-37, Canada received from 30 percent to 46 percent of its imports of iron ore from Newfoundland, and it may be assumed that the present movement of iron ore from the United States goes entirely to the Province of Ontario. This fact is checked by figures of the movement of iron ore through the St. Lawrence Canals. In the absence of data as to the cost of production in Newfoundland and the cost of transporting ore from that country to the points of consumption in Quebec, it cannot be determined whether the cost of transportation from the head of the lakes will be so lowered as to enable American ore to overcome the competition of the Newfoundland ore in the Quebec consuming centers.

Except to Canada the United States exports very little iron ore. There is some possibility that the foreign market for Lake Superior ore will be widened by the proposed development of the St. Lawrence. Iron ore occasionally moves long distances in international trade, provided water transportation can be used; for example, from Chile to North Atlantic United States, from Australia to the United States, from Newfoundland to Germany and the United Kingdom.¹⁴ On the other hand, foreign exports outside of Canada face difficulties which are very great. American ore would face competition from sources which are much closer to foreign markets or which are under the political domination of the importing country. Furthermore, as the higher-grade ores in the Great Lakes area are consumed, the ability of the lower-grade ores to withstand the cost of transportation over long distances is reduced. Finally, the growing utilization of scrap as opposed to pig iron in the manufacture of steel will tend to reduce the international movement of iron ore. In consideration of these factors, it must be concluded that exports to countries other than to Canada are unlikely to expand greatly.

Section 2

PIG IRON

Imports.

The most important type of pig iron imported into the United States is foundry pig iron. The United States Tariff Commission has made a study of the costs of

¹³ American Iron and Steel Institute, *Iron and Steel Works Directory*, 1938, p. 383.

¹⁴ Canada, Dominion Bureau of Statistics, *Iron and Steel and their Products*, 1934-35, pp. 22-3.

¹⁵ Tariff Commission, Report No. 128, *Iron and Steel*, p. 71.

production of foundry iron by districts, in the months January 1929 to June 1930, inclusive, as compared with the average invoice price at New York of pig iron from British India. The East Indian pig iron was priced at about \$18.00 per ton.¹⁵ Although the invoice price was considerably higher than the costs in the Alabama producing district, it was almost a dollar less than the costs of the Eastern producers and nearly \$1.50 less than the costs of the Buffalo producers. At first it would seem that there might be a possibility of large imports into the Great Lakes area.

Table N-4 presents a summary of production, imports, exports and consumption of pig iron. Imports have never reached any great degree of importance relative to the total national consumption. In the years 1928-37, they averaged 132,000 long tons. As a percent of total consumption since 1928, imports have not in any year been more than 1.5 percent. Even if consumption is based not on total production, but only on production for sale, imports since 1928 have not attained 8 percent of national consumption.¹⁶ The inability of foreign exporters to take an appreciable share of the domestic pig iron market is further demonstrated by table N-5 which presents the estimated United States production, consumption and deficit or surplus of pig iron by States, annual averages for 1935-38, and table N-6, which shows United States imports of pig iron by customs districts, annual average for the same years. The total imports of the Atlantic coastal Customs Districts in the period 1935-38 averaged annually 85,000 long tons. The total consumption of the Atlantic seaboard States in this period averaged almost 10,000,000 long tons. In New England domestic producers face especially heavy transportation costs either on the raw materials or on the pig iron itself, yet imports into that area form only about 17 percent of consumption. New England in 1935-38 consumed on an average a total of 178,000 long tons (see table N-5), but imported from foreign countries only 30,618 long tons. Likewise the Pacific coast, another area where the domestic producers must support heavy transportation costs, consumed a total of 126,000 long tons annually and imported only 13,494 long tons, or about 11 percent.

The explanation for the small amount of imports lies in various factors. First, imports, except under unusual circumstances, cannot compete in the field of steel-making pig iron. Pig iron used in the manufacture of steel can most cheaply be converted into steel before it has been allowed fully to cool, and imported pig iron must face the additional costs involved in reheating it. Imports can only compete with pig iron that is made for sale as distinct from pig consumed by the maker. In the years 1928-37 out of an annual average of 25,249,000 long tons of pig iron production only 4,899,000 tons, or 19.4 percent, were made for sale. The proportion of pig iron for sale has been steadily decreasing. In the years 1928-30 the ratio of production-for-sale to total United States production was over 21 percent, while the average ratio 1935-37 amounted to 17.5 percent. For the year 1938 total pig iron production for sale was 2,954,924 long tons and production for sale in the State of New York was 389,639 long tons.¹⁷ A second factor tending to reduce imports, even of foundry iron, is the practice of hand-to-mouth buying on the part of the independent consumers of pig iron.

That Buffalo itself would be able to meet foreign producers despite the possibility of price competition is indicated by the fact that it is so large a shipper of pig iron. In the years 1928-37 it shipped by water an annual average of 227,000 short tons and received 17,000 short tons.¹⁸ Buffalo even ships into New England,

¹⁵ Tariff Commission, Report No. 23, second series, *Iron in Pigs and Iron Kettle*, 1931, p. 12.

¹⁶ Tariff Commission, Report No. 128, second series, *Iron and Steel*, table 47, p. 119.

¹⁷ American Iron and Steel Institute, *Annual Statistical Report*, 1938, p. 7.

¹⁸ United States Army, Corps of Engineers, *Commercial Statistics of the Water-Borne Commerce of the United States, 1929-38*.

where, in relation to foreign producers, it is at a freight disadvantage. Furthermore, if a surcharge of \$2.24 per long ton is added to the ocean rate from India to New York, the difference in price in favor of the Indian pig iron would be completely eliminated. We may conclude, then, that if foreign pig iron can make so little headway in the country as a whole, even in those areas in which it has definite freight advantages, and if Buffalo can compete in New England with the foreign competition, it seems unlikely that Buffalo producers will suffer from imports of pig iron via the Seaway.

In certain years it is possible that an unusual demand for a certain type of iron may bring about imports to meet the specific need. At times, for example, a producer of high-grade pig iron, like Sweden, may be called upon to ship small amounts into the Great Lakes area. There will, too, be an occasional dumping of small amounts of pig iron due to temporary gluts in foreign markets.

Exports.

Exports of pig iron, as shown in table N-2, have been insignificant relative to the total production. In 1937, they were 2.2 percent of total production and in 1938, 2.3 percent, but from 1928 to 1936 they amounted to only 0.2 percent or less. With the exceptions of 1929, 1937, and 1938, for the period 1928-38, exports have ranged 0.5 percent and below of production for sale. In 1937 and 1938 the unusual demand for pig iron by Japan and the United Kingdom brought about a great increase in exports which in 1937 attained 782,000 and in 1938, 433,000 long tons as compared with the years 1931-36 when they averaged about 4,000 long tons.

The total annual exports for the period 1928-37 averaged 95,246 long tons. Japan took 47,142, or slightly under 50 percent, and the United Kingdom took 23,466, or about 25 percent. Among the other important customers, Canada received an annual average of 8,461 long tons. In former years Canada used to be one of the most important customers of the United States, but the very great demand from Japan and the United Kingdom in the last few years has overshadowed Canada's share ²⁹ (table N-7).

As shown in table N-8, exports of pig iron by customs districts were concentrated in New York, Philadelphia, and Maryland. Mobile and New Orleans formed the second largest group. Of the customs districts in the Great Lakes area, St. Lawrence is important.²⁹

If the St. Lawrence Seaway were constructed and the Great Lakes area were to have direct ocean transportation, it would be in a position to export a share of the country's total exports of pig iron proportionate to its share of production. On the basis of data in the Annual Report of the American Iron and Steel Institute, the tributary area is found to have produced 75.3 percent of the United States total of pig iron in the years 1928-37. Ohio produced 24.1 percent. For that portion of Pennsylvania for which the rail rates were more favorable to the Lakes than to the present seacoast, production was estimated by allotting to the territory a percentage of the State's total production equal to its productive capacity for the year 1935. Since the production figures of New York State are grouped with those of Massachusetts in the Institute's Report, production of New York was also estimated on the basis of the relative capacity of the two States.

The annual average exports of pig iron to countries other than Canada in the years 1928-37 was 86,785 long tons, of which 23,466 long tons went to the United Kingdom. Ocean rates per long ton in effect from the North Atlantic range before the outbreak of the present war were, to Japan \$8.06, to United Kingdom \$6, to China \$6.90, and to the Philippines \$6.95. If we accept the premise that ocean carriers in accordance with trade practice would extend their present rates

²⁹ Based on *Foreign Commerce and Navigation of the United States, 1928-38.*

into the Great Lakes, the unit savings can be calculated by the difference in rail costs to the coastal port and to the lake port. In the case of the shipments to United Kingdom and other European points, this premise is certainly sound. To allow for play in rate structure, the savings upon shipments to all countries other than the United Kingdom and Canada have been estimated upon the assumption that in a run from the lakes ports the ocean carrier would ask for \$2.24 more than the rate from North Atlantic ports.

The estimated savings per long ton appear in table N-9. For exports to European points the savings range from \$1.19 from Pittsburgh to \$7.08 from Chicago and Gary. To other countries, excepting Canada, the savings range from \$0.37 from Youngstown-Struthers to \$4.84 from Chicago and Gary. On the later basis there are no savings on shipments from Pittsburgh.

In table N-10 the percentage of United States production for each State of the tributary area is applied to the 1928-37 annual average exports to United Kingdom and to countries other than Canada and the United Kingdom. In this way are estimated exports from the tributary area to United Kingdom and to other countries excepting Canada. An examination of the Monthly Summary of Foreign Commerce of the United States, 1936-37, reveals that during the months, May-November, when the St. Lawrence is open to navigation, 52 percent of the annual exports of pig iron were shipped. The estimated exports from the tributary area have therefore been modified by that amount. We have, then, an estimated in-season movement of exports to the United Kingdom from the tributary area of 9,188 long tons. Eliminating shipments from Pennsylvania there remain exports to other countries of 17,582 long tons. The grand total is 26,770.

To the tonnages estimated as originating in each State, the unit savings are applied in table N-11 to obtain the estimate savings on pig iron. On shipments to United Kingdom they total \$33,162 and to other countries except Canada, \$41,522, or a grand total of \$74,684. This estimate may be slightly reduced by eliminating the tonnage estimated to have moved from Ohio to countries other than Canada. The tonnage is then decreased by 7,934 long tons and amounts now to 18,836 long tons, and the savings decreased by \$2,936, to \$71,748.

As brought out more fully in the section of this study dealing with the exports of finished and semifinished steel products, the Seaway will mean to the Great Lakes producers more than the mere savings estimated for tonnage on the basis of present exports. By the Seaway, the vast productive power of the Great Lakes States is put within reach of direct water transportation to foreign markets and is brought into a much more favorable competitive position vis-a-vis the producers in other exporting countries.

Coastwise Movement

There is now a deficit in production in certain areas along the coast which is being filled by shipments from domestic producers in other areas or by imports. The proposed development would place the Great Lakes into a better competitive position through a reduction of transportation costs.

Special studies have been made by the Bureau of Mines of the consumption of pig iron by States in the years 1935 to 1938. Relating these consumption figures to the production figures of the American Iron and Steel Institute, in table N-5, the average annual surplus or deficit of production by states or areas for the years 1935-38 is estimated without consideration of imports or exports. The outstanding surplus in New York State was 610,000 long tons, no doubt concentrated in the northwestern part of the State. Pennsylvania had a surplus of 225,000 long tons, which also is probably concentrated in the western and central western parts of the State. Among the other States of the Great Lakes area, Ohio had a sizable surplus, and Indiana, Michigan and Wisconsin together had

a deficit of 756,000 long tons. The North Central States as a unit (including Colorado and Utah) had a deficit of 194,000 long tons. If it is assumed that much of New York's and Pennsylvania's surpluses are in the lakes area, the overall view for the tributary area shows an excess. Among the coastal areas showing deficits in these years are New England (87,000 long tons), New Jersey (217,000 long tons), the Southwest (10,000 long tons), and the Pacific Coast (126,000 long tons).

Table N-6 shows United States imports by customs districts for the years 1935-38. It is apparent that part of the deficit was filled by imports. Thus there was an estimated average deficit in New England during the years 1935-38 of 87,000 long tons. Average annual imports during the same period amounted to 30,618 leaving a net domestic deficit of 56,322 long tons. For New York Customs District, in these 3 years there was an annual average of imports of about 8,000 long tons, some of which may have moved into New Jersey and Connecticut. On the other hand larger quantities arrived at the Metropolitan Area from inland points. For instance, in the same years 1935-38, an annual average of 142,000 long tons of pigs and billets moved down the New York State Barge Canal and 86,000 long tons of pigs and billets were received at the port of New York via the Hudson River. The Pacific coast with a deficit of 126,000, imported 13,494, and the Southwest apparently filled most of its deficit of 10,000 long tons from imports.

For the purposes of estimating tonnage available for the St. Lawrence Seaway, we may leave out of consideration New York City, which can be reached from Buffalo by barge; New Jersey, which is close to the Bethlehem producing area; and within accessible distance to barges from Buffalo; and finally, the southwest which is accessible from Birmingham.

The New England deficit of 87,000 long tons is now the object of competition among the producers of Buffalo, Bethlehem, and Baltimore, and even Birmingham, as well as of foreign countries. Sample rates per ton now in effect to Boston are as follows:

From:		
Bethlehem, rail.....		\$4. 02
Buffalo and Erie, rail.....		5. 40
Netherlands:		
Ocean rate.....	\$3. 58	
Tariff.....	1. 12	
Total.....		4. 70
Calcutta:		
Ocean rate.....	4. 70	
Tariff.....	1. 12	
Total.....		5. 82

If the direct water rate from Buffalo or Erie is equivalent to the rail rate less 20 percent, it will amount to \$4.32 which is a substantial improvement in relation to the other producers shown.

How much savings on the shipments now moving from Buffalo to New England would be realized, it is impossible to calculate because of lack of data on the present shipments. Likewise how much, if any, of the deficit that is now being filled by other sources, especially foreign, would be filled from Buffalo or other lake ports is difficult to determine because the matter of pricing of imported pig iron is very flexible and depends greatly on the momentary conditions in the market and the rate of activity of the foreign producer. In any case it is obvious that the St. Lawrence development would place the Great Lakes producers in an improved position to benefit from the reduced rates to New England points.

A similar betterment of the competitive situation of the Great Lakes producers will be felt in relation to the Pacific coast trade, but to a degree not great enough possibly to have concrete effect. The midwestern producers are now at a decided

freight rate disadvantage in competition with the producers along the Atlantic coast. In general the rates to California are a few cents higher per gross ton than those to Washington and Oregon. To Californian ports from Buffalo the combination rail and ocean rate is \$12.78 per long ton; from Cleveland, \$13.59, and from Chicago-Gary, \$16.73, whereas from Bethlehem the rate is \$8.78 and from Sparrows Point and Everett, \$7.39. The all-rail rate from Chicago to the Pacific coast is \$11.44 per long ton. If we assume a direct water haul from Buffalo to be \$2.24 over the water rate from Sparrows Point or Everett, Mass., the rate from the Great Lakes points would amount to \$9.63. The rate then would be lower than that now in effect from Birmingham which is \$9.87. What its relation would be to rates from Calcutta or from the Netherlands we cannot say, because of the unavailability of the rates from those points to the Pacific coast. In respect to the potential traffic to the Pacific coast, the data then, are inconclusive, and merely show that there is a market in that region and that the Great Lakes producers through the proposed development would be in an improved position to supply that market.

Section 3

SCRAP IRON

Scrap iron and steel is used in modern methods of steel manufacture as a substitute for pig iron. Usually pig iron and scrap are used together in varying proportions depending upon the type of steel desired and especially upon the relative costs of the materials. The ratio of scrap to pig iron in the production of steel as a whole has been steadily growing until in the year 1938, it was 54 percent scrap to 46 percent pig iron.

Since 1935 the Bureau of Mines has made a study of the annual consumption of scrap iron and steel.²⁰ In the years 1935-38 the annual average of consumption for the United States as a whole was 30,531,000 long tons, of which 15,860,000 long tons or 52 percent, was home scrap, that is, originated in the place of consumption. The remainder, 14,671,000 long tons, or 48 percent, was purchased scrap. The largest consuming area is that of the North Central States,²¹ which consumed in that period an annual average of 16,147,000 long tons, of which 8,556,000 long tons, or 53 percent, was home scrap. The next largest scrap-consuming States are New York, New Jersey, and Pennsylvania. These three States used an annual average of 8,997,614 long tons, of which 4,888,000 long tons, or 54 percent, was home scrap. Considering that the major part of the consumption of New York and Pennsylvania is in the western parts of the States, it is plain that the Great Lakes area consumes about two-thirds of the scrap utilized in the United States.

Since a ton of scrap is roughly equal to a ton of pig iron or two tons of high grade ore, any change in the transportation costs of scrap is vitally important to the steel industry. The impact of the St. Lawrence upon the scrap iron trade must be analyzed both in terms of transportation economies and in terms of market effects.

There is a movement to restrict or prohibit the exportation of iron and steel scrap on the grounds that it is a national resource. This movement has attained some success during the present emergency, inasmuch as the exports of scrap are limited to Great Britain and to countries in this hemisphere. Since the effect of the St. Lawrence will vary according to the export policy of the Nation, it can best be appraised, first, on the supposition that exports will be unlimited, and second, that they will be wholly restricted.

²⁰ Department of the Interior, *Minerals Yearbook*, 1939, p. 520.

²¹ Ohio, Illinois, Indiana, Iowa, Kansas, Nebraska, Michigan, Wisconsin, Missouri, North Dakota, and South Dakota.

Under conditions of complete freedom in the scrap iron trade it is likely that the price will move toward greater equalization at the Great Lakes and coastal points. *The Iron Age*²² carries monthly average prices of heavy melting scrap at Chicago and in eastern Pennsylvania. In the period 1930-38 the average monthly price for Chicago has been as high as \$20.60 per long ton in March 1937, and as low as \$4.88, in July 1932. In eastern Pennsylvania the average monthly price has been as high as \$20 per long ton in April 1937 and as low as \$6 in May, June, and July, 1932. During this period the price at Chicago was generally lower than the price in eastern Pennsylvania, but at times it was higher especially in the spring of 1934, the fall of 1935 and throughout 1936. In relation to the eastern Pennsylvania price, the price at Chicago has been greater by \$1.50 per ton in December 1936, and less by \$2.40 in March 1938.

At present heavy rail rates bar foreign purchasers from the interior markets of scrap iron and steel. Indeed scrap moves into export trade only from areas close to the coast.

Table N-12 shows the annual average exports of scrap iron and steel by countries, 1928-37. Total exports in these years averaged annually 1,253,674 long tons, of which 654,531 or over 52 percent went to Japan. The United Kingdom took 163,922, Italy 159,638 and Europe as a whole 438,681 long tons.

It is unlikely that the importance of foreign scrap purchasers in the Great Lakes area will be strong enough either to bring about much exportation of scrap from the area or to raise the price of scrap to any marked extent. First, the price at Chicago often is not much lower than the price in eastern Pennsylvania. Furthermore, the Great Lakes already have a deficit of steel and iron scrap, whereas at coastal points the foreign purchaser has surplus areas in which he is protected from competition by the domestic purchaser because of the higher freight rates the latter must pay. Third, each important port of exit on the Great Lakes is an important steel producing center, and the foreign purchaser, who tries to outbid a domestic producer must not only pay the price asked but in addition pay an ocean freight rate equal to about a third or a fifth of the price. Typical ocean rates in effect from North Atlantic ports to major consuming countries of United States scrap iron and steel are shown in table N-13. To Japan the rates shown range from \$4 to \$4.79 per long ton, to the United Kingdom \$4.15 to \$4.59, to Italy \$4.80 to \$5.75. To points other than Europe, in this report it has been assumed that the rate from the United States North Atlantic ports would be increased by about \$2.24 per long ton for a service from Great Lakes ports. In the case of scrap such a rate differential would more than wipe out the differential in the price of scrap at eastern Pennsylvania as opposed to Chicago in all but 3 of 108 months from 1930 to 1939. Exports to Europe amounted, as an annual average 1928-37, to 438,681 long tons, or about 35 percent of United States total exports of scrap. Even the scrap purchasers of Europe are not likely to enter a market where a deficit already exists and where they must meet the price of the domestic buyers and then pay \$4 or \$5 additional in the form of ocean rates, just as the Great Lakes steel producers tend not to go into the coastal areas where surpluses of scrap exist because there they have to meet the price of the foreign purchaser and then take on greater transportation charges.

Finally, the effect of the St. Lawrence upon the price of scrap will be limited to the price of purchased scrap which in the Great Lakes area is about one-half the scrap consumed by steel mills. The remaining half, home scrap, being that portion of the scrap which comes from the steel mills internal operations, cannot, of course, be affected by the export demand.

It seems unlikely then that under these circumstances there will be any sizable exports of iron and steel scrap from the Great Lakes area or that the price of the

²² January 6, 1939, pp. 211-212.

commodity will be greatly affected. This conclusion is borne out by the fact that in the years 1928-37 direct water shipments from the Great Lakes to overseas points averaged yearly only 200 long tons.²³

As to the question whether the construction of the proposed waterway would lower the costs of transportation of scrap from coastal points to Great Lakes steel producing centers, the answer must be that the Seaway would reduce the transportation costs considerably. New England could perhaps move scrap into Buffalo at a feasible all-water rate via the St. Lawrence of \$4.84 per long ton, or 80 percent of the present rail rate. This feasible rate is within the range of the ocean rates to the principal countries that consume United States scrap. How much of the tonnage available in that area might be drawn into the Great Lakes area against the tug of foreign purchasers it is impossible to say. In any case this important source of scrap would be made more accessible to the Great Lakes steel producers.

Under conditions of embargo on scrap exports, the pull of foreign consumers of scrap iron upon the scrap of the great lakes area could not exist. On the other hand, the Great Lakes steel producers would be able to reach out to certain coastal regions at large savings in transportation costs.

There is an excess of scrap iron over consumption all along the coast and normally this excess is to a great extent exported. In the years 1928-37 these exports averaged 1,253,674 long tons.

Table N-14 shows the United States exports of iron and steel scrap by customs districts. The first fact apparent from the table is the wide distribution of exports of scrap among the ports of exit. Almost every coastal or border customs district has partaken in the export of this material. Through the Middle Atlantic customs districts of New York, Philadelphia, and Maryland passed 374,318 long tons, or about 30 percent of the total United States exports during the period 1928-37. Of this amount, 253,640 long tons were from the Customs District of New York. The next largest district, with respect to scrap exports, is the Gulf which averaged in the above period 325,209 long tons, of which 148,587 went from Galveston. Pacific States shipped into export trade 141,161 long tons. New England exported 111,154 long tons; the South Atlantic States, 217,120 long tons.

If the scrap which once moved into export no longer could do so, it would either be left unused or be shipped to the interior to fill the deficit in the Great Lakes area. It can be assumed that in general the direct water rate will be lower than the all-rail rate by from 20 to 30 percent. It is impossible to calculate with any degree of accuracy the tonnage that might move from one coastal population center to a given steel producing center with or without potential decrease in rates. Nevertheless, some idea of a possible movement can be reached. Under restrictions on the exportation of scrap iron and steel, a considerable share of the surplus in New England which used to move into the export trade might go to Buffalo at rates via the St. Lawrence 80 percent of the all-rail rate. From Boston to Buffalo the all-rail rate is \$6.05 per long ton. At 80 percent of this rate or \$4.84, the savings per ton would be \$1.21. If these savings were applied to the annual average exports from Maine and New Hampshire and Massachusetts during the years 1928-37, or 97,390 long tons, the savings would amount to \$117,800. These savings of course would be reduced if the rate comparisons were made from other gathering points than the coastal cities. However, the great centers of population in Massachusetts and Maine are close to the coast and could serve as assembly points for shipments to the Great Lakes as they have for shipments to foreign countries.

²³ Based upon compilations from War Department, Annual Report of the Chief of Engineers, *Commercial Statistics of the Water-borne Commerce of the United States, 1929-30.*

Among the New England States, Connecticut may be omitted from consideration because much of the scrap for inland movement might be gathered in New York City for shipment by the barge canal to Buffalo. Vermont is also not considered because it is not on the coast and its exports move to Canada.

Through the customs districts (see table N-14) of New York, Philadelphia, and Maryland, in the years 1928-37, were exported an annual average of 374,318 long tons. If New York is excluded from consideration as Seaway traffic, because shipments can be made to Buffalo via the New York State Barge Canal, there remain 61,594 long tons from Philadelphia, and 59,084 long tons from Baltimore. If it is assumed that this tonnage moved to Cleveland at rates 80 percent of the all-rail rate or at \$5.54 per long ton from Philadelphia and \$5.37 from Baltimore, the savings per long ton would be \$1.37 from Philadelphia and \$1.34 from Baltimore. The savings would be in that case about \$85,000 on the shipments from Philadelphia, and \$79,000 on the shipments from Baltimore. From Norfolk, Va., to Cleveland the all-rail rate is \$8.29 per long ton. At 80 percent of the all-rail rate, a feasible water rate would be \$6.63. The unit savings would be \$1.66. Applying these savings to the 1928-37 average tonnage exported from Virginia, 63,635 long tons, we have an estimated savings of \$105,600.

The rates from the Pacific coast, either the all-rail or the published combination rates to the Great Lakes area, or the published water rate to Baltimore are very high. The water rate to Baltimore from Seattle and Los Angeles is \$14. Neither the all-rail nor the combination rates from Pacific ports would serve as a basis for estimating an all-water rate into the Great Lakes. No shipments would move at such freight rates which are almost equal to the price of scrap at eastern points. If the demand for scrap iron and steel in the Great Lakes area should be sufficient to call the west coast surplus into use, it would undoubtedly move in large loads under contract arrangements that would represent a marked reduction over the present published rates.

Likewise the present published rail or combination rates from points on the Atlantic coast south of Virginia, although much lower than the corresponding rates from the west coast, are too high for a basis of estimating a water rate via the St. Lawrence. Any percentage relationship that ordinarily would seem a reasonable relationship for all-water rates as compared with present all-rail rates or present rail-water combination rates would be too high to move the traffic. The same may be said of any feasible all-water rate based upon a differential added to the water rate to Baltimore. Either very much lower rates for contract or charter service would be put into effect or the traffic would not move.

Under complete prohibition of exports, then, if we exclude traffic from Vermont, Connecticut, lower New York, and areas along the Gulf, the Pacific or the Atlantic south of Virginia, we have for the St. Lawrence a potential tonnage of 290,000 long tons and estimated transportation savings of \$396,000. If we modify the figure by seven-twelfths we have a potential tonnage of 169,000 long tons and estimated savings of \$231,000. There would undoubtedly be additional traffic from points on the South Atlantic and on the Pacific coast, but the calculated savings would have to be based on charter rates that cannot now be estimated.

In addition to savings in transportation costs, a new market would be opened for scrap iron accumulating in coastal regions, and the price in the middle west would certainly be lower to absorb this new supply.

Section 4

TRANSPORTATION OF IRON AND STEEL PRODUCTS FOR
DOMESTIC CONSUMPTION

In this section the domestic movement of iron and steel semifinished and finished products will be considered. Since iron products usually account for less than 1 percent of the total output of all iron and steel, no distinction between iron products and steel products is made.

Table N-15 presents a summary of United States production, imports, exports and consumption of finished iron and steel products, annual average 1928-37. The annual average production for the period 1928-37 was 26,811,000 long tons. Between 1929 and 1932 production decreased from 41 million to 10 million tons.²⁴ In recent years there has been a large upswing followed by a decline in 1938. Imports and exports are relatively very small in relation to production. Exports during the years 1928-37 averaged 1,327,000 long tons. Imports averaged 271,000 long tons, or about one-fifth as much as exports.

The production of iron and steel products in the United States is concentrated in three major areas. First is the Great Lakes area consisting of the western parts of New York and Pennsylvania and the States of Ohio, Indiana, Illinois, and Michigan. The eastern part of Pennsylvania and Maryland form another important region; the third important region is in Alabama.

Table N-16 shows the United States production by States of hot-rolled iron and steel products for selected years 1913-38. There has been in recent years, especially with the development of the automotive industry, a gradual westward shift of the geographic center of production toward the new consuming markets of the north Middle West. The Pittsburgh area has been for many years the leading producing district, but production in Youngstown, Cleveland, Detroit, and Chicago areas has lately been proportionately greater. Pennsylvania, as a whole, is still the most important steel-producing State. In the year 1938 it was followed by Ohio, Indiana, and Illinois in that order.

From the point of view of tonnage, the most important item among the types of iron and steel produced are the light flat-rolled products as shown in table N-17, and within this group, light flat-rolled sheets is dominant. Light flat-rolled strip and light flat-rolled black plates are also major items. The next group in the order of tonnage is iron and steel bars, especially merchant bars. The importance of the light flat-rolled products in recent years can be explained by the expanding use of these products in the manufacture of automobiles, refrigerators, metal furniture, and many other articles. The production of bars, too, has been fairly well maintained because of the extent to which they are used in the manufacture of automobile parts. Other items which in the past were very important show as of less consequence in recent years, because, moving primarily into capital goods, they did not weather the depression as well as those items that go into consumer goods. Examples of these items are rails and plates. The relatively low rate of production of structural shapes reflects the state of the construction industry in the 1930's.

Many steel products are advanced beyond the stage of hot-rolling. Table N-18 shows the production of selected iron and steel finished products during 1932-38. In 1938 the most important among these items were plain wire, cold-rolled sheets, and tin and terne plate. Other important items in the year 1938 are galvanized sheets, seamless pipes and tubes, and butt-weld and lap-weld pipes and tubes.

In respect to the relative consumption of iron and steel products, there is considerable variation in the relative position of the consuming industries due

²⁴ Tariff Commission, *Iron and Steel Report*, No. 128, second series, p. 132, table 59.

primarily to the degree of activity in each. The automotive industry, however, has been in recent years the most important. In 1938 it consumed 15.5 percent of the United States total; on the basis of the 6-year average, 1926-31 it consumed 16.0 percent. Buildings and construction consumed 15.2 percent in 1938 and 18.4 percent in the 6-year average, 1926-31. In 1938 railroad consumption amounted to only 6.6 percent as compared with an average of 17.7 percent during the years 1926-31. Other important consuming industries are (1), oil, gas, water, mining, (2) containers, (3) agriculture, (4) shipbuilding, (5) machinery and tools, (6) highways.²⁵

According to a special study of the consumption of domestic finished industrial steel by principal States for the year 1935 made by the United States Tariff Commission the results of which are presented in table N-19, the States of Michigan, Ohio, Illinois, Wisconsin, and Indiana together consumed in 1935 about 42 percent of the United States total finished industrial steel, and New York consumed 12 percent and Pennsylvania 6 percent. Michigan, which due primarily to its automobile and automobile parts accessory industries is the most important single steel consuming State, used 21 percent. Ohio and Illinois are also among the very large consumers. The relative position of the States as consumers of iron and steel products would of course vary according to fluctuations among the industries. For example, a marked drop in automobile production would show strongly in the consumption of steel in Michigan, and an increase in railroad purchasing would be reflected strongly in the steel consumption of Pennsylvania.

In connection with its investigation of the steel industry, the Temporary National Economic Committee, through the Department of Justice, gathered data from steel companies as to their shipments of certain steel products for the years 1936-38. The steel companies were asked to supply data covering shipment, first, by consuming States and, second, by consuming districts. The percentage of capacity covered by the questionnaire and replies varied greatly from product to product, and somewhat from year to year. There is also a marked difference in the percentage of capacity covered by the district samples as distinct from the State sample. The latter difference can be accounted for by the fact that some companies' records did not enable them to give a breakdown of the destination of their shipments by districts. In general, therefore, the sample covered by the returns for shipments by districts is less than that of the returns covering shipments by States. These facts can be seen in table N-20. The percentage of the 1938 capacity which was sampled by the questionnaire as to shipments by States ranged from 50.8 percent for concrete reinforcing bars to 99.8 percent for skelp. In the same year the percentage covered by the questionnaire for shipments by districts ranged from 20.6 percent for cold-rolled strip to 90.6 percent for heavy rails. If attention is focused upon the more important tonnage items, the difference in the percentage of capacity sampled by State as compared with that sampled by district is even more apparent. The percentage of capacity covered also shown in table N-20 for some of the major tonnage steel items for 1938 follows:

	<i>State sample</i>	<i>District sample</i>
Sheets, hot-rolled and hot-rolled annealed.....	82.1	49.2
Strip, hot-rolled.....	65.6	26.1
Merchant bars.....	73.7	48.8
Wire rods.....	76.6	57.7
Sheet, cold-rolled.....	79.8	44.5
Sheets, galvanized.....	82.1	52.1
Tinplate.....	89.1	58.1
Wire, plain drawn.....	63.9	46.3

²⁵ *The Iron Age*, March 16, 1939, inset opposite p. 86.

Table N-21 presents the 1937-38 annual average shipments of all steel products from selected Great Lakes producing areas to coastal consuming regions. For those products for which data by consuming districts were available, those data were used to the exclusion of data as to shipments by States. This choice necessarily understated the shipments, since the figures of shipments to consuming districts, as we have seen, generally covered a much smaller percentage of producing (and shipping) capacity. The procedure was followed nevertheless because by so doing it is possible to particularize the shipments and thus to make a more accurate study of the costs of transportation. Furthermore, the use of consuming areas was dictated by the inability otherwise to distinguish the receipts at the New York metropolitan area or the Philadelphia area, for example, from the receipts for the entire States of New York or Pennsylvania. Whenever the receipts of a product by consuming district were used, the receipts of that product by States was not included for any State that formed a part of the consuming district; thus there is no duplication in the totals for the State. To the contrary, the figures of State totals would be higher if only receipts by States had been used.

The total annual average shipments in the 3 years 1937-38 from the selected Great Lakes producing areas to all consuming States of the United States was 5,012,339 net tons. The total shipments of these producing areas to the coastal States and districts as an annual average for the same years was 423,488 net tons. Of this amount almost half, or 204,245 net tons were shipped from the Chicago producing area. Buffalo also was important among these Great Lakes producing areas as regards shipments to the seaboard. Its annual average shipments to these points in 1936-38 were 154,885 net tons. Cleveland, Detroit, Indiana, and Illinois were of much less importance than Chicago and Buffalo. Buffalo's shipments to coastal points are concentrated in the region from Connecticut through Philadelphia and Delaware. Important shipments are also made to Massachusetts and California. Chicago, too, had a slight concentration along the Atlantic coast from metropolitan New York consuming district to Philadelphia and Delaware, but a greater portion of its shipments to coastal points was to the West coast, especially California, and to Gulf States.

Table N-22 shows the shipments of selected semifinished and finished iron and steel products from coastal producing areas to consuming States or districts in the Great Lakes region, annual average 1936-38. The total shipments from these producing areas to all consuming States of the United States averaged 2,789,288 net tons. To the States and consuming districts of the Great Lakes these producing areas sent a total of 127,115 net tons. Most of these shipments originated in the east Pennsylvania and Philadelphia area (68,546 net tons), and the Baltimore area (50,403 net tons). Ohio and Indiana and Michigan were the most important Great Lakes States receiving shipments from coastal producing centers.

Tables N-23 and N-24 present estimates of the unit savings and the total estimated savings on shipments from Great Lakes producing areas to certain coastal areas and from coastal producing areas to selected Great Lakes areas. In determining the tonnage which might be considered potential to the St. Lawrence Seaway, consideration was given first to the volume of traffic from one producing area to each consuming area. Where the tonnage between these specific points was not considered sufficient to warrant the use of water transportation, the shipments were eliminated from consideration. Likewise, those shipments were not considered which might seriously be affected by a competitive waterway or for which the rail haul seemed altogether too short to warrant the use of a more roundabout water haul. This procedure leaves no out-bound movement from Buffalo to New York or New Jersey, or from Chicago to Louisiana, and no in-bound shipments at all from New England, Philadelphia, Alabama, or the Pacific coast. The total shipments between ports which are considered tributary to the

St. Lawrence, annual average, 1936-38, based on table N-21, is 344,325 net tons. Since the waterway will be open 7 months of the year, these figures were modified by 58 percent. We thus have an in-season potential movement of 199,703 net tons.

The most important shipment between the selected producing areas and consuming States is that between Chicago and California, 70,687 net tons, as an annual average, 40,998 as an estimated 58-percent in-season movement. The next largest amount is represented by the shipments from Buffalo producing areas to Philadelphia consuming district. Between these two areas 45,930 net tons were shipped as an annual average, 1936 to 1938, and the open-season shipments are estimated at 26,639 net tons.

Between Chicago and Texas there was also a very large movement, amounting to 36,181 net tons as an annual average, and the open-season shipments were about 20,985.

The smallest shipments which have been considered are those between eastern Pennsylvania and Wisconsin. These shipments amounted to an annual average of 3,147 net tons and an open-season estimate of 1,800. (See table N-22.)

In order to estimate the savings which the construction of the proposed waterway might bring about on this potential traffic, we must determine a feasible rate for the all-water transportation via the St. Lawrence. In determining such a feasible rate, consideration was given to the factors of charging what the traffic will bear, of the need of a certain revenue for the carrier undertaking transportation of the products, and a study of the percentage relationship of actual all-rail and all-water transportation between two given points under varying relationships of distance via water and distance via rail. The all-rail rates, or the combination water-rail rates used as the basis for this study, are taken from compilations of the American Iron and Steel Institute,²⁰ which in turn are based upon the I. C. C. files of freight tariffs. They are in all cases minimum rates.

From Chicago to Massachusetts and to Maryland, the basis chosen was 70 percent of the all-rail rate. To points on the Pacific coast, 90 percent of the combination rail and water rate was taken. From Cleveland to Massachusetts, Connecticut, and New York, 75 percent of the rail rate was considered a feasible rate, whereas 85 percent of the combination rail and water rate was taken as a feasible rate from Cleveland to California. From Detroit to Massachusetts and Connecticut, 80 percent of the all-rail was used. From Buffalo to Maine, Massachusetts, and Virginia 85 percent was applied to the all-rail rate, but 90 percent of the all-rail rate was considered a feasible rate from Buffalo to Philadelphia. From Buffalo to California, 80 percent of the combination rail and water rate was used.

For the in-bound movement from Baltimore to the State of Ohio, 90 percent of the all-rail was employed as against 80 percent to both Illinois and Michigan. From eastern Pennsylvania, 90 percent of the all-rail was considered as a likely all-water rate via the St. Lawrence to Buffalo, 85 percent to Cleveland, Illinois, and Michigan, while to Wisconsin, 80 percent was used.

Applying the percentages to the present rail rate, we have a feasible all-water rate via the St. Lawrence. The difference between the present rail and the feasible water rate would be estimated unit savings. These unit savings range per net ton between \$0.72 from Baltimore to Ohio and \$3.30 from Chicago to Massachusetts. Applying the unit savings to the representative tonnage, we have a total estimated savings of \$304,105. The largest amount of savings between a given producing area and a given consuming area is that which is estimated for shipments from Chicago producing area to California, \$70,517.

²⁰ *Freight Tariffs* Nos. 1-B, 2-C, 3-B, 4-A.

The second largest, of shipments from Buffalo to California, for which the savings are estimated at \$35,503 are as shown in table N-24.

Caution must be used regarding these savings insofar as they make no allowance for hauls to or from the water, either at the producing area or at the consuming area. On the other hand, as we have seen in table N-24, the shipments upon which the savings are based are to a very great degree understated in three respects. First, the movement of only selected products was studied; second, the sample of these products was incomplete; and, third, wherever possible the lower figures for shipments to consuming areas were used instead of shipments to consuming States.

More important, perhaps, than the potential traffic and savings that can be calculated upon the present known movement of iron and steel products will be the repercussions of the proposed Seaway upon the present basing-point price system, the distribution of natural markets, and the location of industry.

A primary aim in the domestic price policy of United States producers has been stability of prices. A mainstay of this policy is the basing-point system. For many years domestic steel producers have followed the practice of quoting delivered prices. For each important product, quotations are published which apply at certain specified localities called basing points. The price of a product delivered at any other point in the United States is the lowest figure obtained by adding to the established price at each basing point the rail freight charges from the basing point to destination. In arriving at the price, no consideration is given of the freight actually paid.

If the freight actually paid is lower than that used to determine the delivered price, the difference is called "phantom freight"; if the freight actually paid is higher, the difference is called "freight absorption."

Thus, if the base price at two basing points is \$40 and the freight is respectively \$4 and \$5, the quoted price would be \$44, as shown in table N-25. Table N-25 shows three producing centers. A and B are at different basing points. C is at no basing point. The base price at A and B is \$40. The freight from A to the point of delivery is \$4, from B, \$5. The delivered price is then \$44 for all three producing centers if they wish to bid for the order. At a delivered price of \$44, A would receive \$40 as its "mill net," B, \$39, and C, \$41. The freight absorption is for A nothing, because the quoted price is calculated from its base price plus the freight from A to the point of delivery. B, however, has to pay \$5 for freight instead of A's \$4. It has then a freight absorption of \$1. C pays only \$3 for freight and it thus has phantom freight of \$1, which is reflected in the mill net of \$41.

Phantom freight may be based not only on lower rail freight rates, but also on ability to use a cheaper means of transportation. In table N-26 we see how water transportation may bring about phantom freight. Here we have two producing centers, A and B; the base price is \$40 at each point; the rail freight is \$4 for A, \$3 for B. The delivered price, as we have seen, would be \$43 for both producers. If the shipment is made by rail, than A would have a freight disadvantage absorption of \$1 and a mill net of \$1 below its base price or \$39. It is assumed, however, that A can use water transportation to the point of destination, and that the water freight is \$2. Despite the fact that the water freight from A is lower than the rail freight from either A or B, the price will be based on the lower rail freight. Thus, A will have a freight advantage if it uses the water transportation of \$1, and its mill net will be \$41.

In its T. N. E. C. papers, United States Steel Corporation gives reasons why company A that might use water transportation to a given point does not quote a delivered price based on the cost of this water transportation. Of the six reasons forwarded, three can be reduced to the fact that generally water transportation

is unsuited to the customer's needs. A fourth reason offered is that closed seasons due to floods or climatic conditions present transportation hazards which prevent sound business determination of price for future delivery. A fifth reason is that shipments by water always involve extra costs both at mill and at destination which greatly reduce or eliminate the savings in transportation. The sixth reason offered is that if the company based its price on water transportation, competing steel companies would meet that price, but not having water service available, they would use the superior rail service and force company A to meet their service if it wished to hold the business. The net result would be that the customer would pay a lower price for all his steel, despite the fact that the freight costs remained actually as they were before the first company lowered its delivered price. There would then come about a general dislocation of price, even for the inland customers who cannot be reached by water transportation, because the mill will not want to see them suffer the loss of their market to the customer favored by water transportation.

Objections have been made on various grounds to the practices of basing the delivered price on only the rail freight. One objection is that the practice is not truly competitive. Since the customer's choice of price is limited, he has no possibility of playing one mill against another to get a lower price. A second objection is that either docking and loading facilities of the customer are allowed to go unused and the advantages which had brought about his investment in his location on the water's edge are in effect being destroyed or the expenditures of the Government are being utilized to their own advantage by the steel companies. A third objection is that the practice may be preventing an expansion of steel consumption which might result from lower rates and prices.

In this report, we need not concern ourselves with the validity of the arguments for or against the basing point method as it affects the public welfare. It is reasonable, however, to expect that by the construction of the proposed seaway the basing-point system as it now stands built almost entirely upon rail freight may be weakened. By means of the Seaway a large proportion of the United States productive capacity will have direct water transportation to coastal markets. At present direct water transportation to coastal points is limited to Sparrows Point, Md. Pittsburgh and Chicago enjoy barge transportation to points along the Mississippi River system and by transfer at New Orleans, to outside points. Birmingham, Ala., has barge transportation to Mobile, from which by transshipment it has access by water to all coastal points. But by means of the proposed Seaway a large proportion of the United States productive capacity will have direct water transportation to all coastal markets.

Not only will the Seaway tend to weaken the basing-point system, but by enabling the Great Lakes producers to ship more cheaply into the coastal areas, it will bring an extension of their markets. For a graphic illustration of how water transportation brings about an extension of the natural market of a mill, the reader is referred to the T. N. E. C. Papers of the U. S. Steel Corporation.²⁷ At present most shipments to coastal areas come from Birmingham, Ala., Sparrows Point, Md., Bethlehem, Pa., and Pittsburgh, Pa. Direct water transportation to the coastal areas will enable the Great Lakes area to enjoy a larger percentage of such shipments, from which they are now mostly barred because of freight costs.

The probability that shipments for longer distance will be made under the stimulus of lower freight rates by water transportation can be seen from a study of the increased average length of a haul of iron and steel products shipped over the Ohio River from 1927 to 1934, as presented by deChazeau.²⁸ In 1929 the

²⁷ Vol. 3, pp. 65-67.

²⁸ Carroll R. Daugherty, Melvin G. deChazeau and Samuel S. Stratton, *The Economics of the Iron and Steel Industry*, vol. 1, pp. 466-7.

completion of slack water developments on the Ohio afforded for the first time a dependable channel for navigation throughout the length of that river. The average haul for iron and steel increased from 242 miles in 1928 to 561 miles in 1934, or 132 percent. A similar increase can be observed in the packed freight. Coal and coke, sand and gravel, on the other hand, showed over the same period but a tiny growth in the average length of haul. The explanation is that iron and steel products and packet freight were able to benefit from the cheaper transportation, while the coal and coke and sand and gravel, being all produced at points quite close to the steel-producing areas where they are consumed, were not able so to benefit.

We have seen that there has in recent years been a trend in the production capacity from Pennsylvania toward the Central Northwest States bordering on the Great Lakes. This tendency is likely to receive some impetus from the St. Lawrence development, not only from the domestic movement, but also from the bettered position that will obtain for the Great Lakes producers in the export trade.²⁹

The interplay of these three factors, weakening of the basing-point system, extension of the markets of Great Lakes producers, and a shift of productive capacity to the Lakes shore will tend each to stimulate the other, so that tonnage tributary to the St. Lawrence should increase.

From the point of view of the coastal consumers of steel, if the above analysis is correct, the St. Lawrence should bring lower prices and possibly some increase in consumption.

Section 5

EXPORT MOVEMENT OF IRON AND STEEL SEMIFINISHED AND FINISHED PRODUCTS

Although exports of semifinished and finished steel products are but a small proportion of total production, they amount to a considerable tonnage. In the years 1928 to 1937, the average total exports for semi-finished and finished products amounted to 1,379,000 long tons (table N-27). In 1928 exports amounted to about 2,255,000 long tons, and in 1929, to over 2,433,000 long tons. See table N-28. During the depression years, exports naturally dropped sharply, but under the impetus of better economic conditions abroad, and especially the rearmament programs of Japan and the European countries, they increased sharply after 1935 and in 1937 reached a high of 2,685,000 long tons.³⁰ The average annual value of iron and steel manufactures, semifinished and finished, exported in the 10 years, 1928-37, was \$47,194,000.³⁰

Table N-28 shows exports by countries for the years 1928-37. Canada has been in previous years by far our most important customer. In more recent years its relative importance has decreased, as shown by its percentage of the total United States exports, which in 1929 was 45.2 percent, but in 1937, only 16.8 percent. The United Kingdom, which in 1929 took 2.6 percent, in 1937 took 5.4 percent of the United States exports. Japan in 1929 received 8.3 percent. In 1937, its share had jumped to 17.5 percent. The great increase in relative importance of Japan and the United Kingdom in 1937 is due primarily to their armament programs.

Despite the amounts shipped to the United Kingdom, the United States foreign markets are principally in the Far East and in Latin America. Small amounts,

²⁹ See secs. 2 and 5.

³⁰ Compiled from Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37*.

however, have gone to such African points as the Union of South Africa and Mozambique.

A few of the countries that are markets for the United States steel products, for example, the U. S. S. R. and Canada, have steel industries of importance, but are on an import basis with respect to many iron and steel products. Others like the United Kingdom and Japan are upon an export basis for finished steel. These two countries, in particular, import amounts of steel which ordinarily they further process and reexport. Many other countries, particularly in South America and the Far East, which are the most important markets of the United States, have only small steel works or mills. These are often referred to as neutral markets.

For the purposes of this survey, a study will be made of the potential movement of iron and steel products exported to countries other than Canada. It is generally assumed that the exports of iron and steel products to countries overseas originate almost entirely in producing areas on or near the seacoast, as Baltimore, Bethlehem, and Birmingham, as well as in Pittsburgh. Nevertheless, reports of certain companies to the Survey and the returns made to T. N. E. C. show that there is a movement of some magnitude from the Great Lakes area to countries other than Canada. In estimating tonnage with exactitude there is the difficulty that there are not available figures on exports broken down both by the States or districts of origin and by the countries of destination. There are available, however, total exports from the producing regions within the tributary area and the total United States exports to Canada. If the assumption is made that all United States exports to Canada originate in the Great Lakes area, then the remainder obtained by subtracting total United States exports to Canada from total exports of the tributary area is the equivalent of the minimum of exports from the tributary area to countries other than Canada. In table N-29 this procedure has been followed for the year 1937. The figures for the export of each major product are based upon returns made to T. N. E. C. The figures of the United States exports to Canada are derived from Foreign Commerce and Navigation of the United States, 1937. The categories of products as reported by the Foreign Commerce and Navigation of the United States do not agree exactly with the categories of the T. N. E. C. schedules; however, combinations of the categories as reported by the Foreign Commerce were selected and grouped so as to be identical as far as possible with those of T. N. E. C. Thus, for example, the tributary area in the year 1937 exported 382,440 short tons of tin plate. The United States as a whole exported to Canada in that year 31,327 short tons of tin plate, Taggers tin, and terneplate. The difference of 351,113 undoubtedly moved from the Great Lakes to countries other than Canada and represents a minimum of the exports of tin plate from the region overseas.

The second most important item is plates, of which the tributary area exported 241,737 short tons in 1937, the United States as a whole exported to Canada 50,040, and the tributary area is estimated to have exported to other countries at least 191,697 short tons. (See table N-29.)

Of sheets, hot-rolled and cold-rolled, 240,608 short tons were exported from the tributary area to all countries. From the United States as a whole 86,542 short tons were exported to Canada. Therefore, 154,066 short tons are estimated to have been exported from the tributary area to countries other than Canada.

The items included in the T. N. E. C. study, as shown in table N-29, totaled 1,524,530 short tons of exports from the tributary area, 469,693 United States exports to Canada, and 1,105,938 exported from the tributary area to countries other than Canada. The totals do not exactly balance by subtraction, because in skelp and cold-rolled strip, United States exports to Canada exceeded the total exports of the tributary area, and of course the tributary area could not be assumed to have exported to Canada an amount greater than its exports to all countries.

These figures to some degree underestimate the exports from Great Lakes areas to countries other than Canada, first because they are based upon only those items for which T. N. E. C. figures were available. These items are all important tonnage products, however. Second, of those items, the entire capacity of the industry was not sampled. (See table N-20.) Thirdly, a certain amount of the exports to Canada no doubt originated in producing districts outside the tributary area.

The tonnage so far estimated as having originated in the Great Lakes area and having been exported to countries other than Canada is a total for the area. That total may be allocated to the individual producing areas on the basis of the percentage which each had of the total exports of the area to all countries. Thus, Pittsburgh, which exported 51.6 percent of the total exports of the area, is assumed to have exported to points other than Canada the same percentage of 1,105,938 short tons, or 570,664 short tons. Youngstown is thus estimated to have exported overseas 263,213 short tons and Chicago 126,077 short tons. (See table N-30.)

It will be seen later that a distinction must be made for the purposes of a more accurate study of rates and savings between the shipments to Europe and the Mediterranean and shipments to other countries. The total exports overseas have been allocated to these regions on the basis of the percentage of the total United States exports during the years 1928-37. In those years Europe and Mediterranean countries received 9.4 percent of the total United States exports of iron and steel, semifinished and finished products. Thus, it is estimated that the tributary area as a whole exported to Europe and Mediterranean countries 103,958 short tons, of which 53,643 originated in Pittsburgh and the North Ohio River District, 24,742 in the Youngstown district and 11,851 in the Chicago district. All other countries received 1,001,980 short tons from the tributary area as a whole, of which 517,022 originated in Pittsburgh and the North Ohio River, 238,471 in Youngstown and 114,226 in the Chicago district.

The St. Lawrence Seaway will be open to navigation between the months of May through November. The exports estimated to have moved to Europe and other countries from the tributary area must then be modified by a seasonal percentage. In the year 1937 of the total annual exports of finished and semifinished iron and steel products, 65.3 percent were shipped during the months May to November inclusive.²¹ The application of this percentage to the annual tonnage already estimated results in total inseasonal movement from the tributary area of 722,178 short tons, of which 372,644 originated in Pittsburgh and the North Ohio River and 171,878 in Youngstown and 82,328 in Chicago. European and Mediterranean countries are estimated to have received 67,885 short tons from the tributary area as a whole and of this amount 35,029 is estimated to have been produced in Pittsburgh and the North Ohio River, 16,156 in Youngstown and 7,739 in Chicago. All countries except Canada, European and Mediterranean countries, are estimated to have received 654,293 short tons. Of these 337,615 are estimated to have come from Pittsburgh, 155,722 from Youngstown, and 74,589 from Chicago. (See table N-30.)

The savings that might accrue directly or indirectly to the Great Lakes producers of iron and steel products depend not only upon the tonnage that might move but also on the difference between the present transportation rates and the rates that may be expected to be in effect after the Seaway is constructed.

Examples of ocean rates in effect from the North Atlantic range to principal foreign markets for United States steel products during the summer of 1939 are shown in table N-31. By comparing these ocean rates with the export rail rates, shown in table N-32, it can be seen that the rail rates from Great Lakes producing

²¹ Based upon Department of Commerce, *Monthly Summary of the Foreign Commerce of the United States*, 1937.

centers to North Atlantic ports are equal to more than half of the ocean rate from those ports to the ultimate foreign market. In some cases, they are almost equal to the ocean rates.

If we assume that the ocean rates from the Great Lakes ports would be about the same as the rates from New York, on the principle of blanketing rates, the estimated savings on potential traffic can be calculated simply by taking the difference between the export rail rate to New York and the rail rate to the nearest lake port. Excepting Youngstown, all of the producing centers in the tributary area are clustered about the Lakes, and require no rail haul to the port. Naturally in the case of those mills in the Lakes districts not located directly on the shore, there would be involved a truck haul to shipside, which would reduce the estimated savings somewhat. In the case of Youngstown, the movement of any volume of traffic into the export trade via Cleveland might well bring about the establishment of an export rate that would be perhaps 25 percent lower than the present rate. Such a rate would increase the savings per ton by about 60 cents.

The principle of blanketing the New York rate to the Great Lakes ports is sound, undoubtedly, for shipments to Europe and to the Mediterranean. For shipments to the Far East, considering the great distance involved in the present voyage from New York, it is possible that any differential that may be added will be quite small. On shipments to South America, however, there probably will be a differential over the New York rate.

On shipments for which the rate from New York is blanketed to Great Lakes ports, the unit savings will be equal to the difference between the rail cost from the point of origin to New York and the corresponding rate to the nearest lake port. In table N-32 are shown indicated savings to Europe and the Mediterranean estimated on this basis. They range per hundred pounds from 3 cents on shipments from Pittsburgh to 27 cents on shipments from Chicago. If it is assumed that a ship operator will require \$2 per short ton additional charge on a run from the lake ports to all countries except the European and Mediterranean countries, the net effect will be to reduce the unit savings estimated on movements to such points by 10 cents per hundred pounds. For points other than Europe and the Mediterranean, then, the savings range from 2 cents per hundred pounds on shipments from Anderson, Illinois, and from Youngstown, Ohio, to 19 cents on shipments from Detroit. Pittsburgh shows no unit savings on such shipments. In terms of dollars per ton, the range of indicated savings is for shipments to Europe and the Mediterranean from \$0.60 per short ton from Pittsburgh to \$5.40 from Chicago and on shipments to other points from \$0.40 from Youngstown and Anderson to \$3.80 from Detroit.

In table N-33 the indicated savings are applied to the seasonal tonnage of steel products moving from the Great Lakes tributary area overseas. On shipments to Europe and Mediterranean countries the savings total \$156,579, of which \$41,791 are estimated for shipments from Chicago, \$38,777 on shipments from Youngstown. On the seasonal exports of steel products to countries other than Europe, the Mediterranean and Canada, estimated savings total \$525,332. Of this amount \$253,603 are estimated for shipments from Chicago; \$126,672 on shipments from Buffalo. The total estimated savings equals \$681,911, of which \$295,394 are on shipments from Chicago, \$151,763 on shipments from Buffalo and \$101,066 on shipments from Youngstown. The unit savings on shipments from Pittsburgh and the North Ohio district to European and Mediterranean points is estimated at only \$0.60. The unit savings to other countries from the Canton-Mansfield district amounts to \$0.90 and from Youngstown district, \$0.40 per short ton. In consideration of these low unit savings all the tonnage estimated as moving from Pittsburgh to both European and Mediterranean and all other

countries except Canada may be eliminated as well as the shipments to other countries from Canton and Mansfield and Youngstown. The 611 short tons that remain as tonnage from Canton and Mansfield to Europe and the Mediterranean and the 722 short tons from Minnesota may also be disregarded as too meager. After these eliminations, the total potential tonnage is estimated at 187,000 short tons and the total savings at \$592,000.

The savings that can be calculated upon traffic actually known to move from the Great Lakes steel centers into export trade is not the only benefit that will accrue to the producers of the area. By the construction of the St. Lawrence Seaway, the position of the United States industry becomes greatly bettered in competition with other steel-producing countries in neutral foreign markets.

The European producers who are the chief competitors of the United States industry in foreign markets are Germany, Belgium-Luxembourg, the United Kingdom and France. The producers of these countries are on the whole either near the coast or enjoy inland water transportation to the coast. In addition efforts to channelize the movement of steel products through given ports have been stimulated by the ports, railroads and inland water carriers involved. Even the various governments have sought to foster national industries, ports and carriers by lower transportation rates to the coast.

Competition among the major exporting countries has been regulated by cartel agreements. United States producers have partaken in some cartels governing the exports of individual products; (for example, the rail, wire-products, and tin plate cartel) but they have never been a member of the International Steel Cartel, which sought to regulate the export of steel products in general. The importance of the International Steel Cartel in the export trade is shown by the fact that in 1935 and 1936 the Cartel countries controlled over 80 percent of the total world exports.

Tables N-34 and N-35 illustrate the bettered position in export trade that will be brought about by the Seaway for that part of the United States steel industry which is on or near the Great Lakes as respects its competition with European countries in neutral markets. These tables are based upon a study of the United States Tariff Commission.³³ They cover five of the products important in United States export trade. The countries of destination shown are those most important for the respective commodities in the year 1937 wherever comparable rate data were available for the United States producing centers and United Kingdom or German ports. Cleveland was chosen as the point on which the study of the shift in competitive position of the Great Lakes producing area was focused, because it lies between the extremes that might be shown had Youngstown or Chicago been chosen.

These tables illustrate, first, the transportation handicap that United States producers, especially those in the interior face in respect to European producers and, second, the enhanced position that the Great Lakes producers can expect from the proposed Seaway.

Table N-34 covers the products, black sheets, tin plate and steel bars. The first column of figures shows the ocean rate from the United Kingdom to selected ports of neutral markets. The remaining columns show the amounts by which the rate from certain United States producing centers is greater or less than the corresponding rate from the United Kingdom ports. Table N-35 presents a similar comparison for iron and steel rails and barbed wire except that, because of the data available, Rotterdam and Antwerp and German ports were used as a basis of comparison instead of the United Kingdom.

³³ Tariff Commission, *Iron and Steel*, Report No. 128, second series, pp. 342-345.

As these examples show, the European producers are generally at an advantage compared with even those American producers that are located on or near the coast. Pittsburgh because of its rail haul is faced in most cases with a sizeable disadvantage. The Great Lakes ports under the present conditions are even more handicapped by their rail costs. Their present disadvantage compared with European producers range, among the items and points considered, from 56 cents per ton on tin plate to Shanghai, to \$11.55 per gross ton on steel bars to Magallanes, Chile. In order to visualize the shift that would be brought about by the proposed St. Lawrence development, we have assumed that for the South American and Far Eastern points shown the rate from the Great Lakes ports would be \$2 over the rate from Baltimore or New York. On this basis, the Great Lakes ports disadvantage disappears in some cases, notably tin plate to the Far East, and the highest disadvantage shown is \$8.40 for steel bars instead of the \$11.55 as matters stand today.

Considering the great capacity of the Great Lakes area, it may well be that such a reduction in the rate disadvantage that the area suffers in the foreign market, may be more important than the savings that we have calculated based upon present exports. This advantage will make itself felt in enabling the Great Lakes producer to quote a better price, and thereby perhaps obtain a larger share of the markets. The United States producers, as a whole, by bringing such a larger proportion of their total productive capacity into more effective play in the foreign markets, will find enhanced their bargaining position with any European competitor or group of competitors regarding formal or informal allocation of neutral markets that may take place after the war.

Section 6

IMPORTS OF SEMIFINISHED AND FINISHED IRON AND STEEL PRODUCTS

Imports of finished iron and steel products into the United States are much smaller in quantity than exports. Since 1928 they have ranged from a maximum of 505,000 long tons in 1928 to 113,000 long tons in 1934. In 1937 they were 291,000 long tons and in 1938, 166,000. As a percent of total consumption since 1928, in no instance were they higher than 2.1 percent (in 1932) and since 1933 they have usually been 0.8 or 0.9 percent. In 1934 they were as low as 0.6 percent.²³ The small ratio of imports of finished steel products to total consumption and the relative steadiness of that ratio indicate that the imports are complementary to the domestic production.

Table N-36 presents United States imports by groups of products, annual average, 1928-37. The entire breakdown of iron and steel semifinished and finished products as reported in *Foreign Commerce and Navigation of the United States* for the year 1937 carries as many as 280 items. Such complexity prohibits a study of the individual commodities, so that in this report, for statistical purposes, all semifinished and finished products are grouped together.

In the years 1928-37, the annual average of total imports of semifinished and finished iron and steel products was 281,732 long tons. Semifinished products, such as blooms, billets, slabs, etc., accounted for only about 10,000 long tons and finished products for 271,583.

Among the finished products, structural shapes and sheet piling were in recent years the most important group from the point of view of tonnage, and during the years under discussion an average of 49,235 long tons of these products was im-

²³ Based upon Department of Commerce, *Foreign Commerce and Navigation of the United States*, 1928-38.

ported. The second largest tonnage was reported for the group, "other steel bars," which includes steel bars, except concrete reinforcement bars and hollow bars and steel drill bars. This country imported an average of 32,891 long tons of "other steel bars." Other important quantity groups were wire rods, sheets, skelp and sawplate, cast iron pipe and fittings, seamless pipes, barbed wire, hoops and bands, and nails, tacks and staples.

Quantity alone is not a sufficient indication of the relative importance of the import groups. In 1937, only 4,033 long tons of flat wire and strip steel were imported, but the value of this amount reached \$2,136,000, or \$530 per long ton. Covered wire and cable in 1937 likewise had the high value of \$305 per long ton. The tin plate imported in 1937 was valued at \$289 per long ton. These groups are to a great degree composed of steel products of special quality for special purposes. For example, important in the value of flat wire and strip steel is the strip for safety razor blades imported from Sweden, and although the United States is the outstanding producer and an important exporter of tin plate, it imports small amounts of tin plate for particular purposes.

This section of the study aims to determine, first, the volume of tonnage that might be expected to move over the proposed Seaway, and the savings; and secondly, the impact of these imports on the domestic producers of steel.

As with other import commodities we may estimate the potential savings on the transportation of semifinished and finished iron and steel products from a study of the consumption of the area and the transportation rates. Table N-37 presents United States imports of semifinished and finished iron and steel products by country of origin, annual average 1928-37. Except for Japan and Canada, the sources of our imports are entirely European, especially Belgium-Luxembourg, Germany, Sweden, France, and the United Kingdom. Excluding imports from Canada, total imports of iron and steel semifinished and finished products in the years 1928-37 averaged annually 274,693 long tons.

The United States Tariff Commission, as a part of its study of the iron and steel industry, analyzed the consumption by industrial consumers of finished steel products, by States, for the year 1935.³⁴ This study excludes rails, line pipe, and highway steel. In the absence of more recent or more comprehensive data, we may apply to the annual average of imports of steel products other than from Canada the percentage of industrial consumption for the tributary area of domestic finished steel. Such a procedure is justified by the fact that imports are complementary to domestic production. Although in individual cases it is not exact, for the entire group the error is likely to be small. As shown in table N-38, Ohio on this basis, having consumed in 1935, 9 percent of the domestic industrial finished steel consumed in the United States as a whole is assumed to have consumed the same percent of the imports other than from Canada, or 24,722 long tons. Likewise Michigan is estimated to consume 21 percent, or 57,685 long tons. The total estimated consumption for the States wholly or nearly wholly in the tributary area is 42 percent of the United States total, or 115,370 long tons. New York State and Pennsylvania, parts of which lie in the Great Lakes area, are likewise estimated to consume respectively, 32,963 long tons and 16,482 long tons. How much of these States' tonnage should be allocated to the tributary area is impossible to determine and no estimate of potential savings has been made.

According to the *Monthly Summary of Foreign Commerce of the United States*, in the years 1936-38, about 58 percent of the imports of semifinished and finished iron and steel products entered the country during the months May to November, the period of open navigation of the St. Lawrence. Modifying the estimates of consumption by this percentage, the inseasonal potential movement is obtained.

³⁴ Tariff Commission, Report No. 128, second series, *Iron and Steel*, p. 325.

For the tributary area as a whole it is 66,915 long tons, of which 33,487 long tons are estimated to move into Michigan, 14,339 into Ohio and 12,745 into Illinois.

The ocean rates in effect before the war from Europe to Atlantic ports of the United States on a few important commodities are shown below.

<i>Product</i>	<i>Per long ton</i>
Structural shapes.....	\$6. 72
Hoops and bands.....	7. 39
Steel bars.....	6. 72
Nails.....	6. 72
Barbed wire.....	8. 74

The range of the items shown is from \$6.72 to \$8.74 per long ton. The rate on other products may be higher as can be seen from the fact that the rates for plates and sheets, half finished, punched, galvanized, cheap, from the Hamburg-Antwerp range to Montreal or St. John were for the early part of 1939, \$19 noncontract and \$15 contract. On some steel products the rate to Montreal is higher and on others lower than the rate to New York for the corresponding product, but in general they do not differ much one from the other.

On imports from Europe we may assume a feasible ocean rate via the St. Lawrence equal to that now in effect from Europe to New York. On this assumption the unit savings would equal the difference between the import rail rate from New York to the point of consumption and the rail rate from the nearest lake port to the same point. Table N-39 shows the rates from New York to selected points in the Great Lakes area for certain groups of iron and steel products. It will be noted that from New York to a given point there is considerable variation in the carload rates, but that the less-than-carload rates are uniform. In the light of the relatively small amount of tonnage involved, the less-than-carload rates may be more accurately used as a basis for estimating savings.

In that case the rail rates from New York range from 44 cents per hundred pounds to Buffalo, to 67 cents per hundred pounds to Milwaukee. To Detroit the rate is 54 cents, to Cleveland and Cincinnati, 48 cents and 54 cents per hundred pounds respectively.

On the points selected as representative consuming centers of the States for which tonnage was estimated, Cleveland, Chicago, Detroit, and Milwaukee are directly on the Lakes; Cincinnati and Indianapolis require an inland rail haul from the lake shore. Cleveland and Cincinnati balance each other for the tonnage of Ohio, which has been evenly divided between them; a more equitable division might have given Cleveland a higher proportion. The true center of steel-consumption for Indianapolis might be nearer Gary, but the choice of the inland point offsets whatever error might creep in from the logical use of Chicago as a representative point for Illinois. Detroit is the center of steel consumption for Michigan, and Milwaukee may be taken for a representative point of Wisconsin.

Applying the estimated unit savings to the tonnage, we have in table N-40 the total estimated saving in transportation costs. For the tributary area, excluding western New York and Pennsylvania, the total is \$757,987, of which Michigan is credited with the largest share, \$404,830, Illinois, the next largest beneficiary, has an estimated savings of \$185,567 and Ohio (Cleveland and Cincinnati) has \$107,611. Indiana and Wisconsin receive an estimated savings of respectively \$12,142 and \$47,837.

With the exception of such high-value items as are already moving into the Great Lakes area, and a few low-value items like barbed wire, the tonnage on imported iron and steel semifinished and finished products that has been estimated, must be considered primarily new tonnage in the sense that at present it cannot move because of freight rates too heavy for it to bear.

The estimation of tonnage and potential savings in imported iron and steel products leads to the question, how great will the effect of these imports be on the producers of the area. It is impracticable for our purposes to make a close statistical analysis of the many individual iron and steel finished products produced in order to determine the degree of competition they involve with the domestic products.

A few observations can be made, however. The articles imported into this country group themselves under three headings. First there are those items of high-grade steel or of steel for very special needs. These items are small in tonnage, high in value. They reach a market that the domestic producing industry does not aim to reach. Since they are of high value, they can and do bear the transportation charges to any part of the country. Among this group are the flat-wire and steel strip and the imported tin plate already mentioned. Other examples are alloyed seamless tubes, that are used in manufacture of ball bearings and come primarily from Sweden, and tool steel and grades of hollow bars used in the manufacture of high-grade tools and mining drills. Round iron and steel wire and wire rope and strand can also be placed in this group.

A second category includes those import items inferior in grade to the domestic product. They are low in value. They reach a market that does not take or does not need the higher grade domestic product. Generally the competition of these imports is today felt only along the coast and a small distance inland. Examples of this group are barbed wire and nails, tacks and staples, which are marketed primarily through mail-order houses.

A third category would include those items that are roughly comparable to the domestic product in quality. They, too, are at present limited to the seacoast. An example of this group is structural shapes and perhaps rails. Even here the imported product aims primarily at the market that is decidedly secondary in the eyes of the domestic producer. For example, imported structural shapes are to a great extent items like fire-escapes as opposed to the heavy shapes of the domestic producers, and imported rails are of lighter weight than those of domestic production, which are mainly over 60 pounds per yard.

In summary, it would appear that the imported articles are brought in to meet the needs of special requirements that the domestic producer either is considered incapable of meeting at a satisfactory price, or that he himself ignores.

Various factors explain why imports can be expected to continue to form a small part of total consumption of iron and steel requirements of the Great Lakes tributary area.

First of these factors is price. With the exception of Sparrows Point, all major steel plants are located in the interior, although some of these, like Pittsburgh and Birmingham, enjoy water transportation. The domestic industry has not found it necessary to establish basing points at Atlantic coastal cities, except Sparrows Point for a few products. Neither has it found it necessary to eliminate the differential that generally exists between Gulf or Pacific coast base prices and inland base points. Nevertheless, imports have not usurped the market in coastal areas.

On the other hand, in the Great Lakes area, important steel plants are located at lake side, at most of the important potential ports of entry. Indeed, most of the principal lake ports are also important basing points. In importance as a basing point, Chicago is surpassed only by Pittsburgh; Cleveland is fourth, preceded by Birmingham, Ala., while Buffalo is fifth. Through the change in price structure which took place in June 1938 practically all interbasing point price differentials were eliminated. Detroit, although technically not a basing point, takes a special delivered price which is lower than the combination of base price plus rail freight from the nearest basing point.

If foreign products have been unable to take over the markets of the coastal areas, despite the handicap that the domestic producers face in transportation costs to those areas, it is scarcely likely that they can compete at Chicago, Cleveland, and Buffalo where such freight costs do not exist or at Detroit where they are much reduced.

Other factors than price and freight rates must be considered in weighing the potential competition of foreign producers in the Great Lakes area. Often these factors are of more consequence than price. First, restrictions are placed upon the use of foreign products in the construction of projects financed in whole or in part by the Federal Government. Second, the need of prompt delivery is often of paramount importance. This need can be more completely satisfied by the domestic producers with their network of factories and warehouses, than by the importers whose warehouses are concentrated in New York and even there are limited in variety and quantity of inventories. Third, the domestic industry benefits by its ability to maintain more convenient contacts with the customer, who thereby is enabled to regulate more satisfactorily the flow of delivery, to keep a closer check on specifications and to benefit from engineering and laboratory services. Fourth, the consuming industry often requires a complete line which can be met only by the domestic producers. This factor is especially important in the matter of replacements. Closely related to completeness of line is the desirability on the part of the consumer of maintaining good relations with his main source of supply. Fifth, there is the reciprocity of interests between the steel producers and certain large consumers of steel, especially the railroads. Finally, foreign producers are not likely to desire aggressively to push into the home market of an industry capable of such production as is the United States industry. The unpleasant possibility of disturbing relations in other markets is too great and likelihood of success in the United States too small.

The United States tariff duty on iron and steel semifinished and finished products ranges from 10 to 35 percent of the foreign value. However, there is little likelihood that recourse would have to be made to a tariff readjustment.

In view of the above factors, it would seem that even with the proposed Seaway the domestic industry will find that imports will continue to be complementary to the domestic production in the Great Lakes area as they are in the coastal areas.

In summary, therefore, possible Seaway traffic in iron and steel products, together with estimated reductions in transportation costs, appear as follows:

	<i>Short tons</i>	<i>Total saving</i>
Domestic traffic:		
Scrap iron.....	189,000	\$231,000
Semifinished and finished products...	200,000	304,000
Exports:		
Pig iron.....	21,000	72,000
Semifinished and finished products...	187,000	592,000
Imports:		
Semifinished and finished products...	75,000	758,000
Total.....	672,000	\$1,957,000

TABLE N-1

Indexes of the importance of the iron and steel and related industries, 1937

No.	Industrial group	Wage earners (average for the year) ¹			Wages			Cost of materials ²		
		Number	Per cent	Ranking	Millions of dollars	Per cent	Ranking	Millions of dollars	Per cent	Ranking
11	Iron and steel and their products, not including machinery.....	1,166,287	13.6	2	1,661	16.4	1	4,048	11.4	4
13	Machinery, not including transportation equipment.....	955,975	11.2	3	1,376	13.6	3	2,424	6.8	5
14	Transportation equipment, air, land, and water.....	623,845	7.3	6	967	9.6	5	4,100	11.5	2
	Total iron and steel and related products.....	2,746,107	32.1	-----	4,004	39.6	-----	10,572	29.7	-----
	All other groups ³	5,823,124	67.9	-----	6,109	60.4	-----	24,967	70.3	-----
	Total United States ³	8,569,231	100.0	-----	10,113	100.0	-----	35,539	100.0	-----

No.	Industrial group	Value of products ²			Value added by manufacture		
		Millions of dollars	Per cent	Ranking	Millions of dollars	Per cent	Ranking
11	Iron and steel and their products, not including machinery.....	7,480	12.3	2	3,433	13.6	2
13	Machinery, not including transportation equipment.....	5,892	9.7	5	3,467	13.8	1
14	Transportation equipment, air, land, and water.....	5,986	9.9	4	1,886	7.5	5
	Total iron and steel and related products.....	19,358	31.9	-----	8,786	34.9	-----
	All other groups ³	41,355	68.1	-----	16,388	65.1	-----
	Total United States ³	60,713	100.0	-----	25,174	100.0	-----

¹ Does not include 173,403 employees for 1937 reported in a separate inquiry and who were not classed as wage earners.

² Cost of materials and value of products include a large amount of duplication due to the use of the products of some establishments as materials by others.

³ Railroad repair shops were not canvassed for 1937.

SOURCE: Department of Commerce, *Biennial Census of Manufactures, 1937*, part 1, p. 22.

TABLE N-2

Indexes of the importance of the iron and steel industry to the Great Lakes area

Item	Total United States	Great Lakes area ¹	Great Lakes area as percent of United States
	Thousands of long tons	Thousands of long tons	
Iron ore production, annual average, 1928-37.....	42,813	36,317	84.8
Coal production, 1937.....	445,531	182,075	40.9
Pig iron production, annual average, 1928-37.....	25,249	19,008	75.3
Steel ingot capacity, 1935.....	70,983	53,438	75.3
Iron and steel finished products consumption, 1935 ²	-----	-----	³ 42.0

¹ Includes Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, and the northwestern parts of Pennsylvania and the northern parts of New York.

² Does not include rails, line pipe and highway steel or any products unclassified as to consuming industry.

³ Does not include New York (12 percent) and Pennsylvania (6 percent).

SOURCES: Iron ore production: Department of the Interior, *Minerals Yearbook, 1928-39*. Iron ore consumption: Department of the Interior, *Minerals Yearbook, 1928-39*. Pig iron production: Compiled from American Iron and Steel Institute, *Annual Statistical Report, 1932, 1933, and 1934*. Steel ingot production capacity: Department of Commerce, Market Research Series No. 14.2, *Basic Industrial Markets in the United States*, the Iron and Steel Industry, December 1936. Finished domestic steel consumption: Tariff Commission, Report No. 128, second series, p. 325.

TABLE N-3

Estimated iron ore reserves in Lake Superior district, 1920-38

Year	Millions of long tons	Year	Millions of long tons	Year	Millions of long tons
1920	1,541	1927	1,447	1934	1,420
1921	1,516	1928	1,432	1935	1,400
1922	1,496	1929	1,411	1936	1,415
1923	1,508	1930	1,404	1937	1,421
1924	1,527	1931	1,415	1938	1,374
1925	1,504	1932	1,441		
1926	1,486	1933	1,454		

SOURCE: Lake Superior Iron Ore Association, *Lake Superior Iron Ores*, p. 314. Department of the Interior, *Minerals Yearbook*, 1939—pp. 549-550.

TABLE N-4

Summary of United States production, imports, exports, and consumption of pig iron¹

[Thousands of long tons]

Year	Production		Imports for consumption ²	Exports	Available for consumption based on—		Ratio of imports or consumption to production based on—		Ratio of exports to production based on—	
	Total	For sale			Total production	Production for sale	Total production	Production for sale	Total production	Production for sale
1928	37,402	7,724	141	85	37,458	7,780	Percent 0.4	Percent 1.8	Percent .2	Percent 1.1
1929	41,767	9,014	148	46	41,859	9,116	.4	1.6	.1	.5
1930	31,021	6,567	137	14	31,144	6,690	.4	2.0	(C)	.2
1931	17,958	4,000	84	7	18,035	4,077	.5	2.1	(C)	.2
1932	8,550	1,714	131	2	8,679	1,843	1.5	7.1	(C)	.1
1933	13,001	2,068	159	3	13,157	2,224	1.2	7.1	(C)	.1
1934	15,077	2,664	114	4	15,787	2,774	.7	4.1	(C)	.2
1935	20,781	3,602	131	4	20,908	3,729	.6	3.5	(C)	.1
1936	30,217	5,134	166	5	30,378	5,295	.5	3.1	(C)	.1
1937	36,130	6,505	112	782	35,460	5,835	.3	1.9	2.2	12.0
1938	18,546	2,955	30	433	18,143	2,552	.2	1.0	2.3	14.7
Average, 1928-37	25,249	4,899	132	95	25,287	4,936	.5	2.7	0.4	1.9

¹ Not including ferro-alloys.² Including pig iron containing dutiable allows.³ Less than one-tenth of 1 percent.

SOURCES: Production, 1929-37 Tariff Commission, report #128 second series p. 119. 1928 and 1938 production, American Iron and Steel Institute *Annual Statistical Report*, 1938. Imports and exports, Department of Commerce, *Foreign Commerce and Navigation of the United States*, 1928 and 1938.

TABLE N-5

Estimated United States deficit or surplus of pig iron, for selected States, annual average, 1935-38

[Thousands of long tons]

States	Production	Consumption	Surplus or (deficit)
Total New England.....	91	178	(87)
New York ¹	1,845	1,235	610
New Jersey.....	7,697	217	(217)
Pennsylvania.....		7,472	225
Others.....			
Total Middle Atlantic.....	9,542	8,924	618
Alabama.....	1,975	1,391	584
Maryland, Virginia, West Virginia, Kentucky, and Tennessee.....	2,057	2,195	(138)
Others.....		56	(56)
Total Southeastern.....	4,032	3,642	390
Total Southwestern ².....		10	(10)
Ohio.....	6,239	5,924	315
Indiana, Michigan, and Wisconsin.....	3,534	4,290	(756)
Illinois.....	2,501	2,274	227
Minnesota, Iowa, Colorado, and Utah.....	469	416	53
Others.....		33	(33)
Total North Central.....	12,743	12,937	(194)
Total Pacific coast ⁴.....		126	(126)
Total United States.....	26,408	25,817	591

¹ Includes Delaware.

² Estimated.

³ Includes: Arkansas, Oklahoma, Louisiana, and Texas.

⁴ Includes: Oregon, Washington, and California.

SOURCES: Compiled from American Iron and Steel Institute, Annual Report, 1938, p. 7 and Department of the Interior, *Minerals Yearbook*, 1939, p. 566.

TABLE N-6

United States imports of pig iron by customs districts, annual average 1935-38

State	Long tons	State	Long tons
Atlantic coast:		Pacific coast.....	13,494
New England.....	30,618	Gulf Coast.....	554
Philadelphia.....	41,783	All other.....	10,659
New York.....	8,170		
Others.....	4,433	Total United States.....	109,711
Total.....	85,004		

SOURCES: Tariff Commission Report No. 128, *Iron and Steel*, 1935, p. 123. Department of Commerce, *Foreign Commerce and Navigation of the United States*, 1936-38.

TABLE N-7

United States exports of pig iron by countries, annual average, 1928-37

Country	Long tons	Country	Long tons
Japan.....	47,142	Mexico.....	297
United Kingdom.....	23,466	Panama.....	306
China.....	1,771	All other.....	13,350
Canada.....	8,461		
Philippine Islands.....	453	Total.....	95,246

SOURCES: Tariff Commission Report No. 128, *Iron and Steel*, 1929-35, p. 124. Department of Commerce, *Foreign Commerce and Navigation of the United States*, 1928, 1936-38.

TABLE N-8

United States exports of pig iron by customs districts, annual average 1928-37

Customs district	Long tons	Customs district	Long tons
St. Lawrence.....	2,401	Mobile.....	20,065
Massachusetts.....	6,999	New Orleans.....	2,850
New York.....	13,814	All other.....	13,797
Philadelphia.....	14,889		
Maryland.....	19,861	Total.....	95,246

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37.*

TABLE N-9

Estimated unit savings on pig iron exported to countries other than Canada

[Dollars per long ton]

State	Representative point	Export rail rate ¹ to—		Estimated unit savings to—	
		Phila- delphia	Lake port	United Kingdom	Countries other than United Kingdom
Pennsylvania.....	Pittsburgh.....	4.11	\$ 2.92	1.19	.....
Ohio.....	Youngstown-Struthers.....	4.55	\$ 1.94	2.61	0.37
Indiana-Michigan.....	Gary.....	7.08	.....	7.08	4.84
Illinois.....	Chicago.....	7.08	.....	7.08	4.84
New York.....	Buffalo.....	\$ 3.29	.....	2.29	1.05

¹ Rates are for minimum of 56,000 pounds.² To Cleveland.³ Estimated barge rate to New York, 80 percent of rail rate, \$4.11.

TABLE N-10

Potential tonnage of pig iron exported from the Great Lakes tributary area

State	Percent of U. S. pro- duction	Exports to United Kingdom		Exports to countries other than Canada and United King- dom	
		Annual	Seasonal ¹	Annual	Seasonal ¹
		Long tons	Long tons	Long tons	Long tons
Pennsylvania in tributary area ²	21.9	5,139	2,672	13,867	7,211
Ohio.....	24.1	5,655	2,941	15,260	7,934
Indiana-Michigan.....	12.8	3,004	1,562	8,105	4,215
Illinois.....	10.0	2,347	1,220	6,332	3,293
New York ³	6.5	1,525	793	4,116	2,140
Total tributary area.....	75.3	17,670	9,188	47,680	24,793
Alabama.....	7.1	1,666	.....	4,496	.....
Pennsylvania outside tributary area ⁴	8.6	2,018	.....	5,445	.....
Massachusetts ⁵.....	.3	70	.....	190	.....
All other States.....	8.7	2,042	.....	5,509	.....
United States total.....	100.0	23,466	.....	63,320	.....

¹ 52 percent of annual.² Includes Allegheny, Beaver, Erie, Lawrence, Mercer, and Washington Counties. Production of these counties was estimated from State total on the basis of production capacity in 1935.³ Includes the entire State, production capacity being concentrated near lakes. Production for New York estimated from combined total New York and Massachusetts on basis of capacity in 1935.⁴ Includes all counties of Pennsylvania other than those mentioned in footnote 2.⁵ Estimated on basis of capacity. See footnote 3.SOURCES: Percent of production based on compilations from American Iron and Steel Institute *Annual Report, 1932 and 1933*. United States total exports to countries other than Canada, annual average, 1928-37, compiled from the Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37*. Seasonal, Department of Commerce, *Monthly Summary of Foreign Commerce of the United States, 1936-38*.

TABLE N-11

Estimated savings on potential traffic of pig iron exported to the United Kingdom and to all other countries excepting Canada

State and representative point	To United Kingdom			To countries other than Canada and the United Kingdom			Estimated savings, grand total
	Estimated in seasonal exports	Unit savings	Estimated total savings	Estimated in seasonal exports	Unit savings	Estimated total savings	
	<i>Long ton</i>	<i>Per long ton</i>		<i>Long tons</i>	<i>Per long ton</i>		
Pennsylvania—Neville Island.....	2,672	\$1.19	\$3,180				\$3,180
Ohio—Youngstown.....	2,941	2.61	7,676	7,934	\$0.37	\$2,936	10,612
Indiana—Michigan—Gary.....	1,562	7.08	11,059	4,215	4.84	20,401	31,460
Illinois—Chicago.....	1,220	7.08	8,638	3,293	4.84	15,938	24,576
New York—Buffalo.....	793	3.29	2,609	2,140	1.05	2,247	4,856
Total, tributary area.....	9,188		33,162	17,582		41,522	74,684

TABLE N-12

United States exports of iron and steel scrap by countries of destination, annual average, 1928-37

Country	Long tons	Country	Long tons
Japan.....	654,531	Belgium.....	9,227
Hong Kong.....	2,410	Czechoslovakia.....	3,684
Kwantung.....	1,557	Sweden.....	3,482
China.....	17,574	Canada.....	94,698
United Kingdom.....	163,922	Mexico.....	19,146
Italy.....	159,638	Others.....	25,077
Poland and Danzig.....	64,897		
Germany.....	17,021	Total.....	1,253,674
Netherlands.....	17,010		

SOURCES: Senate Committee on Military Affairs, Hearings, 75th Congress, on S. 2025, pts. 1-2, p. 82, exhibit 3, 1928-36. Department of Commerce, Metals and Minerals Division, *Exports of Iron and Steel Products from the United States, 1938*, for years 1937 and 1938.

TABLE N-13

Typical ocean rates on scrap iron and steel from North Atlantic ports to Japan, the United Kingdom, Italy, and Gdynia, during the year 1939

Destination and month	Per long ton	Destination and month	Per long ton
Japan:	<i>Dollars</i>	Italy:	<i>Dollars</i>
January.....	\$4.79	April.....	4.80
August.....	4.38	July.....	5.50
September.....	4.00	September.....	5.75
United Kingdom:		Gdynia:	
April.....	4.17	July.....	5.03
August.....	4.15	August.....	4.61
September.....	4.59	September.....	4.99

SOURCE: Computed from data supplied by Tariff Commission.

TABLE N-14

United States exports of iron and steel scrap by customs districts, annual average 1928-37

Customs district	Long tons	Customs district	Long tons
Maine and New Hampshire.....	26,700	San Diego.....	2,856
Vermont.....	5,835	Los Angeles.....	45,735
Massachusetts.....	70,690	San Francisco.....	29,452
Rhode Island.....	7,929	Oregon.....	32,522
Total New England.....	111,154	Washington.....	30,596
New York.....	253,640	Total Pacific coast.....	141,161
Philadelphia.....	61,594	Montana and Idaho.....	21
Maryland.....	59,084	Dakota.....	664
Total Middle Atlantic.....	374,318	Total Montana, Idaho, and Dakota.....	685
Virginia.....	63,635	Duluth and Superior.....	6,496
North Carolina.....	13,786	Michigan.....	58,032
South Carolina.....	16,120	Chicago.....	259
Georgia.....	39,268	Ohio.....	338
Florida.....	84,311	St. Lawrence.....	3,040
Total South Atlantic.....	217,120	Buffalo.....	7,598
Mobile.....	33,155	Total Great Lakes States.....	75,763
New Orleans.....	76,834	All other.....	8,264
Sabine.....	44,310	Total United States.....	1,253,674
Galveston.....	148,587		
San Antonio.....	19,435		
El Paso.....	2,888		
Total Gulf.....	325,209		

SOURCES: Senate Committee on Military Affairs, Scrap Iron and Steel, Hearings, 75th Congress, on S. 2025, pt. 1, 2, p. 83, 1927-1936. Department of Commerce, United States Foreign Trade Statistics, *Exports of Iron and Steel Products from the United States, 1938*.

TABLE N-15

Summary of United States production, imports, exports, and consumption of finished iron and steel products, annual average, 1928-37

Item	Thousands of long tons	Item	Ratio (percent)
Production.....	26,811	Imports to consumption, percent.....	1.1
Imports ¹	271	Exports to production, percent.....	4.9
Exports.....	1,327		
Available for consumption.....	25,756		

¹ General imports 1928-33; imports for consumption thereafter.

SOURCE: For 1929-37 Tariff Commission, Report No. 126, Second Series, p. 132. For 1928 and 1938 production, American Iron and Steel Institute *Annual Statistical Report*, 1928 and 1938; imports and exports, special reports of the Bureau of Foreign and Domestic Commerce.

TABLE N-16

United States production of hot-rolled iron and steel products, by States, 1913 and selected years 1929-38

State	1913	1929	1932	1936	1937	1938
Pennsylvania.....	12,196	14,860	3,270	10,032	11,168	5,878
Ohio.....	4,260	8,812	2,311	7,697	7,755	4,643
Indiana.....	2,136	5,145	1,126	4,431	4,896	2,589
Illinois.....	2,249	3,233	738	2,510	2,771	1,360
Michigan, Wisconsin, and Minnesota.....	251	849	457	1,709	1,981	1,137
New York.....	1,037	1,869	474	1,440	1,832	971
Delaware, Maryland, and Virginia.....	360	1,249	417	1,367	1,769	1,297
West Virginia.....	561	1,298	445	1,191	1,125	726
Alabama.....	540	1,216	368	1,037	1,263	1,001
Kentucky, Tennessee, Georgia, and Texas.....	1,214	692	270	659	594	367
Colorado and Washington.....	1,386	1,701	147	535	545	256
California and the Canal Zone.....	1,53	379	124	469	429	356
Missouri and Oklahoma.....	1,97	301	142	316	289	194
Maine, Massachusetts, Rhode Island, and Connecticut.....	257	267	110	247	231	136
New Jersey.....	194	198	52	111	113	75
Total.....	24,791	41,069	10,451	33,801	36,766	20,986

¹ Includes North Carolina.

² Includes Utah.

³ California only.

⁴ Includes Kansas.

SOURCE: American Iron and Steel Institute, *Annual Statistical Reports 1913-38*.

TABLE N-17

United States production of hot-rolled iron and steel products, by type, selected years 1929-38

Product	1929	1931	1932	1933	1934	1935	1936	1937	1938
Light flat-rolled products:									
Sheets.....	5,255	2,461	1,471	3,093	3,203	5,175	6,996	7,839	4,745
Strip.....	2,503	1,621	1,185	1,830	2,197	2,648	3,225	2,896	1,030
Black plates.....	2,159	1,612	1,142	1,964	1,735	2,060	2,630	2,954	824
Hoops.....	204	56	43	48	49	90	109	103	67
Cotton ties and baling bands ¹	385	57	38	51	28	25	37	62	34
Total.....	10,506	5,807	3,879	6,986	7,212	9,998	12,997	13,854	6,700
Bars:									
Merchant.....	6,460	2,440	1,314	2,285	2,803	3,699	5,063	5,187	2,328
Concrete.....	963	644	385	370	487	558	1,029	845	784
Long splice bars and tie plate bars.....	925	390	148	197	348	268	471	451	199
Total.....	8,348	3,474	1,847	2,852	3,638	4,525	6,563	6,483	3,311
Wire rods.....	3,134	1,845	1,186	2,024	1,724	2,441	2,998	3,009	2,108
Structural shapes.....	4,778	2,063	937	1,109	1,425	1,750	2,897	3,277	1,859
Plates.....	5,022	1,966	830	1,160	1,438	1,455	2,527	3,243	1,714
Skelp.....	3,517	1,499	808	995	1,120	1,352	2,157	2,280	1,253
Rails.....	2,722	1,158	403	416	1,010	712	1,220	1,446	623
Sheet piling.....	103	74	53	45	108	130	117	116	111
All other hot-rolled iron and steel products.....	2,939	1,290	708	1,148	1,295	1,602	2,325	3,058	1,802
Grand total.....	41,069	19,176	10,451	16,735	18,970	23,965	33,801	36,766	19,481

¹ The apparently sharp decline in the production of these products is due in large degree to their reclassification as strip.

SOURCE: American Iron and Steel Institute, *Annual Statistical Reports, 1929-38*.

TABLE N-18

United States production of selected iron and steel finished products advanced beyond hot-rolling

Product	1932 ¹	1933	1934	1935	1936	1937	1938
Sheets (cold-rolled).....	606	1,037	1,080	1,824	2,106	2,406	1,667
Sheets (galvanized).....	553	747	812	1,088	1,358	1,435	1,104
Strip (cold-rolled).....	216	388	378	571	940	775	407
Tin and terne plate.....	1,033	1,769	1,603	1,886	2,356	2,687	1,618
Splice bars and rail joints.....	34	44	83	65	112	133	53
Tie plates.....	110	142	250	193	339	307	124
Wire (plain).....	902	1,464	1,369	1,944	2,401	2,328	1,751
Wire (barbed).....	77	143	137	170	171	164	128
Woven fence.....	97	149	128	220	207	225	181
Wire nails and staples.....	241	399	277	396	532	485	430
Cut nails.....	13	16	16	18	23	22	18
Pipe and tubes (black):							
Butt weld and lap weld.....	485	723	862	964	1,484	1,664	923
Electric weld.....	166	216	232	191	355	403	240
Seamless.....	338	480	733	877	1,415	1,757	1,140
Galvanized pipe.....	173	226	234	257	396	419	322
Total above items.....	5,043	7,943	8,194	10,664	14,094	15,212	10,106

¹ For certain products data for earlier years are either not available or not strictly comparable.

SOURCE: American Iron and Steel Institute, *Annual Statistical Reports, 1932-38.*

TABLE N-19

United States consumption of domestic finished industrial steel, percentages by States, 1935¹

Principal consuming States	Per- cent of U. S. total con- sumed in each State	Percent of State total consumed by principal industries									Total
		Auto- mobiles and parts	Rail- road cars and equip- ment	Con- struc- tion	Con- tain- ers	Elec- trical equip- ment	Agric- ultural imple- ments	Office furni- ture and equip- ment	Job- bers and whol- e-sal- ers	All other	
Michigan.....	21	87							7	6	100
New York.....	12	11		15				54	11	20	100
Ohio.....	9	30		7	19	8		7	11	18	100
Illinois.....	8		6	12	25		15		19	23	100
Pennsylvania.....	6		36	11	17				18	18	100
New Jersey.....	2				52				26	22	100
Wisconsin.....	2	59					20		21	100	
Indiana.....	2	58			17	18			7	100	
Washington, Oregon, California.....	5			23	46				25	6	100
All other States.....	33										
United States total.....	100										

¹ Based on the distribution of 20,600,000 long tons of steel products. Excludes rails, line pipe, and highway steel which usually is ready for consumption and moves directly to point of use. Excludes all steel unclassified or unknown as to consuming industry.

SOURCE: Compiled from information contained in Census of Business and Census of Manufactures for 1935, Department of Commerce.

TABLE N-20

Percent of 1938 capacity sampled by the T. N. E. C. Schedule A and Schedule B as to shipments of semifinished and finished iron and steel products, by products, for the years 1936-38

Product	Percent of 1938 capacity sampled					
	1936		1937		1938	
	State sample	District sample	State sample	District sample	State sample	District sample
Sheet and tin plate bars ¹						
Wire rods.....	71.1	57.7	76.6	57.7	76.6	57.7
Plates.....	81.3	58.4	83.7	58.4	75.8	58.4
Heavy structural shapes.....	87.2	84.1	87.2	84.1	87.2	84.1
Hot-rolled and hot-rolled annealed sheets.....	53.6	36.2	82.1	49.2	82.1	49.2
Hot-rolled strip.....	47.5	26.1	65.6	26.1	65.6	26.1
Cold-rolled sheets.....	60.8	33.9	79.8	44.5	79.8	44.5
Cold-rolled strip.....	30.3	19.4	45.9	20.6	45.9	20.6
Tin plate ¹	83.2	58.1	89.1	58.1	89.1	58.1
Plain drawn wire.....	57.4	46.3	63.9	46.3	63.9	46.3
Blooms, billets, and slabs ¹						
Skelp.....	87.2	75.5	99.8	75.5	99.8	75.5
Sheet piling.....	78.7	78.7	78.7	78.7	78.7	78.7
Heavy rails.....	90.6	90.6	90.6	90.6	90.6	90.6
Merchant bars.....	26.8	21.3	73.7	48.8	73.7	48.8
Concrete reinforcing bars.....	40.4	40.0	50.8	40.0	50.8	40.0
Galvanized sheets.....	70.7	52.1	82.1	52.1	82.1	52.1
Pipe and tubes (butt-weld, lap-weld, seamless only).....	63.4	59.2	68.2	59.2	68.2	59.2

¹ Capacity for this product not listed in the directory.

² Capacity data used includes terns plate.

SOURCES: Temporary National Economic Committee. Capacity data derived from American Iron and Steel Institute, *The Iron and Steel Works Directory of the United States and Canada, 1938.*

TABLE N-21

Domestic shipments of semifinished and finished iron and steel products from Great Lakes producing areas to coastal consuming States and districts, annual average, 1936-38

[Short tons]

Coastal consuming States and districts ¹	Producing areas ¹					Total selected producing areas
	Buffalo	Cleveland	Detroit	Chicago	Indiana, Illinois (other)	
Maine.....	6,367	527	26	2,398	21	9,339
New Hampshire.....	524	74	15	94	-----	707
Massachusetts.....	21,266	4,962	11,405	4,958	17	42,608
Rhode Island.....	1,081	284	27	71	-----	1,463
Connecticut:						
Connecticut consuming district ²	554	3,219	5	548	-----	4,326
Connecticut consuming State ³	4,554	528	4,368	103	-----	9,553
Total Connecticut.....	5,108	3,747	4,373	651	-----	13,879
New York:						
Metropolitan New York, consuming district ¹	25,989	13,282	-----	11,993	1	51,265
New Jersey, consuming State ³	11,745	512	631	354	14	13,256
Total New York and New Jersey.....	37,734	13,794	631	12,347	15	64,521
Philadelphia consuming district ¹	45,930	2,509	239	14,216	4	62,898
Delaware consuming State ³	458	-----	-----	45	1	504
Total Philadelphia and Delaware.....	46,388	2,509	239	14,261	5	63,402
Maryland:						
Baltimore consuming district ¹	295	740	-----	5,116	11	6,162
Maryland consuming district ¹	20	66	-----	107	-----	193
Maryland consuming State ³	1,971	225	14	466	393	3,069
Total Maryland.....	2,286	1,031	14	5,689	404	9,424
Virginia.....	4,097	1,413	13	1,230	867	7,620
North Carolina.....	259	92	-----	96	1,023	1,470
South Carolina.....	159	97	6	64	1,321	1,647
Georgia.....	723	292	6	682	441	2,144
Florida.....	1,388	47	-----	2,267	211	3,913
Alabama:						
Alabama consuming district ²	116	37	-----	1,295	-----	1,448
Birmingham consuming district ²	797	114	-----	11,525	18	12,454
Alabama consuming State ³	1,469	-----	1	1,207	108	2,785
Total Alabama.....	2,382	151	1	14,027	126	16,687
Mississippi.....	179	16	-----	1,310	1,199	2,704
Louisiana.....	1,335	54	162	10,624	2,125	14,300
Texas.....	3,677	270	-----	36,181	2,464	42,592
Washington.....	2,186	148	19	12,830	81	15,264
Oregon.....	742	80	-----	13,778	9	14,609
California.....	17,004	3,552	285	70,687	3,667	95,195
Total shipments to selected States and districts.....	154,885	33,140	17,222	204,245	13,996	423,488
Total shipments to U. S. consuming States.....	921,224	352,864	827,684	2,748,350	162,317	5,012,339

SOURCE: Compiled from T. N. E. C. Steel Inquiry Forms A and B.
See footnotes on next page.

¹ In tables *N-19* and *N-20*, consuming districts and producing areas of the same name embrace the same territory. They are defined below:

CONNECTICUT: All counties *except* Fairfield County.

METROPOLITAN NEW YORK:

New York State: Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester counties

New Jersey: Bergen, Essex, Hudson, Middlesex, Monmouth, Morris, Passaic, Somerset, Union counties.

Connecticut: Fairfield County.

BUFFALO:

New York State: Niagara, Erie, Cattaraugus, Chautauqua, Genesee, Monroe, Orleans, Livingston, Wyoming, Allegany.

Pennsylvania: Erie.

PHILADELPHIA:

Pennsylvania: Bucks, Philadelphia, Montgomery, Chester, Delaware.

New Jersey: Mercer, Hunterdon, Burlington, Camden, Atlantic, Gloucester, Salem, Cumberland, Cape May, Ocean.

EASTERN PENNSYLVANIA:

Pennsylvania: Northampton, Monroe, Pike, Wayne, Susquehanna, Lackawanna, Wyoming, Luzerne, Carbon, Columbia, Perry, Dauphin, Northumberland, Snyder, Montour, Union, Lycoming, Sullivan, Bradford, Tioga, Schuylkill, Lehigh, Berks, Lebanon, Lancaster, York, Adams, Potter, Cumberland, Clinton, Center, Mifflin, Juniata, Huntingdon, Fulton, Franklin.

New Jersey: Sussex, Warren.

Delaware: All counties.

CLEVELAND:

Ohio: Lorain, Cuyahoga, Lake, Erie, Geauga, Ashtabula, Portage, Summit, Medina, Huron.

YOUNGSTOWN:

Ohio: Trumbull, Mahoning, Columbiana.

Pennsylvania: Crawford, Mercer, Lawrence.

NORTH OHIO RIVER:

Ohio: Jefferson, Belmont, Monroe, Washington, Noble, Morgan.

West Virginia: Hancock, Brooke, Ohio, Marshall, Tyler, Pleasants, Wood.

CANTON-MASSILLON-MANSFIELD:

Ohio: Guernsey, Muskingum, Stark, Carroll, Wayne, Ashland, Richland, Harrison, Tuscarawas, Coshocton, Holmes.

OHIO: All counties in Ohio other than those listed under Cleveland, Youngstown, North Ohio River, Canton-Massillon-Mansfield, and South Ohio River districts.

INDIANA: All counties *except* Lake County.

CHICAGO:

Illinois: Cook, Du Page, Lake, Kane, Will.

Wisconsin: Kenosha, Racine, Milwaukee.

Indiana: Lake.

ILLINOIS: All counties *except* Madison and St. Clair Counties and those included under Chicago district.

DETROIT:

Michigan: Saint Clair, Macomb, Oakland, Livingston, Lapeer, Ingham, Jackson, Washtenaw, Wayne, Genesee, Hillsdale, Lenawee, Monroe, Shiawassee.

MICHIGAN: All counties *except* those listed under Detroit district.

WISCONSIN: All counties *except* Kenosha, Racine and Milwaukee Counties.

BALTIMORE:

Maryland: Calvert, Anne Arundel, Howard, Carroll, Baltimore, Baltimore City, Harford, Cecil, Kent, Queen Anne, Caroline, Talbot, Dorchester, Wicomico, Somerset, Worcester.

MARYLAND: All counties *except* Allegany and Garrett Counties and those listed under Baltimore district.

BIRMINGHAM:

Alabama: Jefferson, Etowah, Bibb, Calhoun, St. Clair, Shelby, Tuscaloosa, Blount, Walker.

ALABAMA: All counties *except* those listed under Birmingham district.

WEST COAST: States of California, Washington, and Oregon.

² Figures for consuming districts apply only to following products: (a) Wire rods. (b) Plates. (c) Heavy structural shapes. (d) Sheets hot-rolled and hot-rolled annealed. (e) Strip hot-rolled. (f) Strip cold-rolled. (g) Tin plate. (h) Plain wire drawn.

³ Figures for consuming states apply only to following products: (a) Blooms, billets and slabs. (b) Steel sheet piling. (c) Rails (over 60 lbs.). (d) Merchant bars. (e) Concrete reinforcing bars. (f) Sheets galvanized. (g) Sheets cold-rolled. (h) Pipes and tubes (seamless, lap-weld and butt-weld). (i) Skelp. (j) Sheet and tin plate bars.

TABLE N-22

Domestic shipments of selected semifinished and finished iron and steel products from coastal producing areas to consuming districts and States in the tributary area, annual average, 1936-38

[Short tons]

Tributary area consuming districts and States ¹	Producing areas					
	New England	Baltimore	East Pennsylvania, Philadelphia, and Delaware	Birmingham	West coast	Total selected producing areas
Buffalo.....	27	5,744	5,350	-----	73	11,194
Ohio:						
Cleveland, consuming district ²	288	1,502	5,944	-----	-----	7,734
Youngstown, consuming district ²	1	1,624	2,621	9	-----	4,255
North Ohio River, consuming district ²	-----	827	332	-----	-----	1,159
Canton-Mansfield, consuming district ²	-----	646	721	-----	(⁴)	1,367
Ohio (other), consuming district ²	58	3,074	5,466	1	-----	8,599
Ohio, consuming State ²	1,001	3,907	2,988	47	-----	7,943
Total Ohio.....	1,348	11,680	18,072	57	(⁴)	31,057
Indiana:						
Indiana (other), consuming district ²	37	1,213	3,198	66	-----	4,514
Indiana, consuming State ²	52	1,187	1,699	90	-----	3,028
Total Indiana.....	89	2,400	4,897	156	-----	7,542
Illinois:						
Chicago, consuming district ²	203	13,202	9,789	31	-----	23,225
Illinois (other), consuming district ²	7	477	1,069	1	-----	1,554
Illinois, consuming State ²	1,001	5,185	2,270	31	-----	8,577
Total Illinois.....	1,301	18,864	13,128	63	-----	33,356
Michigan:						
Detroit, consuming district ²	43	3,511	8,489	-----	-----	12,043
Michigan (other), consuming district ²	310	438	968	-----	(⁴)	1,716
Michigan, consuming State ²	1,259	3,615	9,657	3	-----	14,534
Total Michigan.....	1,612	7,564	19,114	3	-----	28,293
Wisconsin.....	57	2,643	3,147	2	-----	5,849
Minnesota.....	197	421	1,365	-----	-----	1,983
Iowa.....	62	675	2,701	-----	-----	3,438
North Dakota.....	-----	10	56	2	-----	68
South Dakota.....	-----	62	27	-----	2	91
Nebraska.....	4	263	680	-----	266	1,213
Idaho.....	16	177	9	87	2,742	3,031
Total shipments to selected States and districts.....	4,713	50,403	68,546	370	3,083	127,115
Total shipments to U. S. consuming States.....	71,924	867,049	801,779	717,850	330,686	2,789,288

¹ For definition of producing areas and consuming districts, see table N-19, footnote 1.

² For products included in consuming districts, see table N-19, footnote 2.

³ For products included in consuming States see table N-19, footnote 3.

⁴ Less than $\frac{1}{2}$ ton.

Source: Compiled from T. N. E. C. Forms A and B.

TABLE N-23

Estimated unit savings on the domestic movement of iron and steel products from selected producing areas to selected consuming States and districts

Producing area and consuming State or district	Present rail rate	Feasible all-water rate		Unit savings
		Basic percent of rail rate	Per net ton	
Chicago producing area:	<i>Per net ton</i>			<i>Per net ton</i>
Massachusetts.....	\$11.00	70	\$7.70	\$3.30
New York, consuming district.....	10.40	70	7.28	3.12
Philadelphia, consuming district.....	10.00	70	7.00	3.00
Maryland.....	9.40	70	6.58	2.82
Texas.....	(¹)	80		
Washington.....	² 16.60	³ 90	14.85	1.65
Oregon.....	² 18.50	³ 90	14.85	1.65
California.....	² 17.20	³ 90	15.48	1.72
Cleveland producing area:				
Massachusetts.....	8.80	75	6.60	2.20
Connecticut.....	8.60	75	6.45	2.15
New York consuming district.....	8.20	75	6.15	2.05
California.....	² 18.40	³ 85	15.64	2.76
Detroit producing area:				
Massachusetts.....	9.20	80	7.36	1.84
Connecticut.....	9.00	80	7.20	1.80
Buffalo producing area:				
Maine.....	8.20	85	6.97	1.23
Massachusetts.....	7.40	85	6.29	1.11
Philadelphia, consuming district.....	6.80	90	6.12	.68
Virginia.....		85		
California.....	² 18.00	³ 80	14.40	3.60
Baltimore producing area:				
Ohio.....	7.20	90	6.48	.72
Illinois.....	9.40	80	7.52	1.88
Michigan.....	8.40	80	6.72	1.68

¹ Rates unavailable.² Rail-water rate.³ Percent applied to rail-water rate.

TABLE N-24

Potential tonnage and estimated savings on the domestic movement of iron and steel products from selected producing areas to selected consuming States and districts

Producing area and consuming State or district	Unit savings per net ton	Tonnage (net tons)		Estimated savings
		Annual	Open season, 58 percent	
Chicago Producing Area:				
Massachusetts.....	\$3.30	4,968	2,876	\$9,491
New York consuming district.....	3.12	11,993	6,956	21,703
Philadelphia consuming district.....	3.00	14,216	8,245	24,735
Maryland.....	2.82	5,689	3,300	9,306
Texas.....		26,181	20,985	
Washington.....	1.65	12,830	7,441	12,278
Oregon.....	1.65	13,778	7,991	13,185
California.....	1.72	70,687	40,998	70,517
Cleveland Producing Area:				
Massachusetts.....	2.20	4,962	2,878	6,332
Connecticut.....	2.15	3,747	2,173	4,672
New York consuming district.....	2.05	13,282	7,704	15,793
California.....	2.76	3,552	2,060	5,686
Detroit Producing Area:				
Massachusetts.....	1.84	11,405	6,615	1,217
Connecticut.....	1.80	4,373	2,536	4,565
Buffalo Producing Area:				
Maine.....	1.23	6,367	3,693	4,542
Massachusetts.....	1.11	21,266	12,334	13,691
Philadelphia consuming district.....	.68	45,930	26,639	18,114
Virginia.....		4,097	2,376	
California.....	3.60	17,004	9,862	35,503
Baltimore Producing Area:				
Ohio.....	.72	11,580	6,716	4,836
Illinois.....	1.88	18,664	10,641	20,569
Michigan.....	1.68	4,564	4,387	7,370
Total.....		344,325	199,706	304,105

TABLE N-25
Phantom freight and freight absorption

	Producing mills				Producing mills		
	A	B	C		A	B	C
Base price.....	\$40	\$40	-----	Mill net.....	\$40	\$39	\$41
Freight.....	4	5	\$3	Freight absorption.....	0	1	-----
Delivered price, quoted.....	44	44	44	"Phantom" freight.....	-----	-----	1

SOURCE: Based on United States Steel Corporation, *T. N. E. C. Papers*, Vol. III, pp. 55-6.

TABLE N-26
Phantom freight, based upon water transportation

	Producing mills			Producing mills	
	A	B		A	B
Base price.....	\$40	\$40	Freight advantage (water).....	\$1	-----
Rail freight.....	4	3	Mill net on shipments by water from	-----	-----
Delivered price.....	43	43	A, by rail from B.....	41	\$40
Water freight.....	2	-----			

SOURCE: Based upon United States Steel Corporation, *T. N. E. C. Papers*, Vol. III, p. 65.

TABLE N-27
United States exports of semifinished and finished iron and steel products¹ to
Canada and other countries

[Thousands of long tons]

Product	Annual average by types, 1928-37		
	Total United States exports	Exports to Canada	Exports other than to Canada
Semifinished:			
Ingots, blooms, billets, slabs, sheet bars.....	52	11	41
Finished:			
Iron bars.....	2	(²)	2
Steel bars, concrete reinforcing bars.....	84	41	43
Wire rods.....	33	8	25
Boilers and other plate, plain and fabricated.....	113	52	61
Skelp-iron or steel.....	76	75	1
Iron and steel sheets galvanized.....	82	10	72
Iron and steel sheets, black.....	134	60	74
Strip steel, H. R. or C. R.....	44	35	9
Tinplate, terneplate, Taggers tin.....	188	20	166
Tanks.....	12	(²)	12
Structural shapes plain and fabricated.....	136	(²)	136
Metal lath.....	3	(²)	3
Frames, sashes and sheet piling.....	13	7	6
Rails and R. R. equipment ²	104	3	101
Cast iron pipe and fittings.....	30	1	29
Other pipes and tubes.....	133	15	118
Iron or steel wire, plain or galvanized.....	34	5	29
Barbed wire.....	37	1	36
Wire rope.....	4	(²)	4
Other wire and manufactures ⁴	10	3	7
Nails, tacks, and staples.....	17	(²)	17
Bolts and machine screws, rivets, washers.....	8	2	6
Iron and steel castings or forgings.....	19	13	6
Car wheels, tires, and axles.....	13	2	11
Total finished.....	1,327	353	974
Total semifinished or finished.....	1,379	364	1,015

¹ Not including pig iron, ferro-alloys or scrap.

² Less than ½ of 1 ton.

³ Includes rail joints, splice bars, switches, frogs, crossings, railroad spikes, nuts, etc.

⁴ Includes woven wire fencing and screen cloth.

SOURCE: Compiled from Department of Commerce, *Foreign Commerce and Navigation of the United States*.

TABLE N-28

United States exports of semifinished and finished iron and steel products,¹ by countries, 1928-37

[Thousands of long tons]

Market	1928	1929	1930	1931	1932	1933	1934	1935	1936 ²	1937 ³
Canada.....	959	1,098	706	349	118	100	201	241	291	451
Mexico.....	78	97	73	40	18	30	74	63	76	151
Brazil.....	84	72	38	23	10	54	85	46	74	109
Philippine Islands.....	83	102	69	53	46	57	69	64	71	95
Soviet Union.....	4	14	11	3	(*)	2	15	35	64	93
Japan.....	214	202	108	60	27	45	80	83	52	470
China.....	83	61	29	31	17	30	55	37	50	106
Cuba.....	64	68	41	16	11	14	31	45	50	61
Columbia.....	65	41	24	12	11	24	37	27	35	58
Argentina.....	98	94	59	40	18	46	42	34	35	46
Union of South Africa.....	7	8	5	5	2	10	16	23	31	53
Venezuela.....	80	68	38	10	8	19	42	18	28	68
Mozambique.....	1	3	5	3	1	2	12	16	23	34
Panama.....	16	19	17	14	15	13	17	20	21	16
Chile.....	70	67	79	24	2	10	25	28	20	43
United Kingdom.....	52	63	41	38	4	3	7	9	16	145
Peru.....	27	35	17	14	3	4	15	13	14	27
All other countries.....	270	321	244	100	64	102	162	153	262	659
Total.....	2,255	2,433	1,604	825	365	565	975	955	1,213	2,685

¹ Not including pig iron, ferro-alloys, or scrap.

² Preliminary.

³ Less than 500 tons.

Source: Special reports of the Department of Commerce, from the Tariff Commission Report No. 128, *Iron and Steel*, p. 141, table 69.

TABLE N-29

Estimated tonnage in iron and steel semifinished and finished products, exported to countries other than Canada, 1937

[Short tons]

Product	Exports from tributary area ¹	United States exports to Canada	Exports from tributary area to countries other than Canada ¹
Blooms, billets, and slabs.....	64,403	10,986	53,417
Sheet and tin-plate and merchant bars.....	131,711	² 24,553	97,158
Concrete reinforcing bars.....	25,576	477	25,099
Skelp.....	45,308	83,534	-----
Wire rods.....	22,827	3,745	19,082
Steel sheet piling.....	7,437	1,657	5,780
Rails (over 60 pounds).....	36,016	4,265	31,751
Plates.....	241,737	³ 50,040	191,697
Heavy structural shapes.....	72,361	⁴ 62,883	9,478
Sheets, hot rolled and cold rolled.....	240,608	⁵ 86,542	154,066
Sheets, galvanized.....	49,074	6,533	42,541
Strip, cold rolled.....	7,047	⁶ 19,922	-----
Strip, hot rolled.....	65,289	⁷ 51,470	13,819
Pipes and tubes.....	123,652	⁸ 19,647	104,005
Tin plate.....	382,440	⁹ 31,327	351,113
Plain wire drawn.....	9,044	¹⁰ 2,112	6,932
Total, above items.....	1,524,530	469,693	1,105,938

¹ Includes the producing districts of Pittsburgh and North Ohio River, Buffalo, Cleveland, Detroit, Chicago, Canton, Mansfield, Youngstown, Indiana; other Illinois and Minnesota.

² Steel bars, others, not containing alloy, stainless, and containing alloy but not stainless.

³ Boiler, and other plate not fabricated, not containing alloy, stainless or containing alloy but not stainless.

⁴ Structural shapes, not fabricated and fabricated; water, oil, gas, and other storage tanks; plates, fabricated punched or shaped.

⁵ Steel sheets, black, not containing alloy, stainless, and containing alloy but not stainless.

⁶ Strip, hot-rolled, not containing alloy, stainless, and containing alloy but not stainless.

⁷ Strip, cold-rolled, not containing alloy, stainless, and containing alloy but not stainless.

⁸ Boiler tubes, seamless and welded; casing and oil line pipe seamless and welded; black pipe, casing other than oil line; pipes and fittings, screwed, malleable; black pipe welded, steel; pipes galvanized, steel; pipes riveted.

⁹ Tin plate and Taggers tin; terne plate (including long ternes).

¹⁰ Iron or steel wire, uncoated.

Source: Exports from the tributary area, T. N. F. C., *Steel Investigation, Schedule A*. United States Exports to Canada, Department of Commerce, *Foreign Commerce and Navigation of the United States*.

TABLE N-30

Potential tonnage on steel, finished and semifinished products exported to countries other than Canada, 1937

Producing area	Percent of total exports of tributary area	Estimated exports to countries other than Canada (short tons)					
		Annual			Seasonal		
		Total, 100 per cent	To Europe and Mediterranean, 9.4 per cent	To other countries, 90.6 per cent	Total, 100 per cent	To Europe and Mediterranean, 9.4 per cent	To other countries, 90.6 per cent
Pittsburgh and North Ohio River.....	51.6	570,664	53,642	517,022	372,644	35,029	337,615
Buffalo.....	8.8	97,323	9,149	88,174	63,552	5,974	57,578
Cleveland.....	1.8	19,907	1,871	18,036	12,999	1,222	11,777
Detroit.....	1.6	17,695	1,663	16,032	11,555	1,065	10,469
Chicago.....	11.4	126,077	11,851	114,226	82,328	7,739	74,589
Canton and Mansfield.....	.9	9,953	936	9,017	6,500	611	5,889
Youngstown.....	23.8	263,213	24,742	238,471	171,878	16,156	155,722
Minnesota.....	.1	1,106	104	1,002	722	66	654
Total, tributary area.....	100.0	1,105,938	103,958	1,001,980	722,178	67,885	654,293

SOURCE: Percent of total exports of tributary area from each producing area, Temporary National Economic Committee, Steel Investigation, Schedule A. Total Annual Exports, t. III. Seasonal percentage of exports, based upon Department of Commerce, *Monthly Survey of the Commerce of the United States*. Percentages of exports to Europe and to other countries, t. N-26.

TABLE N-31

Ocean export rates on iron and steel, viz: Sheets, plates, etc. from the North Atlantic range to selected countries, in effect as of summer 1939

Destination	Rate		Destination	Rate	
	Cents per 100 pounds	Per long ton		Cents per 100 pounds	Per long ton
Belgium, Germany, United Kingdom, and Trieste.....	31	\$6.94	China, Manila.....	36	\$8.06
South America.....	31	6.94	Australia.....	45	10.08
Japan.....	36	8.51	New Zealand.....	51	11.42
			Capetown.....	25	5.00

TABLE N-32

Indicated differential on iron and steel finished and semifinished products, exported to countries other than Canada

Representative point	Export rail rate to New York	Domestic rail rate to lake port	Indicated differential			
			To Europe and the Mediterranean ¹	To other points ²	To Europe and the Mediterranean ¹	To other points ²
	Cents per 100 lb.	Cents per 100 lb.	Cents per 100 lb.	Cents per 100 lb.	Per short ton	Per short ton
Pittsburgh.....	23	\$ 20	3		\$0.60	
Buffalo.....	21		21	11	4.20	\$2.20
Cleveland.....	26		26	16	5.20	3.20
Detroit.....	29		29	19	5.80	3.80
Chicago.....	\$ 27		27	17	5.40	3.40
Canton.....	26	\$ 11½	14½	4½	2.90	.90
Youngstown.....	25	\$ 13	12	2	2.40	.40
Anderson ³	35	\$ 23	12	2	2.40	.40

¹ Export rail rate to New York, minus rail rate to lake port.

² Indicated differential to Europe and the Mediterranean, minus 10 cents per 100 pounds or \$2 per short ton.

³ To Cleveland.

⁴ To New Orleans, via barge.

⁵ For Illinois other, Indiana other district.

⁶ To Toledo.

TABLE N-33

Estimated savings on steel finished and semifinished products exported to countries other than Canada, 1937

Producing area	Potential tonnage			Unit Savings		Estimated savings		Total
	Total	To Europe and Mediterranean	To other countries	To Europe and Mediterranean	To other countries	To Europe and Mediterranean	To other countries	
	Short tons	Short tons	Short tons	Per short ton	Per short ton			
Pittsburgh and North Ohio River.....	372,644	35,029	337,615	\$0.60		\$21,017		21,017
Buffalo.....	63,552	5,974	57,578	4.20	\$2.20	25,091	\$126,672	151,763
Cleveland.....	12,999	1,222	11,777	5.20	3.20	6,354	37,686	44,040
Detroit.....	11,555	1,086	10,469	5.80	3.80	6,299	39,782	46,081
Chicago.....	82,328	7,739	74,589	5.40	3.40	41,791	253,603	295,394
Canton and Mansfield.....	6,500	611	5,889	2.90	.90	1,772	5,300	7,072
Youngstown.....	171,873	16,156	155,722	2.40	.40	38,777	62,289	101,066
Minnesota.....	722	68	654					
Total, tributary area.....	722,178	67,885	654,293			156,579	525,332	\$681,911

TABLE N-34

Excess of transportation rates on certain iron and steel products to selected foreign markets from selected United States producing centers over rates from United Kingdom ports, April 1937

[Dollars per long ton]

Country of destination	Rate from United Kingdom ports	Excess or deficit over rates from United Kingdom ports			
		Pittsburgh via New York	Baltimore direct	Cleveland	
				Via Baltimore ¹	Feasible direct ²
(A) BLACK SHEETS					
Venezuela:					
La Guaira.....	9.04	+4.51	² -0.08	+5.07	+1.92
Maracaibo.....	11.63	+4.16	² -0.43	+4.72	+4.72
Colombia: Cartagena.....	8.63	+2.79	-1.13	+4.02	+0.87
Japan: Yokohama.....	4.85	¹ +4.74	+0.15	+5.30	+2.15
(B) TIN PLATE					
Japan: Yokohama.....	8.98	+0.61	-3.98	+1.17	-1.98
China:					
Shanghai.....	9.54	+0.55	-4.04	+0.56	-2.04
Hongkong.....	8.93	+0.66	-3.93	+1.22	-1.93
Brazil:					
Pernambuco.....	6.27	+3.82	+0.73	+5.88	+2.73
Bahia.....	6.92	+6.17	+1.58	+6.73	+3.58
Rio de Janeiro.....	5.67	+4.42	-0.17	+4.96	+1.83
(C) STEEL BARS					
Japan: Yokohama.....	5.00	+3.59	-1.00	+4.15	+1.00
China:					
Shanghai.....	3.81	+6.28	+1.69	+6.84	+3.69
Hongkong.....	3.81	+5.78	+1.19	+6.34	+3.19
Chile:					
Iquique.....	7.56	+2.03	⁴ -2.56	+2.59	-0.56
Magallanes.....	7.56	+10.99	⁴ +6.40	+11.55	+8.40

¹ Ocean rate from Baltimore to port of destination plus export rail rate (1940) from Cleveland to Baltimore.² Ocean rate from Baltimore plus \$2 differential.³ Ocean rate applicable from New York only.⁴ Rate applies on minima shipments of 50 tons; less than 50 tons the rate is \$3 higher.⁵ Black sheets, as: Sheets, plain and corrugated, including bent and/or punched.SOURCE: Compiled from Tariff Commission, *Iron and Steel*, Report No. 128, Second Series, table 224.

NOTE: + denotes excess; - denotes deficit.

TABLE N-35

Excess of transportation rates on iron and steel rails, and barbed wire, to selected foreign markets from selected United States producing centers over rates from German ports, Antwerp and Rotterdam, as of April 1937

[Dollars per long ton]

Country of destination	Rate from German ports, Antwerp, and Rotterdam	Excess or deficit over rates from German ports, etc.				
		Birmingham via Mobile	Pittsburgh via Baltimore	Baltimore direct	Cleveland	
					Via Baltimore ¹	Feasible direct ²
(A) IRON AND STEEL RAILS						
China:						
Shanghai.....	6.98	+0.87	+2.04	-0.98	+4.17	+1.02
Hong Kong.....	6.98	+0.37	+2.44	-1.48	+3.67	+0.52
Brazil: Pernambuco.....	7.37	+2.48	+4.55	+0.63	+6.78	+2.63
(B) BARBED WIRE						
Brazil: Pernambuco.....	8.01	+2.41	+3.08	-1.51	+3.64	+0.49

¹ Ocean rate from Baltimore to port of destination plus export rail rate (1940) from Cleveland to Baltimore.
² Ocean rate from Baltimore plus \$2 differential.

SOURCE: Compiled from Tariff Commission, *Iron and Steel*, Report No. 128, Second Series, table 224.

NOTE: + denotes excess; - denotes deficit.

TABLE N-36

United States imports of finished and semifinished iron and steel products by types, 1928-38¹

Product	Average 1928-37	Product	Average 1928-37
Semifinished:	<i>Gross tons</i>	Finished—Continued.	<i>Gross tons</i>
Steel ingots, blooms, billets, etc.....	10, 149	Seamless tubes.....	² 13, 448
Finished:		Barbed wire.....	11, 547
Concrete reinforcement bars.....	³ 11, 562	Round iron and steel wire.....	3, 867
Hollow bar and steel drill.....	³ 1, 395	Covered wire and cable.....	49
Other steel bars.....	³ 32, 891	Flat wire and strip steel.....	1, 999
Iron bars and slabs.....	1, 466	Wire rope and strand.....	2, 177
Wire rods.....	13, 434	Other wire.....	1, 245
Boiler and other plate.....	1, 817	Cotton ties.....	⁴ 4, 741
Sheets, skelp and sawplate.....	16, 869	Hoops and bands, n. o. s.....	⁴ 22, 055
Tin plate, Taggers tin, terne plate.....	997	Nails, tacks, staples.....	11, 823
Structural shapes.....	³ 48, 068	Bolts, nuts, and rivets.....	413
Sheet piling.....	³ 1, 167	Horse and mule shoes.....	⁴ 321
Rails and fastenings.....	7, 206	Castings and forgings.....	⁴ 1, 966
Cast-iron pipe and fittings.....	13, 486	Total finished.....	271, 683
Malleable cast-iron pipe fittings advanced.....	³ 182	Total semifinished and finished.....	281, 732
Welded pipe.....	³ 5, 437		

¹ Not including pig-iron, sponge iron, ferro-alloys or scrap.

² 7-year average 1931-37.

³ 4-year average 1935-38.

⁴ 8-year average 1930-37.

⁵ The sum of the individual 1928-37 averages for finished iron and steel products differs from the true 1928-37 average, namely, 271,683 long tons, by 39,495 long tons. The difference is due to the fact that for seven products shown a 7-year period was used, for three products a 4-year period, and for one product an 8-year period was used in computing the respective averages.

SOURCE: Years 1928, 1936, 1937, 1938 compiled by Tariff Commission from special Reports of Department of Commerce; years 1929-35 inclusive, Tariff Commission, *Iron and Steel*, Report No. 128, p. 135, t. 63.

TABLE N-37

*United States imports of semifinished and finished iron and steel products by countries, 1928-38*¹

Country	Average, 1928-37	Country	Average, 1928-37
	<i>Long tons</i>		<i>Long tons</i>
Belgium-Luxemburg.....	112,059	Austria.....	246
Germany.....	80,516	Japan.....	445
Sweden.....	22,813	Canada.....	7,039
France.....	43,569	All others.....	600
United Kingdom.....	10,655		
Netherlands.....	2,541	Total.....	281,732
Czechoslovakia.....	756	Total other than Canada.....	274,698
Norway.....	403		

¹ Not including pig iron, sponge iron, ferro-alloys or scrap.

SOURCE: Department of Commerce, Special Repts. 1928, 1937, 1938. Tariff Commission Report No. 128, *Iron and Steel*, p. 137, 1929, 1931-36. 1930 compiled by Tariff Commission.

TABLE N-38

Potential tonnage in iron and steel semifinished and finished products imported other than from Canada

Principal consuming States	Percent of United States total consumption of industrial finished steel ¹	Potential tonnage other than from Canada (long tons)	
		Annual	Seasonal ²
Ohio.....	9.0	24,722	14,339
Indiana.....	2.0	5,494	3,187
Illinois.....	8.0	21,975	12,745
Michigan.....	21.0	57,685	33,457
Wisconsin.....	2.0	5,494	3,187
Total tributary area.....	42.0	115,370	66,915
New York.....	12.0	32,963	19,119
Pennsylvania.....	6.0	16,482	9,560
New Jersey.....	2.0	5,494	3,187
Washington, Oregon, and California.....	5.0	13,735	7,966
All other States.....	33.0	90,649	52,576
Total United States.....	100.0	274,698	159,323

¹ Based on the distribution of 20,600,000 long tons of steel products. Excludes rails, line pipe, and highway steel, which usually is ready for consumption and moves directly to point of use. Excludes all steel unclassified or unknown as to consuming industry.

² Based on 58 percent.

SOURCE: Percent of United States total consumption of industrial finished steel, U. S. Tariff Commission, Report No. 128 (Second Series) *Iron and Steel*, p. 325. Total tonnage other than from Canada compiled from *Foreign Commerce and Navigation of the United States, 1928-37*.

TABLE N-39

Import rates on steel products from New York, N. Y., to selected points

[Cents per 100 pounds]

To—	Articles in note 1		Articles in note 2		Articles in note 3	
	Carlot	Less than carlot	Carlot	Less than carlot	Carlot	Less than carlot
Buffalo, N. Y.-----	34	44	38	44	26	44
Erie, Pa.-----	39	49	43	49	26	49
Cleveland, Ohio-----	41	1 48	42	1 48	1 30	1 48
Detroit, Mich.-----	43	1 54	47	1 54	1 33	1 54
Cincinnati, Ohio-----	46	1 54	46	1 54	1 34	1 54
Chicago, Ill.-----	52	1 65	58	1 65	1 40	1 65
Milwaukee, Wis.-----	52	1 67	58	1 67	1 41	1 67

¹ Published as import rates. Other rates are domestic rates and apply, as well, on import traffic.

NOTE 1.—Allowed seamless tubes, flat wire and steel strips, tool steel and hollow drill bars, tin plate, round iron and steel wire, wire rope, barbed wire, nails and staples.

NOTE 2.—Shoe tacks, iron or steel tacks, other than shoe; iron or steel, with steel heads.

NOTE 3.—Wire rods.

SOURCE: American Iron and Steel Institute, special compilation.

TABLE N-40

Estimated savings on iron and steel semifinished and finished products imported other than from Canada

To consuming States	Representative points	All-rail rate from New York City	Rail rate from lake port to consuming point	Unit savings		Potential tonnage (long ton)	Estimated savings
				Cents per 100 lbs.	Per long ton		
New York-----	Buffalo-----	Cents per 100 lbs. 0.44	Cents per 100 lbs. 0.44	0.44	\$9.86	(¹)	(¹)
Pennsylvania-----	Erie-----	.49	.49	.49	10.98	(²)	(²)
Ohio-----	(Cleveland-----	1.48	.48	.48	10.75	7,169	\$77,067
Indiana-----	(Cincinnati-----	1.54	.19	.19	4.26	7,170	30,544
Illinois-----	Indianapolis-----	1.65	.37	.17	3.81	3,187	12,142
Michigan-----	Chicago-----	1.54	.65	.65	14.56	12,745	185,567
Wisconsin-----	Detroit-----	1.67	.54	.54	12.10	33,457	404,830
	Milwaukee-----	1.67	.67	.67	15.01	3,187	47,837
Total tributary area-----						66,915	757,987

¹ Less than carload lots.

² Not estimated.

³ From Cleveland.

⁴ From Detroit.

Appendix O

WOOD PULP AND NEWSPRINT

Section 1

PRODUCTION, CONSUMPTION, AND IMPORTS OF WOOD PULP

The United States is the largest wood pulp-producing country in the world. Between 1929 and 1938 minimum production in this country amounted to 3,800,000 short tons in 1932 and maximum production reached 6,600,000 short tons in 1937. As shown in table O-1, Canada is the second largest producer of wood pulp, closely followed by Sweden and Germany. Finland and Norway are other important producers.

The State of Maine is the largest producer of wood pulp, followed closely by the State of Washington. Wisconsin is the third largest producer and New York the fourth in importance.

In the United States there have been three distinct movements in production. One was the early growth of a large pulp industry in New England, which is still important but has been losing ground in relation to the rest of the country, due partially to receding forests and partially because machinery is old, making many mills marginal producers. The second has been the growth of the pulp industry in the Pacific Northwest. The third development, the most recent, has been the growth of the pulp industry in the South—a development of the past decade. During all of this time the pulp industry of the Lake States developed gradually, having come to an important place following the early New England growth.

In spite of the fact that the United States is the largest producer of wood pulp in the world, it still consumes a greater amount than it produces, and consequently depends to a substantial extent upon imports from other countries. In table O-2 are presented figures, from 1916 to 1938, of domestic production, imports, exports, and apparent consumption. It appears from this table that since 1929 annual retention of wood pulp in the United States has varied between a low of 5,194,000 short tons in 1932 and a high of 8,645,000 short tons in 1937. During this time, between 22.8 percent and 31.6 percent had to be imported. The average annual gross imports during the decade 1929-38 amounted to 1,886,000 short tons, which was 28.1 percent of the average annual retention, amounting to 6,711,000 short tons.¹

The principal countries from which the United States purchases wood pulp for import are shown in table O-3. Of the average annual imports during the period 1929-38 of 1,885,260 short tons, 830,200 short tons, or 44 percent, came from Sweden, and 599,210 short tons or a little less than a third from Canada. Finland, Norway, and Germany were other principal exporters to the United States.

An examination of the seasonality of wood-pulp imports during the years 1937 and 1938 shows that about 63 percent entered United States customs districts

¹ Department of Commerce, Trade Promotion Series No. 182, *United States Pulp and Paper Industry*, table 8, pp. 67-69.

during the months of May to November, inclusive; in other words, applying this to the 1929-38 average annual imports, the in-season movement would be 63 percent of 1,885,260 tons, or 1,187,714 tons.

The most important port of entry for imported wood pulp is New York. In 1936, 328,540 short tons, out of total United States imports of 2,277,500 short tons, entered the United States via the New York customs district. Similarly, in 1938, 270,155 short tons out of total United States imports of 1,710,393 short tons came through this district. As shown in table O-4, next to New York, Maine and New Hampshire customs district are the important points of entry for wood pulp. The Michigan customs district is third and the Philadelphia customs district fourth in importance as points of entry.

The question that confronts us is to determine how much wood pulp is transported into the tributary area of the Great Lakes from the Atlantic coast, by what means it is now being transported, and how much potential tonnage there might be if the St. Lawrence Seaway were constructed?

Section 2

CONSUMPTION IN THE TRIBUTARY AREA

The United States has a deficiency in all the principal types of wood pulp that are utilized in papermaking and other industries. The following tabulation indicates the extent of deficiency of the different kinds of wood pulp in the United States as a whole during 1935:¹

Kinds of wood pulp	Production	Consumption	Excess of production (+) consumption(-)
Thousands of short tons			
Sulphite.....	1,594	2,558	-964
Sulphate.....	1,468	2,084	-616
Ground wood.....	1,356	1,563	-207
Soda.....	396	400	-4
Other ¹	130	132	-2
Total.....	4,944	6,736	-1,792

¹ Except in the South, production of "other" pulp consists of screenings. In the South the figures for production of other pulp cover semichemical pulp and screenings.

In 1935 it appears there was a deficiency of 1,792,000 short tons of wood pulp. More than half of this deficiency was in sulphite wood pulp, and about a third in sulphate wood pulp. The geographical spread of this deficiency gives a significant clue with regard to the movement of wood pulp between regions. The total deficiency of 1,792,000 short tons for the United States as a whole was spread between different wood pulp producing and consuming regions, as follows:²

	<i>Thousands of short tons</i>
Northeastern region.....	-1,101
Lake and Central region.....	-882
Southern region.....	-96
Pacific region.....	+287
Total.....	-1,792

² Tariff Commission, Report No. 126, *Wood Pulp and Pulpwood*, 2d Series, 1938, p. 11.

³ Tariff Commission, *op. cit.*, p. 11.

Another significant fact is that in every one of the regions of the United States, the capacity of pulp mills is greater than actual production; in some cases, as in the Northeastern region and the Southern region, greater even, than total consumption. In spite of this fact, however, large amounts of imports as has been pointed out, have been brought into the country from the Scandinavian countries and Canada.

The Lake and Central region comprises the Lake States of Michigan, Wisconsin, Minnesota, Ohio, Indiana, and Illinois, and, further, the States of Iowa, Missouri, and Kansas. The production of wood pulp is concentrated largely in Michigan, Wisconsin, and Minnesota, which are also large producers of paper and paperboard. Ohio produces some wood pulp, but is important chiefly as a consumer. The other States in this region are not producers of wood pulp, but manufacture paper and board. This region accounted for nearly half of the United States deficiency of wood pulp in 1935. Out of the total deficiency of 1,792,000 short tons, 882,000 short tons were in the Lake and Central region. This deficiency was distributed among the different kinds of wood pulp as follows: ⁴

Kinds of wood pulp	Production	Consumption	Excess of production (+) consumption (-)
Thousands of short tons			
Sulphite.....	370	907	-537
Sulphate ¹	217	426	-209
Ground wood.....	284	372	-88
Soda.....	54	101	-47
Other ²	7	8	-1
Total.....	932	1,814	-882

¹ The small quantity of sulphate produced in the Northeastern region is combined with the Lake and Central region.

² See footnote 3, p. 5.

Sulphite Pulp.

The analysis of wood pulp shipments must be made by kinds of wood pulp, as each kind has different points of origin and consumption. The total consumption of sulphite pulp amounted to 907,000 short tons in the Lake and Central region. This was exactly half of the total consumption in the Lake and Central region of 1,814,000 short tons. There were only 370,000 short tons of sulphite pulp produced in this region. Consequently, 537,000 short tons had to be brought in from the outside.

The break-down of the total consumption of sulphite pulp in the Lake and Central region in 1935 shows the following sources of origin: ³

Regional production.....	Short tons 358, 000
Other domestic sources.....	134, 000
Total domestic.....	492, 000
Imported from Canada.....	76, 000
Imported from Europe.....	339, 000
Total imported.....	415, 000
Total domestic and imported.....	907, 000

³ *Ibid.*

⁴ Tariff Commission, *op. cit.*, p. 170, table 73.

Thus it appears that 415,000 short tons were obtained from foreign sources, principally European; in other words, of the total deficiency of 537,000 tons of sulphite pulp, 339,000 short tons were supplied from Europe and 76,000 short tons from Canada. The rest of the deficiency was obtained from domestic sources as follows: ⁶

	<i>Thousands of short tons</i>
Northeastern region.....	39
Southern region.....	10
Pacific Coast.....	85
Total domestic sources.....	134

In 1935 the United States imported the following amounts of unbleached and bleached sulphite from foreign countries: ⁷

Country	Un-bleached sulphite	Bleached sulphite	Total
Canada.....	75,029	225,773	300,802
Sweden.....	377,320	69,237	446,557
Norway.....	16,539	52,407	68,946
Finland.....	146,166	29,550	175,716
Germany.....	50,024	30,231	80,255
Other countries.....	27,948	22,226	50,174
Total.....	693,026	429,424	1,122,450

The principal country from which bleached and unbleached sulphite is imported is clearly Sweden, followed by Canada.

Wisconsin, Michigan, and Ohio are the chief States consuming sulphite in the Lake and Central region. Nearly 90 percent of the total regional consumption reported to the United States Tariff Commission in 1935 took place in those States. Of the remaining 10 percent, more than half was consumed in Minnesota, and most of the rest in Illinois and Indiana. Unquestionably, therefore, the deficiency of 537,000 short tons of sulphite pulp in this region occurred in the tributary area of the Great Lakes. In Wisconsin predominantly domestic pulp was used, although both unbleached and bleached sulphite pulp were also imported in substantial quantities.⁸ In Michigan and Ohio, imported sulphite exceeded domestic pulp in consumption, the excess being principally in unbleached sulphite.

In the Lake and Central region, there were four districts which accounted for nearly 85 percent of the imported and 75 percent of the domestic, or about 80 percent of the combined domestic and imported bleached sulphite consumption reported in 1935. These four districts also consumed about 70 percent of the domestic and imported unbleached sulphite pulp. These important sulphite consuming districts and the percentages of the regional total which they accounted for, were as follows: ⁹

	<i>Percentage of regional total</i>
Southern Ohio and eastern Indiana.....	24
Southeastern Michigan and northern Ohio.....	4
Southwestern Michigan.....	18
Eastern and central Wisconsin.....	30
Other not included in districts.....	24

⁶ *Ibid.*

⁷ *Ibid.*, table 66, p. 163, and table 67, p. 164.

⁸ *Ibid.*, p. 175-6.

⁹ *Ibid.*, p. 176.

A further break-down of the consumption of these districts shows that 53.4 percent of the bleached and unbleached sulphite consumption was from domestic sources, and 46.6 percent from foreign sources. The foreign supply was divided between Canada (9.7 percent) and Europe (36.9 percent). The proportion of the total consumption of bleached and unbleached sulphite by districts and by sources is given in the brief tabulation below:¹⁰

Region	Percent of total domestic wood pulp	Percent of total imported wood pulp	Total for district
Southern Ohio and eastern Indiana.....	6.9	17.0	23.9
Southwestern Michigan and northern Ohio.....	2.3	1.5	3.8
Southwestern Michigan.....	3.5	14.4	17.9
Eastern and central Wisconsin.....	25.6	4.7	30.3
Points outside above districts.....	15.1	8.0	24.1
Total.....	53.4	46.6	100.0

From this tabulation it is quite clear that a large proportion of the consumption of sulphite in the southern Ohio and eastern Indiana district was imported pulp. The same was true of the sulphite consumed in southwestern Michigan. On the other hand, eastern and central Wisconsin received less than 5 percent of its total consumption of sulphite from abroad.

Application of these percentages to the total consumption of sulphite pulp of 907,000 short tons in the Lake and Central Region, yields a break-down by sources of origin and destinations as shown in table O-5. It is clear from the break-down in table O-5 that 423,000 short tons were imported from abroad, of which 335,000 short tons were from Europe and 88,000 from Canada.

The largest movement of domestic sulphite pulp came from producing mills in the Pacific Northwest, where there was an excess of production over consumption, and whence a considerable amount of western pulp was shipped by rail to the westerly portions of the lake and central region.

Practically all of the sulphite imported into the United States from European countries moves from Baltic ports by freight liners and chartered vessels through North Atlantic ports and thence by rail; or through Montreal and Sorel, Canada, where it is transhipped to canal and lake vessels and sent to South Haven and Detroit, Mich., Green Bay, Wis., and Toledo Ohio.

In 1935 about 25 percent of the imports of European sulphite pulp to North Atlantic ports moved into the eastern portions of the lake and central region, and of course all of the imports through lake ports were probably consumed in this area. In 1935 the following quantities of European imports of sulphite pulp took place:¹¹

	<i>Short tons</i>
Atlantic coast ports.....	589,000
Lake ports.....	203,000
Gulf ports.....	14,000
Pacific coast ports.....	16,000
Total.....	822,000

Thus, of the 335,000 short tons of sulphite pulp imported from Europe into the Lake and Central region in 1935, 203,000 short tons came through lake ports and presumably 132,000 short tons by rail from Atlantic coast ports.¹²

¹⁰ *Ibid.*, p. 177.

¹¹ *Ibid.*, table 80, p. 179.

¹² Total sulphite imported in the central region from Europe in 1935 was 334,683 tons (table O-5) of which 203,000 tons were reported received via Lake ports; the difference is assumed to have moved by rail.

Sulphate Pulp.

The Lake and Central region had a total consumption of 426,000 short tons of sulphate pulp in 1935. Of this, 217,000 short tons were produced locally and 209,000 short tons represented net deficiency which had to be brought in from the outside. The 209,000 short tons of deficiency were obtained as follows: ¹³

	<i>Short tons</i>
From mills in Southern region.....	7, 000
Imported from Canada.....	32, 000
Imported from Europe.....	170, 000
Total.....	209, 000

The total consumption of 426,000 short tons of sulphate in the region was divided among the important districts within the region as follows: ¹⁴

	<i>Percent of regional total consumption</i>
Southern Ohio and eastern Indiana.....	18
Southeastern Michigan and northern Ohio.....	13
Southwestern Michigan.....	9
Eastern and central Wisconsin.....	32
Other points not included in districts.....	28
Total.....	100

In Wisconsin and Minnesota, domestic sulphate pulp constitutes the great bulk of consumption. In Michigan, also, a substantial amount of consumption is domestic pulp, which is consumed by the producing mills themselves. However, more than half of the consumption is imported. In the other sections of the Lake and Central region, most of the requirements are met by imported sulphate pulp.¹⁵ The 28 percent of the total consumption in the above tabulation consumed at points other than those included in the districts named was distributed, 18 percent in Michigan, Wisconsin, Minnesota, and the rest in other scattered parts of the region.¹⁶

In addition to the Lake and Central region, in 1935 the Northeastern region consumed 346,000 short tons of sulphate pulp. All of this was imported: From Europe, 289,000 short tons, and from Canada, 57,000 short tons.¹⁷ Northwestern New York, one of the districts important in the consumption of sulphite pulp, is not of great importance in the consumption of sulphate pulp. On the other hand, central and northern Vermont and New Hampshire, which are of little importance as consumers of sulphite, take substantial quantities of sulphate pulp. These two districts, in 1935, accounted for 32 percent of the total consumption in the district. However, since New Hampshire and Vermont lie east of the St. Lawrence, their consumption of sulphate pulp will be left out of consideration. The north central New York area consumed 9 percent of the 346,000 short tons of imported sulphate pulp, or 31,000 short tons. It is likely that a large part of this amount is Canadian sulphate pulp, since most of the 57,000 short tons of imported Canadian pulp in 1935 was consumed in the north central New York region and in New Hampshire and Vermont.

In addition to the Lake and Central region, as above described, included in the Great Lakes tributary area, one must take into account firms located in northern

¹³ Tariff Commission, *op. cit.*, table 97, p. 219.

¹⁴ *Ibid.*, p. 221.

¹⁵ *Ibid.*, p. 221.

¹⁶ *Ibid.*

¹⁷ *Ibid.*, p. 219.

and western New York, which require wood pulp for paper manufacturing. Such firms are located in the proximity of the St. Lawrence and Lake Ontario. In 1935 there was a total consumption of 1,251,000 short tons of sulphite pulp in the Northeastern region;¹⁸ 625,000 short tons were imported, divided as follows: 449,000 short tons from Europe, and 176,000 short tons from Canada; of the total consumption of 1,251,000 short tons in the northeastern region, 17.4 percent, or 217,674 short tons, were consumed in the north central and northwestern New York and northeastern Pennsylvania area, around Brownville and Niagara Falls, and west of Niagara Falls near the shores of Lake Erie.¹⁹ More than half of the 217,674 short tons, in 1935—or in actual figures, 125,100 short tons—were imported. This was distributed in Canadian sulphite pulp, 77,562 short tons, and European sulphite pulp, 47,538 short tons. The amounts by source of origin of sulphite pulp consumed in these areas are summarized below:

	Total	Total domestic	From Canada	From Europe	Total imported
	Short tons				
North central New York.....	95,076	37,530	22,518	35,028	57,546
Northwestern New York.....	122,598	55,044	55,044	12,510	67,554
Total.....	217,674	92,574	77,562	47,538	125,100

Mechanical Pulp.

In 1935 total consumption of ground wood or wood pulp produced by mechanical means amounted to 372,000 short tons in the Lake and Central region. Of this amount, 285,000 short tons were for domestic mills in the same region, and the remaining 87,000 short tons were imported, 60,000 short tons from Canada and 27,000 short tons from Europe.²⁰ As only about one-half of 1 percent of domestic ground wood used in the area was transported over distances sufficiently great to warrant shipment by rail, there is no problem involved of shipping domestic mechanical wood pulp to the Great Lakes region.

Mechanical pulp imported from Europe is introduced into this region in the same manner and under the same general conditions as sulphite and sulphate pulp. The greater part of the movement of Canadian mechanical pulp came by rail. Some mechanical pulp from mills located on or near lake transport facilities came by boat.

In 1935, 191,000 short tons of ground wood were received from abroad in the United States, of which as stated above 87,000 short tons were consumed in the Lake and Central region, and most of the rest in the northeastern area. However, it is impossible to allocate the consumption of the northeastern area so as to show how much of it might have been taken by mills in the tributary area, and hence ground wood for this region as potential traffic for the St. Lawrence will be disregarded.

Summary of Imports into Tributary Area.

Summarizing the foregoing calculations of importation of sulphite, sulphate, and ground wood pulp into the lake region and north central and northwestern

¹⁸ *Ibid.*, p. 169, table 72.

¹⁹ *Ibid.*, p. 175.

²⁰ *Ibid.*, table 108, p. 237.

New York districts, we obtain a total of 868,000 short tons brought into these areas from Canada and Europe, distributed as follows:

	Total	Canada	Europe		Total	Canada	Europe
	Short tons				Short tons		
Lake region:				New York region:			
Sulphite.....	423,000	88,000	335,000	Sulphite.....	125,000	77,500	47,500
Sulphate.....	202,000	32,000	170,000	Sulphate.....	31,000	31,000	.....
Ground wood.....	87,000	60,000	27,000	Total.....	868,000	288,500	579,500

At the beginning of this section we had the deficiency of different kinds of pulp during 1935 in the lake and central region. In the light of the preceding analysis, it appears that all of this deficiency, except in sulphite, was met by imports. In the case of sulphite, nearly 80 percent was obtained from foreign countries. The distribution of the supply of deficiency by sources of origin may be summarized as follows:

	Deficiency	Supplied from Canada	Supplied from Europe	Supplied from United States sources outside region
	Short tons			
Sulphite.....	537,000	88,000	335,000	114,000
Sulphate.....	208,000	32,000	170,000	7,000
Ground wood.....	88,000	60,000	27,000	1,000
Total.....	834,000	180,000	532,000	122,000

Thus, 712,000 tons, out of a total deficiency in the Lake and Central region of 882,000 short tons, were supplied from Canadian and European sources.²¹

It was indicated above that 203,000 short tons of European sulphite pulp were imported into the United States through lake ports. Presumably, the rest of the European imports of sulphite into this area, or 132,000 short tons, came by rail from North Atlantic ports. It would be assumed that the 203,000 short tons of European pulp that arrived at lake ports came via the 14-foot canals on the St. Lawrence. Examination of the Canadian *Canal Statistics* for 1935 indicates that there were 336,000 short tons of wood pulp which traveled from Canadian ports to United States ports via the St. Lawrence Canal.²² An additional 16,000 tons came from other sources via the canal to United States lake ports, or a total of 352,000 tons traveling up the St. Lawrence canals during 1935. As the Tariff Commission reports that 203,000 tons of European pulp came into lake ports in that year, it would be assumed that all but 16,000 tons of them were transhipped at Montreal, and thereby appeared in the *Canal Statistics* as shipments from Canada to United States lake ports via the St. Lawrence. In other words, if we assume that all of the 16,000 tons came from Europe direct, then the difference between 16,000 tons and 203,000 tons, or 187,000 tons, consisted of European pulp that was transhipped at Montreal for United States lake ports. The difference between this figure and the total of 336,000 tons from Canada to United States ports, or 149,000, must have been Canadian pulp moving into the United States via the St. Lawrence to lake ports.

²¹ See text table, pp. 297, 302.

²² Canada, Dominion Bureau of Statistics, *Canal Statistics*, 1935, table 20, p. 34.

Since the total imports from Canada to the tributary area were estimated in this year at 288,500 tons, it would seem that the rest—at least 139,500 tons—came by rail from Canada into the tributary area. The total importation from Europe into the tributary area was estimated at 579,500 tons. As 203,000 tons came into lake ports via the St. Lawrence, then the difference, 376,500 tons, must have come into this area by rail.²³

Table O-4 of this text shows that customs receipts of wood pulp in the St. Lawrence, Duluth-Superior, west Michigan, Ohio and Wisconsin districts amounted to 567,000 short tons. The difference between estimated Canadian and European shipments to this area and the receipts at the customs districts in the same region amounts to 75,500 short tons. This must be explained by the fact that in our estimates of receipts we have eliminated certain regions adjacent to these customs districts—for instance, New Hampshire and Vermont near the St. Lawrence district—from our calculations. Also, we have not considered any imports of soda pulp that may have entered into this district. Since our estimates are below the receipts in those customs districts, it may be said that our estimates of consumption of Canadian and European pulp in the region during 1935 are well within conservative limits.

The following brief tabulation summarizes the routings of imports into the north central-northwestern New York and lake and central regions:

	Total	St. Lawrence River	Rail
Canadian pulp.....	288,500	<i>Short tons</i> 149,000	139,500
European pulp.....	579,500	203,000	376,500
Grand total.....	868,000	352,000	516,000

It may be asserted that the present discussion, predicated upon a study of the 1935 situation, is not representative of later years. This, however, is not borne out by an examination of domestic production, import, and consumption figures. Imports in 1935 were but slightly higher than the 10-year average, 1928-37. In 1936 and 1937, imports were substantially higher. The increase in the production of wood pulp in the tributary area has been slight.

The important change in the situation, of course, is the destruction of the normal production market structure of the wood-pulp industry as a result of the European war. This situation, however, is too uncertain to be made a part of this report.

At the end of the preceding section it was stated that 63 percent of the imports moved into the United States during the open navigation season from May to November, inclusive. If this percentage is applied to the total imports into the tributary area as calculated—namely, 868,000 short tons in 1935—the imports during the open navigation season would be 546,840 short tons. Since, however, 352,000 short tons came up the St. Lawrence during that year, then 194,840 tons must have entered the tributary area during the season of open navigation by rail. What proportion of this rail movement in the open navigation season came from Europe and what proportion from Canada cannot be definitely discovered, since no information is available on the subject. Furthermore, we cannot study in detail the distribution of this incoming rail movement during the open navigation season by points of destination. However, if we assume that the same proportion from each principal source of origin came into the United States during the open navigation season by rail as during the whole

²³ The total imports from Canada and from Europe into the lake region amounted to 491,500 tons (Canada, 288,500 short tons; Europe, 203,000 short tons).

year of 1935, then we may say that 37 percent of 194,840 short tons, or 72,090 short tons, came from Canada, and the rest, 122,750 short tons, from Europe.

Section 3

POTENTIAL SAVINGS ON THE TRANSPORTATION OF WOOD PULP INTO THE TRIBUTARY AREA

The consideration of the potential savings that may be derived from the construction of the St. Lawrence Seaway must take into account the fact that a substantial amount of wood pulp travels over the 14-foot canals on the St. Lawrence. The origin of this incoming wood pulp via the St. Lawrence and the lake ports is in Europe and in eastern Canada. The savings in this particular case can be no more than the advantage of direct shipment by a deeper draft vessel instead of transshipment at Montreal and Sorel. Even though there is no additional charge made in the present arrangements between importers, shippers, and consumers for transshipment, there is still a rate advantage, although a small one, between the direct route into the St. Lawrence from European points by small, shallow-draft Swedish and Norwegian liners and the ocean and lake rate where there is transshipment at some Canadian port. In 1935 and 1936, the following rates were effective from Swedish and Finnish ports to Great Lakes ports per short ton:

	1935			1936		
	Ocean rate	Lake rate	Total	Ocean rate	Lake rate	Total
Lake Erie ports and Port Huron.....	\$3.58	\$1.78	\$5.36	\$3.58	\$2.00	\$5.58
Lake Huron and eastern Lake Michigan.....	3.58	2.58	6.16	3.58	2.91	6.49
Chicago, western Lake Michigan, and Lake Superior..	3.58	2.58	6.16	3.58	3.12	6.70

The direct rates on through steamers, compared with the 1935 transshipment rates, were \$5.13 per short ton for points east of the Straits of Mackinac, and \$5.58 per short ton for all points west. At these rates, there was a saving of 23 cents per short ton on the through shipments from Swedish and Finnish ports to Lake Erie and Lake Huron ports, and a saving of 58 cents per short ton on shipments beyond the Straits of Mackinac. In this comparison, rail rates from lake port to port of consumption are immaterial, since in both instances the same rates would be effective regardless of whether wood pulp came to lake port direct from European ports or whether it was transshipped at Montreal. In 1935, as it was shown in the preceding section, 16,000 short tons of imports came direct through the St. Lawrence from European ports, and 187,000 short tons came via the St. Lawrence through some Canadian port. On this 187,000 tons, some saving could, therefore, be achieved even at that time. Table O-6 previously showed that about a third of the imports from Europe went to southwestern Michigan, and about 10 percent to eastern and central Wisconsin. As 18.5 percent of the imports from Europe went to points not definitely allocated in the Lake and central region, it may be fair to say that some 50 percent of the imports from Europe went to points west of the Straits of Mackinac. Hence, on 50 percent of 187,000 short tons, or 93,500 short tons, a saving of 58 cents per short ton could be applied. This would have resulted in a saving to these points on the shipments arriving by lake of \$54,230. If we apply a saving of 23 cents on

the rest, an additional saving of \$21,505 is shown, or a total saving of \$75,735. This is on the basis of 1935 rates; it does not also allow for the fact that larger through-lines might be able to offer better rates than the small Fjell Line boats.

The combination ocean and lake rates in 1936 were raised, as shown in the preceding tabulation. On the 1936 basis, the direct shipments showed savings of 45 cents in Lake Erie and Port Huron, 91 cents to Lake Huron and the eastern shore of Lake Michigan, and \$1.12 to Chicago and western Lake Michigan and Lake Superior. On the basis of these savings, about \$135,000 could have been saved if service by larger vessels at the same rate as were offered by the smaller vessels direct from Baltic ports had been available in 1936, on the basis of 1935 imports via lake ports. The combination rates via Montreal and the St. Lawrence in effect in 1939 were the same as those in effect in 1936.

To estimate further savings that may be effected in the shipment of European pulp which travels by rail, rate comparisons between the ocean-rail rate via Baltimore and the ocean-lake-rail rates via Montreal are presented in Table O-6. It appears from this table that savings on ocean-lake-rail route over ocean and rail from Baltimore ranged between 22 cents to Chillicothe, Ohio, and \$3.82 at Appleton and Wisconsin Rapids, Wis. If we were to substitute direct Europe to lake port rates in place of the ocean-lake rate, we would obtain savings that range between 45 cents to Chillicothe and \$4.40 at Appleton and Wisconsin Rapids, Wis.

On the basis of these rates of saving on the direct route over the ocean-rail combination from Baltimore, it would be conservative to assume that there might be an average saving of \$2.00 a short ton on the estimated 122,751 short tons of European pulp that was estimated to move into the tributary area by rail in 1935. On this basis, the saving on the rail movement of European wood pulp during the open navigation season might be put at \$250,000, which would be in addition to the \$135,000 which we estimated could have been saved on the movement of European wood pulp into the lakes via Montreal or Sorel, or a total of \$385,000. This does not include any potential saving that may accrue on the shipment of Canadian pulp, estimated on the basis of 1935 imports at around 72,090 short tons which entered the United States by rail during the open season of navigation, which might utilize the Seaway if deeper draft vessels could carry the wood pulp direct from such producing centers as New Brunswick to the lakes. However, on the assumption that if they could achieve substantial savings they would have used the present canals, no account is taken of the possibility of savings on this rail movement of Canadian pulp during the summer and fall months.

This saving would be greater to the extent that there is now a larger rail movement into the tributary area than in 1935, for the simple reason that combination ocean-lake route has since then diminished in popularity, to some extent because lake port facilities for the receipt and storage of wood pulp are not considered very satisfactory. The consumers of wood pulp depend to a large extent upon frequent delivery of rail shipments; however, there is nothing inherently difficult in the development of proper facilities, since wood pulp is immune to atmospheric influences. Swedish and Finnish producers of wood pulp, for instance, on the Gulf of Finland, which is closed to navigation practically 6 to 7 months of the year, store the accumulated wood pulp in open areas, until the navigation season is open. If this can be accomplished in the producing center, there would seem to be little reason why it could not just as easily be accomplished at the point of destination. Hence, it may be possible that with cheaper direct transportation facilities, not only would 63 percent of the annual importation be received in the open navigation season, but perhaps a larger proportion may be purchased, delivered, and stored during the late summer months for winter consumption. With such a development, the savings would certainly amount to more than the

\$385,000 here indicated on the basis of 1935 consumption of in-season movement of European pulp.

The foregoing estimates do not include any possible shipment of Pacific coast sulphite pulp, which is moved into the lake and central region. In 1935, there were 85,000 short tons of sulphite pulp brought into this region from the Pacific coast. It is possible that steamers returning from the West coast, after having delivered such supplies as automobiles and machinery from the tributary area, may pick up some of this cargo. It is possible that as much as 50,000 short tons may be brought back into the tributary area. The rates from the Pacific coast to Baltimore are around \$6.50 per short ton. If this pulp could be picked up as return cargo at this rate, or even at a rate of \$7.50 or \$8 a short ton, there might be a saving of 1 to 4 dollars a ton on this shipment, even after allowing the rail rate from lake port to interior point of consumption. Assuming again an average of \$2 a short ton saving, there might be an additional potential saving of \$100,000 on Pacific sulphite pulp that comes into the lake regions.

Section 4

PRODUCTION OF NEWSPRINT PAPER IN THE UNITED STATES AND CANADA

The production of newsprint paper in the United States has been receding steadily since 1926. As a percentage of apparent consumption it has been decreasing regularly for more than 2 decades. A corresponding increase has occurred in Canada's production and exports to us. The main reasons for the decrease in domestic output are apparent. The newsprint mills entered the New England area, where the main portion of the industry was located, long after the lumber operators. United States paper requirements grew rapidly and the supplies of pulpwood diminished more rapidly than before, receding further and further from the mills. Receding pulpwood supplies meant increased costs. To keep up even in part with increased demand, the newsprint mills were forced either to import both wood pulp and pulpwood or move to other regions.²⁴ The newsprint industry adopted the course of relocating in Canada, where supplies of pulpwood were more plentiful.

The steady movement of mills from the United States to Canada can be well visualized from a study of table O-7, showing United States production, imports, and exports of newsprint paper. This table shows that while in 1914 the United States produced 85.4 percent of the apparent domestic consumption, there has been, with few exceptions, a steady decline in the country's ability to meet its demand, so that by 1939 it was estimated that only 26.5 percent of apparent newsprint consumption requirements were produced domestically.

Of the approximately 19 newsprint mills remaining in the United States, five are located in the tributary area, two in Minnesota, two in Michigan, and one in Wisconsin. It is estimated from data contained in *Post's Paper Mill Directory*²⁵ that capacity in the newsprint mills of the tributary area in 1940 is approximately 231,350 tons per year. This does not represent actual production, however. In 1939, for example, production of newsprint in this area was probably between 200,000 and 210,000 short tons. This estimate is based on capacity of production in the area and the estimated rate of operations for newsprint mills in the United States during 1939.

²⁴ Department of Agriculture, *A National Plan for American Forestry*, 1933, pp. 197-267.

²⁵ *Post's Paper Mill Directory*, 1940. L. D. Post, Inc., N. Y.

As pointed out above, the loss in United States domestic production was Canada's gain. In 1913, for example, the Canadian newsprint industry was in its infancy. The tremendous growth of this "infant" industry can be seen from a study of table O-8. A study of tables O-1 and O-2 combined gives an idea of how our domestic industry declined to Canada's gain. It should be observed that newsprint exports are a vital part of Canada's economy. In the fiscal year ending March 31, 1938, they were the most valuable single export item.²⁶

The present trend is well established; a possible future trend will be treated later in this report. As pointed out above, the trend has been away from the United States to Canada. In existence today are a group of newsprint paper mills in Maine; three in New York State; those already mentioned in the tributary area; one in Texas, and four on the West coast. It is possible that the factors which caused the former New England newsprint industry to decline may have a like effect upon some of the remaining mills in the northeast.

In Canada, the chief area of production is in southeastern Quebec, in an area near the St. Lawrence River, extending from its mouth to Ottawa. The other main sections are scattered throughout the Province of Ontario, mainly near the lakes, with another group of mills in the far West.

Exports of newsprint paper from the United States are negligible, and promise to continue so.

Section 5

IMPORTS AND CONSUMPTION OF NEWSPRINT IN THE UNITED STATES

Total imports of newsprint paper into the United States have risen nearly every year, both in quantity and in percent of domestic consumption. This can be seen from table O-7. The principal source of imported newsprint has been Canada. In 1938, for example, Canada supplied 86.3 percent of all imported newsprint, and 62.7 percent of our consumption. Statistics of our imports of newsprint paper by chief regions of supply are given in table O-9. In addition to Canada, the United States imports newsprint from Finland, Norway, Sweden, and Germany. Average imports for 1928-37 from these countries amounted to 7.2 percent of total United States imports of newsprint paper.

In recent years, Finland increased her exports of newsprint paper to the United States and has gained a larger share of our total trade. For example, in 1922 Finland supplied 2.5 percent of all newsprint paper imported into this country. In 1938 her share had increased to 6.6 percent.

Table O-10 presents the 1928-37 annual average imports of newsprint via the customs districts of the Great Lakes and St. Lawrence region. Out of total United States imports in the 10 years 1928-37 of 2,317,000 short tons, 1,515,000 short tons, or 65.4 percent, cleared through the customs districts of the Great Lakes. The most important districts in this area were Michigan, through which passed an annual average of 529,000 short tons; St. Lawrence, 418,000 short tons; and Buffalo, 256,000 short tons.

These imports through the Great Lakes and St. Lawrence customs districts come almost entirely from Canada. This fact is demonstrated by the west-bound shipments over the canals on the St. Lawrence River and the Welland Canal for the years 1931-38 and by the 1932-33 receipts by members of the American Newspaper Publishers Association as presented to the Interstate Commerce Commission.²⁷ For the years 1928-30, no figures are available on the

²⁶ Canada, Dominion Bureau of Statistics, *The Pulp and Paper Industry*, 1937, p. 72.

²⁷ Ex parte No. 115, Exhibit No. 410-P8.

movement of paper on the Canadian canals, but in the 8 years 1931-38, the annual average of up-bound through traffic to United States ports of all kinds of paper, but mostly newsprint, was as follows: ²⁸

	From Canadian ports to U. S. ports	From U. S. or other ports to U. S. ports	Total to U. S. ports
St. Lawrence Canal.....	<i>Short tons</i> 79, 207	<i>Short tons</i> 721	<i>Short tons</i> 79, 928
Welland Canal.....	135, 410	1, 760	137, 170

During the 8 years over either canal system, 99 percent of the up-bound movement to United States ports was originated in Canadian ports.

The figures showing the up-bound movement over the Canadian canals originating in Canadian ports may contain some goods transhipped at Montreal or other St. Lawrence ports, but originated overseas. No such error is likely in the figures of receipts by the newspaper publishers. As an exhibit for an Interstate Commerce Commission rate case, the American Newspaper Publishers Association presented figures of receipts of newsprint by country of origin and by mode of transportation. These data are based upon returns from selected members of the association with great variation in different areas as to the percentage of newspaper consumption covered; therefore, for individual towns and indeed for individual States, the use of these data might lead to serious error, but the figures for the tributary area as a whole can be used to gain an idea of the origin of the newsprint received in the area. The annual average receipts of newsprint in the tributary area as sampled by the American Newspaper Publishers Association during the years 1932-33 is as follows: ²⁹

From:	<i>Short tons</i>	<i>Percent of total</i>
United States mills.....	130, 000	21. 5
Canadian mills.....	475, 000	78. 5
European mills.....	219	(1)
Total.....	605, 219	100. 0

¹ Less than $\frac{1}{4}$ of 1 percent.

Once again, then, imports into the tributary area from sources other than Canada are insignificant.

There are indications that, except to the Great Lakes ports, newsprint moves from Canada into the Great Lakes area by rail. Table O-11 presents the 1934-38 annual average water-borne imports of newsprint from Canada by the most important Great Lakes ports.³⁰ In these 5 years a total annual average of 247,716 short tons of newsprint arrived by water from Canada at the selected ports. Of this 161,000 short tons, or about two-thirds were received at Chicago, 36,000 short tons at Cleveland, and 30,000 short tons at Detroit. The relatively large amounts moving by water to Chicago represent, no doubt, the shipments of the Chicago Tribune from its mill at Thorold, Ontario, on the Welland Canal. These

²⁸ Canada, Dominion Bureau of Statistics, *Canal Statistics*, 1931-38.

²⁹ American Newspaper Publishers Association, Traffic Department, Ex parte No. 115. The States included in the tributary area are: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin, New York (northern part), Pennsylvania (western part).

³⁰ The figures of preceding years 1928-33 are not comparable. The States included are Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin, upper New York, and the cities of Erie and Pittsburgh, Pa.

shipments take place in company-owned or -leased boats. They also account to a great extent for the fact that up-bound shipments over the Welland Canal are so much larger than those over the St. Lawrence Canals. The fact that most of the shipments from Canada into the United States Great Lakes area are by rail is borne out by the exhibit of receipts sampled by the American Newspaper Publishers Association.²¹ Of the 1932-33 total annual average of receipts, over 409,300 short tons, reported from Canada in the United States Great Lakes area, 211,600 short tons, or 51.8 percent, came by rail, and 194,700, or 47.4 percent, by water. Only 117 short tons were reported as shipped by combination of rail and water and 2,900 short tons, or 0.7 percent, by truck. Among the 195,000 short tons received in the area all-water, 137,000 were received at Chicago, 26,000 at Detroit, and 20,000 at Cleveland. Small shipments by water were reported at Buffalo, Albany, and Milwaukee.

While newsprint paper consumption has increased in the past two decades, both the increase and the trend may be misleading. In tons of paper consumed, a fair estimate of total newsprint paper consumption can be obtained from table O-7. However, the trend in the past decade has been toward mergers of some newspapers, the elimination of numerous editions, and in some instances, of newspapers themselves. In addition, newspapers are now exploring possibilities of cutting down the size of their paper. For example, one New York newspaper, by cutting the size of the sheet 1 inch, but keeping the same number of columns and inches to a page, saved an estimated 3,000 tons of newsprint in 1939. It is highly possible that these practices will be more fully developed in the future. The trend in the newspaper industry is toward fewer papers within an area and fewer editions of a particular paper. Hence, the total consumption of newsprint paper may only increase slightly or perhaps decline. Of course a tendency toward increased consumption is indicated with a growing population, although news and advertising by radio tends to displace this influence.²²

Section 6

POTENTIAL TRAFFIC IN NEWSPRINT

There are no official data available on the consumption of newsprint paper in the tributary area of the Great Lakes; however, population estimates may be used to obtain approximate consumption. Based on the census estimates of population, annual average 1928-37, and the United States consumption of newsprint in the same years, the annual average consumption was 54.5 pounds per capita. In the years 1928-37 the annual average of estimated population in the tributary area, excluding New York and Pennsylvania, was 32,326,000 persons.²³ Based on these data, the annual average of newsprint paper consumption in the "tributary area" in the years 1928-37 is estimated at 1,762,000,000 pounds or 881,000 short tons. Based on similar data, it is estimated that consumption in 1950 in the "tributary area" will lie between 1,013,000 and 960,000 short tons, and in 1965, 1,128,000 and 960,000 short tons.

Perhaps a better method of estimating the consumption of newsprint in the tributary area is based upon the allocation of the 10-year average consumption of the country as a whole to the individual States according to the proportion they consume of cost of materials and supplies of the newspapers and periodicals industry. Excluding those industrial areas of Pennsylvania and of New York

²¹ American Newspaper Publishers Association, Traffic Department, Ex Parte No. 116.

²² Department of Agriculture, *A National Plan for American Forestry*, 1933, p. 261.

²³ The States included are Ohio, Indiana, Michigan, Illinois, Wisconsin, Iowa, Minnesota, North Dakota, South Dakota, and Nebraska.

that are on or close to the Great Lakes, the tributary area as a whole, average based on 1933, 1935 and 1937, consumed 27.6 percent of the total national consumption of materials and supplies of newspapers and periodicals; Illinois alone consumed 10.2 percent and Ohio 7.8 percent. In table O-12 these percentages are applied to the 1928-37 average United States consumption of newsprint. See table O-7. By this method the annual consumption of Illinois is estimated to be 348,000 short tons, and that of Ohio to be 266,000 short tons. The tributary area, excluding New York and Pennsylvania, as a whole is thus estimated to have consumed 941,000 short tons. This compares with 881,000 short tons estimated upon the basis of per capita consumption for the year 1939. Including the industrial areas of Buffalo, Rochester, and Pittsburgh on the basis of cost of materials consumed in printing and publishing newspapers and periodicals, the estimated consumption of the tributary area is 1,036,867 short tons.

Production figures by States are not available for years since 1929. In order to estimate the deficit of newsprint in the tributary area from the estimated consumption of the individual States, we subtracted the 1929 production figure for the States of Minnesota and Wisconsin for which they were available. That this figure is probably high is indicated by the fact that the national production in 1929 was much higher than in any succeeding year. No 1929 production figure for Michigan was published but its capacity in 1939 according to Lockwood's Directory, 1940, was 77,500 short tons per year of 310 days, which figure has been subtracted from the State's estimated consumption to obtain the estimated deficit. In table O-12, the estimated deficit for the tributary area is given. For the area as a whole, it amounts to 723,000 short tons. Minnesota and Wisconsin have estimated surpluses of, respectively, 64,000 and 59,000 short tons. The largest estimated deficit is in Illinois, 348,000 short tons and the second largest in Ohio, 266,000 short tons.

The findings as regards consumption of newsprint in the tributary area may be summarized as follows: Imports via the Great Lakes customs districts amount to approximately 1,515,000 short tons and come almost solely from Canada; the consumption of the area is about 1,040,000 and the deficit about 723,000 short tons. The problem of estimating tonnage potential tributary to the St. Lawrence Seaway is complicated. Before a clear answer can be gotten, precise points of origin and of destination must be determined, as well as the mode of transportation which is now being used.

Returning, then, to our estimates of deficit and tonnage, first an estimate will be made of the potential traffic of newsprint from Quebec to the major industrial areas directly on the Great Lakes for which no transshipment by rail will be necessary and, secondly, the potential traffic to the States immediately tributary to the Great Lakes, for which a transshipment by rail or waterway will be necessary.

In table O-13 is shown the estimated newsprint traffic moving from Quebec plants located on navigable streams to industrial areas on the Great Lakes. The deficit for each area was calculated by applying to the State deficit the area's percentage of the State's total cost of materials in the newspaper and periodicals printing and publishing industry. For the Chicago Industrial Area the percentage used was based upon the relationship of the area to the sum of Illinois' and Indiana's cost of materials, and it was applied to the deficit of the two States as a unit. For Buffalo and Rochester the deficit was taken as estimated in table O-12. From the data of the American Newspaper Publishers Association, it seems that the deficit of these areas is being met by imports from Canada. Canadian imports of newsprint into these areas would have to originate in either Ontario or Quebec, which produce most of the Dominion's newsprint. Since in the 2 years 1937-38, 64.3 percent of the total production of newsprint by both

Ontario and Quebec was made in Quebec, the deficit for the industrial areas was modified by this percentage. In the case of the Chicago Industrial Area, the percentage was applied only after subtracting from the estimated deficit, 132,500 short tons or the annual consumption of the Chicago Tribune, most of which comes from Thorold, Ontario.³⁴ Furthermore, only 69.4 percent of the newsprint productive capacity of Quebec in 1934 was on navigable streams. In order to eliminate from consideration tonnage that might have to be transshipped before beginning the water journey, the deficit was therefore again modified by 69.4 percent. Finally, in the years 1936-38, during the months of open navigation of the St. Lawrence, May-November, 61.8 percent of the annual total imports of newsprint were received. This percent was applied to the estimated deficit. After these successive reductions, we have in table O-13 estimated tonnage moving from plants on navigable streams in the Province of Quebec to United States industrial areas on the Great Lakes during the open season of navigation. The total for the tributary area is 81,500 short tons. For Chicago the tonnage is calculated at 52,000 and for Cleveland, 11,500 short tons. The figure of 81,500 short tons for the industrial areas on the Great Lakes compares closely with the 79,200 short tons that we have seen passed up-bound through the St. Lawrence Canals from Canadian to United States ports.³⁵ Together they indicate that most of the shipments from Quebec to lake points are now made by water. The St. Lawrence development would, then, enable those shipments of roughly 80,000 short tons to be made in more efficient vessels without need of any transshipment.

Newsprint is moving from Canada not only to the areas immediately adjacent to the Great Lakes but also further inland. Table O-14 presents an estimate of the tonnage moving from Quebec to this inland area. The procedure of estimating this tonnage is similar to that followed in the case of the industrial areas on the lakes shore—namely, estimated deficit modified by the percentages 64.3, 69.4, and 61.8 percent to reduce the amounts, first, to receipts from Quebec, then to receipts from plants on navigable streams in Quebec and, finally, to receipts from those plants during the months of open navigation. In addition an allowance of 15 percent was made for receipts from United States sources. This is a very generous allowance inasmuch as the total estimated deficit already makes allowance for production in the State, and the data of the American Newspaper Publishers Association shows that about 12.4 percent of the receipts of the area are from United States sources. Lastly, the estimated tonnage received in the tributary area from plants on navigable streams in the Province of Quebec is reduced by the estimated tonnage consumed at the important lake shore industrial areas, the consumption of the Chicago Industrial Area being divided between Illinois and Indiana in the same proportions as their estimated total receipts from Quebec. In this way, an estimated tonnage moving primarily to inland points is obtained. For the area as a whole, it is 121,000 short tons, for Illinois 37,000, and Ohio 48,000 short tons.

Section 7

POTENTIAL SAVINGS IN TRANSPORTATION COST

The shipments of newsprint from Canada to points in the Great Lakes area not directly on the shore are now for the most part all-rail. An analysis of the

³⁴ 71st Cong., Special Sess. of the Senate, 1930, Doc. No. 214, *Newsprint Paper Industry*, p. 64 (a report of the Federal Trade Commission).

³⁵ See p. 308.

savings that might be made possible through the utilization of the St. Lawrence after the proposed development is difficult because the present water rate from Quebec points to United States lakes ports are not available. To estimate a feasible combination rate we have had, then, to take recourse in a percentage of the present all-rail rate. Eighty percent of the all-rail was taken as combination rate which would be likely to be established in view of the practice of ratemaking.

Before a feasible unit savings can be established, representative points of destination and origin must be chosen. The choice of points of destination representative of each State was based upon central location and importance of population. The selection of points of origin was more difficult. Production of newsprint in the Province of Quebec is clustered in three groups along the Saguenay River, especially at Kenogami, along the St. Lawrence from Beauport just below the city of Quebec to Three Rivers some distance above it, and along the Ottawa River at Gatineau, Buckingham, and Hull. Of these groups the most representative is that along the St. Lawrence. Because of the availability of rates, then, the city of Quebec in the midst of this group was chosen as a representative point of origin.

In table O-15, unit savings per short ton have been estimated ranging from \$1.68 to Pittsburgh, Pa., to \$4.16 to Des Moines, Iowa. Applying the savings per ton to the estimated tonnage of table O-15, a total estimated savings of \$263,000 is obtained. For Illinois and Ohio, the savings are estimated respectively at \$76,000 and \$84,000. Whether these savings will actually be realized depends, of course, upon whether the St. Lawrence will actually be used for combination rail-water shipments from points on the navigable streams of Quebec to points in the United States hinterland of the Great Lakes. Two main objections are raised to the utilization of water or the combination rail-water routes.

The first objection raised to the utilization of the proposed Seaway in shipments to the Great Lakes area is that publishers make it a practice to keep on hand only a few days supply, that their requirements must be filled exactly on schedule and that, therefore, they must have the rapid and regular transportation supplied only by railroads. The very existence of such volume of traffic on the Great Lakes as has already been shown can be considered sufficient to destroy the force of this argument. But, in addition, for the country as a whole about a month's requirements were maintained by the publishers during the year preceding August 1940. Tables O-16 and O-17 present the monthly figures of consumption by publishers, stocks at publishers, and stocks in transit to publishers, August 1939-August 1940. In the 13 months shown and the monthly averages for the years 1928-39, respectively, only once were the stocks at publishers below the consumption of the succeeding month. The average monthly stocks at publishers in the 12 months August 1939-July 1940 amounted to 116 percent of the average monthly consumption. During the years 1928-39, the annual monthly averages bring out much the same picture. As a percent of consumption, monthly averages of stocks at publishers ranged from a low of 76.2 percent in 1929 to a high of 159.5 percent in 1938. The 10-year monthly average (1928-37) of stocks at publishers was 97.9 percent of consumption (see table O-17). It may be concluded, then, that there is no validity to the argument that water transportation is ruled out of consideration for newsprint on the grounds that since publishers stocks are so small they cannot make use of a service less frequent or less regular than rail.

The second objection to the possible use of the St. Lawrence for the transportation of newsprint to the interior points of the Great Lakes area is the undesirability of transshipment. Newsprint is shipped in heavy rolls, difficult to handle and easily damaged if it strikes any hard object. The undesirability of trans-

shipment particularly affects the use of the present St. Lawrence Canals. From a Quebec mill to a point of destination on the Great Lakes at least one transshipment is necessary under present conditions, from the small canal boats to the lake boats. For a point in the interior of the Great Lakes area a second transshipment is necessary from lakes to rail or highway carrier. Whether the final destination is a lake shore point or an inland point, the proposed Seaway will reduce the transshipment on the water route by one, leaving no transshipment necessary to a lake port and only one to an inland point. Nevertheless, it is difficult to decide whether the savings estimated as feasible will be sufficient to induce the shipments actually to take place.

In estimating the tonnage and savings that might result from the construction of the St. Lawrence, no consideration has been given to such tonnage as might originate at points in the Province of Ontario, like Ottawa, that lie below the International Section of the St. Lawrence, or to such tonnage as might move from New Brunswick or Nova Scotia points.

In addition to the traffic moving from the Province of Quebec to points on the Great Lakes and to the States close to the Lakes, there is a great movement via the customs districts of the Great Lakes to points far distant. The estimated deficit of the States generally considered in this report as tributary area is about 723,000 short tons (see table O-12), whereas the 10-year, 1928-37, annual average of imports via the customs districts of the area was about 1,515,000 (see table O-10). There remain then about 802,000 short tons moving to points further south, and modifying that amount by 64.3 percent \times 69.4 percent \times 61.8 percent, we have about 221,000 additional short tons estimated to move from mills located on navigable streams in the Province of Quebec during the open season of navigation. No estimate has been made of the savings that might result if this tonnage were to be sent by the Seaway, but certainly part of it might be so shipped.

In the future there are certain changes in the production and consumption patterns of newsprint that can be anticipated with a fair degree of reliability. First, despite measures of economy in size of newspaper pages and reduction in the numbers of editions and papers, it can be expected that the consumption of newsprint will increase as population increases. Second, production in the Great Lakes area can be expected to decrease rather than increase. There will then be need of greater imports. The greater part of these imports will come from Canada, but by the construction of the proposed Seaway the newspaper publishers of the United States Great Lakes area will be able, more cheaply than before, to obtain newsprint from such sources as Newfoundland, New Brunswick, and the Scandinavian countries. We have seen that in the country as a whole, Finland's imports have already been increasing in recent years. The present rate from Scandinavia to North Atlantic ports is as low as \$8.50 per short ton. By the construction of the proposed Seaway the transportation rates to the Great Lakes from Scandinavian ports may be lowered inasmuch as more efficient ships may be used. Lower rates may in turn stimulate the consumption of Scandinavian newsprint.

The production of newsprint has begun in the southwest of the United States. If this continues and expands, there may be some repercussions on the imports into the Great Lakes area, but for some time to come such repercussions will, no doubt, be limited to reducing the movement of newsprint into the Southwest and central South, via Great Lakes customs districts. The ability of Alaska to produce quantities of newsprint at low cost is also being explored. It is likely, however, that the impact of Alaskan production for many years will be felt only along the Pacific coast and perhaps the Gulf and South Atlantic coasts.

TABLE O-1

Production of wood pulp by selected countries

[Thousands of short tons]

Year	United States	Canada	Sweden	Germany	Finland	Norway
1925.....	3,962	2,773	1,911	1,763	689	896
1927.....	4,313	3,279	2,307	2,013	857	902
1929.....	4,863	4,021	2,800	2,286	1,072	1,056
1930.....	4,630	3,619	2,680	2,249	1,186	1,027
1931.....	4,409	3,168	2,423	1,944	1,195	608
1932.....	3,760	2,653	2,201	1,843	1,392	992
1933.....	4,276	2,980	2,825	1,912	1,520	943
1934.....	4,436	3,636	3,163	2,178	1,728	1,083
1935.....	4,926	3,868	3,282	2,315	1,904	949
1936.....	5,715	4,550	3,478	2,550	2,086	1,047
1937.....	6,600	4,992	3,767	2,755	2,380	1,186
1938.....	5,994	3,668	3,374	.....	2,009	1,482

SOURCE: United States Pulp Producers Association, *World Wood Pulp Statistics* (2d ed.) 1926-36.

TABLE O-2

United States production, foreign trade, and apparent consumption of wood pulp, 1916-38

[Thousands of short tons]

Year	Domestic production	Imports	Total supply	Exports	Consumption	
					Total apparent consumption ¹	Percent supplied by imports
1916.....	3,435	684	4,119	40	4,079	16.8
1917.....	3,510	678	4,188	39	4,149	16.3
1918.....	3,314	578	3,892	22	3,870	14.9
1919.....	3,518	636	4,154	40	4,114	15.5
1920.....	3,822	906	4,728	32	4,696	19.3
1921.....	2,876	697	3,573	28	3,545	19.7
1922.....	3,522	1,289	4,781	25	4,756	26.5
1923.....	3,789	1,383	5,172	23	5,149	26.9
1924.....	3,723	1,523	5,246	32	5,214	29.2
1925.....	3,962	1,664	5,626	38	5,588	29.8
1926.....	4,395	1,732	6,127	34	6,093	28.4
1927.....	4,313	1,676	5,989	32	5,957	28.1
1928.....	4,511	1,755	6,266	33	6,233	28.2
1929.....	4,863	1,881	6,744	54	6,690	28.1
1930.....	4,630	1,830	6,460	48	6,412	28.5
1931.....	4,409	1,597	6,006	53	5,953	26.9
1932.....	3,760	1,482	5,242	48	5,194	28.5
1933.....	4,276	1,942	6,218	79	6,139	31.6
1934.....	4,436	1,806	6,242	143	6,099	29.6
1935.....	4,926	1,933	6,859	172	6,687	28.9
1936.....	5,695	2,278	7,973	104	7,779	29.3
1937.....	6,573	2,395	8,968	323	8,645	27.7
1938.....	5,934	1,711	7,645	140	7,505	22.8
Average 1929-38.....	4,950	1,886	6,836	125	6,711	28.1

¹ Total supply minus exports.² Preliminary.

SOURCE: Department of Commerce, Trade Promotion Series No. 182, *United States Pulp and Paper Industry*, pp. 67, 78, and 85, tables 8, 14, and 27, respectively. 1916-26: Department of Agriculture, *American Forests and Forest Products*, p. 272, table 151. 1926-36: Department of Commerce, *United States Pulp and Paper Industry*, p. 90, table 33. 1937-38: Department of Commerce, computed by the Pulp and Paper Section of Forest Products Division.

TABLE O-3

Imports of wood pulp by countries of origin, 1922-38

[Short tons]

Year	Total	Canada	Finland	Germany	Norway	Sweden	Other sources
1922	1,259,000	646,000	68,500	28,100	95,700	409,800	10,900
1923	1,383,200	723,000	110,900	66,000	120,000	336,100	27,200
1924	1,522,700	712,600	88,900	84,300	102,100	494,700	40,100
1925	1,663,600	876,900	87,800	69,800	109,400	478,900	40,800
1926	1,731,500	861,200	102,100	92,600	92,100	539,200	44,300
1927	1,675,800	779,000	111,200	58,600	89,400	596,400	41,200
1928	1,754,900	874,900	154,200	72,700	94,800	601,900	46,400
1929	1,880,700	796,700	176,400	70,200	95,700	708,100	33,600
1930	1,830,200	735,700	174,100	74,400	94,500	722,800	28,700
1931	1,696,500	550,100	194,100	78,800	43,300	692,300	37,900
1932	1,481,800	425,300	191,000	90,800	111,300	620,300	43,100
1933	1,941,600	550,900	234,100	86,800	117,700	898,800	53,300
1934	1,806,000	541,800	217,100	91,800	99,000	808,700	47,600
1935	1,933,200	541,000	266,600	80,200	93,200	898,900	53,300
1936	2,277,500	671,000	310,900	74,700	125,300	1,014,900	80,700
1937	2,394,700	712,200	286,000	69,100	103,000	1,130,100	94,300
1938	1,710,400	467,400	258,900	38,000	70,400	807,100	68,600
Average 1929-38	1,885,260	599,210	230,920	75,480	95,340	830,200	54,110
Percent of total imports	100.0	31.8	12.2	4.0	5.1	44.0	2.9

SOURCE: Department of Commerce, *United States Pulp and Paper Industry*.

TABLE O-4

United States imports for consumption of wood pulp by specified customs districts, 1935-38

[Short tons]

Customs district	1935	1936	1937	1938
Maine and New Hampshire	241,673	282,468	307,606	211,649
Vermont	62,635	803,369	85,131	69,946
St. Lawrence	65,341	79,902	94,143	40,640
New York	310,618	328,540	321,846	270,155
Philadelphia	170,772	220,904	209,526	194,502
Maryland	165,392	232,157	294,388	182,704
Duluth and Superior	55,854	50,516	47,622	26,032
Wisconsin	80,374	99,390	70,392	65,167
Michigan	253,752	278,080	262,796	201,494
Massachusetts	157,694	202,062	245,359	161,150
Ohio	111,818	92,447	53,309	29,103
All other	257,526	330,665	382,487	257,851
Total United States imports	1,933,249	2,277,500	2,394,605	1,710,393

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1935-38*.

TABLE O-5

Consumption of sulphite in important consuming districts in Lake and Central Regions ¹

[Short tons]

Region	Domestic	Imported			Total consumption
		From Canada	From Europe	Total	
Southern Ohio and eastern Indiana.....	62,583	42,629	111,561	154,190	216,773
Southwestern Michigan and Northern Ohio.....	20,861	1,814	11,791	13,605	34,466
Southwestern Michigan.....	31,745	12,698	117,910	130,608	162,353
Eastern and central Wisconsin.....	232,192	10,884	31,745	42,629	274,821
Points outside above districts.....	136,957	19,954	61,676	81,630	218,587
Total.....	484,338	87,979	334,683	422,662	907,000

¹ The allocation by source of origin was made on the basis of percentages given in Tariff Commission Rept. No. 126, 2d ser., 1938, *Wood Pulp and Pulpwood*, p. 177. The percentages on that page are for the period January to September, 1935, which have been applied for our purposes to the whole year's consumption. The discrepancy in the figure of total imports of 422,000 as compared with 415,000 appearing in Tariff Commission Rept. No. 126, 2d ser., 1938, p. 170, may be due to the fact that the percentages are on a 9-month basis, whereas the total consumption is on a 12-month basis. It is very likely that the proportion of wood pulp consumption between foreign and domestic might change in the winter months in favor of domestic.

TABLE O-6

Comparison of ocean-rail rates via Baltimore and ocean-lake-rail and ocean-lake rates, 1935

[Per short ton]

Destination	Ocean plus rail from Baltimore	Ocean-lake rate via Montreal	Rail from lake port	Ocean-lake-rail	Estimated savings per ton
INDIRECT ROUTE					
Southwestern Ohio and eastern Indiana:					
Chillicothe, Ohio.....	\$8.38	\$5.36	\$2.80	\$8.16	\$0.22
Hamilton, Ohio.....	8.78	5.36	2.20	7.56	1.22
Middletown, Ohio.....	8.78	5.36	2.20	7.56	1.22
Southeastern Michigan:					
Monroe.....	8.18	5.36	1.00	6.36	1.82
Port Huron.....	8.18	5.36	1.80	7.16	1.02
Southwestern Michigan:					
Kalamazoo.....	9.08	6.16	1.20	7.36	1.72
Niles.....	9.18	6.16	1.20	7.36	1.82
East central Wisconsin:					
Appleton.....	11.58	6.16	1.60	7.76	3.82
Wisconsin Rapids.....	11.78	6.16	1.80	7.96	3.82
DIRECT ROUTE					
Southwestern Ohio and eastern Indiana:					
Chillicothe, Ohio.....	\$8.38	\$5.13	\$2.80	\$7.93	\$0.45
Hamilton, Ohio.....	8.78	5.13	2.20	7.33	1.45
Middletown, Ohio.....	8.78	5.13	2.20	7.33	1.45
Southeastern Michigan:					
Monroe.....	8.18	5.13	1.00	6.13	2.05
Port Huron.....	8.18	5.13	1.80	6.93	1.25
Southwestern Michigan:					
Kalamazoo.....	9.08	5.58	1.20	6.78	2.30
Niles.....	9.18	5.58	1.20	6.78	2.40
East central Wisconsin:					
Appleton.....	11.58	5.58	1.60	7.18	4.40
Wisconsin Rapids.....	11.78	5.58	1.80	7.38	4.40

TABLE O-7

Apparent newsprint consumption in the United States, 1914-39¹

Year	Capacity per year 310 days	Production	Imports ²	Exports ³	Apparent domestic consumption	Percent of apparent domestic consumption		
						Production	Imports	Exports
Short tons of 2,000 pounds						Production	Imports	Exports
1914.....		1,313,300	269,000	44,500	1,537,800	85.4	17.5	2.9
1915.....		1,239,100	324,600	62,800	1,500,900	82.5	21.6	4.1
1916.....		1,316,000	438,700	63,600	1,690,100	77.8	26.0	3.8
1917.....		1,359,000	491,600	72,600	1,778,100	76.4	27.6	4.0
1918.....		1,260,300	596,500	96,700	1,760,100	71.6	33.9	5.5
1919.....		1,323,900	627,900	110,300	1,841,500	71.9	34.1	6.0
1920.....		1,512,000	729,800	45,900	2,195,900	68.9	33.2	2.1
1921.....		1,237,400	792,500	16,800	2,013,100	61.5	39.4	.9
1922.....		1,447,700	1,029,300	26,800	2,450,200	59.1	42.0	1.1
1923.....		1,621,100	1,208,800	16,400	2,713,500	56.1	44.5	.6
1924.....		1,481,400	1,302,200	17,200	2,766,400	53.5	47.1	.6
1925.....	1,773,500	1,563,300	1,448,400	22,700	2,989,000	52.3	48.5	.8
1926.....	(⁴)	1,686,700	1,850,700	19,300	3,518,100	47.9	52.6	.5
1927 ⁴	1,968,200	1,616,900	1,987,100	12,300	3,491,700	43.4	56.9	.3
1928.....	1,891,300	1,415,500	2,157,100	11,400	3,561,200	39.7	60.6	.3
1929.....	1,695,100	1,409,200	2,422,700	18,700	3,813,200	37.0	63.5	.5
1930.....	1,712,100	1,226,100	2,279,600	10,200	3,495,600	35.1	65.2	.3
1931.....	1,636,500	1,203,300	2,066,900	9,700	3,260,500	36.9	63.4	.3
1932.....	1,649,800	1,047,000	1,792,100	8,500	2,830,600	37.0	63.3	.3
1933.....	(⁵)	928,300	1,793,500	11,100	2,710,700	34.2	66.2	.4
1934.....	1,237,800	989,700	2,209,700	23,400	3,176,000	31.2	69.6	.8
1935.....	1,081,300	947,700	2,383,300	22,600	3,308,500	28.6	72.0	.6
1936.....	1,007,800	938,300	2,751,600	14,600	3,675,300	25.5	74.9	.4
1937.....	1,000,400	975,900	3,317,000	17,000	4,275,900	22.8	77.6	.4
1938.....	960,400	832,300	2,274,600	6,600	3,101,300	26.8	73.3	.1
1939 ⁶		939,400	2,615,100	13,500	3,541,000	26.5	73.9	.4
Average, 1928-37.....	1,434,678	1,108,100	2,317,350	14,710	3,410,730	32.5	67.9	

¹ "Apparent consumption" is estimated by adding imports to domestic production, and deducting exports, this also applies to the percentage columns. It does not allow for newsprint imported or produced in 1 year, used in the next, or allow for stocks.

² Imports for consumption year 1914 to 1917, inclusive, fiscal years ending June 30; remainder calendar years.

³ 1926, not available, average given below for this item based on 9 years.

⁴ Because of change of method of reporting, figures for 1927 and previous years are not strictly comparable with succeeding years.

⁵ Preliminary figures subject to revision; production figures estimate of News Print Service Bureau.

SOURCES: Production figures: Bureau of the Census, years 1914, 1919; Federal Trade Commission, years 1915 to 1918, inclusive, 1920, 1922, 1924; Bureau of the Census, years 1921, 1923, 1925, 1927 to 1938, inc. Import and export figures, Bureau of Foreign and Domestic Commerce, United States Department of Commerce. *Foreign Commerce and Navigation of the United States.*

TABLE O-8
Canadian production and exports of newsprint, 1913-39

[Short tons—2,000 pounds]

Year	Production	Exported to—			Balance at home
		Overseas	United States	Total	
1913.....	350,000	39,000	218,000	257,000	93,000
1914.....	415,000	48,000	310,000	358,000	57,000
1915.....	489,000	53,000	367,000	420,000	69,000
1916.....	608,000	53,000	473,000	526,000	82,000
1917.....	686,000	61,000	535,000	596,000	90,000
1918.....	735,000	60,000	577,000	637,000	98,000
1919.....	803,000	86,000	622,000	708,000	95,000
1920.....	876,000	92,000	670,000	672,000	114,000
1921.....	808,000	64,000	655,000	709,000	99,000
1922.....	1,082,000	72,000	888,000	960,000	122,000
1923.....	1,266,000	23,000	1,115,000	1,138,000	128,000
1924.....	1,353,000	27,000	1,192,000	1,219,000	134,000
1925.....	1,522,000	81,000	1,321,000	1,402,000	120,000
1926.....	1,882,000	104,000	1,628,000	1,732,000	150,000
1927.....	2,087,000	134,000	1,748,000	1,882,000	205,000
1928.....	2,381,000	272,000	1,935,000	2,207,000	174,000
1929.....	2,729,000	342,000	2,173,000	2,515,000	214,000
1930.....	2,504,000	326,000	2,008,000	2,333,000	171,000
1931.....	2,221,000	255,000	1,753,000	2,008,000	213,000
1932.....	1,914,000	257,000	1,520,000	1,777,000	137,000
1933.....	2,017,000	318,000	1,520,000	1,838,000	179,000
1934.....	2,599,000	454,000	1,960,000	2,414,000	185,000
1935.....	2,753,000	523,000	2,052,000	2,575,000	178,000
1936.....	3,209,000	594,000	2,369,000	2,993,000	216,000
1937.....	3,648,000	556,000	2,899,000	3,455,000	193,000
1938.....	2,625,000	487,000	1,938,000	2,425,000	200,000
1939.....	2,869,000	452,000	2,207,000	2,659,000	210,000

SOURCE: News Print Service Bureau, Bulletin No. 265, Feb. 15, 1940.

TABLE O-9
United States imports¹ of standard newsprint paper, by countries, 1919-38

[Short tons]

Year	Total	Canada	Finland	Germany	Norway	Sweden	Newfoundland and Labrador	All other
1919 ²	627,734	624,479	—	—	—	—	3,208	47
1920 ²	729,869	678,733	3,244	21,066	5,918	18,875	576	1,457
1921 ²	792,508	656,703	22,664	39,013	20,194	48,933	446	4,555
1922.....	1,029,268	896,311	26,205	32,837	17,293	51,812	—	4,810
1923.....	1,308,843	1,108,466	41,884	52,290	33,831	64,571	—	7,801
1924.....	1,357,233	1,197,005	35,640	38,901	17,261	61,452	3,798	3,176
1925.....	1,448,425	1,295,324	21,685	25,865	17,965	65,518	20,080	2,388
1926.....	1,850,675	1,656,859	34,292	12,885	6,176	46,020	93,890	533
1927.....	1,987,065	1,775,752	29,527	6,993	16,798	67,865	89,251	879
1928.....	2,157,166	1,926,748	40,239	9,167	10,864	55,619	114,172	357
1929.....	2,422,701	2,194,587	32,607	9,250	3,498	50,719	131,915	125
1930.....	2,279,652	1,989,285	41,796	13,799	9,327	69,267	156,186	2
1931.....	2,066,906	1,756,056	47,992	21,910	14,444	66,687	159,782	35
1932.....	1,792,130	1,533,389	46,626	14,323	22,692	59,986	113,827	1,287
1933.....	1,793,541	1,545,293	56,577	12,058	16,591	68,062	94,944	16
1934.....	2,209,698	1,956,037	56,814	5,740	16,417	68,091	106,598	1
1935.....	2,383,315	2,061,890	73,928	7,158	22,570	93,430	124,336	3
1936.....	2,751,680	2,422,317	123,030	9,750	22,075	87,488	86,910	10
1937.....	3,317,024	2,894,708	154,649	13,022	24,672	101,630	128,344	—
1938.....	2,274,603	1,963,436	151,134	9,557	10,801	71,654	68,121	—
Average, 1928-37.....	2,317,371	2,028,031	67,426	11,617	16,315	72,098	121,701	183

¹ General imports through 1933; imports for consumption thereafter.² Includes approximately 10 percent, or less, of printing paper for books.SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1919-38*.

TABLE O-10

United States imports of standard newsprint paper by customs districts, annual average, 1928-37

Customs district	Short tons	Customs district	Short tons
St. Lawrence.....	417, 928	Vermont.....	132, 080
Rochester.....	5, 303	Massachusetts.....	20, 583
Buffalo.....	255, 969	New York.....	175, 747
Duluth-Superior.....	135, 229	Philadelphia.....	31, 559
Wisconsin.....	15, 513	Maryland.....	28, 854
Michigan.....	528, 814	New Orleans.....	37, 832
Chicago.....	129, 398	All other.....	375, 246
Ohio.....	37, 316	Total.....	801, 901
Total selected customs districts.....	1, 515, 470	Grand total.....	2, 317, 371

¹ 6-year average 1933-38.

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37*.

TABLE O-11

United States water-borne imports of newsprint from Canada by selected Great Lakes ports, annual average 1934-38

Port	Short tons	Port	Short tons
Duluth-Superior.....		Erie.....	
Milwaukee.....	9, 724	Buffalo.....	128
Chicago.....	161, 147	Rochester.....	1, 211
Detroit.....	29, 957	Oswego.....	1, 054
Toledo.....	8, 179	Total selected ports.....	247, 716
Cleveland.....	36, 316		

SOURCE: War Department, *Annual Report of The Chief of Engineers, Commercial Statistics of the Water-borne Commerce of The United States, 1935-39*.

TABLE O-12

Estimated annual deficit of newsprint in the Great Lakes tributary area

Area	Estimated consumption		Production 1929 (short tons)	Estimated deficit (-) or surplus (+) (short tons)
	Percent	Short tons		
United States total.....	100.0	3, 410, 740	1, 409, 169	-2, 001, 571
Illinois.....	10.9	347, 895	(¹)	-347, 895
Indiana.....	1.6	54, 572		-54, 572
Iowa.....	1.6	54, 572		-54, 572
Michigan.....	2.7	92, 090	\$ 77, 500	-14, 590
Minnesota.....	1.7	57, 983	121, 563	(+)63, 580
Nebraska.....	.5	17, 054		-17, 054
Ohio.....	7.8	266, 038		-266, 038
North Dakota.....	.1	3, 411		-3, 411
South Dakota.....	.1	3, 411		-3, 411
Wisconsin.....	1.3	44, 340	103, 458	(+)59, 118
Buffalo (N. Y.) Industrial Area.....	.9	30, 897	\$ 7, 287	-23, 610
Rochester (N. Y.) Industrial Area.....	.5	17, 054	\$ 4, 231	-12, 823
Pittsburgh (Pa.) Industrial Area.....	1.4	47, 750		-47, 750
Total tributary area.....	30.4	1, 036, 867	314, 039	-722, 828

¹ 1929 capacity for Illinois 28,520 tons, discontinued.

² Capacity for 1939, in lieu of production, as reported in *Lockwood's Directory of the Paper, Stationery, and Allied Trades, 1940*.

³ Production figures estimated by applying percentage of value of production in terms of state total to volume of production for the State, 1929.

SOURCE: Total United States consumption, annual average 1928-37 compiled from table I. Percentages—*Census of Manufactures, 1937, p. 590*. Cost of materials in the printing and publishing, newspapers and periodicals industry. Production: *Census of Manufactures, 1929, pp. 548-549*.

TABLE O-13

Estimated tonnage of newsprint imported by industrial areas on the Great Lakes from the plants of the Province of Quebec located on navigable streams

Industrial area	Estimated annual deficit for the State	Percent of State's consumption of material in newspaper and periodicals industry, 1937	Estimated annual deficit for the industrial area	Estimated tonnage from Quebec plants on navigable streams	
				Annual	Seasonal (61.8 percent)
	<i>Short tons</i>		<i>Short tons</i>	<i>Short tons</i>	<i>Short tons</i>
Chicago, Ill. and Indiana.....	¹ 402,467	² 79.1	318,351	³ 82,935	51,254
Detroit, Mich.....	14,590	73.6	10,738	4,789	2,960
Cleveland, Ohio.....	266,038	15.7	41,768	18,629	11,513
Toledo, Ohio.....	266,038	3.9	10,375	4,627	2,859
Milwaukee, Wis.....	16,440	64.0	10,522	4,602	2,900
Buffalo, N. Y.....	(⁴)		⁵ 23,410	10,441	6,453
Rochester, N. Y.....	(⁴)		⁵ 12,823	5,719	3,534
Total, selected industrial areas.....			427,987	131,832	81,472

¹ Illinois and Indiana combined.

² Based upon Illinois and Indiana combined.

³ Not estimated.

⁴ See table 6.

⁵ Based upon estimated annual deficit 318,351 minus average annual consumption of newsprint by Chicago Tribune, 132,600 short tons, most of which comes from Thorold.

SOURCE: Estimated deficit for the State, see table 6. Percent of consumption of materials consumed in the printing and publishing of newspapers and periodicals, *Census of Manufactures, 1937*.

TABLE O-14

Potential traffic of newsprint imported from Canada into the Great Lakes region, excluding coastal industrial areas

State	Estimated annual deficit	Estimated imports				Potential tonnage to lake-shore industrial area (short tons)	Potential tonnage to hinterland ¹
		From Canada (85 percent of deficit)	From Province of Quebec (64.3 percent of Canadian imports)	From Quebec mills located on navigable waterways (69.4 percent of imports from Province)			
				Annual	Seasonal (61.8 percent)		
Illinois.....	347,895	295,710	190,142	131,959	81,551	¹ 44,155	37,395
Indiana.....	54,572	46,386	29,826	20,699	12,792	¹ 7,068	5,694
Iowa.....	54,572	46,386	29,826	20,699	12,792		12,792
Nebraska.....	17,054	14,496	9,321	6,469	3,998		3,998
Ohio.....	266,038	226,132	145,403	100,910	62,362		47,990
North Dakota.....	3,411	2,899	1,864	1,294	800		800
South Dakota.....	3,411	2,899	1,864	1,294	800		800
Pittsburgh (Pa.) industrial area.....	47,750	40,588	26,098	18,112	11,193		11,193
Total tributary area.....		675,496	434,344	301,435	186,287	65,625	120,662

¹ Chicago industrial area, apportioned to Illinois and Indiana on basis of total estimated in-seasonal imports of the States from Quebec.

² 15 percent deduction applied to column 6.

SOURCE: Estimated deficit, see table 6.

TABLE O-15

Estimated savings on newsprint imported from the Province of Quebec

Representative city	Rail rate from Quebec, Quebec	Feasible water rail rate, 80 percent	Unit savings	Potential traffic	Estimated savings
	<i>Per short ton</i>	<i>Per short ton</i>	<i>Per short ton</i>	<i>Short ton</i>	
Peoria, Ill.....	\$10.20	\$8.16	\$2.04	37,395	\$76,285
Columbus, Ohio.....	8.80	7.04	1.76	47,990	84,462
Des Moines, Iowa.....	1 20.80	16.64	4.16	12,792	53,215
Omaha, Nebr.....	1 15.00	12.00	3.00	3,998	11,994
Fargo, N. Dak.....	1 24.80	19.84	4.96	800	3,968
Sioux Falls, S. Dak.....	1 22.80	18.24	4.56	800	3,648
Pittsburgh, Pa.....	8.40	6.72	1.68	11,193	18,804
Indianapolis, Ind.....	9.20	7.36	1.84	5,694	10,477
Total tributary area.....				120,662	262,853

1 Minimum, 40,000 pounds.

TABLE O-16

United States newsprint consumption and stocks at publishers and in transit to publishers monthly, August 1939–August 1940

[Short tons]

Month	Consumption by publishers	Stocks at publishers	Stocks in transit to publishers
1939:			
August.....	206,108	277,624	41,484
September.....	238,667	283,315	47,815
October.....	257,578	285,333	50,073
November.....	240,571	295,675	50,704
December.....	254,781	284,283	43,948
1940:			
January.....	218,488	285,776	42,760
February.....	216,095	278,306	36,061
March.....	251,269	246,228	38,727
April.....	244,181	238,670	42,329
May.....	257,565	247,206	43,312
June.....	241,639	257,567	47,435
July.....	206,913	318,609	44,679
August.....	213,105	361,179	41,484
Monthly average, August 1939–July 1940.....	236,158	274,883	44,111
Average, 1927–38.....	221,298	216,567	41,497

SOURCE: Department of Commerce, *Survey of Current Business*, October 1940, p. 52.

TABLE O-17

United States newsprint production, consumption and stocks at publishers' stocks in transit at publishers 1928-39, monthly averages for years indicated

Calendar year	Column 1	Column 2	Column 3	Column 4	Percent: Column 3+ column 1 (publishers' stocks are percent of consumption)	Stocks in transit as percent of consump- tion
	Consump- tion by publishers	Produ- ction	Stocks at end of month at publishers	Stocks in transit at publishers		
	<i>Short tons</i>	<i>Short tons</i>	<i>Short tons</i>	<i>Short tons</i>		
1928.....	228, 835	118, 131	195, 780	46, 357	85. 6	-----
1929.....	244, 724	116, 023	186, 426	50, 151	76. 2	20. 7
1930.....	234, 901	106, 864	219, 847	44, 154	93. 6	18. 8
1931.....	218, 143	96, 453	195, 939	39, 356	89. 8	18. 0
1932.....	187, 907	84, 049	181, 632	30, 195	96. 7	16. 0
1933.....	178, 857	78, 865	162, 847	29, 837	91. 0	16. 6
1934.....	206, 387	80, 117	231, 805	37, 651	112. 3	18. 2
1935.....	221, 924	76, 033	224, 535	36, 049	101. 2	16. 2
1936.....	244, 952	76, 784	215, 941	44, 747	88. 2	18. 3
1937.....	246, 353	78, 810	349, 613	56, 044	141. 9	22. 7
1938.....	221, 123	68, 338	352, 637	34, 564	159. 5	15. 6
1939.....	227, 903	78, 287	257, 298	40, 402	113. 9	17. 7
Total, 1928-37.....	2, 212, 983	912, 129	2, 165, 667	414, 969	-----	-----
Average, 1928-37.....	221, 298	91, 213	216, 567	41, 497	97. 9	-----

SOURCE: Department of Commerce, *Survey of Current Business*, 1940, Supplement, p. 146.

Appendix P

PACKING HOUSE PRODUCTS

INTRODUCTION

In considering the effect of the proposed St. Lawrence Seaway upon the transportation of packing-house products, it is well to keep in mind that in addition to the major producers in the industry, the farmers who ship their livestock to the meat packers will be affected. In this study it is not possible to trace the quantitative effects of cheaper transportation beyond packers and their products, lard, and meats. In the last section of this report an attempt is made to indicate the probable incidence of the benefits obtained by the Seaway as between consumers, packers, and farmers. In the main body of the report, however, the quantitative analysis is confined to determining the influence of the Seaway upon the cost of transportation of lard and meat products.

Considered as an industry by itself, without reference to the thousands of livestock growers who supply it, meat packing is a major industry, giving employment, in 1937, to 127,477 wage earners. The total value of its products in 1937 was 2,787 million dollars. Of the wage earners, 63 percent, or 80,311, were employed in the territory tributary to the Great Lakes.¹ And 1,792 million dollars in value of output, or 64 percent, of the total value of meat-packing products, also came from this area.²

The magnitude of American foreign trade in packing-house products is shown by table P-1. It is there indicated that total exports of packing-house products declined from 1,382,000,000 pounds in 1929 to 262,000,000 pounds in 1936. In the middle 30's there was a large drop in exports, to some extent because of the severe drought conditions in the cattle and farm country. The largest item of export is lard and neutral lard. Nonfresh meats are also important. Exports of fresh meats are almost inconsequential. Edible animal oils and fats other than lard used to be quite important in the past, but since 1929 there has been a steady decline in these exports so that by 1938 they had shrunk to almost one-tenth of what they were in 1929.

The analysis of the meat packing industry is presented in two major sections. Lard and meat products are separately treated because many elements that enter into the analysis are peculiar to each product. Different consumption ratios, different rail rates, different transportation facilities—all of these necessitate separate analysis.

Section 1

PRODUCTION, CONSUMPTION, AND EXPORTS OF LARD

The United States is the world's leading producer and exporter of lard. The approximate United States average production for the 10-year period from 1909

¹ The 12 States considered tributary to the Great Lakes are: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, North Dakota, South Dakota, and Wisconsin.

² Department of Commerce, *Biennial Census of Manufactures, 1937*, pt. 1, p. 188, table 2.

to 1918 is 1.6 billion pounds; for the period from 1925 to 1934, 2.3 billion pounds as indicated in table P-2. After the drought of 1934, there was a decrease to 799 million pounds in 1935. However, the trend upward in ensuing years indicates the production for 1940 is likely to be about 2 billion pounds, or nearly the same as the average for the predrought years.

The consumption of lard in the United States rose from 1.1 billion pounds in 1909 to 1.8 billion pounds in 1932, which was the peak year.³ The 1926-35 average is 1.6 billion pounds. In 1937 approximately 34 percent of the total lard consumption of the United States was in the tributary area.⁴ This is a low estimate, as fractions of States are not included.

The average exports of lard for 1930-34 from each of the principal exporting countries, are shown in table P-3. The preeminence of the United States in this trade is clearly indicated. The United States' exports represent 83 percent of the total of the principal exporting countries. However, during the depression of the 30's, United States exports decreased appreciably, reaching a low of 97,359,000 pounds in 1935, as compared with the peak year of 1929, when exports were 847,868,000 pounds (table P-1).

The sharp reduction of exports from 1935 to 1937 was largely caused by the droughts of 1934 and 1935.⁵ Since then there has been appreciable recovery, United States exports of lard and neutral lard having reached 204,603,000 pounds in 1938 but are still considerably below the 1920-29⁶ average. The volume of exports of lard has always represented a large proportion of total United States production. During the years 1925 to 1934, between 21 and 35 percent of total domestic lard production has been exported. Lard is exported in the form of lard and neutral lard; the latter is a more highly refined type and accounts for approximately 1 percent of total exports.

The United Kingdom, as shown in table P-4, has always been the destination for a large proportion of total United States exports of lard; in 1931, 257,879,000 pounds, or 43 percent of total exports, were destined for the United Kingdom. Although exports to the United Kingdom fell off proportionately with total exports in 1936 and 1937, in 1938 the trend again appeared upward, when the United Kingdom received 119,311,000 pounds or 63 percent of total United States exports of lard. Cuba is the United States' second largest customer, receiving, in 1938, 44,776,000 pounds, or about 24 percent of the total lard exported from the United States. Table P-4 shows United States exports of lard, including neutral lard, by countries of destination, 1931-38.

Section 2

COST OF TRANSPORTING LARD IN EXPORT TRADE

Prior to 1933 lard was exported to European points principally by rail to New York and from New York by Atlantic liners. The combined rate on this movement was 96 cents per 100 pounds, of which 50 cents was the ocean rate and 46 cents covered the rail cost from Chicago to New York. From points farther west, of course, the rail rates were higher.

In 1933 direct all-water Great Lakes-to-Europe competition was established with the rail-ocean route, when a Norwegian steamship company instituted service from lake ports to the United Kingdom and Scandinavian countries. In that

³ Department of Agriculture, *Agricultural Outlook Charts, Hogs, 1940*, October, 1939, p. 7.

⁴ Computed from 1928-37 average per capita consumption and population of tributary States.

⁵ Department of Agriculture, *Agricultural Outlook Charts, 1940*, Hogs, October 1939, p. 9.

year 17,694 tons of lard were shipped direct from Chicago to European ports, mainly the United Kingdom.⁵

The steamship line operating direct from Great Lakes ports carried this freight for as low as 40 cents per 100 pounds from Chicago to the United Kingdom. In order to meet this competition, the railroads and North Atlantic conference lines, through mutual agreement, lowered their rates to 62 cents per 100 pounds from Chicago to the United Kingdom, composed of 29 cents ocean freight and 33 cents rail rate from Chicago to New York. This lowered rate, however, established by the railroads and the shipping lines, was effective only during the open navigation season on the Great Lakes. In the winter time the rate was put back to the 96-cent level.

Since the boats of the Norwegian line could obtain more profitable freight than lard, they discontinued bidding for this business. From 1934 to 1939, therefore, no lard was carried direct from lake ports to Europe. In the absence of this direct-route competition, the railroads and the North Atlantic freight conference have gradually raised their summer rates from 62 cents to 75 cents per 100 pounds from Chicago to Europe, of which 36 cents covers the ocean haul and 39 cents the Chicago-New York rail haul. In the winter time the rate is \$1.01 per 100 pounds, of which 46 cents goes to the railroads from Chicago to New York and 55 cents to the shipping lines from New York to Europe.

This situation creates difficulties in the selection of the proper rail-water combination rates for comparison with a feasible rate that may be used for the direct route via the St. Lawrence. If the practice of blanketing rates from Atlantic seaports to Europe is applied to lake ports, then the question is raised as to which rate should be blanketed, since the ocean rates from the North Atlantic ports have varied between 29 cents and 55 cents per 100 pounds. Again, we know that a 40-cent rate was used by the Norwegian line in 1933-34 but then this company refused to bid for traffic on this or any other basis because it felt that the packing-house firms were using it as a competitive threat to lower rail-water combination rates via North Atlantic ports. The selection of the comparative rail-water rate is also confused since these rates have varied between 62 cents per 100 pounds and 105 cents.

In order to escape the necessity of making an arbitrary selection of comparative rates in the succeeding discussion, three different bases of comparison are used. First, the rates in effect in 1934, both on the Norwegian line as well as the combination rail-water rates via New York, are used. This comparison recommends itself particularly since it involves actual rates in effect under which lard was transported by both routes. This comparison, therefore, involves a 40-cent per 100 pounds rate for the direct haul from Chicago to the United Kingdom, as compared with 62 cents combination rail-water rate through New York. Of the 62 cents, 29 cents was the share of the shipping lines from New York. This indicates, then, that the 40 cents from Chicago via the St. Lawrence was 11 cents higher than the then existing North Atlantic-to-Europe rates.

A second comparison will be on the basis of the highest rate in the past 8 years which has been in effect from New York to the United Kingdom; namely, 55 cents per 100 pounds, which is, in fact, a rate effective in the winter time, and is considered to be profitable. This rate is blanketed to lake ports as a rate which would be satisfactory to direct lake-to-Europe carriers. This is substantiated by the opinion expressed by one of the direct-route carriers which has been operating from lake ports to Europe since 1933. This rate, then, is compared with the combination rate that was in effect in the summer of 1939; namely, 75 cents per 100 pounds, divided between North Atlantic shipping lines, 36 cents, and rail-

⁵ War Department, Annual Report of the Chief of Engineers, Part II, *Commercial Statistics of the Water borne Commerce of the United States*, 1934, p. 776.

roads from Chicago to New York, 39 cents. In this case, too, the feasible Seaway rate is 19 cents higher than the rate from New York to the United Kingdom. As such, this comparison may be considered very conservative.

A third basis of comparison is used by taking the actual rate that was offered by the Norwegian line in 1934—namely, 40 cents per 100 pounds—and comparing it with the summer combination rate of 75 cents in effect in the summer of 1939. The 40-cent rate is defensible only as a rate that was at one time in effect from Chicago to the United Kingdom. Under conditions of competition among shipping lines which may have access to the lake ports, if the Seaway is constructed it may be that this rate will be considered an acceptable rate. If we had adopted in this particular case the general policy of blanketing rates in effect from North Atlantic ports to Europe, we could have taken 29 cents, 30 cents, 31 cents, 36 cents, 50 cents, or 55 cents for purposes of comparison, all of these rates having been in effect at some time since 1933. In the second method above described, we did use the 55 cents as a basis of comparison. Here the 40-cent rate is used, not only because it was an actual rate in 1934 but also it is higher than any summer rates in effect in the past seven seasons from North Atlantic ports to Europe. The combination rate of 75 cents is used for comparative purposes because it was in effect in 1938 and 1939 and because it is unlikely that with competition on the Great Lakes established, the railroads and North Atlantic carriers will again resort, over any length of time, to the abnormally low rates of 1934. With sufficient carrying capacity available at Great Lakes ports, it would be unnecessary to resort to cut-throat methods of rate war, since at any levels direct water carriers could underbid the combination rail-and-water rates.

Tables P-5, P-6, and P-7 show the comparisons of rates, as explained in the foregoing paragraphs, that were made to determine savings in transportation costs via the Seaway. In each case the indicated savings are averaged. This average will be applied to the estimated potential tonnage. This is done upon the assumption that the export trade in lard emanating from the tributary area is equally divided among the principal producing centers; namely, Kansas City, South Omaha, Sioux City, St. Louis, St. Paul, and Chicago. This assumption may not be correct. It is likely that production centers nearer the lakes will have a larger share of the export trade. In this case the average savings as computed in tables P-5, P-6, and P-7 would be grossly understated.

Since the rates to Cuba via the rail-ocean route now used are at variance with rates to the United Kingdom and Europe by both routes, there will also be a difference in savings in transportation costs via the St. Lawrence Seaway. Consequently, total savings in transportation costs on lard for export to Cuba will be shown separately.

In order to estimate the potential savings in transportation costs under these different methods, it is necessary to calculate the export of lard from the tributary area of the Great Lakes. The average annual exports of lard and neutral lard during the decade from 1928 to 1937 were 478,324,000 pounds. As 64 percent of the total value of United States production of lard is centered in the tributary area, upon the assumption that the same ratio of lard exports would move out of the tributary area as the rate for the tributary area production holds to the United States, it is possible to assume that this same proportion, or 306,127,000 pounds on the basis of 1928-37 average exports, came from the tributary area. An examination of the monthly export figures of lard as compiled by the Department of Commerce indicates that 57 percent of the total exports moved out during the open navigation season from May 1 to December 1. The average export traffic out of the tributary area, therefore, during the open season may be considered to be approximately 174,492,000 pounds, or 87,246 short tons. It is on this potentially available traffic that the potential savings must be calculated.

Table P-8 shows United States exports of lard to Cuba, 1928-37, and the average for these years.

The same method that was followed in obtaining percent of total exports available from the tributary area during the Great Lakes-St. Lawrence open navigation season was used in the case of Cuba. Following is the break-down of total potential exports of lard and neutral lard via the Seaway to the United Kingdom and Europe, and to Cuba. Since these destinations account for such a large proportion of total United States exports of lard, no further break-down is deemed necessary.

Table P-9 shows the total potential savings on lard and neutral lard for export to the United Kingdom and Europe as computed from the averaged savings in transportation costs via the Seaway, indicated by each of the three bases of comparison of rates, as shown in tables P-5, P-6, and P-7. The savings on the export of lard and neutral lard to Europe, including United Kingdom, on these different bases vary between \$191,000 and \$425,000. These results are obtained by applying the unit savings to the 57 percent of the annual average exports during 1928-37.

Whether there will be any savings on exports of lard to Cuba depends on the availability of direct shipping service from the Great Lakes. The United States enjoys a substantial trade with Cuba. United States imports from Cuba appear to be more constant in volume and value than general world trade. In 1938 when United States trade with Cuba underwent a substantial decrease, the reduction of imports was smaller than the corresponding change in United States world trade.⁷ In this year imports from Cuba were 5.4 percent of total United States imports, the bulk of which was in sugar. In view of this fact, it seems reasonable to assume that shipping service would be available between Cuba and Great Lakes ports, and a direct movement of lard from Great Lakes ports to Cuba is feasible. Conversely, an examination of our imports from Cuba indicates that the lard carriers should have little, if any, difficulty in securing return cargo in the form of sugar, molasses, rum, coffee, bananas, manganese and chrome ore and a variety of other Cuban exports to the United States.

A direct Seaway rate on lard, Great Lakes ports to Cuba, of 60 cents per 100 pounds has been assumed as a reasonable rate. This rate is 16 cents over the New York-to-Cuba conference rate of 44 cents and 20 cents over the Great Lakes-to-Europe rate; whereas, the 1939 conference rate, New York to Cuba, is only 8 cents over the summer rate, New York to Europe. Table P-10 shows potential savings in transportation costs in terms of cents per 100 pounds, on lard for export to Cuba via the St. Lawrence Seaway.

By applying 17 cents per 100 pounds average saving (table P-10) to 15,721,403 pounds of lard, there is indicated a potential saving on exports of lard and neutral lard to Cuba during the open season of navigation of \$26,726. Total potential saving on all exports of lard and neutral lard, upon the basis of past exports, might be said, therefore, to be between \$217,800 and \$451,700, depending on competitive costs of transportation.

In addition to lard and neutral lard, the United States exports other types of edible oils and fats. The total exports of edible animal oils and fats excluding lard and neutral lard, as shown in table P-11, amountd to 88,613,000 pounds in 1929. After 1933, drastic declines in these exports occurred so that by 1935 total exports had gone down to 14,555,000 pounds, and in 1938 to less than 9 million pounds. The reasons for this situation are many. The rise in the price of corn as a result of the drought and the diminution in the number of hogs

⁷ Department of Commerce, *Foreign Trade of the United States*, Calendar Year 1938, Part II, Trade by Regions and Countries, page 19.

raised are important factors. In addition, exchange restrictions by importing countries and the desire of those countries to encourage home production of imported products are other factors which resulted in this drastic decline in American exports. If ever our exports of edible animal oils and fats other than lard rise to the level of 1929, then we may say that, allowing for the percentage of the industry located in the tributary area (64 percent) and the proportion exported in the open navigation season (71 percent), total available traffic of this product would be 40,266,000 pounds, or 20,133 short tons.

On the other hand, if we took the exports during the worst year—1938—the exports from the tributary area during the open navigation season would amount only to 4,048,250 pounds or 2,024 short tons. A conservative estimate of average annual exports of this product in future decades might be somewhere near 50,000,000 pounds, which would yield as a potential tonnage of exports from the tributary area during open season of 22,720,000 pounds or 11,360 tons. If we apply the savings per 100 pounds estimated for lard under each of the three different methods of calculation to this figure, we obtain the following estimates of savings:

Amount (100 pounds)	Average savings per 100 pounds (cents)	Total savings
227,200	14.50	\$32,944.00
227,200	26.40	59,980.80
227,200	32.25	73,172.00

Adding these estimates to the estimated savings on lard, the total potential savings on all edible animal oils and fats including lard and neutral lard would amount to between \$250,754 and \$524,896, or in round numbers \$525,000, depending on the competitive freight-rate situation.

Section 3

POTENTIAL TONNAGE AND SAVING IN COASTWISE SHIPMENT OF LARD

It was pointed out in section 1 that the United States is a large consumer of lard. The annual per-capita consumption of lard has varied between 10 and 14 pounds. The average for the period 1929-38 was 12.3 pounds.⁸ Lard is produced principally in the Middle West. Illinois is the principal center of production, with Iowa second and Minnesota and Ohio third and fourth, on the basis of 1937 production figures. Whereas these Middle Western States have large surpluses of lard to export to other regions of the country, the most populous States, on the other hand, show large deficiencies in lard production. Among these, New York, Pennsylvania, California, and Texas are all importers of lard from other regions of the country. This situation is the basis for a considerable coastwise movement of lard from the Great Lakes area to the Atlantic and Pacific coasts.

In order to estimate the amount of lard that may so travel via the St. Lawrence, it is necessary to estimate the amount of deficiency in the total consumption requirements of the coastal States. Deficiencies in the consumption requirements of urban population may be calculated on the broad assumption that rural and farm population will be able to meet its requirements from local sources and that urban population purchases its lard from commercial channels. Hence, by estimating the total consumption of urban populations on the basis of average per capita consumption of 12.3 pounds in the past decade, and offsetting against

⁸ Dept. of Agriculture: *Agricultural Statistics* p. 357, table 500.

it total commercial production in the respective States, it is possible to calculate the net deficiency, which should be very conservative. On this basis it is estimated that the three west coast States, California, Oregon, and Washington, would have to import annually at least 36,698,000 pounds of lard, and New York, New Jersey, and Massachusetts would have to import about 126,800,000 pounds of lard. In terms of short tons, this gives a total of 18,349 tons to be shipped to the west coast and 63,400 short tons to be imported in to the North Atlantic cities. Including other east coast urban areas, one may estimate that a deficiency of almost 80,000 short tons of lard a year would have to be imported to the urban centers of the East from the Middle Western area. Adding to this figure the west coast consumption in the urban areas, we may assume that between 98,000 and 100,000 short tons of lard a year are transported from the Middle West to supply the city populations of the North Atlantic coast and the west coast. Assuming an even distribution of this tonnage during the 12 months, at least 58,000 short tons of lard may be considered to be potential traffic on the St. Lawrence during the open navigation season, divided as follows: North Atlantic, 36,800 short tons; South Atlantic, 10,600 short tons; and west coast, 10,600 short tons.

There is no question that there would be considerable saving on the transportation of lard by water to the west coast. From Chicago to the Pacific coast the rail rates on lard in 1940 were \$1.68 per hundredweight. From St. Paul, Omaha, and Kansas City the rate was \$1.51, and from St. Louis, \$1.60. Chicago would be most favored in the shipment of lard to the west coast, as a rate of \$1 per hundredweight, or \$20 a ton would be a very satisfactory revenue on the transportation of lard by water to the west coast. This would yield, then, a saving of 68 cents a hundredweight, or \$13.60 per short ton. If all the lard consumed on the west coast were shipped from Chicago, an assumption that is not improbable since by far the largest surplus production of lard takes place in Illinois, and particularly in Chicago, then the total saving on the shipment of 10,600 short tons during the open navigation season would be \$144,160.

On the shipment to the east coast the savings per ton would, of course, be much smaller. Rail rates to Boston, Massachusetts, from Chicago are 58 cents; to New York, 57 cents; to Philadelphia, 54 cents; to Baltimore, 53 cents. If we assume that the rate in coastwise trade will be about 70 percent of the direct rail rate, the rate to the east coast from Chicago would then be about 40 cents per hundredweight, or \$8 a short ton. On this basis, the saving would average around 13 to 17 cents, or say 15 cents, per hundredweight, or \$3 per short ton. At this rate of saving, there will be a total saving of \$110,400 on the shipment of 36,800 short tons of lard during the open navigation season to the North Atlantic ports. If a saving could be achieved to South Atlantic ports of no more than \$3 per short ton, an additional total potential saving on 10,600 tons of lard of \$31,800 can be counted on. The total saving on the coastwise movement of lard estimated in this very conservative fashion must be put down as around \$286,360. Adding this saving to the estimates of possible savings on foreign exports of lard and other edible oils and fats which were given in the preceding section as varying between a minimum of \$250,754 and a maximum of \$524,896 we obtain an estimate of possible total savings in the transportation of lard via the Seaway of between \$537,114 and \$811,256. This range of savings might result on an estimated tonnage for both foreign and domestic shipments during the open navigation season of 143,112 short tons of lard and edible oils and fats.⁹

⁹ The export figures include exports of lard and neutral lard to Europe including United Kingdom and Cuba only, calculated on the basis of 1928-37 averages and estimated averages of edible oils and fats of 13,250 tons. Coastwise shipments include only estimated deficiencies of lard in the coastal urban regions and do not include any traffic in other edible oils and fats.

Section 4

EXPORT TRADE IN MEAT PRODUCTS

Total exports of meats, both fresh and nonfresh, including beef, hogs, mutton, and lamb, varied between 445,529,000 pounds in 1929 and 123,700,000 pounds in 1937 (table P-1). The average for the years 1928-37 was 257,000,000 pounds. All but a small fraction of this was nonfresh. The amount of fresh meats exported has varied from year to year without any definite indication of a trend. As shown in table P-1, during the 10-year period 1929-38, exports of fresh meats have varied between 45,000,000 pounds in 1934 and 8,800,000 pounds in 1936. In 1929 these exports stood at 19,800,000 pounds, and in 1938 at 16,200,000 pounds. On account of the small quantity of these fresh meat exports and the special service requirements, over which there is considerable controversy, we have decided to disregard the possibilities of fresh meat exports via the St. Lawrence.

Confining our attention to nonfresh meat product exports, an analysis of the destination of these indicates that European countries, principally those bordering on the Atlantic Ocean and the Baltic Sea obtain nearly 68 percent of total American exports, on the basis of the averages of the years 1928-37. The break-down of the average annual exports during the years 1928-37 is presented in table P-12. The United Kingdom, it appears, took a little over 50 percent of all nonfresh meat exports, with Germany second in importance and Cuba third in line. The average annual exports to European countries during the years 1928-37 amounted to nearly 180,000,000 pounds. Average annual exports to Caribbean countries equaled nearly 33,000,000 pounds. All other countries took the remaining 44,000,000 pounds. It is possible, therefore, to estimate potential tonnage and savings in the same manner as for lard. Only 60 percent of meat product exports move during the open navigation season, as shown by an examination of the seasonality of exports during 1936, 1937, and 1938. If 64 percent of the export trade is allocated to the tributary area, we may then consider 38.4 percent ($60\% \times 64\%$) of the average annual exports as potential traffic to the St. Lawrence. This would give total potential traffic of 98,523,000 pounds, or 49,260 tons, in meat products.

As there may be some question as to whether exports to the Caribbean countries and to all other countries may originate in the tributary area, we shall allocate exports to countries other than Europe and the Caribbean countries—namely, 77,000,000 pounds annually during the years 1928-37, to sources outside the tributary area; or, at any rate, we shall not consider even 38.4 percent of this amount as available traffic during the open navigation season. Among the Caribbean countries, it is very likely that exports to Cuba will supply traffic to the St. Lawrence, insofar as there will be shipping bringing in imports of sugar, molasses, etc. Also exports to Panama and Mexico may move via the St. Lawrence, insofar as there may be shipping to bring in bananas from those areas, and meat exports, as well as dairy product exports, would provide good return cargo for such ships.

In spite of these possibilities, all of the trade in nonfresh meats to countries other than those in Europe will be considered as originating outside the tributary area. This eliminates 30 percent of the export trade. Having done this, it would be justified to assume that, with the opening of the St. Lawrence, practically all exports of nonfresh meats destined for Europe would be shipped from the middle western packing houses whenever shipping services are available. Hence, only a seasonality factor of 60 percent will be applied to the exports to Europe, without further modification by 64 percent to take account of the location factor.

Hence, the average potential savings on the different bases of rate comparisons as applied in the case of lard will be applied to the total average annual exports

of 180,000,000 pounds to Europe, modified to 60 percent to allow for exports in the open navigation season, or 108,000,000 pounds. This amounts to 54,000 short tons. Applying average rates of savings, on three different bases, as in the case of lard, we obtain the following savings:

Amount (100 pounds.)	Average savings per 100 pounds (cents)	Total savings
1,080,000-----	14. 50	\$156, 600
1,080,000-----	26. 40	285, 120
1,080,000-----	32. 25	348, 300

The savings on exports to Europe, then, will vary between \$156,000 and \$348,000, depending on the competitive rate situation.

Heretofore, it was estimated that export and coastwise traffic through the St. Lawrence in lard and other animal oils and fats might have amounted to 143,112 short tons savings ranging between \$537,114 and \$811,256, depending on the competitive rate situation. Adding to these the minimum and maximum estimates on the export of meat products, we obtain total potential tonnage of 212,500 and savings of \$694,000 as a minimum and \$1,160,000 as a maximum.

TABLE P-1
United States exports of edible meat products, 1929-38

[Thousands of pounds]

Year	Meats			Edible animal oils and fats			Grand total
	Fresh	Non-fresh	Total	Lard and neutral lard	Other edible animal oils and fats	Total edible animal oils and fats	
1929-----	19, 765	425, 764	445, 529	847, 868	88, 613	936, 481	1, 382, 010
1930-----	24, 670	355, 631	380, 301	656, 018	78, 118	734, 136	1, 114, 437
1931-----	14, 937	238, 368	253, 305	678, 296	66, 945	645, 241	898, 546
1932-----	11, 284	179, 729	191, 013	552, 154	61, 098	613, 252	804, 265
1933-----	20, 058	211, 380	231, 438	584, 238	55, 816	640, 054	871, 492
1934-----	45, 111	206, 282	251, 393	434, 892	38, 663	473, 555	724, 948
1935-----	17, 357	137, 990	155, 347	97, 359	14, 555	111, 914	267, 261
1936-----	8, 789	126, 571	135, 360	112, 168	14, 716	126, 884	262, 244
1937-----	10, 919	112, 781	123, 700	136, 778	9, 398	146, 176	269, 876
1938-----	16, 245	142, 055	158, 300	204, 603	8, 909	213, 512	371, 812

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States*.

TABLE P-2
United States production of lard, 1909-38

Year	Production	Year	Production
	<i>Million lbs.</i>		<i>Million lbs.</i>
1909-----	1, 612	1924-----	2, 635
1910-----	1, 538	1925-----	2, 133
1911-----	1, 728	1926-----	2, 185
1912-----	1, 639	1927-----	2, 240
1913-----	1, 633	1928-----	2, 432
1914-----	1, 535	1929-----	2, 435
1915-----	1, 669	1930-----	2, 201
1916-----	1, 685	1931-----	2, 279
1917-----	1, 436	1932-----	2, 351
1918-----	1, 881	1933-----	2, 446
1919-----	1, 904	1934-----	2, 066
1920-----	1, 943	1935-----	1, 267
1921-----	2, 092	1936-----	1, 673
1922-----	2, 283	1937-----	1, 441
1923-----	2, 692	1938-----	1, 750
		Average, 1926-37-----	2, 059

SOURCE: Department of Agriculture, *Agricultural Statistics, 1940*, table 554, p. 413.

TABLE P-3

Annual exports of lard by principal producing countries, 1930-34 averages

Principal exporting countries	Exports	Percent of total	Principal exporting countries	Exports	Percent of total
	1,000 lbs.			1,000 lbs.	
United States.....	553, 553	83.1	Madagascar.....	2, 041	0.3
Netherlands.....	35, 865	5.4	Australia ¹	1, 608	.2
Denmark.....	41, 720	6.3	Sweden.....	2, 576	.4
China.....	5, 435	.8	Yugoslavia.....	1, 911	.3
Hungary.....	8, 493	1.3	Brazil.....	6, 583	1.0
Canada.....	2, 727	.4			
Ireland.....	3, 125	.5	Total.....	665, 637	100.0

¹ Year ending June 30.SOURCE: Department of Agriculture, *Agricultural Statistics, 1939*, page 333, table 466.

TABLE P-4

United States exports of lard and neutral lard by countries, 1930-38, year ending June 30

[Thousands of pounds]

Destination	1931	1932	1933	1934	1935	1936	1937	1938 ¹
United Kingdom.....	257, 879	240, 103	256, 371	314, 229	160, 374	53, 357	53, 940	119, 311
Germany ²	103, 738	143, 606	159, 113	72, 734	5, 171	6, 125	1, 772	2, 846
Netherlands.....	29, 742	32, 534	43, 682	24, 869	1, 394	132	257	354
Belgium.....	9, 406	5, 750	10, 150	16, 850	1, 070	610	1, 364	701
Italy.....	6, 064	7, 125	5, 646	9, 264	483	-----	781	652
Denmark.....	1, 453	804	647	911	219	73	-----	-----
Sweden.....	766	765	471	734	210	62	46	33
Norway.....	529	455	210	89	-----	-----	-----	-----
Other Europe.....	15, 806	9, 715	13, 826	14, 267	2, 149	578	1, 277	4, 663
Total Europe.....	430, 383	440, 757	490, 116	453, 947	171, 070	60, 941	59, 437	128, 560
Cuba.....	49, 004	38, 406	10, 023	14, 247	31, 179	24, 154	35, 369	44, 776
Mexico.....	67, 491	35, 483	38, 085	47, 630	8, 969	943	2, 788	9, 009
Canada.....	12, 224	6, 197	3, 482	282	2, 604	1, 076	3, 405	1, 399
Colombia.....	11, 836	4, 284	113	103	3	169	380	172
Other countries.....	25, 491	25, 193	24, 038	35, 204	13, 577	2, 294	2, 332	6, 184
Total exports.....	596, 429	550, 320	565, 857	551, 413	227, 402	89, 577	103, 711	190, 100

¹ Preliminary.² Includes Austria beginning May 6, 1938.SOURCE: Department of Agriculture, *Agricultural Statistics, 1939*, p. 439, table 603.

TABLE P-5

Comparison of competitive rail-ocean and Seaway rates on exports of lard from selected United States points of origin to Europe, 1933-34

[Cents per 100 pounds]

Points of origin	1934 cost of transportation			Feasible rates via St. Lawrence			
	All-rail to New York	Ocean rate New York to Europe	Total rail-ocean	Rail to Chicago	Direct rate Great Lakes to Europe ¹	Total rate via St. Lawrence Seaway	Potential savings via St. Lawrence
Kansas City, Mo.....	76.5	29	105.5	36	40	76	29.5
S. Omaha, Nebr.....	76.5	29	105.5	36	40	76	29.5
Sioux City, Iowa.....	76.5	29	105.5	36	40	76	29.5
St. Louis, Mo.....	53.5	29	82.5	20.5	40	60.5	22
Chicago, Ill.....	33	29	62	-----	40	40	23
St. Paul, Minn.....	52.5	29	81.5	² 15.5	40	55.5	26
Average savings via St. Lawrence Seaway.....							26.4

¹ Actual rate Great Lakes ports to United Kingdom in effect 1933.² All-rail to Duluth, the nearest lake port.

TABLE P-6

Comparison of 1939 and feasible Seaway rates on exports of lard from selected United States points of origin to Europe

[Cents per 100 pounds]

Points of origin	1939 cost of transportation			Feasible rates via St. Lawrence			
	All-rail to New York	Ocean rate New York to Europe	Total rail-ocean	Rail to Chicago	Direct rate Great Lakes to Europe ¹	Total rate via St. Lawrence Seaway	Potential savings via St. Lawrence
Kansas City, Mo.....	69.5	36	105.5	40	55	95	10.5
S. Omaha, Nebr.....	69.5	36	105.5	40	55	95	10.5
Sioux City, Iowa.....	69.5	36	105.5	40	55	95	10.5
St. Louis, Mo.....	46.5	36	82.5	24.5	55	79.5	3
Chicago, Ill.....	39	36	75	-----	55	55	20
St. Paul, Minn.....	67.5	36	103.5	² 16	55	71	32.5
Average savings via St. Lawrence Seaway.....							14.5

¹ Feasible all-water rate lake ports to Europe (normal).

² All-rail rate from St. Paul to Duluth, the nearest lake port.

TABLE P-7

Comparison of actual Seaway rates of 1933 and present rail-ocean rates on exports of lard from selected points to Europe

[Cents per 100 pounds]

Points of origin	Present cost of transportation			Feasible rates via St. Lawrence			
	All-rail to New York	Ocean rate New York to Europe	Total rail-ocean	Rail to Chicago	Direct rate Great Lakes to Europe	Total rate via St. Lawrence Seaway	Potential savings via St. Lawrence
Kansas City, Mo.....	69.5	36	105.5	36	40	76	29.5
S. Omaha, Nebr.....	69.5	36	105.5	36	40	76	29.5
Sioux City, Iowa.....	69.5	36	105.5	36	40	76	29.5
St. Louis, Mo.....	46.5	36	82.5	20.5	40	60.5	22
Chicago, Ill.....	39	36	75	-----	40	40	35
S. St. Paul, Minn.....	67.5	36	103.5	¹ 15.5	40	55.5	48
Average savings via St. Lawrence Seaway.....							32.25

¹ Rail to Duluth, the nearest lake port.

TABLE P-8

United States exports of lard and neutral lard to Cuba, 1928-37

Year	1,000 pounds	Year	1,000 pounds
1928.....	84,176	1934.....	26,348
1929.....	80,541	1935.....	24,295
1930.....	65,213	1936.....	31,010
1931.....	45,003	1937.....	41,363
1932.....	22,102		
1933.....	10,908	1928-37, average.....	43,096

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37.*

TABLE P-9

Estimated potential savings in transportation costs of lard for exports to United Kingdom and Europe via the St. Lawrence Seaway, based on average savings

Available for export from tributary area May 1 to Dec. 1		Average savings in transportation costs	Total savings
100 lbs.		<i>Cents per 100 lbs.</i>	
1,317,822	-----	¹ 14.50	\$191,084
1,317,822	-----	² 26.40	347,905
1,317,822	-----	³ 32.25	424,998

¹ Average savings indicated by comparison of 1939 rail-ocean rates and feasible Seaway rates.

² Average savings, indicated by comparison of 1933, 1934 rail-ocean and Seaway rates.

³ Average savings indicated by comparison of 1939 rail-ocean rates and 1933 Seaway rates.

Source: Based on text table, p. 327.

TABLE P-10

Potential savings in transportation costs of lard for export to Cuba via the St. Lawrence Seaway

[Cents per hundred pounds]

Points of origin	1939 rail-ocean rates			Feasible rates via the St. Lawrence Seaway			Potential saving via the St. Lawrence
	All-rail to New York	Ocean to Cuba	Total rail-ocean	Rail to Chicago	Great Lakes to Cuba	Total rate via the St. Lawrence	
Kansas City, Mo.-----	69.5	44	113.5	40	60	100	13.5
S. Omaha, Nebr.-----	69.5	44	113.5	40	60	100	13.5
Sioux City, Iowa-----	69.5	44	113.5	40	60	100	13.5
E. St. Louis, Ill.-----	46.5	44	90.5	24.5	60	84.5	6
Chicago, Ill.-----	39	44	83	-----	60	60	23
S. St. Paul, Minn.-----	67.5	44	111.5	16	60	76	35.5
Average savings via St. Lawrence Seaway-----							17

TABLE P-11

United States exports of edible animal oils and fats, except lard and neutral lard, by regions, 1929-38

[Thousands of pounds]

Year	Total	European countries ¹	Caribbean countries ²	All other countries
1929-----	88,613	74,633	5,578	8,402
1930-----	78,118	65,520	6,189	6,409
1931-----	66,945	56,134	5,387	5,424
1932-----	61,098	51,875	6,522	2,701
1933-----	55,816	47,841	6,681	1,294
1934-----	38,663	32,639	4,269	1,755
1935-----	14,555	13,433	487	635
1936-----	14,716	13,435	774	507
1937-----	9,398	8,921	298	179
1938-----	8,909	8,380	230	299

¹ Includes only Austria, Belgium, Czecho-Slovakia, Denmark, France, Germany, Italy, Netherlands, Norway, Poland and Danzig, Sweden, Switzerland, and United Kingdom.

² Includes Panama, Mexico, Trinidad and Tobago, Cuba, Netherlands, West Indies, French West Indies, and Venezuela.

Source: Department of Commerce, *Foreign Commerce and Navigation of the United States*.

TABLE P-12

*United States exports of non-fresh-meat products by country of destination—
annual average, 1928-37*

Country	Pounds	Country	Pounds
European country:		Caribbean countries:	
Austria.....	171, 964	Panama.....	5, 786, 156
Belgium.....	3, 441, 384	Mexico.....	1, 382, 565
Czecho-Slovakia.....	107, 727	Trinidad and Tobago.....	1, 487, 797
Denmark.....	1, 189, 478	Other British West Indies.....	1, 380, 235
France.....	3, 837, 158	Cuba.....	17, 784, 862
Germany.....	19, 201, 260	Netherlands West Indies.....	1, 725, 487
Italy.....	5, 824, 732	French West Indies.....	1, 843, 303
Netherlands.....	7, 239, 408	Venezuela.....	1, 327, 732
Norway.....	2, 725, 160		
Poland and Danzig.....	2, 671, 800	Total, above Caribbean	
Sweden.....	3, 579, 349	countries.....	32, 718, 137
Switzerland.....	484, 319		
United Kingdom.....	129, 134, 568	All other countries.....	44, 244, 810
Total, above European		Grand total.....	256, 571, 263
countries.....	179, 608, 307		

SOURCE: Department of Commerce, *Foreign Commerce of the United States*.

Appendix Q

BURLAP AND JUTE

Section 1

PRODUCTION AND IMPORTS

Jute is a soft fiber obtained from inside the bark of a full-grown stem of two species of tropical plant. It is the world's cheapest fiber and in quantity grown is second only to cotton. The low cost of jute has made jute fabrics the world's leading wrapping and sacking material. The causes of the low price of jute are heavy production per acre and cheap and abundant labor, and the ease with which the fiber can be prepared for spinning. About 98 percent¹ of the total world production is produced in British India, principally in Bengal. The ideal requirements for production of jute are met by the region about Calcutta. They are: First, raw and moist climate; second, deep, rich alluvial soil (supplied by the Ganges and Brahmaputra Rivers); and third, cheap labor. Other countries which produce some quantities of jute are Nepal, Formosa, Iran, Japan, and Indo-China. That part of jute which moves into international trade can be said to come entirely from the area close to the great jute market of Calcutta.

Because the consumption of jute in hand spinning and weaving in India is incalculable, exact production figures are difficult to obtain. According to the official figures of the producing countries as gathered by the U. S. Department of Agriculture,¹ the annual average world production in the years 1928-37 was 3,489,000,000 pounds.

In its woven form jute is referred to, often indiscriminately, as burlap, hessian or gunny. Outside of Calcutta, the most important manufacturing center for jute products is Dundee, Scotland. Dundee products generally are more specialized and of a higher quality. A third region of minor importance is Italy which also produces a finer grade of material.

In the years 1928-37 the United States imported an annual average of about 780,775,000 pounds of jute and jute products (table Q-1). Of the total imports of jute and burlap about 84 percent came from British India, 7 percent from the United Kingdom and 9 percent from all other countries.² About 46 percent of the United States imports of jute and burlap passed through the customs districts of Massachusetts, New York, and Philadelphia. New York alone was credited with about 30 percent; New Orleans about 18 percent. The Washington and San Francisco customs districts together received an annual average of about 9 percent.³

Jute enters the United States in various forms as shown in table Q-1. Unmanufactured jute fiber was imported during the years 1928-37 to the extent of an annual average of 119,139,000 pounds and unmanufactured jute butts to the amount of 37,283,000 pounds. The average annual unmanufactured jute received in the United States in this period was 156,422,000 pounds. Unmanufactured jute is manufactured into such things as yarns, cordage and burlap cloth. Unman-

¹ *Agricultural Statistics*, 1940, p. 133.

² U. S. Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37*.

ufactured jute butts go mostly into the production of cotton bagging used to wrap cotton bales for shipment.

Among the manufactured forms of jute imported into the United States, the most important is burlap and other woven fabrics. Of these 509,702,000 pounds were imported as an annual average in the years 1928-37. Burlap is used primarily as a container for a great variety of products, especially grains, bran, and feed, fertilizers, sugar, flour, and other produce. Considerable quantities are also used in the shipment of cement. In time of war, burlap may be a strategic material because of its use as sandbags either in trenches or other forms of barricade or to protect important buildings and monuments from the effects of bombing or shelling.

Burlap bags are often competitive with cotton bags, but generally the two have peculiar advantages which make each of them desirable for certain uses. Since cotton does not have the strength of burlap, except usually at much higher prices, burlap is superior to cotton for sacking heavy commodities. It is inferior for small packages or when the lint might affect the contents, as with certain foodstuffs; or when a closely woven fabric is required, as for flour; or when the bag is to receive an elaborate trade mark. The best illustration of the relative advantages of burlap over cotton for certain purposes is the use of burlap for bailing cotton itself.

The second most important item among the imports of manufactured jute is waste bagging and waste sugar-sack cloth of which an annual average of 47,467,000 pounds were received in the years 1928-37. Bags or sacks already cut and sewed were imported during the same period in the amount of 39,903,000 pounds. Other jute items include woven fabrics and webbing. The latter is a narrow jute woven product used in the upholstery of the automobile and furniture industry.

The total of the manufactured jute products imported into the United States in the years 1928-37 was about 624,350,000 pounds.

Section 2

POTENTIAL TRAFFIC AND SAVINGS

The problem of estimating potential tonnage in jute products for the proposed St. Lawrence Seaway is complicated by the facts that the commodity moves into this country under such a variety of forms and that no data are available as to the consumption by States of jute and jute products as a whole, or even the consumption by industries of the individual forms under which jute enters into the country. Because of the lack of data an estimate of the potential tonnage of burlap only can be made.

Over 80 percent of the burlaps imported into the United States is consumed in the manufacture of container bags. The consumption of burlap by States may be estimated on the basis of the cost of materials in the "bags other than paper" industry. There may be a possibility of error in such an allocation due to the fact that the "bags other than paper" industry¹ produces cotton bags as well as burlap bags. In 1937, for example, the industry produced 1,937,000,000 cotton bags and 676,000,000 burlap bags and 68,000,000 other types of bags manufactured from other materials. Usually, however, domestic companies which specialize in the manufacture of new textile bags make both burlap and cotton bags.

The census data on the costs of materials in the "bags other than paper" industry for the year 1937 are very incomplete inasmuch as several of the States in the Great Lakes area are included among the "all other States" in order not to

¹ Biennial Census of Manufactures: 1937, p. 334.

disclose the activities of a given company. For this reason, in allocating the consumption of imported burlaps, the 1935 figures for the cost of materials in the "bags other than paper" industry has been used. Thus, the State of Illinois, which in the year 1935 consumed 4.6 percent of the total materials of the "bags other than paper" industry, is assumed to have consumed 4.6 percent of the 1928-37 annual average of imported burlaps. For New York, only the industrial Area of Buffalo was considered. Since the consumption of the cost of materials for this industrial area was not disclosed in the 1935 Census of Manufactures, the 1937 figures were used. In that year Buffalo consumed 4.9 percent of materials in the "bags other than paper industry."

Before applying the percentages of cost of materials consumed in that industry to the imports of burlaps, the total imports were reduced to 80 percent because, as has been said, only about that percentage of burlaps goes into the manufacture of bags. The imports and the estimates based thereon were subdivided into those from British India and those from Europe in order to facilitate the application of feasible savings in transportation which will be discussed later. By this method, then, there is a total estimated consumption for the tributary area of 83,937,000 pounds from British India and 12,703,000 pounds from Europe. Ohio is estimated to have consumed 18,771,000 pounds of Indian burlaps and 2,841,000 pounds of European burlaps. The Buffalo Industrial Area is estimated to have consumed 17,354,000 pounds of burlaps from British India and 2,626,000 pounds of European burlaps (table Q-2).

The figures of the monthly receipts of burlaps in the years 1936-38, as reported in the Monthly Summaries of Foreign Commerce of the United States⁴ show that during those years 58.2 percent of the total annual imports of burlaps were received within the months May through November. Because the St. Lawrence is open to navigation only through those months, the estimate of consumption of imported burlaps was reduced by the application of 58.2 percent. Thus, during the season of open navigation, there is an estimated consumption of burlaps and jute in the entire tributary area of 48,851,000 pounds from British India and 7,393,000 pounds from Europe. In Ohio the consumption of imported burlaps is estimated at 10,924,000 pounds from British India and 1,653,000 from Europe. In New York State the Buffalo area is estimated to have consumed 10,100,000 pounds from British India and 1,529,000 from Europe; Illinois 9,482,000 pounds from British India and 1,435,000 from Europe.

Table Q-3 presents the annual average imports of burlap by customs districts during the years 1928-37. New York received in this period an annual average of 158,113,000 pounds. Massachusetts, New York and Philadelphia as a group received 225,166,000 pounds. New Orleans was credited with 124,870,000 pounds; San Francisco and Washington together, 56,337,000 pounds.

The ocean rate for burlap and other woven fabrics varies according to the supply and demand of shipping space on ships moving from India or from the United Kingdom. In 1938 the ocean rate from British India to the Atlantic and Gulf coasts of the United States was about 50 cents per hundred pounds. In 1939 from British India to Montreal, the United States North Atlantic and South Atlantic ports, the rate was about 41 cents per hundred pounds. From the United Kingdom to Atlantic ports of the United States in 1938 a typical rate can be taken as 46 cents per hundred pounds; from Italy to the same points, 44 cents per hundred pounds.

In estimating the savings in the cost of transportation of burlap which might be brought about by the proposed St. Lawrence Seaway, it may be assumed that the ocean rate from European points to the Great Lakes will be about the same as

⁴ Department of Commerce, *Monthly Summary of Foreign Commerce of the United States*.

the ocean rates to New York and other Atlantic ports. The practice of the shipping trade makes it possible that even on shipments from British India, nearly the same rate will apply to the Great Lakes ports as to the Atlantic ports. However, in this report the assumption is made that the ship operator will require an additional 10 cents per hundred pounds over the rate to New York and other Atlantic points; this is 20 to 25 percent higher than the rates to New York and Montreal. On this basis, then, the savings in transportation costs of burlap imported from Europe into the Great Lakes area will equal the difference between the rail rate from coastal ports to the point of destination and the rail rate from the nearest lake port. On burlap imported from British India, the savings will be this difference in rail transportation rates minus 10 cents per hundred pounds.

In table Q-4 the unit savings in transportation costs are estimated. For each State a representative point of destination was chosen on the basis of the available information as to the location of the "bags other than paper" industry within the State. In the case of Ohio two representative points were considered necessary because of lack of one dominant center. The points chosen, Cleveland and Cincinnati, balance each other as regards distance from the Lakes and the estimated savings. The rail rate with which the rate from the nearest lake port was compared is either that from New York, by far the dominant port on the Atlantic in respect to receipts of burlap, or from New Orleans, whichever was lower. The estimated unit savings on shipments from Europe to the selected representative points range, then, from 14 cents per hundred pounds in the cases of Indianapolis and Cincinnati, to 42 cents in the case of Chicago and Milwaukee; and on shipments from British India from 4 cents per hundred pounds in the cases of Indianapolis and Cincinnati to 32 cents per hundred pounds in the case of Chicago and Milwaukee.

In table Q-5 the estimated unit savings of table Q-4 are applied to the potential tonnage of table Q-2. The total savings on shipments from Europe amount to \$21,700 and on shipments from British India \$94,500. The grand total amounts to \$116,200. The largest total estimated savings accrues to Chicago, \$36,400. The next most important is to the Industrial Area of Buffalo, \$22,500.

These estimates of potential tonnage and estimated savings are based on only the 80 percent of United States imports of burlap which go into the manufacture of bags or sacks. They do not include the other 20 percent which go into miscellaneous uses. Neither do they embrace a variety of other forms under which jute enters the United States. Unmanufactured jute butts and bagging for cotton are consumed in the cotton-ginning area. These two items, together, were imported to the amount of 57,590,000 pounds. However, in addition to them and to the burlaps that have been studied, the United States imports annually about 200,000,000 pounds of other forms of jute. Much of these other forms doubtless finds its way into the Great Lakes area—for example, of bags and sacks of burlap the United States imported during the years 1928-37, about 39,903,000 pounds. The most important use of burlap bags is as containers for grains, bran, and feed, sugar, flour, and other produce and for fertilizer and cement. A considerable proportion of all these products for which burlap is used as containers is produced in the Great Lakes area, excluding northern New York and northwestern Pennsylvania. However, no further estimates are made for these types of consumption.

TABLE Q-1

United States imports of jute and jute manufactures, by types, annual average, 1928-37¹

Type	Thousands of lbs.	Type	Thousands of lbs.
Unmanufactured jute fibre.....	119,139	Yarns.....	492
Unmanufactured jute butts.....	37,283	Cordage, twine, etc.....	181
Total unmanufactured jute.....	156,422	Waste bagging and waste sugar-sack cloth.....	47,467
Burlaps and other woven fabrics wholly of jute.....	509,702	All other.....	28,127
Bags and sacks.....	39,903	Total manufactured.....	624,353
Woven fabrics.....	18,481	Grand total.....	780,775

¹ Based upon general imports 1928-33 and on imports for consumption, 1934-37.

² Includes carpets, carpeting, mats, matting or rugs, webbing, bagging for cotton and jute slivers.

SOURCE: U. S. Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37*.

TABLE Q-2

Estimated consumption of imported burlap in the Great Lakes area, by the "bags other than paper" industry

State	Percentage of cost of material consumed in "bags other than paper" industry, 1935	Estimated consumption of imported burlap in the manufacture of bags (thousands of lbs.)				From all sources, seasonal (58.2 percent)
		From British India		From Europe ¹		
		Annual	Seasonal (58.2 percent)	Annual	Seasonal (58.2 percent)	
Total, United States.....	100.0	354,163	206,123	53,598	31,194	237,317
Illinois.....	4.6	16,292	9,492	2,466	1,435	10,917
Indiana.....	2.4	8,500	4,947	1,286	748	5,695
Iowa.....	.1	354	206	54	31	237
Michigan.....	.7	2,479	1,443	375	218	1,661
Minnesota.....	4.3	15,229	8,863	2,305	1,342	10,205
New York ²	4.9	17,354	10,100	2,626	1,529	11,629
Ohio.....	5.3	18,771	10,924	2,841	1,653	12,577
Wisconsin.....	1.4	4,958	2,886	750	437	3,323
Total, specified States.....	23.7	83,937	48,851	12,703	7,393	56,244

¹ Based upon 80 percent of United States imports of burlap.

² Buffalo Industrial Area only; the percentage of cost of materials consumed is based upon 1937 figures.

SOURCE: Percentage of cost of material, etc., based upon Department of Commerce, *Biennial Census of Manufactures, 1935 and 1937*. Total United States imports, Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-37*.

TABLE Q-3

United States imports of burlap by customs districts, annual average, 1928-37

Customs districts	Thousands of pounds	Percent of total
Massachusetts.....	26,604	5.2
New York.....	158,113	31.1
Philadelphia.....	40,449	7.9
New Orleans.....	124,870	24.5
San Francisco.....	45,572	8.9
Washington.....	10,765	2.1
All other customs districts.....	103,329	20.3
Total, United States.....	509,702	100.0

SOURCE: Department of Commerce, *Foreign Commerce and Navigation of the United States, 1928-38*.

TABLE Q-4

Estimated unit savings on burlap or jute

[Cents per 100 pounds]

Representative point of destination	Rail rate		Estimated unit savings	
	From New York	From nearest lake port	From Europe (based on blanketed ocean rate)	From British India (based upon ocean rate with 10c surcharge)
Chicago, Ill.....	1 42		42	32
Indianapolis, Ind.....	1 42	4 28	14	4
Des Moines, Iowa.....	1 49½	4 32½	17	7
Detroit, Mich.....	39		39	29
Minneapolis, Minn.....	57	4 33	24	14
Buffalo, N. Y.....	28		28	18
Cleveland, Ohio.....	39		39	29
Cincinnati, Ohio.....	1 42	4 28	14	4
Milwaukee, Wis.....	42		42	32

1 From New Orleans.
 2 From Toledo.

3 From Duluth.
 4 From Chicago.

TABLE Q-5

Estimated savings on the transportation of burlap

Representative point of destination	From Europe			From British India			Total estimated savings
	Potential tonnage	Estimated savings		Potential tonnage	Estimated savings		
		Unit	Total		Unit	Total	
	<i>Pounds</i>	<i>Cents per 100 pounds</i>		<i>Pounds</i>	<i>Cents per 100 pounds</i>		
Chicago, Ill.....	1, 434, 932	42	\$6, 026	9, 481, 661	32	\$30, 341	\$36, 366
Indianapolis, Ind.....	748, 660	14	1, 048	4, 946, 954	04	1, 979	3, 027
Des Moines, Iowa.....	31, 194	17	53	206, 123	07	144	197
Detroit, Mich.....	218, 359	39	852	1, 442, 861	29	4, 184	5, 036
Minneapolis, Minn.....	1, 341, 349	24	3, 219	8, 863, 292	14	12, 409	15, 628
Buffalo, N. Y.....	1, 528, 515	28	4, 280	10, 100, 030	18	18, 180	22, 460
Cleveland, Ohio.....	826, 645	39	3, 224	5, 462, 261	29	15, 841	19, 065
Cincinnati, Ohio.....	826, 646	14	1, 157	5, 462, 261	04	2, 185	3, 342
Milwaukee, Wis.....	436, 718	42	1, 834	2, 885, 723	32	9, 234	11, 068
Total.....	7, 393, 018		21, 694	48, 851, 166		94, 497	116, 191