

The Institute of Economics
INVESTIGATIONS IN INTERNATIONAL COMMERCIAL
POLICIES

THE TARIFF ON ANIMAL AND VEGETABLE OILS

By PHILIP G. WRIGHT

WITH THE AID OF THE COUNCIL AND STAFF OF
THE INSTITUTE OF ECONOMICS

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The problem discussed in this book first came to public notice at the time the Tariffs Acts of 1921 and 1922 were passed, and has since constituted one of the knottiest problems before the tariff-making authorities. The commodities discussed include a considerable number of vegetable oils and animal fats. The principal vegetable oils under consideration are cottonseed oil, linseed oil, olive oil, corn oil, and peanut oil; the principal animal fats are butter, lard, tallow, and the fish fats. The movement to protect these commodities has had the backing not only of the direct producers but of the agricultural interests as a whole.

The book answers the following questions: Have the duties on these products stimulated production? Have they raised prices? Have they helped the farmers? Have they burdened consumers? Have they proved a handicap to the users of oils as raw materials?

The writer of this volume was employed as an expert on the staff of the United States Tariff Commission for five years, and is known as a professional economist of standing. In this volume an effort is made to present the facts concerning an important aspect of the tariff question in a scientific spirit without partisan bias.

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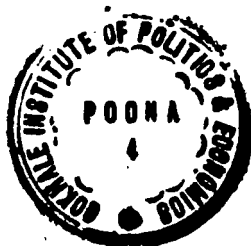
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THE INSTITUTE OF ECONOMICS
INVESTIGATIONS IN INTERNATIONAL COMMERCIAL POLICIES



THE TARIFF ON ANIMAL
AND VEGETABLE OILS



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BY

PHILIP G. WRIGHT

WITH THE AID OF THE COUNCIL AND STAFF
OF THE INSTITUTE OF ECONOMICS

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DIRECTOR'S PREFACE

Within the last decade a new set of economic relationships between the United States and the rest of the world has developed. Certain old questions have reappeared in new aspects and with changed implications. The tariff, as the most important expression of the trade policy of this country, requires a fresh examination, and this the Institute of Economics has undertaken.

But before attempting any broad generalizations regarding the wisdom of American tariff policy as a whole, the Institute is presenting a series of studies dealing with specific commodities in their relation to the tariff. In the view of the Institute the tariff is not a single problem to be solved by the application of a general formula. Its application to each particular industry gives rise to questions of public policy which may be peculiar to that industry. There has been an abundance of abstract theorizing in the United States about free trade and protection and there has been no dearth of statistical evidence submitted by interested parties for the purpose of bolstering a theory or advancing a private interest, but there has been little dispassionate investigation of the concrete effects of particular tariff duties.

In the Institute's commodity studies answers are sought to the following questions: What precise objects were in mind in imposing a particular duty? Has the duty in fact attained the objects sought? Has it had other effects beneficial or injurious to the industry in question, to other industries, or to the general public? What are likely to be the effects of changes from the present rate?

It will be noted that the conclusions thus reached are conclusions of fact or at most are inferences from facts. They in no wise relate to public policy. They state what have been the effects and what are likely to be the effects of certain duties, without raising the question whether the duties ought or ought not to be imposed. In regard to conclusions of this character, if the data are handled by sound statistical methods, a fair degree of unanimity may be expected.

Conclusions as to sound national policy are, however, much more difficult to reach and unanimity is hardly to be expected. Individuals differ in their ideals, prejudices, and political affiliations, and even when in general agreement in these matters attach different weights to specific items of public policy. Some stress, as the paramount national ideal, a maximum of wealth in the form of economic goods and services; others stress as of greater importance than wealth national self-sufficiency and national security in the event of war. To some the nature of a country's activities is a matter of indifference.

They may be few or many, exclusively industrial or exclusively agricultural. The important thing is a maximum of output with a minimum of effort. To others a considerable diversifying of business activities seems a matter of national importance to be encouraged even at some sacrifice of output. Especially, in this connection, is it felt by many to be good public policy to maintain a "proper balance" between agriculture and manufacturing. Moreover, after making an intensive study of a single industry, one's judgment of what ought to be done with the duty is likely to be influenced by the existing status of that industry and its relation to other industries. When an industry, involving large commitments of capital and of highly skilled labor, has grown up under the shelter of a protective tariff, especially if over a large area other businesses are dependent on its prosperity, one may well hesitate to remove the duty abruptly even though it can be shown that in the absence of such commitments of labor and capital the duty has little to commend it. Finally, in arriving at a conclusion whether a duty on a specific commodity ought to be removed or retained, one's judgment is necessarily influenced by the general tariff policy that is to prevail. If there is to be a general reduction all along the line, that is one thing; if the tariff is to remain highly protective, it is another matter.

In the light of these considerations, and particularly the last one, in the Institute's specific com-

modity studies the conclusions are in the main confined to conclusions as to what has been and what is likely to be the effect of the duty. Only when the case seems very clear does the Institute venture to express an opinion as to what specific changes in tariff rates ought in the interest of public policy to be made. If the Institute succeeds in revealing the concrete results of particular tariff schedules, we believe that a real service will have been rendered. Because of the cloud of propaganda that surrounds nearly all tariff discussion the public is left largely in the dark as to the actual effects of the duties. It is our primary function to disclose the facts and to clarify the issues involved.

The present study of the animal and vegetable oils is one of a series on agricultural products. Studies on sugar, wool, and cattle and beef have already appeared, and a study on wheat is in preparation. Hitherto protection has been applied chiefly for the benefit of manufacturing interests. Recently, however, farmers, feeling that these manufacturing interests were benefiting at their expense, have sought to "equalize the benefits of protection" by imposing higher duties on agricultural products. The Institute's studies should be of service to farmers by showing them the extent to which they do in fact benefit and can expect to benefit by such duties, and hence aid them in deciding on the wisdom of the policy on which they have embarked.

DIRECTOR'S PREFACE

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The conclusions of the present volume will be found summarized on pages 252-254.

HAROLD G. MOULTON,
Director.

Institute of Economics,
November, 1927.

AUTHOR'S ACKNOWLEDGMENTS

The author makes grateful acknowledgment to Director Harold G. Moulton, Dr. Thomas Walker Page, Dr. Edwin G. Nourse, and Dr. Charles O. Hardy of the Institute of Economics for their painstaking collaboration and criticism made in the preparation of this book. The manuscript was also carefully read by several persons not connected with the Institute, whose criticism proved most helpful. These were L. B. Zapoleon, of the Food Research Institute of Stanford University, J. B. Gordon of the Bureau of Raw Materials for American Vegetable Oils and Fats Industries, Charles W. Holman of the National Cooperative Milk Producers' Federation, and A. M. Loomis of the National Dairy Union. Acknowledgment is also made to C. K. Lewis and P. W. Bidwell of the United States Tariff Commission for valuable suggestion and criticism. Sheldon B. Akers rendered invaluable aid in the collection and compilation of data. Ralph P. Ward prepared the many charts and diagrams which appear in the text and in the appendices.

PHILIP G. WRIGHT.

Washington, D. C.,
November, 1927.

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**THE TARIFF ON ANIMAL
AND VEGETABLE OILS**

THE TARIFF ON ANIMAL AND VEGETABLE OILS

INTRODUCTION

THE tariff acts of 1921 and 1922 placed heavy duties on linseed, cottonseed, peanut, coconut, soya bean, and edible olive oils. Three of these oils, cottonseed, coconut, and soya bean, were previously on the free list. On the other three the duties were greatly increased. Flaxseed, cottonseed, peanuts, and soya beans, raw materials of four of the above-mentioned oils, were also made dutiable at high rates, two of them, cottonseed and soya beans, being removed from the free list. The duties were also increased on butter, on castor oil, and on certain other oils and fats. Several, however, including Chinese nut, inedible olive, palm, palm kernel, perrilla, and sesame oils, remained on the free list.

These changes were brought about as part of a general movement among farmers to obtain high rates of duty for agricultural products. The duties were not so much in the interest of producers of the oils as of producers of the raw materials of the oils; namely, dairymen, and flaxseed, cottonseed, soya

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bean, and peanut growers. Prices of agricultural products were low in comparison with those of manufactured goods, farmers as a class were suffering severely, and the end in view was frankly to improve their position by raising the prices of their products.

These and other duties on agricultural products raise questions of great national importance. Can farmers as a whole be aided by agricultural protection? Is the aid to some farmers more than offset by the burden imposed on others? Even if all farmers can be benefited, is agricultural protection likely to impose burdens on other classes of the community so great as to make such a policy unwise from a national point of view?

The question of agricultural protection is thus seen to be of wide national importance, and even that phase of it which concerns the animal and vegetable oils alone is of sufficient magnitude to assume national significance. Linseed oil is the principal raw material of paints, varnishes, linoleum, and printers' ink. Castor oil has important uses in the textile industries, in medicine, and as a lubricant for airplanes. A great variety of oils in huge quantities is consumed in the manufacture of soap. Oils are used in the preparation of leather, in the textile, steel, and tin-plate industries, and as lubricants and illuminants. Finally, the oils and fats have important food uses. Nearly two billion pounds of butter are consumed every year in the United States, and one has merely to mention such

articles as lard, lard and butter substitutes, and salad oils to indicate how important are the oils and fats in the economy of every household. It is clear that a change in tariff policy with respect to these commodities is of national importance.

It is the purpose of this study (1) to afford the reader a comprehensive view of the properties and uses of the oils and fats and the conditions surrounding the industries which produce them; (2) to show what effects the changes in the oils duties in the acts of 1921 and 1922 have had on the prices, domestic output, and imports of the oils and fats affected; (3) to make some appraisal of the benefits and burdens which have resulted from these duties as a means of arriving at sound conclusions as to the tariff policy which, in the case of these commodities, will best promote the public welfare.

Chapter I will deal with the chemical composition of the fatty oils and with certain facts connected with the production of them, and will show in broad outline the bearing of these facts on the tariff.

In Chapters II and III the several oils and fats will be taken up one by one and will be treated with respect to the raw materials from which they are derived, the regions in which they are produced, their properties, their uses, and their importance in industry and commerce. The vegetable oils will be treated in Chapter II and the animal oils in Chapter III.

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Chapter IV will show from production, import, and export data the competitive position of the United States in the world markets for the oils and fats. To this end, in addition to the data just referred to, data will be presented showing the distribution of the fatty oils among their principal uses, the classification by uses which may be based on such distribution, and finally the bearing of such classification on the competitive position of the United States with respect to the several classes.

Chapter V will describe briefly the policies underlying the oils tariff in Acts preceding the Acts of 1921 and 1922, the situation which led to a change in policy in the latter Acts, and will show what the nature of this change in policy was. The remainder of the chapter will be devoted to a statistical investigation, the object of which will be to determine some of the larger effects of the increase in duties on prices, production, imports, exports, and revenue.

Chapters VI and VII will continue the discussion begun in Chapter V, but more in detail. The subject will be taken up oil by oil, and an attempt will be made to find what changes in price, production, imports, and exports in the case of each oil may be attributed to the change in duty as distinct from such changes as were due to other causes. Butter alone, both because of its importance and because the interpretation of the data is difficult, will form the subject matter of Chapter VI. Other fatty oils will be considered in Chapter VII.

In Chapter VIII the objects aimed at in levying the increased duties will be stated, and the extent to which these objects have been attained will be summarized. Against whatever benefits may have been gained by certain classes from the attainment of the objects of the duties will be set the burdens to which other classes have been subjected by them, and some attempt will be made at an appraisal of the benefits and burdens.

Appendix B deals with a mathematical problem of no small importance in tariff discussions. It is known that the effects of a duty on the price, imports, and domestic production of the taxed article differ greatly with different commodities. It is also known that in determining what the effect will be, the elasticities of the domestic and foreign supply and demand are the dominating factors. In this Appendix a formula is given, by the aid of which the effects to be expected from a given duty may be accurately computed, provided the above mentioned elasticities and other necessary data are known and also a statistical analysis by which the elasticities may be estimated from available data. It is hoped that some contribution has been made to this important but involved subject.

CHAPTER I

ELEMENTS OF THE OILS TARIFF PROBLEM

THE wisdom of imposing protective duties on oils and fats cannot be intelligently judged without a clear understanding of certain fundamental facts relating to their chemical composition, their classification, and their production. These facts will be the subject matter of this chapter and will be discussed under the following heads: (1) Chemical composition, (2) Partial interchangeability, (3) Classification, (4) Factors in the production of oils bearing on the tariff.

I. CHEMICAL COMPOSITION OF THE FATTY OILS

The term oil covers three very different kinds of substances—the mineral oils, the essential oils, and the fatty oils. Only the last named will receive consideration in this study.¹

¹The mineral oils are derived chiefly from petroleum, which is a substance consisting of numerous hydrocarbons, some of the marsh-gas series, C_nH_{2n+2} , others of the olefine and naphthene series, C_nH_{2n} , and others of the benzene series, C_nH_{2n-6} . In some petroleums sulphur, nitrogen, and asphaltum are also present. It will be noted that the mineral oils are composed of compounds of carbon and hydrogen. While having a family resemblance among themselves, they are compounds quite distinct from the

ELEMENTS OF OILS TARIFF PROBLEM 7

The fatty oils are of animal or vegetable origin, and they bear a family resemblance to one another in their chemical composition. The most important are butter, lard, tallow, and the animal greases; fish and whale oils; and the vegetable oils derived from cottonseed, flaxseed, the coconut, the olive, the peanut, the castor bean, and the soya bean. This list is by no means exhaustive, but is sufficient to give an idea of the class of oils to be considered. Some of the substances named, as butter and coconut oil, are ordinarily solid, and others, as whale oil and olive oil, are ordinarily liquid. The former, especially when of animal origin, are called fats. There is no important chemical distinction between a fat and an oil.

The oils and fats as they occur in nature are mixtures in varying proportions of certain chemical compounds known as glycerides of the fatty acids.²

animal and vegetable oils, which, in addition to carbon and hydrogen, contain oxygen.

The essential oils, though of vegetable origin, are complex chemical compounds distinct from the "vegetable oils," so-called. They are liquids which give the characteristic odors to plants and include oil of turpentine, thymol, menthol, oil of bergamot, oil of cloves, eucalyptus oil, oil of peppermint, oil of wintergreen, and attar of roses.

²The foundation of all these compounds is the hydrocarbon C_3H_8 . If three molecules of hydroxyl (OH) be substituted for three atoms of hydrogen the result is glycerol or glycerin, $C_3H_8(OH)_3$. The action of a fatty acid on glycerol results in a glyceride. Thus $3(C_{18}H_{34}O_2) + C_3H_8(OH)_3 = (C_{18}H_{33}O_2)_3 C_3H_8 +$
oleic acid glycerol olein

$3H_2O$. The fatty acids are numerous and their glycerides are water

named from them, as olein, the glyceride of oleic acid; stearin, the glyceride of stearic acid. The most important of the glycerides for the purposes of the present discussion are those

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For example, butterfat is a mixture chiefly of the glycerides of oleic, palmitic, stearic, and butyric acids, together with small quantities of the glycerides of capric, caproic, and other acids. Cottonseed oil is a mixture of the glycerides of oleic (30 per cent), linoleic (46 per cent), palmitic (23 per cent) and arachidic (1 per cent) acids.

II. PARTIAL INTERCHANGEABILITY

From what has been said of the chemical composition of the fatty oils it is apparent that the properties of any one of them depend on the properties of the glycerides of which it is composed and the proportions in which they are blended. Hence arises the possibility of reproducing by art, by a proper blending of glycerides, an oil which occurs in nature. By a proper blending of the glycerides of oleic, linoleic, palmitic, and arachidic acids an oil could be produced which to all intents and purposes would be cottonseed oil, though none of the ingredients was derived from cottonseed.

Again since some of the glycerides have a close family resemblance to others it often happens that one oil may have approximately the same properties as another and serve much the same purposes, even though composed of different glycerides or of the same glycerides in different proportions. For example, derived from the following fatty acids: oleic, stearic, palmitic, butyric, caproic, caprylic, hypogæic, linoleic, linolenic, isolinolenic, and ricinoleic.

ample, olive oil, cottonseed oil, corn oil, and peanut oil are by no means identical in composition yet they are all acceptable salad oils.

Finally, by a process known as hydrogenation a glyceride of an "unsaturated"³ fatty acid may be converted into the corresponding glyceride of a "saturated" acid.

In determining what duty, if any, should be levied on an oil it is necessary to take into account the possibility of substitution. This is because of the interchangeability referred to above. Interchangeability, however, is not perfect. The products made from different combinations of oils are seldom identical. They differ in appearance and quality and hence command different prices. Moreover, even if the final products are identical, the process of fitting one oil for a given product may be so much more costly than that of fitting another that if the two oils are to compete on even terms one of them must sell at a much lower price than the other. For example, by mixing and processing various fatty oils a substance closely resembling butter may be produced. This product, however, is not identical with butter. It is inferior and, hence, if it is to

³ A saturated acid of the acetic series has for its general formula $C_nH_{2n}O_2$. An unsaturated acid of the acrylic series has for its general formula, $C_nH_{2n-2}O_2$. It will be seen that each acid of the former series has two more atoms of hydrogen than the corresponding acid of the latter. The process of hydrogenation adds two atoms of hydrogen to an unsaturated acid and converts it into the corresponding saturated acid. Thus: $C_{18}H_{34}O_2$ (oleic acid) + $2H = C_{18}H_{36}O_2$ (stearic acid).

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compete with butter it must sell at a lower price. Again, soya bean oil may be applied to certain food uses; the cost of fitting it for these uses, however, is so much greater than the cost of fitting cottonseed oil for the same uses, that it will not be so used unless it can be obtained at a lower price. Hence in adjusting duties, the qualities of competing products made from different oils, and the respective costs of fitting competing oils for competing products should be taken into account.

III. CLASSIFICATION

Some oils resemble one another closely in their uses, others differ widely; hence the possibility of interchange is much greater in some cases than in others. It follows that ordinarily in determining the duty to be imposed on a given oil it is not necessary to consider the possibility of substitution from a list made up of all the other oils but only from a list made up from those which resemble it rather closely in their properties. For the purpose of adjusting duties the oils may be classified.

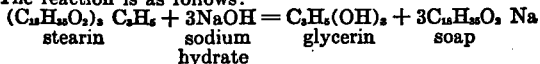
A convenient classification for tariff purposes is into soap oils, food oils, and drying oils. There is considerable overlapping, it is true. Any oil may be made to yield a soap, and this use often claims the poorer grades of oils which may properly be classed as food oils or drying oils. Some oils, as soya bean and corn oils, enter into all three classes. More-

over, most of the oils serve uses other than soap, food, or the uses calling for a drying oil. Indeed, in some cases the uses outside of those implied in the classification are the most important. This is true of the greases and of castor oil. Nevertheless, the classification will be found convenient and helpful. Over 90 per cent of all the oil and fat consumed in the United States is consumed in one or more of these uses and with a few exceptions the consumption of a given oil in a single use so preponderates over its consumption in other uses as to leave no doubt as to its classification. In general it may be said that two oils belong to the same class when the chief use to which each of them is put is the same.

Soap oils. As just noted, all of the oils are potentially soap oils. They are all glycerides of the fatty acids, and if treated with potassium or sodium hydrate, glycerin will be set free and the remaining compound will be a "soap," which is, chemically speaking, an alkaline salt of a fatty acid.⁴

"Soap" is thus seen to be a class name covering a great number of compounds which differ among themselves in accordance with the several glycerides or the alkali used. In general, potassium soaps are

⁴The reaction is as follows:



Similar reactions could be shown for other oils and fats either with sodium hydrate (NaOH) or with potassium hydrate (KOH). It will be noted that glycerin is set free in the process of soap making. Hence, glycerin is a joint product. In some toilet soaps, however, the glycerin remains in the soap.

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soft and sodium soaps hard. Castor oil imparts transparency. Coconut oil soaps possess excellent lathering qualities, desirable in the manufacture of shaving and other free lathering soaps. They will lather even in hard or salt water, thus constituting the so-called marine soaps. If the coconut oil is free from fatty acids it lends itself to "cold-process" soap making. Low grade olive oil or olive oil "foots" is used in the manufacture of the well-known "Castile" soap. Hempseed oil produces a soft soap of a dark green color. For the production of certain mottled soaps sesame seed oil is used. Manufacturers build up a business on the basis of some particular formula. Hence a serious burden may be imposed upon soap makers by levying a duty on an imported oil which they need in order to continue manufacturing the particular variety of soap for which they have built up a market.

The soap kettle is a sort of catch-all. Vast quantities of animal fats and greases find their way into it. With these go the "foots" of vegetable oils, that is, the residue resulting from their manufacture; oils and fats of inferior grade, such as inedible olive oil; and oils and fats of such chemical composition that the cost of refining from the crude to the edible state is too great to be warranted by the higher price they would bring.

There is no sharp line of distinction between a soap oil on the one hand and an edible or a drying oil on the other. Any oil or fat which cannot find a

market as an edible or drying oil may be used as a soap oil.

Food oils. Under this head are included butter, lard, and all oils and fats suitable for manufacture into lard substitutes, margarin, or mayonnaise dressing, or for use as salad oils or in fish packing. In the United States, aside from butter and lard, the chief oils and fats serving in one or more of these uses are tallow, cottonseed oil, coconut oil, corn oil, peanut oil, and olive oil. Soya bean oil also may be used as a food oil but in the United States this has always been a minor use. It has a disagreeable "beany" flavor, which may be removed but is likely to return. Moreover the cost of removing the flavor and of otherwise fitting the oil for use as food is so great that in its crude form it must sell at a lower price in order to compete with other edible oils.

The drying oils. Certain oils, especially those containing the glycerides of linoleic, linolenic, and ricinoleic acids, are oxydized when exposed to the air, and are converted into thick gummy or resinous masses, or, in thin layers, form dry, hard, transparent or translucent films. Such oils are called drying oils. They form the basis of paints and varnishes and are used in the manufacture of printers' ink and linoleum. By far the most important of these oils is linseed oil, but Chinese nut oil, soya bean oil, and menhaden oil are also important. Soya bean oil is to be classed as a semi-drying oil rather than as a drying oil; that is, it cannot be used alone but may

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be mixed with linseed oil up to 20 per cent with good results. Drying and semi-drying oils may be used as soap oils and some of them as edible oils. Even linseed oil is so used in some countries but not in the United States. The converse, however, is not true. A non-drying oil cannot be used as a drying oil—the glycerides of which it is composed will not oxydize in the manner described.

Competition among oils in the same class tends to regulate the price of each of them. Even within a class, however, interchangeability is not perfect. Each oil ordinarily has its preferred uses and each use its preferred oils. Nevertheless, the possibility of substitution tends to establish a price relationship among the oils in the same class. There is, roughly speaking, a price relation among the soap oils, and if the price of any one of them rises much above its place in the scale another will be substituted for it. A similar statement may be made of the food oils and the drying oils. For example, soya bean oil was largely used as a soap oil until a duty was imposed on it in 1921. Since that date its use for soap making has nearly ceased in the United States; but since the price of drying oils is not affected by the competition among the soap oils, soya bean oil is still imported for making paints, varnishes, and the like.

In brief, it may be said that the prices of oils in the same class are held together by an elastic bond. Sometimes the elasticity is more in evidence and

sometimes the bond, but any increase above normal in the price of a given oil tends to lead consumers to discontinue its use and to substitute some cheaper oil of the same class. The diminished use tends to lower the price, thus bringing the oil back to its normal place on the scale. If, however, the rise in price is caused by the permanent reduction of supply by means of a duty, the substitution will be permanent and the oil will disappear from that class.

The possibility of substitution limits the power of a protective duty to raise the price of a domestic oil. Competing foreign oils may indeed be excluded by the tariff, but if an abundant supply of other domestic oils of the same class is available, any tendency of the given oil to rise in price is likely to be checked by the substitution of such other domestic oils. Examples of this principle will appear in the discussion of the effects of the tariff on the prices of cottonseed and peanut oils appearing in Chapter VII.

IV. FACTORS IN THE PRODUCTION OF OILS BEARING ON THE TARIFF

Two facts incident to the production of the fatty oils have an important bearing on the tariff: (a) the production of an oil includes two stages, (b) many important oils and fats are by-products.

The production of an oil includes two stages. The oils and fats are products of nature occurring in the tissues and milk of animals and the seeds of plants.

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They are obtained from their raw materials by several processes: by "churning," as in the case of butter; by "rendering," as in the case of lard; by "crushing," as in the case of cottonseed and linseed oils; or by treating the raw material with some solvent such as gasoline or benzol and then separating the oil from the solvent. The production of an oil, therefore, requires, first, the production of the raw material, usually an agricultural process; and, second, the extraction of the oil or fat from the raw material, a manufacturing process.

The oils tariff problem, therefore, involves protecting two groups of producers with differing interests. The production of the raw material and the extraction of the oil are generally separate industries, and if the tariff raises the price of raw material it will hurt the manufacturers of oil unless the tariff includes a compensatory duty for their benefit. Thus the duty on oil must include both a compensatory and a protective rate. The most important case of this kind arises in connection with linseed oil. Flaxseed is grown in several states of the Middle West but not in sufficient quantities to meet the demand of domestic crushers. Large amounts of flaxseed are therefore imported. But the oil produced both from the home-grown and imported seed is not sufficient to meet the demand for linseed oil. Hence linseed oil also is imported. The tariff problem of linseed oil from a protective standpoint, therefore, involves the imposition of a proper duty on seed, and a duty

on oil adjusted both with regard to compensation for the duty on flaxseed, and protection for the manufacturing processes of the crusher.

Many important oils and fats are by-products. Lard, tallow, and the greases are by-products of the packing houses. Cottonseed oil, by far the most important of the vegetable oils, is a by-product in the production of cotton for lint. Peanuts are grown chiefly for sale to vendors, to manufacturers of peanut butter, and for use in the confectionery trade. The culls, unfit for these purposes, are crushed for oil. The case is similar with olives. They are grown in the United States in a single state, and in the main are marketed as fruit. The oil crushed from the culls is distinctly a by-product. Corn oil is a minor by-product of the great starch, glucose, and corn sugar industries. The production of cattle for dairy purposes is closely associated with the production of cattle for beef, and the production of milk for butter is closely associated with the production of milk for city distribution and for the manufacture of cheese and condensed milk.

When the protected commodity is a by-product or a joint product, the power of a duty to benefit producers is limited. The ultimate purposes of a protective policy are numerous, but the immediate purpose is always to afford pecuniary benefit to persons engaged in the protected industries. In the case of the duties imposed on the fatty oils and their raw materials, pecuniary aid to farmers was not only the

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immediate but virtually the sole aim in making the tariff of 1921. Assuming that the immediate effect of the duty is to raise the price of the by-product, such an improvement in price should normally tend towards increased production. But if the production of the by-product is so connected with that of the principal product that an increase in one necessarily involves an increase in the other, the increased output of the principal product resulting indirectly from the duty on the by-product will tend to reduce its price. The reduced price of the principal product may offset any gain in price of the by-product.

Again if the several products are so connected that the output of one may be increased by transferring labor and capital from the others, then any increase in price in one of them resulting from a duty is likely to be followed by such a transfer of labor and capital, resulting in increased output, which in turn will tend to lower the price and thus neutralize the effect of the duty. The dairy industry is an example. A rising price of butter is likely to induce owners of dual purpose animals to emphasize the production of milk rather than beef, and to divert the milk supply into butter making and away from use as a beverage and from the production of cheese and evaporated milk. The consequent increase in the domestic production of butter will tend to reduce the price of it, and thus the purpose of the duty will be nullified.

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The commodities concerned in the present discussion are important and the tariff problems complex. The bare enumeration of the oils and the industries dependent on them is sufficient to indicate the importance in our domestic economy of the articles treated in this study. They include, directly or indirectly, butter, lard, tallow, oleo- and nut-margarin, lard substitutes, salad oil, peanut butter, soap, paint, varnish, oil cloths, printers' ink, important lubricants and illuminants, and articles contributing more or less remotely to the prosperity of many important industries not included in the above. It has also been made apparent that the tariff problem is far from simple. Both of these considerations suggest the danger of injudicious tariff action and the need of careful, comprehensive study.

As a preliminary to such study it is essential that the reader should have a more intimate knowledge of the subject matter. The next chapter, therefore, will present more in detail the sources, characteristics, uses, and processes of production of each of the oils and fats with which we shall be concerned.

CHAPTER II

PROPERTIES, USES, AND COMMERCIAL IMPORTANCE OF THE FATTY OILS

THE treatment of each oil will include a brief statement in regard to its composition, properties, and uses, the methods employed in its production, and its importance in domestic and foreign trade. This chapter will cover the principal vegetable oils—namely, castor oil, Chinese nut oil, coconut oil, corn oil, cottonseed oil, linseed oil, olive oil, palm oil, palm kernel oil, peanut oil, and soya bean oil. The animal oils and some oils of minor importance will be discussed in Chapter III.

I. CASTOR OIL

The raw materials. Castor oil is derived from the seeds of the castor-oil plant (*ricinus communis*). The plant is indigenous to India and Africa but its cultivation is now widespread throughout the world. It was introduced into the United States from Jamaica in the eighteenth century and in the past has been grown on a commercial scale to a limited extent especially in the Middle West. The maximum production was reached in 1879 with a crop of

about 800,000 bushels. The production then declined and after 1900 was practically abandoned—this in spite of a duty of 50 cents per bushel from 1883 to 1894 and of 25 cents per bushel from 1894 to 1913. During the World War, because of the importance of castor oil as a lubricant for airplanes a special effort was made by the Federal Government to revive domestic production of the beans. Growing districts were organized and contracts were made with the growers carrying a government guarantee of \$3.00 per bushel to planters for beans delivered directly to the government and \$3.50 per bushel to subcontractors. Some 6,000 tons of beans were obtained from India by arrangement with Great Britain, of which 200 tons were planted and the remainder converted into oil. In spite of this effort the results were small and temporary. The castor bean is not a profitable crop to the American farmer, and since the war its production on a commercial scale has again fallen to insignificance.

The production of oil from imported beans is, however, a domestic industry of some importance. Over a million bushels are annually imported for this purpose.

The principal source of castor-bean imports is India (94 per cent), whence they come either direct or via England. Small quantities of beans are also imported from Brazil (about 5 per cent of the total) and still less from Japan and China. Castor-oil imports are derived chiefly from England, France, Ger-

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many, and Belgium. There are also extensive crushing establishments in Hull, Marseilles, and Hamburg.

Composition, properties, and uses. Castor oil is very viscid and is the heaviest of the vegetable oils. Its chief constituents are the glycerides of stearic and ricinoleic acids. It appears on the market in two grades known in the American trade as No. 1 and No. 3. No. 1 is a "cold-drawn" oil, obtained by pressure without heat, while No. 3 is extracted from the resulting "cake" with a volatile solvent such as gasoline or benzol. The No. 1 oil is a pale, yellowish, transparent, viscid liquid having a faint, mild odor and a bland, afterwards slightly acid and nauseating, taste. For medicinal purposes only the cold-pressed, No. 1 oil can be used, since the castor beans contain a poisonous principle, known as ricine, which is carried into the oil by the other methods of extraction.

Though best known for its use as a purgative, this is by no means the use of most commercial importance. One of its most important industrial uses is in the manufacture of "Turkey-red" oil, which is an alizarin¹ assistant used in dyeing and printing cotton goods. It is also used in the manufacture of soap, to which it imparts transparency; as a preservative and softener of leather belting, boots, and harness; and as an adhesive agent in the manufac-

¹The "alizarin dyes" are derived from anthracene, a coal-tar product. An "assistant" is a substance used in connection with applying the dye.

ture of fly-paper. Its high viscosity adapts it to use as a lubricant for rapid-running and heavy machinery. It retains its viscosity at high temperatures and thus can be used under conditions in which other oils lose their lubricating quality. This property especially adapts it to use with airplanes and accounts for the efforts made by the government to stimulate its domestic production during the World War. For many of the industrial uses the No. 3 oil will serve, but when used for lubrication a high-grade oil is required, either the No. 1 or an oil refined from the No. 3. It is also used in blends for automobile lubrication.

Domestic production and imports. Domestic production of castor oil, almost exclusively from imported beans; imports of castor beans; and imports of castor oil, in recent years, are shown in the table below. No exports are recorded.

DOMESTIC PRODUCTION OF CASTOR OIL, AND IMPORTS OF CASTOR BEANS AND CASTOR OIL, 1920-1926

(In thousands of pounds)

Year	Production of Castor Oil	Imports of Castor Beans	Imports of Castor Oil
1920.....	24,187	62,965	1,372
1921.....	20,595	38,812	151
1922.....	31,487	81,674	884
1923.....	37,383	88,539	1,019
1924.....	37,434	84,977	293
1925.....	45,050	107,232	330
1926.....	44,394	100,796	450
Average	34,361	80,712	643

II. CHINESE NUT OR TUNG OIL

Raw material. Under the title Chinese nut oil are included two oils very similar in their uses and characteristics, namely, Chinese tung oil and Japanese tung oil. They are obtained from the nuts of different species of the tree *Aleurites*. The nuts consist of about 49 per cent shell and 51 per cent kernel, and the kernel, in turn, yields from 40 to 42 per cent of its weight in oil on crushing. There is no domestic production of the nuts, though experiments by the United States Department of Agriculture in introducing the tree into the Southern States have met with some little success. Neither are the nuts imported; the oil, however, is imported in large quantities.

Composition, properties, and uses. Chinese tung oil is of a pale yellow to dark brown color, and dries rapidly, forming a hard film. It contains the glycerides of oleic and elæomargaric acids. It is highly laxative. Two grades are recognized in the foreign market; "white tung oil," obtained by cold pressing and "black tung oil" obtained by hot pressing. The former is the exportable grade. The latter is consumed chiefly in China. The press cake is poisonous and is used as a fertilizer and in the manufacture of lampblack.

Its drying qualities fit it for use in the paint, varnish, and linoleum industries. It dries even more quickly than linseed oil but, unless subjected to spe-

cial treatment, is inferior to it for paint because of the opacity and inelasticity of the film. In the manufacture of varnishes and enamel paints, however, it is superior to linseed oil. When heated and treated with rosin it gives a varnish that is water-proof, wears longer than ordinary varnishes, and does not turn white.

The Japanese tung oil has a lower specific gravity, and does not dry so quickly as the Chinese; otherwise it is similar in its chemical composition, properties, and uses.

Imports of the oil are large and increasing. The following figures show, in thousands of pounds, the imports for the years specified.

1914	1919	1920	1921	1922	1923	1924	1925	1926
80,168	58,858	67,962	27,249	79,089	87,292	81,582	101,554	83,004

Except for the year of depression, 1921, and a setback in 1924 and 1926, a steady and substantial annual increase may be noted.

III. COCONUT OIL

Raw material. Coconut oil is commercially one of the most important of the vegetable oils. It is derived from the fruit of the coconut palm tree (*cocos nucifera*) which is widely distributed throughout the tropics. The tree grows wild in many places but the yield and quality of the nuts from cultivated trees are better. It is estimated that over 28,000,000 acres are devoted to the cultivation of the coconut

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palm. From a commercial standpoint the products of chief importance are the nuts in their unbroken condition; the desiccated or shredded meats of the nuts; the dried meats, called copra; the oil and cake obtained from copra; and "coir," the tough fiber which surrounds the shells. While all of these products are commercially important, only copra, oil, and oil cake are pertinent to the present discussion.

Copra is obtained from the Philippine Islands, Australia, Ceylon, British and French Oceania, and the Dutch East Indies. Imports are also received from Central and South America and the West Indies. Three methods of drying the coconut meats are practiced—sun drying, smoke drying, and machine drying. Where climatic conditions are favorable, copra of excellent quality can be produced by the simple process of exposing the meats to the light and heat of the sun. Many regions, however, are too rainy. In the Philippine Islands, from which over 70 per cent of the imports are received, the greater part of the copra is smoke dried on bamboo grates placed over crude furnaces. Copra so prepared is much inferior to the sun dried. Only a small part of the copra is obtained by "machine drying," that is, drying in kilns by hot air or steam, though when so prepared it is of high grade. The best grade of copra contains not more than 6 per cent moisture. Ordinary sun-dried copra contains about 9 per cent, and smoke dried often as high as 20 per cent. Sun-dried copra averages about 50 per

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cent of its weight in oil, while kiln-dried often contains 65 and sometimes over 70 per cent in oil. In the preparation of copra, the coconuts are husked, split in two pieces, and exposed to heat to separate meat from shell. The meats are then dried by one of the methods just mentioned.

The distribution of sources of supply for 1920 and 1926 is shown in the table below:

SOURCES OF COPRA IMPORTS, 1920 AND 1926
(In thousands of pounds)

Country of Origin	1920	1926	Country of Origin	1920	1926
Philippine Islands	22,718	275,696	French Oceania..	24,660	31,898
Australia	51,861	9,017	Other Oceania...	29,204	.....
British Oceania..	40,526	40,691*	Other Countries.	46,219	19,033
			Total	215,188	457,599

* British Oceania and Malaya.

The great increase in imports, both absolutely and relatively, from the Philippine Islands will be noted. The increase was from about 23 million pounds or 10 per cent of the total in 1920 to about 284 million pounds or 78 per cent of the total in 1925, and to 276 million pounds or 60 per cent in 1926.

Copra when crushed yields two products, coconut oil and coconut oil cake. Besides the crushing in the United States of imported copra, much copra is crushed or otherwise manufactured into oil in the countries of origin, especially in the Philippine Islands where in recent years large modern crushing plants have been erected. The oil crushed in the

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United States, therefore, competes with oil imported duty free from the Philippine Islands as well as with dutiable oil from foreign countries.

The demand for coconut oil, and consequently for copra, is strong and growing. There is, however, every prospect of an abundant supply of copra. It was reported in 1918 that in the Philippine Islands alone over 60,000,000 trees had been planted of which at that date only about one-half had come into bearing.

Composition, properties, and uses. Coconut oil contains the glycerides of many fatty acids, among which are myristic, palmitic, stearic, lauric, capric, caprylic, and caproic. It liquefies at 72° F. and hence is liquid in the tropics though ordinarily solid at the temperatures prevailing in the United States, at least in winter. When refined it is white with a slight odor.

Commercially, it is one of the most important of the vegetable oils, serving many purposes both as a food and as an industrial oil. Its most important industrial use is in soap making. Especially when of a high grade and free from fatty acids does it lend itself to the manufacture of soap by the "cold process." Coconut oil soaps possess excellent lathering qualities, hence its use in the manufacture of shaving and marine soaps, the latter lathering even in salt and hard water. Other industrial uses arise in connection with the manufacture of cosmetics, perfumes, and candles.

As a food oil its chief use is in the manufacture of the so-called "nut-margarin." In 1918, 49 per cent of the vegetable oil used in the margarin industry was coconut oil; in 1923, 70 per cent. It is also used, but to a less extent, in the manufacture of lard substitutes, in the confectionery trade as a basis for certain candies, and by bakers as filling for fine cakes and wafers. Its solid consistency, however, forbids its use as a salad oil.

Methods of production. A high grade variety, "Cochin oil," is obtained in the Orient by a simple native process. The nuts are split and exposed to the heat of the sun. When the meats dry and separate from the shell, they are pounded or shredded and boiled in water. The oil rises to the surface and can be skimmed off. Oil so produced is free from fatty acids and lends itself to the cold process soap making above mentioned.

Oil is also extracted by compression. The copra, prepared by any of the methods above described, is freed from dirt, pieces of metal, and other foreign matter, then is ground, heated, and put through "expeller presses," working on a principle something like that of a meat grinder. The residual meat still contains considerable oil. It is reground, cooked, formed into cakes, and subjected to hydraulic pressure. By this method 95 per cent of the oil is extracted. The "oil cake" remaining is either ground and sacked and sold as meal, or sold in the cake form. In either form it is a valuable cattle feed.

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Domestic production and consumption. Of all the vegetable oils coconut oil ranks third in the quantity consumed in the United States, and its use both absolutely and relatively to that of other oils has increased in recent years. In 1914, of a total consumption of a little less than 2,500,000,000 pounds, 94,118,000 pounds or 3.8 per cent was coconut oil. In 1926, of a total of a little over 3,500,000,000 pounds, the consumption of coconut oil had increased to 490,216,000 pounds or 13.5 per cent.

The domestic production of coconut oil has increased from 284 million pounds in 1920 to 500 million pounds in 1926.

Imports. These are chiefly in the form of crude oil. All of the coconut oil consumed in the United States is obtained by importation either of the oil or of its raw material. The development of the Philippine Islands since 1920 as the chief source of the raw material has already been noted. A similar change has taken place with respect to the sources of oil imports. In 1920, of 216,327,000 pounds imported, 153,181,000 pounds or 70.8 per cent, were from the Philippines; in 1926, of 245,456,000 pounds imported, 245,129,000 or 99.8 per cent, were from the Philippines. That is, during this period imports from sources other than the Philippine Islands had decreased from 29.2 per cent of total imports to less than 1 per cent. Moreover in 1920 imports were received from no less than 20 different countries; in 1925 imports from nearly all of these

countries except the Philippine Islands had disappeared.²

Exports. These are almost exclusively in the form of refined oil. In 1919 they totaled 119 million pounds; then fell off to 7 million in 1921; and have since slightly recovered, amounting to 16 million in 1926. Equally striking is the change in destination. In 1919, shipments to Canada, Mexico, and Cuba constituted only 2.3 per cent of the total shipments, while shipments to other countries, chiefly European, constituted 97.7 per cent. In 1925, the percentages were very nearly reversed—94.1 per cent to Canada, Mexico, and Cuba, and 5.9 per cent to other countries.

² In this study the Philippine Islands are treated as if they were United States territory since free trade with the Islands prevails. Hence, coconut oil, whether imported as oil from this region or crushed in the continental United States from imported copra from all sources, is regarded as of domestic production. It is desirable, however, for some phases of the tariff study to separate the Philippine Islands from the continental United States, hence the following table has been prepared to show the importance of the Philippine Islands in the "domestic" production of coconut oil. The figures are in millions of pounds.

Derivation of Oil	1914	1919	1920	1921	1922	1923	1924	1925	1926
Produced in U. S. from Philippine Copra . . .	•								
Produced in U. S. from other Copra	23.4	18.6	18.9	49.5	133.2	184.3	156.9	161.9	153.5
Produced in Philip- pines and Exported to U. S.	14.9	202.0	117.3	68.7	52.3	51.7	34.4	45.7	101.5
Total Domestic Produc- tion	26.2	201.3	153.2	164.0	224.2	180.7	224.6	232.5	245.1
	64.5	416.9	284.4	277.2	409.7	416.6	416.0	440.1	500.2

The production from Philippine and other copra is estimated on the assumption that the oil yield from all imported copra averages the same whether imported from the Philippine Islands or elsewhere.

IV. CORN OIL

Raw material. Corn oil is a by-product resulting from the manufacture of cornstarch, glucose, degerminated cornmeal, and hominy. A kernel of Indian corn is made up of three parts: the skin, the germ, and the endosperm. The germ, which is the source of corn oil, constitutes only 10 per cent of the kernel, and could not be profitably separated for making oil as an independent industry. From 30 to 50 per cent of the weight of the germ is oil, hence the oil is only from 3 to 5 per cent of the whole kernel. The germ is separated from the kernel by either the dry or the wet process. In the dry process the separation is mechanical and is applied in the manufacture of degerminated cornmeal and hominy. In the wet process, applied in the manufacture of starch and glucose, the corn is softened in diluted sulphurous acid in a "steep tank" and then ground in "cracker mills," which break up the corn but do not affect the tough, oil-bearing germ. The ground corn is then carried along by a stream of water flowing through long, narrow troughs. The germs rise to the surface and pass over a dam at the end of the trough. They are pressed for their oil content, and the residue, constituting oil cake, is used for cattle feed.

Composition, properties, and uses. Corn oil is composed chiefly of the glycerides of oleic and linoleic acids, containing also the glycerides of palmitic,

arachidic, and stearic acids. It is of a clear, yellow color, has a distinctive odor and a characteristic "grainy" taste. It is sold in two grades: "prime crude corn oil" and "prime refined corn oil." The crude oil is used in soap making and in dressing leather. It is also a semi-drying oil and hence may be mixed with linseed oil and used in the manufacture of paint and linoleum. In all of these industrial uses it is competitive with other vegetable and animal oils. When modified by a vulcanization process it forms a substitute for rubber, and when treated with sulphuric acid, it results in a soluble oil, similar to turkey-red oil, which is used as an alizarin assistant.

The refined oil is edible and is competitive with other edible oils in the manufacture of oleomargarin and lard substitutes and particularly as a salad oil, the form in which over 80 per cent of the output of refined corn oil is consumed.

Domestic production and exports. The oil is only 3 to 5 per cent of the weight of corn, and oil is therefore a relatively unimportant by-product of the industries which produce it. The more important products of these industries are starch, glucose, cornmeal, and hominy. Moreover, all of these industries combined consume but a small portion of the total corn crop; starch and glucose, 2 per cent; hominy and grits, 1 per cent; and cornmeal, 3 per cent. So enormous is the corn crop, however, varying annually from 2.5 to over 3 billion bushels, that the

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6 per cent consumed by these industries looks big when stated in absolute numbers, say, 168,000,000 bushels, as does also the small percentage of this consumption which finally appears as oil. In 1926 the oil output was 120,041,000 pounds.

Of this output 118,717,000 pounds were retained for domestic consumption and 1,324,000 pounds were exported. No imports are recorded.

V. COTTONSEED OIL

Sources of raw material. Out of an estimated world output of 13.5 million tons of cottonseed (1924-25) the United States produces about 6 million tons or 44 per cent. Other cottonseed producing countries are India, China, Egypt, Russia, Brazil, Mexico, Peru, Uganda, and Chosen.

Composition and properties. Cottonseed oil is derived from the seeds of the cotton plant (*Gossypium hirsutum*). It is composed of the glycerides of oleic, stearic, palmitic, and other fatty acids; and when refined is of a pale straw color, odorless, and pleasant to the taste.

Methods of production and uses. It is obtained from the seeds by compression, the yield being about 18 per cent of the weight of the seed. The residual oil cake is a valuable cattle feed. The crude oil as it first comes from the press is red or reddish brown, and for most of the purposes for which it is used

must be refined. The refining process consists of treatment with an alkali which combines with the free fatty acid in the oil to form a soap, insoluble in the oil. This soap, together with coloring and albuminous matter and the excess of lye, settles to the bottom in a mass known as fots. The clear oil may then be drawn off. The fots and inferior grades of oil are used in soap making. But cottonseed is preëminently an edible oil, and as such it commands a better price than when used for soap. Therefore as much is sold for purposes other than soap making as possible.

The refined oil may be still further refined by the use of fuller's earth. On standing or by chilling, the palmitin and stearin in part crystallize and may be removed by pressing. The resulting fat is called "cottonseed stearin" and is used in making margarin. The separated oil is used as a salad oil, and is also used with oleomargarin to soften it in cold weather. But by far the most important use of cottonseed oil is in the manufacture of lard substitutes. It constitutes about 85 per cent of all oils and fats consumed in this use, and this use absorbs about 70 per cent of the cottonseed oil consumed in the United States. In the manufacture of lard substitutes it is hydrogenated and used alone, or blended with oleo stearin, tallow, coconut oil, or some other oil or fat.

Aside from soap making cottonseed oil has other minor industrial uses, as for example in the manu-

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ufacture of washing powder, glycerin, and waterproofing preparations.

Domestic production and consumption. Cottonseed oil ranks first among the vegetable oils in both consumption and production. In 1914 production reached 1,790,000,000 pounds and consumption was 1,589,000,000 pounds, or 89 per cent of the output and 64 per cent of all the vegetable oil consumed. For some years following, owing chiefly to the pernicious effectiveness of the boll-weevil, the output fell off and by 1922 had sunk to but little more than half its former amount. Since that year there has been rapid recovery. The year 1926 showed an output of 1,760,530,000 pounds, which was equal to about 55 per cent of all the vegetable oil annually consumed in this country in that year.

Foreign trade. Imports, never large in proportion to consumption, declined rapidly after 1920 and for several years disappeared. They were 6,679,000 pounds in 1926. Between 80 and 90 per cent of these imports came from China (including Kwantung) and Japan, and were of a low grade useful for soap making but not suitable for refining. Exports have also declined but are still considerable.

The importance of cottonseed oil in production and trade is shown in the table on page 37.

VI. LINSEED OIL

Raw material. Linseed oil is derived from the seed of the flax plant (*Linum usitatissimum*). Flax

PROPERTIES AND USES

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PRODUCTION, CONSUMPTION, IMPORTS, AND EXPORTS OF COTTONSEED OIL, 1920-1923

(All figures are in thousands of pounds, and in terms of crude oil)*

Year	Production	Consumption	Imports	Exports
1920.....	1,142,671	946,847	9,458	205,282
1921.....	1,277,300	997,360	669	230,609
1922.....	934,628	850,978	20	83,670
1923.....	973,753	918,658	25	55,120
1924.....	1,154,434	1,106,275	..	48,159
1925.....	1,510,802	1,442,563	..	68,239
1926.....	1,760,530	1,721,764	6,679	45,445

* The figures for exports differ from those given in Appendix A, p. 264. The latter are expressed in terms of refined oil. In order to make them comparable with figures for production and imports (which are expressed in terms of crude oil) they must be increased by 11.1 per cent to cover refining loss.

is also grown for its fiber, the raw material of linen, but oil and linen can hardly be considered joint products. When grown for the fiber the flax must be pulled before the seeds are ripe. Such seeds may be pressed for oil if aged for several months, but the oil is inferior to that produced from ripe seeds. On the other hand, if the plants are allowed to remain in the ground until the seeds have ripened, the fiber is not suitable for linen. Hence in growing flax for seed there is a great waste of straw. Experiments show that such straw can be utilized for making a high-grade paper. Paper making from flax straw, however, has not yet been found practicable on a commercial scale because the manufacturing costs are high and, relative to its value, straw is bulky and transportation costs are also high. The Ford Motor Company is now manufacturing linen from flax straw

by a new process which, it is claimed, makes possible the utilization of both seed and fiber.

The principal countries in which flax is grown for seed are Argentina, India, Canada, Russia, and the United States. In the United States, production has been tried in nearly every state of the Union, but is at present confined to Minnesota, the Dakotas, Montana, and Wyoming. In these states it is an important crop and there is no reason for supposing that its cultivation will not again be taken up in other states if it can be made profitable.*

Composition, properties, and uses. Linseed oil is the most important of the drying oils. It contains about 65 per cent of the glycerides of linoleic and linolenic acids together with those of oleic and other fatty acids. It is the presence of the two first mentioned glycerides that gives to linseed oil its distinctive drying property. "Boiled" oil, that is, oil heated with certain "driers," as litharge, lead acetate, manganese peroxide, or manganese borate, dries more rapidly than the "raw" oil. If the "boiling" is continued for 10 or 12 hours at a high temperature, the oil becomes a thick, sticky, viscid mass, used as the basis of printers' ink.

If a small quantity of the oil is brought to a high heat with one of the above-mentioned metallic salts,

*One reason for abandoning this crop is the appearance of the disease "flax wilt" after a few years of cultivation. A resistant variety has recently been developed.

a dark-colored liquid "drier" or "japan" is formed, which when mixed with a greater quantity of the raw oil gives to the whole mass as good drying qualities as those of the kettle-boiled oil.

The most important uses of linseed oil are those based on its drying property, namely, the manufacture of paints, varnishes, printers' ink, and linoleum. The foots and some of the poorer grades find their way to the soap kettle. Cold-pressed oil is not unpleasant to the taste and may be used for food. Indeed, it is so used in Russia, Hungary, Germany, and India, but not in the United States.

The oil may be extracted from the seed by cold or hot pressing or by the use of a volatile solvent. Hot pressing is the method employed in the United States. The seed is crushed, conveyed to a heater, heated to a temperature of from 180 to 190 degrees, and subjected to preliminary pressing to form it into cakes. The cakes are then wrapped in cloths and subjected to hydraulic pressure of about 3,600 pounds to the square inch. The oil is filtered and allowed to settle. The mucilaginous, heavier portion, the so-called "foots," sinks to the bottom. The crude oil is then decanted from the tank. The foots may be pressed for more oil or sold to the soap manufacturers. An important by-product is the oil cake, a cattle food.

The crude oil is often refined by treatment with sulphuric acid, settling, and subsequent agitation

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with stearin. The refined oil is similar to the crude oil in its properties, but is less viscous and lighter in color.

Production, consumption, and trade. The domestic consumption of linseed oil in 1926 was 727,153,000 pounds, of which 720,110,000 pounds or 99 per cent was of domestic production and 9,610,000 or 1.3 per cent was imported. The domestic production and imports as just given are in excess of consumption as a small quantity of oil, 2,567,000 pounds or 0.3 per cent, was exported. Of the domestic production about 335,605,000 pounds or 46.6 per cent was produced from domestic seed in 1926, and 384,884,000 pounds from imported seed.

VII. OLIVE OIL

Raw material. Olive oil, as the name indicates, is derived from the fruit of the olive tree (*olea Europea*). The chief sources are the Mediterranean countries, especially Spain and Italy. In the United States it is produced only in California.

Composition, properties, and uses. It is a non-drying oil, consisting of about 72 per cent olein and linolein and 28 per cent of palmitin and stearin. It varies in color, depending on the quality, from pale yellow with a greenish tinge (due to traces of chlorophyl) to greenish or brownish yellow in the poorer qualities. The better grades are odorless and pleasant to the taste but the lower grades are strong smelling and unpalatable.

Olive oil is preëminently an edible oil, its use as food dating far back into antiquity. To be used for food it must be of good grade; the poorer grades are fit only for industrial uses. Connoisseurs recognize many grades. It is claimed that the excellence of the oil depends not only upon the process of manufacture but also upon the variety of the tree (and there are numerous varieties), the age of the tree, and the location, hill or lowland, upon which the tree is grown.

The tree is grown for the fruit as well as for the oil. The fruit, from which are prepared the familiar stuffed and pickled olives, is the primary product of the California growers, who market the olives to be consumed as such and send only the culls to the crushers. It is maintained that the varieties best for fruit are not the varieties best for oil, and hence that the domestic oil—especially since it is produced only from the culls—is inferior to high-grade European oils.

Aside from its use as a food, olive oil is used for an illuminant, a lubricant, for oiling wool after scouring, and for making "Turkey-red oil." ⁴ The "foots" resulting from the refining process and the poorer grades of oil are important materials for soap making.

Methods of production. Oil is contained in the kernels as well as the pulp of the olive, but the oil

⁴ In the manufacture of "Turkey-red" oil, olive oil is now largely superseded by castor oil.

derived from the pulp is of better quality. Hence to utilize the fruit most economically, the process of extraction is made to include several stages. It is first crushed in mortars or edge runners (care being taken not to break the kernels) and cold pressed at moderate pressure. The small quantity of "virgin oil" thus obtained is of the flavor and quality most highly appreciated by consumers. The residue is then stirred with hot water and subjected to harder pressure. The residue from the second process is then ground, crushing the kernels, stirred with hot water and pressed as hard as possible. Finally, from the press cake of the third process the remaining oil may be extracted with carbon disulphide, or it may be put into pits with water and allowed to ferment for some weeks, when the oil rises to the top and may be skimmed off.

From the above description it is clear that the olive oils sold on the market may differ greatly in quality. Certain regions attain a reputation for the excellence of their oils, and the oils come to be known by the names of the regions from which they are derived, as the Aragon, Tortosa, and Borgas oils of Spain and the Calabria, Betonta, and Riviera oils of Italy. To satisfy the most exacting taste oils from several regions are blended.

The poorer grades of oil may be refined, but it is claimed that no refined oil is quite equal to the virgin oil. The refining is accomplished by heating, to coagulate the albuminous matter, and by settling.

The mucilaginous mass settling to the bottom of the tank constitutes the "foots."

Production and trade. Production of olive oil in the United States is insignificant compared with consumption. In 1926 it amounted to only 1,383,000 pounds compared with a consumption of 132,882,000 pounds—about 1 per cent. Of the 132,882,000 pounds of oil consumed, about 61 per cent was edible and 39 per cent inedible. The total imports in 1926 were, edible, 80,777,000 pounds; inedible, 50,703,000 pounds. The chief sources of importation were, in order, Italy, Spain, France, Greece.

VIII. PALM OIL AND PALM KERNEL OIL

Raw material. These oils are both obtained from the fruit of a species of palm tree (*Eloeis guineensis*) growing in vast forests on the west coast of Africa.⁵ The fruit consists of a soft, fibrous pulp (*pericarp*) surrounding a nut (*endocarp*), within which is the kernel. Palm oil is obtained from the pericarp and palm kernel oil from the kernel within the endocarp. Though obtained from the fruit of the same tree,

⁵The cultivation of the palm tree for oil has recently been introduced in Sumatra. It is estimated that within the next ten years the production from this source will rival that from West Africa. The Sumatra product, owing to the scientific methods of cultivation and preparation employed, is far superior to and commands a higher price than the African Oil. See Redecker, Sydney B., and Messenger, Frank, "Palm Oil Industry of Sumatra and West Africa," U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, *Trade Information Bulletin* No. 471, p. 1.

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the two oils are different in composition and properties.

Properties and uses of palm oil. Palm oil is a mixture of palmitic acid, palmitin, and olein, and in consistency ranges from that of soft butter to that of tallow. When fresh it is red or orange yellow, but on standing, especially if exposed to sunlight, it becomes brownish yellow or drab. It may be bleached by heating and blowing in air, or by treating with potassium bichromate and hydrochloric acid. When fresh and comparatively free from fatty acid it has a pleasant odor, but it quickly becomes rancid, increases its fatty acid content, and becomes offensive. Three grades are recognized in the trade—soft, hard, and mixed. The free fatty acid content is much greater in the hard than in the soft oil.

The better grades are used by the natives of Africa as food and are palatable to some Europeans. The chief uses, however, are in the manufacture of soap and of candles. Palm oil is also used in the tin-plate industry to preserve the surface of the heated sheet iron until dipped in the molten tin, and in textile mills for the softening and finishing of cotton goods.

Methods of production. The oil varies greatly in quality, since the pulp from which it is obtained decomposes rapidly when overripe or when allowed to stand. Because of this the oil must be extracted in the region where the fruit is gathered and is, in fact, produced by crude native methods. Men climb the trees, cut the fruit, and let it fall to the ground.

Much of it is bruised. It is then carried on the heads of women to neighboring villages, pounded in mortars (to separate the pulp from the nut) and boiled. The oil rises and is skimmed off. During this crude process decomposition sets in, forming free fatty acids.

Production and imports. Neither palm oil nor its raw material is produced in the United States. Imports are considerable with a tendency to increase—(1922) 57,517,000 pounds; (1923) 128,495,000 pounds; (1924) 101,780,000 pounds; (1925) 139,179,000 pounds; (1926) 130,747,000 pounds.

Properties and uses of palm kernel oil. This oil closely resembles coconut oil in appearance, composition, and uses. It is white to pale yellow in color. When fresh it has an agreeable odor and taste and may be used in the manufacture of butter and lard substitutes. Its chief use, however, is in the manufacture of soap, especially in cold process soap making.

Methods of production. The nuts from which the oil is obtained are dried in the sun, and cracked by women or children with a stone hammer. The kernels are extracted, conveyed to the seaboard and shipped. Arrived at their destination the kernels are screened, passed over magnetic separators, and ground to a paste between rollers. The oil is extracted either by hydraulic pressure or by means of volatile solvents. The cake after pressing still contains 6 to 8 per cent of the oil. It may be used as

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cattle feed, but as the nitrogen content is low it is generally more profitable to treat it with volatile solvents in order to recover as much oil as possible.

Export duty on palm kernels. Palm kernels are produced in British possessions on the African coast. For some years the British Government maintained an export duty on palm kernels when shipped to any destination outside the British Empire. As palm kernel oil during this period was admitted free of duty in the United States, the export tax put domestic crushers at a disadvantage and they discontinued the manufacture of the oil. The export tax has since been repealed and domestic production has been resumed on a small scale.

Imports. Until recently imports of palm kernel oil were small, averaging about 2,000,000 pounds annually. In 1924 they increased to 4,739,000 pounds, in 1925 to 52,624,000 pounds, and in 1926 to 74,980,000 pounds.

IX. PEANUT OIL

Raw material. Until comparatively recent years the peanut was an unimportant crop in the United States. Several causes, however, have contributed to raise it to a highly dignified position in American agriculture. Among these may be mentioned an increasing demand for peanut products, especially the war demand for oils. In parts of the South also there was some small transfer of land into peanut

growing owing to the pressure brought upon Southern farmers by the boll weevil to find an alternative crop to cotton. In 1889 the total acreage devoted to peanuts was 143,000; in 1921 it was 1,214,000. Since 1921 there has been some falling off. In 1925 the acreage was 958,000 and in 1926, 852,000.

Peanuts are grown to be consumed directly as food, to be ground into peanut butter, or to be crushed for oil. The form in which the peanut crop will be utilized depends largely upon the comparative prices of the products mentioned. In the United States the situation is such that good grades of peanuts are seldom used for oil. The peanuts that go to the oil mills consist mainly of culls.

The peanut is also grown as a forage crop. About a million acres in addition to the acreage mentioned above are annually "hogged off," and some 300,000 acres are cut for hay.

Domestic production is important only in the Southern states. Several varieties are grown—the Spanish, Virginia bunch, and Virginia runner. The Spanish has the highest oil content. In Virginia and North Carolina, peanuts are grown primarily for roasting and for the confectionery trade; further south and west, especially in Georgia and Alabama, they are grown more for oil and for forage. A few mills have been built for crushing peanuts, but in the main they are crushed in mills erected primarily for crushing cottonseed. The additional expense of adapting the mills for peanut crushing is small.

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Domestic production both of peanuts and of peanut oil is affected by the relation between the price of peanuts, the price of peanut oil, and the price of cotton. For example, a low price of cotton stimulates the growing of peanuts and a high price of peanut oil stimulates the crushing of peanuts for oil.

Composition, properties, and uses. Peanut oil is composed of the glycerides of oleic, palmitic, arachidic, and hypogæic acids. Unrefined, it is of a light, greenish yellow color with a characteristic odor and taste; when refined, it is colorless as well as almost odorless and tasteless. In the United States the oil is usually extracted under heavy hydraulic pressure from peanuts of poor quality. The "crude" oil must be refined to be used as food but even when refined it has not so good a flavor for use as salad dressing as the "virgin" oil described below. It is, however, so used and is also used in the manufacture of nut margarin, in sardine packing, in the preparation of cosmetics, and for pharmaceutical purposes. As an industrial oil it is used in making soap, as a burning oil for miners' lamps, in oiling wool, in kid-glove and silk manufacture, and in the artificial leather industry. Its chief special use is found in the manufacture of "nut" margarin. Under a ruling of the Labeling Division of the Pure Food Bureau "nut" margarin must be made from "nut" oils exclusively, which permits the use of coconut and peanut oils.

Methods of production. The oil constitutes from 35 to 42 per cent of the shelled peanut and is obtained by crushing. If perfect peanuts are used and are subjected to moderate cold pressure, the "virgin oil" resulting is of high grade, fit for use as a salad oil without further treatment, and preferred by some even to olive oil. Much Spanish olive oil is in fact a blend of olive oil with peanut oil and in the United States local dealers often blend the two oils.

Peanut oil cake is an important by-product. It is used as livestock feed but cannot be used alone as it makes the fat of the animals too soft.

Production, imports, and exports. Data for recent years are shown in the following table:

PRODUCTION, IMPORTS, AND EXPORTS OF PEANUTS AND PEANUT OIL, 1920-1926

(In thousands of pounds)

Year	Production		Imports		Exports	
	Peanuts	Peanut Oil	Peanuts	Peanut Oil	Peanuts	Peanut Oil
1920..	841,474	86,545	119,513	95,076	9,366	1,425
1921..	829,307	67,434	40,164	3,070	14,493	1,708
1922..	633,114	46,116	11,166	2,386	12,621	963
1923..	636,462	5,359	52,302	8,009	4,806	203
1924..	748,925	6,691	55,539	5,076	3,127	39
1925..	698,475	15,156	71,088	2,540	3,489	...
1926..	626,866	10,644	38,754	5,930	4,232	...

From this table it is clear that the greater part of the peanuts produced and imported are used for other purposes than for making oil. For the seven years shown the total imports and domestic output

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combined amounted to 5,403,149,000 pounds. Assuming an average oil yield of 38 per cent a possible domestic output would have been about 2 billion pounds of oil. The actual production was 238,119,000 or about 11.9 per cent of the possible production. During the last four years of the table it was only 3.2 per cent. It is also to be noted that the imports both of oil and peanuts fell off decidedly after 1920.

Imports. Both peanuts and peanut oil are imported. Imports of peanuts in 1925 were 83,591,062 pounds—96 per cent coming from China; imports of peanut oil 3,026,950 pounds—93 per cent coming from China and France.⁶

X. SOYA BEAN OIL

Raw material. The soya bean (*soja hispida*) from which the oil is derived is grown in the United States, but not to any considerable extent for the oil. It is grown rather for forage and for introducing nitrogen into the soil. The quantity of oil produced in the United States is less than 2 per cent of domestic consumption. When the domestic "production" of soya bean oil is referred to, it generally means only the refining of crude oil imported from the Orient.

Properties and uses. The crude oil varies in color from yellow to dark brown and has a distinctly

⁶The figures are for "General Imports." Those in the preceding table are for "Imports for Consumption."

"beany" taste and odor. When refined and deodorized it is light yellow, nearly odorless and tasteless, closely resembling refined cottonseed oil.

It is primarily a soap oil, but it is also a semi-drying oil and hence is used in the manufacture of paints, varnishes, oil cloths, linoleums, and printers' inks. As a drying oil it is for most purposes inferior to linseed but may be mixed with linseed in proportions not to exceed 20 per cent with satisfactory results. For some uses it is used alone and is said to be superior to linseed. Finally, when refined, and, if necessary, hydrogenated, it is an edible oil and is used, but not extensively in the United States, in the manufacture of lard substitutes, oleomargarin, and as a salad oil.

The value of soya bean oil has been fully appreciated only within recent years. Discovery of its possibilities was due to a strong demand from soap manufacturers for additional raw material and from consumers of drying oils for some oil to supplement linseed. Soya bean oil was found to meet both these requirements. Refining and especially hydrogenation have expanded its usefulness. It is now among the most important of the vegetable oils.

Methods of production. The oil, constituting about 18 per cent of the bean, is obtained by crushing or by the use of a solvent, such as benzine. A higher percentage of the oil content of the bean is obtained by the use of a solvent—95 as against 50 to 75 per cent—but at a loss of the oil cake.

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Production, imports, and exports. Data for recent years are shown in the table below:

PRODUCTION, IMPORTS, AND EXPORTS OF SOYA BEAN OIL,
1914 AND 1919-1926

(In thousands of pounds)

Year	Production	Imports	Exports
1914.....	2,767	12,554	3
1919.....	....	195,808	27,715
1920.....	....	112,549	43,512
1921.....	....	16,711	1,944
1922.....	751	13,634	2,458
1923.....	1,404	33,222	1,356
1924.....	950	11,210	2,264
1925.....	2,520	15,905	520
1926.....	2,646	26,370	1,567

“Production” here means the extraction of crude oil from the beans. None is shown for the years 1919, 1920, 1921. In more recent years some beans have been harvested for oil in the Middle West and in North Carolina, and some mills have been erected for crushing, resulting in a small domestic production. The considerable exports shown, especially in the years 1919 and 1920, represent refined oil produced from imported crude oil.

The chief sources of imports of soya bean oil are China (especially Kwantung) and Japan. Both imports and exports have declined greatly since 1919. European countries import large quantities of the beans for crushing. This, however, is not the practice in the United States and there is no record of imports of soya beans.

CHAPTER III

PROPERTIES, USES, AND COMMERCIAL IMPORTANCE OF THE FATTY OILS (CONTINUED)

THE preceding chapter covered the principal vegetable oils. This chapter will deal with the principal animal oils and fats, namely, butter, butter substitutes, cod and cod liver oil, menhaden and other fish oils, lard, tallow, oleo stock, grease, and whale oil. A brief consideration will also be given to certain oils of minor importance which are of vegetable origin, and attention will be called to the similarity in chemical composition of all the fatty oils, whether animal or vegetable.

I. BUTTER

Composition, properties, and uses. Butter consists primarily of the butterfat derived from milk. In the form in which it enters into commerce it contains other ingredients, water, salt, and color.¹ Butterfat is made up of the glycerides of a considerable

¹"Federal regulations require that the butterfat content of butter shall be not less than 80 per cent by weight. In commercial practice this tends to be the maximum. In 100 pounds of butter about 80 per cent consists of fat, 16 per cent of water, and the balance of salt and color." U. S. Tariff Commission, *Preliminary Statement with Respect to the Cost of Production of Butter*, March 11, 1925, Section 1, p. 16.

number of fatty acids, of which oleic, palmitic, stearic, and butyric are the most important. Small quantities of the glycerides of capric, caproic, and other acids are also present, together with certain mineral salts and casein.

Its appearance and uses are too well known to call for description except to note that the familiar yellow color is generally more or less artificial. The natural yellow of the butter derived from the milk of cows turned out to pasture in May and June is taken as a standard. At other times, especially during the winter, the natural color is paler or almost white. The color is brought up to standard by the addition of coloring matter. Annatto is the coloring matter most used for this purpose, but carrot juice, saffron, turmeric, and certain harmless coal-tar products are also used.²

Methods of production. Butter is still produced in large quantities on the farm, to some extent by

²The yellow color is "natural" to butter derived from milk yielded by cows feeding upon green pasture. It is due to the yellow pigments, carotin and xanthophyll, found in fresh green pasturage, accompanying and hidden by the chlorophyll. During the flush of the milk-producing season the cows are in green pasture and the butter golden yellow. Towards fall as pastures dry the natural color becomes lighter and in winter is only faintly yellow. Hunziker, Otto T., *The Butter Industry*, 1920, p. 300.

Extracts from various plants may serve as butter colors. The bulk of the butter color of commerce to-day is coloring matter extracted from the seed of the annatto plant (*Bixa orellana*) by means of some neutral oil, as cottonseed or corn. Formerly aniline colors were extensively used. Their use is now prohibited by the Pure Food Act of 1907, except the following: Yellow, A. B. (Benzeneazo-B-naphthylamine) and Yellow O. B. (Ortho-Tolueneazo-B-naphthylamine) *Ibid.*, p. 301.

the primitive method—permitting the cream to rise from the milk in pans, skimming, hand churning, and subsequent salting and working. The pan, however, has now generally given way to the centrifugal separator and the subsequent processes (churning in large power-propelled churns, washing, salting, coloring, and working) are increasingly performed in separate establishments, the factory output now being more than double that of the farms.³ Factories for the production of butter are called creameries. The larger creameries drawing their cream from wide areas, sometimes from distances as great as 600 miles, are often called centralizers, leaving the word “creamery” to apply to the smaller establishments whose sources of supply are local. The smaller creameries are of two types: the independents which, like the centralizers, are either privately owned or else operate as partnerships or stock companies, purchase cream at the best market price and operate for profit; and the co-operatives which are owned and controlled by the farmers who furnish the cream. The co-operatives furnish about 20 per cent of the factory butter produced east of the Rockies. The centralizers differ from the creameries also in technic. The sour cream received from great distances must be neutralized and otherwise treated with great skill to obtain a wholesome and palatable product. Until recently most of the creameries also used sour cream but it was received in much better

³ See Appendix A, p. 276.

condition than that consumed by the centralizers. There is now a trend among the creameries, especially the co-operatives, toward the manufacture of sweet cream butter. Much of this co-operative sweet cream butter scores ⁴ 92 or better. Centralizer butter scores somewhat lower, about 89. It is a good butter of fairly uniform quality and by some, because of its slightly acid flavor, is preferred to the sweet cream butter of the co-operatives.

Domestic production. The total domestic production of butter in 1926 was estimated at 1,925,389,000—not far from two-fifths the entire output of the chief butter producing countries of the world. It is produced in all parts of the United States, but the chief center of the industry is in the Middle West. Expressed in millions of pounds the quantity of factory ⁵ butter produced in ten states in 1921 (namely, Minnesota, 154; Wisconsin, 126; Iowa, 107; Ohio, 79; California, 69; Nebraska, 67; Michigan, 55; Illinois, 49; Indiana, 48; Missouri, 42)⁶ accounted for more than three-fourths of the total output of factory butter in that year in the entire United States.

The chief centers of co-operative territory are (1) a large contiguous region made up of central, eastern, and southern Minnesota, western Wisconsin, and northeastern Iowa, (2) southwestern Michi-

⁴ See p. 59.

⁵ That is, creamery and centralizer, as distinguished from farm butter.

⁶ U. S. Tariff Commission, Preliminary Statement, Sec. I, p. 25.

gan. Independent creameries and some smaller centralizers tend to center (1) in contiguous territory in Nebraska and Kansas, (2) in contiguous territory in Ohio, northeastern and extreme southern Indiana, and (3) in eastern Michigan. The great centralizers are found chiefly in regions to the north, west, and south of the region of co-operative and independent creameries, that is, in regions where dairy herds are more scattered and the hauling of sweet cream to the factories by farmers is impracticable.

Butter production is carried on along with the production of several other important commodities. Cattle are bred for both beef and milk. Dual-purpose animals, especially in the centralizer regions, are raised for both of these products. The conduct of the business varies all the way from farms organized to produce milk as a principal product to farms on which milk is only an incidental by-product. The milk itself when produced may be consumed as a beverage or may be manufactured into butter, cheese, or evaporated milk. The manufacture of butter necessarily involves the production of skim milk, the most general use of which is as feed for hogs. So important is this use that in some countries, notably Denmark, butter and hogs may fairly be called joint products.

Foreign production. Expressed in millions of pounds and using the most recent figures available, the output in the principal butter producing countries of the world is as follows: Argentina, 73.6;

Australia, 267.1; Canada, 263.4; Denmark, 304.2; France, 421.7; Germany, 584.0; the Netherlands, 153.0; New Zealand, 174.0; Russia, 65.0; Switzerland, 28.7; United States, 1,925.4. The pre-war output of Russia was over 300 million pounds. It fell off greatly during the war but is now recovering. The ultimate possibility of enlarging the output is probably greater in Russia than in any other country. The immediate prospect is not great. New Zealand, Argentina, Australia, and Canada are also capable of greatly increased production.

Domestic trade. The marketing of butter is accomplished by several methods. The great centralizers often have their own distributing agencies in the large markets and themselves put much butter in cold storage. This is especially true of the big packers. Others ship to large receivers and yet others to chain-store organizations. The co-operative creameries in some places have arranged for a "pick-up" refrigerator car service and have thus concentrated local shipments into carload lots. Much high-grade co-operative butter goes to wholesalers, who often pay a premium for a continuous supply from certain creameries. One large co-operative creamery federation has contracts with chain-store organizations.

The trade has developed a considerable degree of standardization. Produce exchanges have been organized which set up rules of trading, provide methods of settling disputes, and establish methods of

grading. Grading requires trained and experienced graders because much reliance must be placed on the senses of taste and smell. Standard score cards are used on which flavor counts 45; body, 25; color, 15; salt, 10; and package, 5; yielding a theoretical perfection of 100. In addition to the inspection service rendered by the exchanges, the United States Department of Agriculture provides for butter inspection at the principal markets and has done much to standardize grades as between markets. The standard grade of creamery butter is "92 score." This is the norm from which prices of butter of other grades are reckoned. It closely corresponds with Danish butter and also the better grades imported from New Zealand.⁷

Butter quotations are determined in the produce exchanges. Members of the produce exchanges deal in butter both for present and future delivery. Some of the sales are privately made between members and some are made by open bids and posted. Quotations are made up by both government and private reporters who consider both posted and private sales. Competition in butter is so active that prices in the principal markets—New York, Chicago, Philadelphia, and Boston—are held closely together. In a general way an increase in price going east and west from Chicago is normal.

⁷The comparison is made because for several years of heavy importation Denmark was, and now New Zealand is, our principal foreign competitor, and because in the adjustment of duties similar grades should be compared.

Foreign trade. The United States both imports and exports butter. During the period 1921-1926 exports averaged about 8 million pounds a year. The chief countries of destination were Mexico and other Latin-American countries, although in 1924 exports amounting to about 25 per cent of the total were shipped to the United Kingdom. During the same period annual imports averaged about 14 million pounds. Imports are highly seasonal; 69 per cent are received during the five months November-March and only 31 per cent during the remaining seven months. It will be noted that both imports and exports are quite insignificant as compared with domestic production—imports about 0.8 of one per cent and exports about 0.4 of one per cent—and both appear to be declining.

The chief exporting countries are Denmark, New Zealand, Australia, the Netherlands, Argentina, Canada, Sweden, and Finland. Their annual exports amount altogether to nearly 600 million pounds. Russian exports were discontinued entirely during the war but have now been resumed on a small scale; and it is possible that they may increase greatly in the future.

During the period 1920-1924 Denmark was the chief source of imports into the United States, averaging about 48 per cent of the total. In more recent years imports from Denmark have sharply fallen off both absolutely and relatively. Canada and New Zealand are now the chief sources of butter imports.

II. BUTTER SUBSTITUTES

Composition, properties, and uses. In spite of its complex composition butter may be closely imitated in both flavor and appearance. Most of the glycerides of butterfat are found also in other oils and fats and hence, by making a proper selection among them, blending them in proper proportions and churning in milk in order to introduce the components not otherwise obtainable, a mixture may be formed having approximately the same chemical composition and properties as butterfat. If salt and coloring matter be then worked into the mixture, it is not easily distinguishable from butter. Even the vitamins characteristic of butter may be introduced. However, the mixture behaves somewhat differently in cooking, and to most palates is inferior to the better grades of butter, though preferable to much farm butter. It is a wholesome food and is used by many people of moderate means as a substitute for lard or butter in cooking and as a substitute for butter at the table.

Both animal and vegetable oils are used in the manufacture of butter substitutes, the most important being oleo oil and neutral lard among the animal oils, and coconut, cottonseed, and peanut among the vegetable oils. Other oils and fats used to a greater or less extent are corn and peanut oils and butterfat, oleo stearin, and oleo stock. In addition to the animal and vegetable oils, the mixture, com-

monly known as margarin, contains about $2\frac{1}{2}$ per cent salt, $13\frac{1}{2}$ per cent moisture, and $\frac{1}{2}$ per cent casein. Butter substitutes are classified as "oleomargarin" and "nut-margarin," though under the Oleomargarin Law of August 2, 1886, both products must be labeled "oleomargarine." The oils chiefly used in "nut-margarin" are coconut and peanut.⁸

Domestic production. For the manufacture of margarin the oils must be of high quality and must be rectified to be free of rancidity and acidity. The oils having been mixed in the proper proportions are churned in milk which has been pasteurized and "ripened" (to secure the desired flavor) by means of pure cultures of lactic-acid producing organisms. The result of the "churning" is an emulsion. This is allowed to "crystallize," after which the margarin is often allowed to "ripen" further, and is then salted, "worked," and packed.

The margarin industry is of considerable importance. The average domestic output for the seven-year period 1920-1926 inclusive was 253,645,000 pounds. Production fluctuates considerably: during

⁸Under the provisions of the Oleomargarin Law of August 2, 1886, enforced by the Bureau of Internal Revenue of the Treasury Department, oleomargarin prepared from nut oils is required to be labeled with the term "oleomargarine." Many of the products bear a secondary labeling, indicating that they owe their fat content exclusively to nut oils. The labeling of oleomargarin with any statement, design, or device indicating the fat content to be derived from nuts is considered as misbranding if cottonseed oil, soya bean oil, or other oil not derived from nuts is used in whole or in part. Peanut and coconut oils are permissible.

the same seven-year period it varied from 190,950,000 pounds in 1922 to 391,283,000 pounds in 1920.

Production of margarin varies with the price of butter. Margarin is used chiefly as a butter substitute. It serves in general the same uses as butter but is admittedly inferior in many of these uses to the better grades of butter. If it is to compete at all it must compete because of a lower price.

Since 1913, except for the seasons of 1919-20 and 1923-24, the output and price of margarin have risen and fallen with the price of butter. From this close positive correlation of the output and price of margarin with the output and price of butter several important inferences may be drawn. (1) As the price of butter rises people turn to the substitute because it is cheaper and when the price of butter falls they return to butter because it is better. (2) As the price of butter rises the producers of margarin not only can market a greater quantity but can also obtain a better price. And when the price of butter falls they must content themselves with a lower price on a smaller output. (3) The quickness and ease with which the supply of margarin on the market can be increased or diminished tend to moderate fluctuations in the price of butter.

It is important to remember the relationship between the price of butter and of margarin when studying the effectiveness of protective duties. As the domestic supply of margarin can be increased

almost *ad libitum* it is impossible by means of a duty to raise the price of butter above the point at which consumers prefer taking margarin at the lower price.

The consumption of margarin relatively to butter is less in the United States than in Europe. Margarin is to a great extent regarded by consumers merely as a somewhat inferior substitute for butter. In Europe the substitute is used in great quantities. In the United Kingdom margarin comprises 53 per cent of the combined butter-margarin consumption; in Germany, 52 per cent; in France, 41 per cent; in the Netherlands, 42 per cent; and in Denmark, although a great deal of butter is exported, 72 per cent of the domestic consumption is margarin. In the United States, however, the corresponding figure since 1921 has averaged only 10 per cent.⁹

National and state legislation handicap American margarin production. The smaller relative consumption in the United States is doubtless mainly due to the fact that consumers are better off than in Europe and therefore can better afford butter. But it is due in some measure to regulatory laws which are intended to restrict the margarin industry. So far as foreign competition is concerned, domestic producers have nothing to fear. Margarin is subject to a duty of 8 cents per pound and, in addition, foreign margarin bears an internal tax of

⁹U. S. Department of Commerce, *Trade in Philippine Copra and Coconut Oil*, 1925, p. 111.

15 cents per pound. The combined taxes are prohibitory of imports.

The chief domestic competitor of margarin is butter and to meet the competition margarin must be sold at a lower price than butter. The cost of producing margarin, however, and hence the price at which it can be sold are artificially raised both by national and by state legislation. If colored it must pay a Federal tax of 10 cents per pound and if uncolored $\frac{1}{4}$ of a cent per pound. In addition manufacturers are required to pay a Federal tax of \$600 per year and to be bonded for \$5,000. Wholesalers who deal in colored margarin are taxed \$480 per year and those who deal only in uncolored margarin \$200. The taxes on retailers are respectively \$48 and \$6 for the colored and uncolored varieties. To these Federal taxes are added in some cases state taxes and state restrictions. An example of the latter is the law requiring proprietors of restaurants, hotels, and other eating places who furnish margarin to their patrons to post a sign indicating that they serve oleomargarin. In some states more drastic legislation has been attempted. In Wisconsin, a law was passed in 1925 making it unlawful to manufacture or sell any butter substitute made by combining oleaginous substances with milk, thus preventing the introduction into margarin of ingredients essential to its becoming a satisfactory substitute for butter. This law was declared unconstitutional the following year.

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Custom or habit has determined a popular preference for yellow as the color of butter. In deference to this preference the manufacturers of butter maintain a standard color by the use of artificial coloring matter, and no exception is taken to their so doing. But margarin is subject to a heavy tax when sold artificially colored. It is true that dealers may sell coloring matter separately which may be worked in by the housewife. This, however, is an inconvenience and injures the appearance of the product.

Whether taxes and other restrictions are necessary to prevent the fraudulent sale of margarin as butter and whether they are otherwise for the public interest are questions beyond the scope of this study. Their bearing on the tariff discussion is this: they obviously place margarin at a disadvantage in competition with butter and hence in a sense are a protection against domestic competition and thereby tend to preserve whatever benefit the dairy industry may receive from the tariff. In spite of restrictive legislation, however, the margarin industry is one of no small importance. The output in recent years has averaged about 227,000,000 pounds of which about 5 per cent is colored. It cannot be doubted, therefore, that this industry sets a limit to the power of the tariff to raise the price of butter.

Imports and exports. Exports of margarin are considerable and appear to be increasing. Expressed in thousands of pounds they were: (1924), 901;

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(1925), 774; (1926), 1,578. No imports are recorded.

III. THE FISH OILS

Oils are derived from several varieties of fish. Among the most important of such oils are those derived from the cod, the menhaden, the herring, the sardine, and the salmon.

A. Cod and Cod Liver Oil

These oils are derived from the codfish. The better grades are medicinal and are known as cod liver oil, while the poorer grades, used in currying leather and for other purposes, are called cod oil, though both are obtained from the liver. These oils are composed of the glycerides of oleic, stearic, and palmitic acids.

These oils are produced in the United States as a by-product of the food fish industry. The domestic production, however, is small compared with imports. In 1926 it was 1,358,494 pounds—about 4 per cent of the imports of 32,602,680 pounds for the same year. In spite of the dependence of domestic demand upon foreign sources of supply exports are considerable. They were 457,420 pounds in 1922, which was equal to 71 per cent of domestic production.

B. Menhaden Oil

Raw material. The most important of the domestic fish oils is menhaden oil. This oil is extracted

from the menhaden or poggy, a fish found only in the waters off the Atlantic coast of the United States, and hence its manufacture is a purely domestic industry. The menhaden is not an edible fish, being very bony and quickly becoming rancid. Hence its use for the manufacture of oil is in no way uneconomic. No valuable food product is sacrificed for what might be considered a less important use.

Properties and uses. The oil as first rendered has a brownish color, a fishy odor, and dries on exposure to the air. As a drying oil it is a partial substitute for linseed, being especially adapted to use in making paints which are to be used on smoke stacks or other surfaces subjected to high temperature. It is also used in the manufacture of soap, for currying leather, for tempering steel, and in the oil cloth and linoleum industries.

Until recently, because of the strong taste and odor, it was thought to be unsuitable for food. It may now be so used, however, when refined. A process for eliminating the odor has been discovered by a Japanese chemist and this discovery together with that of hydrogenation, brings it into the class of oils at least potentially suitable for food. Indeed, because of the vitamins present in the oil, it is claimed that butter substitutes may be improved by using it in proper proportion.

The residual fish cake and meal resulting from the process of manufacturing the oil has a high protein

content and forms a valuable feed for hogs and poultry. It is also used as a fertilizer.

Methods of production. The industry is in the hands of a number of comparatively small corporations, each of which owns one or more fishing steamers. The oil is one of the few varieties that are not by-products of some other industry. The fish are brought by the steamers to the factories, cooked by steam and the oil and water extracted. The liquid then flows into vats where the oil is separated from the water by steaming and skimming.

Production and trade. The production of menhaden oil is a domestic industry of some consequence. Production reached its highest point in 1923, and has fluctuated considerably since that year.¹⁰ The output of oil in 1925 was not far short of 47,000,000 pounds and the output of fish cake and meal about a hundred thousand tons. As the oil is manufactured only in the United States, there are no imports. Only in one year, 1922, is there a record of exports—906,188 pounds.

C. Other Fish Oils

Raw material. Besides menhaden oil, other fish oils, notably sardine oil, herring oil, and salmon oil are manufactured in the United States. These oils are derived from edible fish. To use the whole fish for this purpose is regarded as wasteful and is re-

¹⁰ Output in pounds: 1919, 12,827,541; 1920, 27,573,401; 1921, 46,953,565; 1922, 53,270,078; 1923, 56,897,017; 1924, 29,429,000; 1925, 46,619,000; 1926, 30,517,000.

stricted by state laws.¹¹ The refuse of the fish, however, such as heads, tails, and entrails, may be thus used. Sardine oil is prepared from refuse of the canning industries of California and Maine; herring oil from herring offal in southeastern Alaska and Maine; salmon oil from salmon waste in Oregon, Washington, and Alaska.

Properties and uses. Sardine, herring, and salmon oils are closely similar in chemical composition to menhaden oil; they may be similarly deodorized and hydrogenated, and hence may be used for the same purposes.

Production and trade. The California output of sardine oil in 1921 was about 1¼ million pounds. In 1922 Maine and Alaska produced about 3⅓ million pounds of herring oil. The production of salmon oil in 1922 was about 195,000 pounds. The combined output of these oils in 1923 was 12,765,164 pounds. Imports are less than exports, 2,414,415 pounds against 3,791,704 pounds, though both are substantial in comparison with domestic production.

IV. LARD, TALLOW, OLEO STOCK, GREASE

These fats are produced in enormous quantities in the United States by the big packing houses, by small butchers, and on the farm. They are derived from the fatty tissues of animals and resemble one

¹¹ California, for example, in the case of sardine oil, permits up to 25 per cent of the catch to be used for oil.

another in their chemical composition, being made up of the glycerides of oleic, stearic, and palmitic acids, the last named being present in lard only in minute quantities. In their natural state these fats are contained in membranous tissue which putrifies after the animal has been killed, causing the fats to become rancid. Hence, the quicker they are "rendered" after the animal has been killed the better. The rendering, or separation from the tissue, may be accomplished by "trying out" in open kettles, by boiling in water with sulphuric acid, or by treating with direct steam under pressure. In the following paragraphs packing house methods are described.

Lard is derived from the fat of the hog and is of three kinds—prime steam, kettle rendered, and neutral.

The greater part of the lard output of the packing houses is prime steam lard. It is made from all edible fats of the hog not used for other purposes and is rendered in tanks in which the ingredients are subjected to the direct action of steam. After rendering, the lard is drawn off, refined or bleached with fuller's earth, run through filter presses and cooled on a "lard roll" which chills it before the stearin has time to crystallize, thus giving it a fine grain. Lard which is eventually to be pressed for lard oil and stearin is not run over a lard roll as the purpose of the lard roll is to prevent the separation of the oil and stearin.

Kettle rendered lard is derived chiefly from the

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pure leaf and back fat of the hog. Pork trimmings, caul and ruffle fat are also used. It differs from prime steam lard in that the rendering is effected in open steam-jacketed kettles equipped with agitators instead of through the direct action of steam under pressure. It has a distinct and separate flavor. After rendering, the lard is allowed to settle and is siphoned off through strainers into containers.

Neutral lard is made for use in oleomargarin. It is derived from the leaf and back fat and, in rendering, a water-jacketed instead of a steam-jacketed kettle is used and the rendering is accomplished at a much lower temperature than is applied in making kettle rendered lard. The kettle, as in kettle rendered lard, is equipped with paddles or agitators. Neutral lard is clear in color and sweet but without a lard taste or porky odor.

The principal use of lard is for culinary purposes. It is also used in the manufacture of oleomargarin, for ointments and salves, and in making lard oil and lard stearin. Inedible grades known in this country as "white grease" are used in the manufacture of soap and lard oil. Some is shipped to Europe, treated in such a way as to make it edible, and marketed as "Dutch lard."

Lard oil and lard stearin are derived from lard by pressure. As noted, lard is composed of olein and stearin. Under pressure the liquid olein is forced out, leaving the solid stearin on the press cloths. Lard oil is a pale yellow, limpid, nearly colorless

liquid, composed of almost pure olein. As it does not become rancid or gummy when used on machinery, it is a satisfactory lubricant. It is also used in leather dressing. The stearin is often used for stiffening lard of low titer.¹²

Lard production by the big packing houses in 1923 and 1924 reached over a billion pounds and the production by small butchers and on the farms was about the same, the total production for 1923 being estimated at 2,005,823,000 pounds, and in 1924, 2,002,869,000 pounds. Since 1924 there has been a considerable falling off. The total production in 1925 was 1,553,521,000 pounds and in 1926, 1,625,348 pounds. About half of this enormous output is exported—727,668,000 pounds in 1926. Imports of lard, even when there are any, are negligible; for example, 170 pounds in 1922.

Tallow and oleo stock are derived from the fatty portions of the steer and the sheep and are essentially the same in chemical composition—about two-thirds stearin and palmitin and one-third olein, but they differ in their modes of preparation and in their uses.

¹² "Titer" is the temperature at which a molten fatty acid or wax solidifies. "In some sections of the country considerable trouble is encountered in making lard of sufficient hardness to stand up under the climatic conditions. It is not permissible, under the regulations of the United States Bureau of Animal Industry, to add anything to lard except lard stearin, which may be used up to five per cent. This, of course, refers to inspected houses only. In certain sections of the country uninspected houses are now adding as high as fifty per cent of tallow and beef fats to lard, which they either market under a trade name, or sell as a compound." *The Packers' Encyclopedia*, p. 109.

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The better grades of tallow are edible and are used largely in the manufacture of lard substitutes. Small quantities are also used in the manufacture of oleomargarin. The inedible grades for the most part go to the soap kettle, but some is pressed, yielding tallow oil and tallow stearin. The oil is used for lubricating and in the preparation of illuminating oil and for other industrial purposes. The stearin is used by tanners for dressing leather and by candle makers.

Oleo stock is produced solely to be separated into oleo oil and oleo stearin—the former used primarily in the manufacture of oleomargarin and to a minor extent in the manufacture of lard substitutes; the latter used for the same purposes but with the primary and secondary use reversed.

Whether the fats from the killed animal shall be used for edible tallow or oleo stock depends mainly on the relative costs and prices of these products. Fats from certain parts, however, are more especially reserved for oleo stock and fats from other parts for tallow.

In making oleo stock the fats are first passed through a cutting machine. They are then chilled for 12 hours or more in cold water, hashed, and melted in water-jacketed melting kettles equipped with paddles, the process being similar to that employed in the production of neutral lard. When the melting is completed the agitators are stopped, the liquid fat treated with salt and allowed to settle.

The pure oil is then siphoned into a clarifying tank and given four or five hours further settling with salt to remove any remaining impurities which may have come over in the siphoning. The purified product is oleo stock.

To obtain oleo oil and oleo stearin the oleo stock is drawn off into hardwood trucks, known as "seeding trucks," and wheeled into the "seeding room" where it is held for from 72 to 96 hours, during which the oleo stearin crystallizes and settles to the bottom, allowing the oleo oil to remain in liquid form. The whole mass is then placed in press cloths and pressed, the oleo oil passing through and the oleo stearin remaining on the cloths.

Tallow is rendered from ox or sheep fat in tanks under the direct action of steam, the process being similar to that employed in the production of prime steam lard. All fats coming from the beef department which are not utilized for oleo stock are made into tallow, except a small quantity that goes into the production of brown grease. Theoretically, if all the fats could be thoroughly cleaned and utilized when fresh the production of only the highest grade tallows would result. This, however, is impracticable. Accordingly the tallows are graded, the grades being based on the condition of the raw product when it enters the tank and on government regulations which provide that certain products cannot be used for edible tallow. After rendering, the tallow is drawn off into vats, having passed through a sepa-

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rator or settling device which removes moisture and fibrous material. The grades, based on color, titer, free fatty acid, moisture and impurities, are (1) Edible, (2) Prime, (3) No. 2, and (4) Brown Grease.

The domestic output of tallow in 1926 was about 483,495,000 pounds. That of the other items mentioned was: oleo oil, 161,427,000 pounds; stearin, 102,485,000 pounds; tallow oil, 12,754,000 pounds. Exports were: tallow, 10,628,000 pounds; oleo oil, 96,902,000 pounds; oleo stearin, 10,758,000 pounds. Imports were: tallow, 13,647,000 pounds; stearin, 1,960,000 pounds. They consist of low grades suitable for soap making and are chiefly mutton tallow.

The greases like the inedible tallows are products of the tank house and, except some of the brown grease, are hog products. Like the tallows they are rendered from the fats by live steam, and are then drawn off, settled, and stored. The greases are graded by color, titer, and free acid content. The grades are: A white grease, B white grease, yellow grease, and brown grease. Other kinds recognized in the trade are bone, garbage, recovered, and tankage grease. Greases are used chiefly for lubricating purposes and in the manufacture of soap. Degras, a grease derived from wool, is used also in currying leather.

The combined output of greases in 1926 was 365,534,000 pounds: imports, 11,797,000 pounds; and exports 72,640,000 pounds.

V. WHALE OIL

Raw material. Whale oil is obtained from the blubber of the whale. The whale fisheries formerly constituted an important domestic industry, one of the principal centers being Nantucket Island off the coast of Massachusetts. At present the domestic industry has disappeared from the Atlantic coast, though it still survives and is of considerable importance on the Pacific coast.

Properties and uses. Whale oil is used in the manufacture of soap, in tanning leather, and as an illuminant. It may even be, though it seldom is, so treated as to become edible.

Production and imports. The annual domestic output is about 9,000,000 pounds. Large and increasing quantities, however, are imported. The business of supplying oil to Atlantic ports is in the hands of Norwegians. Their vessels fish in the southern seas in winter and their agents make sales in advance of the return of the whaling vessels later in the spring. This whale oil is of high grade and is sold to the highest bidder among a comparatively small number of buyers. It is especially desired because of the peculiar whiteness it gives to soap. There are no published price quotations for these sales. Imports, in thousands of pounds, from 1920 to 1926 were as follows:

1920	1921	1922	1923	1924	1925	1926
651	2,748	32,112	28,853	37,518	53,558	39,249

The great increase in the imports after 1921 should be noted.

In this connection mention may be made of sperm oil obtained from the sperm whale. This is not a true oil but a liquid wax. It is used as a lubricant for rapid running machinery, as an illuminant, a leather dressing, and for tempering steel. The annual consumption of about 2,500,000 pounds is obtained from both domestic and foreign fisheries in about equal amounts.

VI. OTHER OILS

The oils and fats so far considered by no means exhaust the list of those which, as glycerides of the fatty acids, compete in some of their uses with those enumerated, and hence are proper subject matter for the present study. Among them may be mentioned hempseed oil, perilla oil, poppyseed oil, rapeseed oil, and sesame oil. None of these oils is produced in appreciable quantities in the United States. They are all imported, however, partly to serve some specific use for which each is best adapted, and partly, when price conditions favor, to serve in uses where they come in competition with domestic oils. Hempseed and perilla oils are drying oils and though inferior to linseed oil may be used to some extent as substitutes. Poppyseed oil is also a drying oil, having properties that especially fit it for the manufacture of artists' colors. It is also used as a salad oil and with olive oil in the manu-

facture of castile soap. Rapeseed oil is used for quenching steel plates, as a lubricant, as an illuminant, and in the manufacture of soap. Sesame oil is a semi-drying oil, and possesses properties which make it peculiarly suitable also for extracting the odors from flowers in the manufacture of perfumery. It is possible to make it edible.

All these oils and others that might be mentioned have each their characteristic properties fitting them for specific uses and their more general properties permitting them to compete in many uses with other oils.

The Principal Glycerides of the Fatty Oils and Their Similarity

In the description of each of the fatty oils in this and the preceding chapter was included an enumeration of the glycerides of which it is composed. If the oils be compared with respect to their chemical composition it will be found that olein (the glyceride of oleic acid) was present in all but two, and that stearin, palmitin, and linolein were present in varying proportions in a large number. It is largely to this fact that the oils owe their partial interchangeability. Each of these glycerides has certain definite properties and hence mixtures of them, even though in somewhat different proportions, are likely to resemble one another. For example, the chief salad oils are composed almost wholly of the

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three glycerides: olein, palmitin, and linolein: corn oil, 98 per cent; cottonseed oil, 99 per cent; olive oil, over 99 per cent.

In addition to one or more of the four glycerides of chief importance most of the oils contain other glycerides, and it is the presence of these other glycerides, and sometimes of extraneous substances, together with the varying proportions in which the principal glycerides are mixed, that gives to an oil its distinctive character adapting it to some specific use. The glycerides of linoleic, linolenic, and isolinolenic acids, constituting 95 per cent of the constituents of linseed oil, give to it its drying property. Olein and linolein at ordinary temperatures are liquids, while stearin and palmitin are solids. Hence mixtures containing high percentages of the latter glycerides will be "fats," and mixtures containing high percentages of the former glycerides will be "oils." From the fact that for certain food purposes fats are more valuable than oils arises the importance of "hydrogenation," by which process olein may be converted into stearin.

It is significant of the close family relationship of the fatty oils that the four glycerides which enter into nearly all of them and constitute by far the greater portion of their bulk are all derived from the saturated or unsaturated fatty acids having 16 or 18 carbon atoms to the molecule.¹³ This is true

¹³ Palmitic acid, $C_{16}H_{32}O_2$; Hypogæic acid, $C_{18}H_{34}O_2$; Oleic acid, $C_{18}H_{34}O_2$; Linoleic acid, $C_{18}H_{32}O_2$; Linolenic and Isolinenic acids,

also of several of the other glycerides. Glycerides having a molecular structure based on a number of carbon atoms other than 16 or 18 are of comparatively rare occurrence.

$C_{18}H_{36}O_2$; Stearic acid, $C_{18}H_{36}O_2$. The glycerides next in importance are those derived from arachidic acid, $C_{20}H_{40}O_2$ (occurring in small quantities in 5 oils) and from myristic acid, $C_{14}H_{28}O_2$ (occurring in small quantities in 3 oils).

CHAPTER IV

THE POSITION OF THE DOMESTIC INDUSTRY IN COMPETITION

THE composition of the fatty oils, their partial interchangeability, and certain factors relating to their production, were discussed in Chapter I. Chapters II and III described their production more in detail, enumerated their uses, and gave the volume of trade of the United States in each of them. The present chapter will present in broad outline the competitive position of the United States with respect to the fatty oils as indicated by production, import and export data, and by data showing quantitatively the uses to which each of them is put, thus making it possible to understand the true nature and extent of the interchangeability referred to in Chapter I.

Tables to facilitate such a comprehensive view have been prepared, but on account of their length and complexity they are presented in an Appendix (pp. 257-285). They show the annual production of the oils and fats in recent years, both the total production and the production from domestic raw materials; and the imports, exports, and consumption of them.

These tables indicate where the domestic industry is strong in competition with foreign oil industries, where it might be aided by a protective tariff, and also the limitations to such aid. The conclusions to be drawn from the tables with respect to these questions will now be presented.

The total domestic output of the fatty oils surpasses the domestic consumption. Table I, Appendix A, p. 260, shows for 1914 a grand total of about 5.8 billion pounds as the domestic output. With the exception of 1920 and 1925 every year since 1914 shows an increase over the preceding year, the total in 1926 being almost 7.9 billion pounds, an increase of 35 per cent above the production of 1914. During the same period the annual consumption in the United States increased from a little less than 5.3 billion pounds to over 7.5 billion pounds, the differences representing an annual excess of exports over imports ranging from 359 million to over a billion pounds. It is noteworthy, however, that this excess has shown a marked tendency to decline since its maximum in 1921. In that year it was 1,095 million pounds, while in 1926 it had sunk to 357 million pounds.

Nor does even this export surplus tell the whole story. Large quantities of oil are consumed in the manufacture of lard substitutes, oleomargarin, soap, and paint and these derived products also show a substantial export surplus, the oil content of which may be roughly estimated at 70 million pounds.

Such a showing as this indicates a strong competitive position. It does not prove, however, that all duties on oils are ineffective or, from a protective standpoint, undesirable. Self-sufficiency is held by Protectionists to be a legitimate object of protection and a country can hardly be regarded as self-sustaining with respect to an industry unless the raw materials as well as the finished products are of domestic origin. Is the United States, in this sense, self-sustaining with respect to its oil supply?

Production of fatty oils in the United States from domestic raw materials is nearly equal to domestic consumption. This is shown by Table V, Appendix A, pp. 268-271. In 1920 production from domestic raw materials was about 5.3 billion pounds, with domestic consumption 5.3 billion pounds. The corresponding figures for 1926 were 7.4 billion pounds for production and 7.6 billion pounds for consumption. It thus appears that taken in the gross the United States is nearly self-sustaining in its supply of fatty oils.

But the fatty oils are far from completely interchangeable and before pronouncing on the self-sufficiency of the country or the effectiveness of protection it is necessary to examine production and consumption data more in detail.

The United States is more than self-sufficient in its supply of animal oils, but is far from self-sufficient in its supply of vegetable oils. Production of the animal oils, all of which are produced from

domestic raw materials, vastly exceeds consumption. The figures for 1920 are: production, 3,710 million pounds; consumption, 3,005 million pounds; excess, 705 million pounds. The corresponding figures for 1926 are: production, 4,746 million pounds; consumption, 3,944 million pounds; excess, 802 million pounds. What is true of this group of oils collectively is also true of most of them individually.¹ The United States would suffer no great inconvenience if cut off entirely from foreign supplies of the animal oils and fats.

This cannot be said of the vegetable oils. The excess of consumption over production from domestic raw materials is substantial when totals are compared and even more conspicuous in the case of individual oils. Indeed, cottonseed and corn oils are the only vegetable oils showing an excess of production from domestic raw materials over consumption. The situation here described is clearly shown in Table V, pp. 268-271, from which it appears that the excess of consumption over production from domestic raw materials was 708.4 million pounds in 1920 and 993.2 million pounds in 1926.

It would therefore appear that the vegetable oils might offer a field favorable to the application of protective duties whether levied with a view to na-

¹The exceptions are butter, fish oil, and whale oil. The excess of consumption of butter over production is so insignificant that it is no exaggeration to speak of the United States as self-sustaining in the production of butter.

tional self-sufficiency or as an aid to specific domestic industries.

The power of such duties, however, to benefit domestic producers of oils or their raw materials is much restricted by the possibility of substituting for the protected oil a domestic oil which maintains an export surplus and which for this reason cannot be appreciably affected by protective duties. To estimate the extent of this possibility of substitution it is necessary to classify the oils with respect to the uses to which they may be put.

The distribution of the fatty oils among their principal uses warrants their classification for tariff purposes as food oils, soap oils, and drying oils. This conclusion follows from a study of their actual distribution as shown in the tables on pages 87, 88, and 89 and in the chart on page 90.

About 93 per cent of the total consumption of the fatty oils in the United States is covered by the three major uses implied in this classification. Of this 93 per cent, food oils take 62 per cent, soap oils 18 per cent, and drying oils 13 per cent. However, the "miscellaneous" uses are of considerable importance in a tariff discussion though unfortunately data are not available to distribute the oils among such uses. They include lubrication, illumination, leather dressing, dyeing, and tin-plate manufacture and many others. Their importance in a tariff discussion lies in this: a duty on a foreign oil may be incapable of affecting the price of a domestic oil

DISTRIBUTION OF THE FATTY OILS AMONG THEIR PRINCIPAL USES *

I. Oils Used for Soap

Kind of Oil	In Millions of Pounds	As a Percentage of All Oils Used for Soap	Percentage of the Total U. S. Consumption of the Given Oil Which Is Applied to		
			Soap Making	Other Major Uses	Unclassified Uses
Inedible tallow.	401.9	33.7	100.0	...	...
Coconut	268.0	22.5	66.8	21.7	11.5
Greases	140.3	11.7	39.3	...	60.7
Palm and palm kernel	105.6	8.9	80.6	...	19.4
Vegetable oil foots	52.7	4.4	100.0	...	...
Fish	44.2	3.7	44.5	55.5	...
Whale	41.3	3.5	95.4	...	4.6
Inedible olive and foots ...	28.6	2.4	67.2	...	32.8
Cottonseed ...	10.8	.9	1.2	93.0	5.8
Peanut	6.9	.6	39.2	60.8	...
Corn	5.6	.5	5.2	91.2	3.6
Soya bean	3.3	.3	9.9	90.1	...
Castor	2.0	.2	5.2	...	94.8
Miscellaneous .	79.7	6.7	81.8	18.2	...
Total	1,190.9	100.0			

* The figures appearing in this table and the table on page 91, are for 1923, the most recent year for which data could be obtained. There is no reason for supposing that the distribution has materially changed since 1923. Sources: For margarin, lard substitutes, and soap, U. S. Tariff Commission, *Certain Vegetable Oils*, Part II, 1926, pp. 161, 163, 168. For drying oils, estimate based on *Census of Manufactures*, 1920, and the known consumption of linseed, Chinese nut, and soya bean oils in 1923. For salad oils, estimate based on known consumption of olive oil, and a large part of the consumption of cottonseed and corn oils after deducting the quantities known to have been used for other purposes. The total consumption differs from that given in Table IV, Appendix A. It includes vegetable oil foots (52,700,000 pounds) not included in that table. Also 2,200,000 pounds of butterfat and 97,500,000 pounds of miscellaneous oils and fats. On the other hand 81,100,000 pounds included in Table IV, as the aggregate consumption of hempseed, perilla, poppy seed, rapeseed and sesame oils are not here specifically mentioned, though probably included under the head "miscellaneous." The estimates for butter, margarin, lard, lard substitutes, and soap may be accepted with considerable confidence. The estimate for "uses calling for a drying oil" can be accepted only as a rough approximation. The estimate of "salad, mayonnaise, and packing" means only that it is known that practically all the edible olive oil, and large quantities of corn and cottonseed oil were used for these purposes. The estimates for "miscellaneous uses" mean only that it is known that the oil in question had other uses. The figures set down are merely the residue left after deducting from the total consumption of the given oil the sum of the quantities consumed in the several uses for which an estimate had previously been made. Hence, the figures for salad and for miscellaneous uses probably vary widely from the truth. With these qualifications, however, it is believed that the table and chart present a fairly accurate picture of the situation.

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II. Oils Used for Food

Kind of Oil	In Millions of Pounds	As a Percentage of All Oils Used for Food	Percentage of the Total U. S. Consumption of the Given Oil Which Is Applied to		
			Food Uses	Other Major Uses	Unclassified Uses
Butter	1,862.2	45.8	100.0	...	...
Lard	946.0	23.2	100.0	...	...
Cottonseed ...	859.4	21.1	92.8	1.4	5.8
Oleo oil and stearin	99.5	2.4	69.5	...	30.5
Corn	96.7	2.4	90.4	6.0	3.6
Coconut	86.9	2.1	21.7	66.8	11.5
Olive	74.1	1.8	100.0	...	...
Edible tallow ..	23.4	.6	100.0	...	...
Peanut	10.7	.3	60.8	...	...
Soya bean	7	...	2.1	97.9	...
Miscellaneous .	11.3	.3	51.8	48.2	...
Total	4,070.9	100.0			

III. Oils Used as Drying Oils

Kind of Oil	In Millions of Pounds	As a Percentage of All Drying Oils	Percentage of the Total U. S. Consumption of the Given Oil Which Is Applied to		
			Drying Oil Uses	Other Major Uses	Unclassified Uses
Linseed	693.3	79.4	100.0	...	...
Chinese nut ...	87.3	10.0	100.0	...	...
Fish	55.2	6.3	55.5	44.5	...
Soya bean	29.3	3.4	88.0	12.0	...
Corn .....	.9	.1	.8	95.6	3.6
Cottonseed ...	.2	..	..	94.2	5.8
Miscellaneous .	6.5	.8	8.6	91.4	...
Total	872.7	100.0			

POSITION OF DOMESTIC INDUSTRY 89

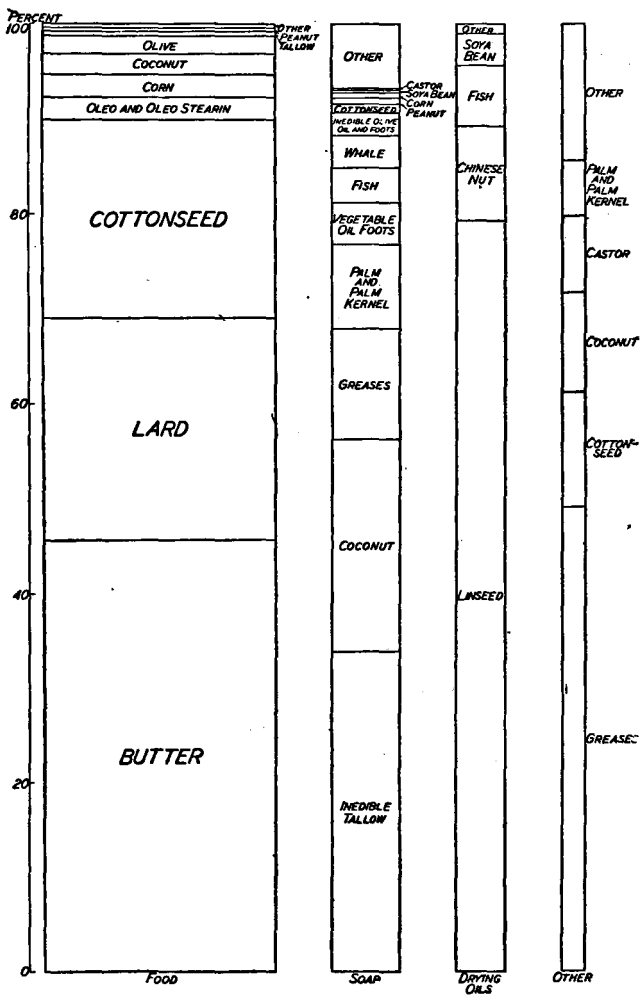
IV. Oils Used for Miscellaneous Purposes

Kind of Oil	In Millions of Pounds	As a Percentage of All Oils Serving Unclassified Uses	Percentage of the Total U. S. Consumption of the Given Oil Which Is Applied to	
			Unclassified Uses	Major Uses
Greases	216.9	49.0	60.7	39.3
Cottonseed ...	53.8	12.2	5.8	94.2
Coconut	46.3	10.5	11.5	88.5
Oleo oil and stearin	43.6	9.9	30.5	69.5
Castor	36.4	8.2	94.8	5.2
Palm and palm kernel	25.4	5.7	19.4	80.6
Inedible olive .	14.0	3.2	32.8	67.2
Corn	3.8	.9	3.6	96.4
Whale	2.0	.4	4.6	95.4
Total	442.2	100.0		

for one of its major uses because some other domestic oil which cannot be affected by the tariff may be substituted for it. But if it also serves some minor use for which no other domestic oil can be substituted, then a duty on the foreign oil may raise the price of the domestic oil, if an insufficient quantity is produced to meet the demand for it in its minor use.

Many of the oils appear under two or more of the heads. Cottonseed and soya bean oil, for example, are shown in each of the major classes. This fact, however, does not destroy the value of the classification. If the appropriation of an oil to a given use constitutes only an insignificant part of its total consumption, a duty can have little or no effect on

DISTRIBUTION OF OILS AMONG THEIR MAJOR USES *



* Vertical distances show percentages. Areas proportional to quantities used.

its price, provided that some other domestic oil which cannot be affected by the tariff can be substituted for it in its major use. For tariff purposes, therefore, though an oil may serve several uses, it may generally be classified as a soap oil, a food oil, or a drying oil, on the basis of its predominant use.

On this basis the following oils are unquestionably food oils: butter, lard, cottonseed oil, oleo oil, oleo stearin, corn oil, edible olive oil, and edible tallow. Together they constitute 97.3 per cent of all the oils and fats used as food, and food uses consume the following percentages of the total consumption of each: butter, 100; lard, 100; cottonseed oil, 92.8; oleo oil and oleo stearin, 69.5; corn oil, 90.4; edible olive oil, 100; edible tallow, 100.

A sub-classification of the food oils, still further delimiting the possibilities of substitution, may be

DISTRIBUTION OF THE FATTY OILS AMONG THEIR PRINCIPAL FOOD USES

I. Oils Used for Margarin

Oil	Million Pounds	As a Percentage of All Oils Used for Margarin	As a Percentage of Total Consumption of Given Oil
Coconut	65.7	36.2	16.4
Oleo oil	46.6	25.7	78.2
Lard	29.6	16.3	3.1
Cottonseed	18.4	10.4	2.0
Oleo stearin	7.1	3.9	8.5
Peanut	6.9	3.8	39.2
Butter	3.8	2.1	.2
Miscellaneous ..	2.9	1.6	13.3
Total	181.4	100.0	2.7*

* Percentage used for margarin of total consumption of all fatty oils.

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II. Oils Used for Lard Substitutes

Oil	Million Pounds	As a Percentage of All Oils Used for Lard Substitutes	As a Percentage of Total Consumption of Given Oil
Cottonseed	640.6	84.6	69.2
Oleo stearin	43.1	5.7	51.6
Tallow	23.4	3.0	5.5
Coconut	21.2	2.8	5.3
Lard	7.1	.9	.8
Corn	6.7	.9	6.3
Peanut	3.8	.5	21.6
Oleo oil	2.7	.4	4.5
Soya bean .....	.7	.1	2.1
Miscellaneous ..	8.4	1.1	38.5
Total	757.7	100.0	11.5*

* Percentage used for lard substitutes of the total consumption of all fatty oils.

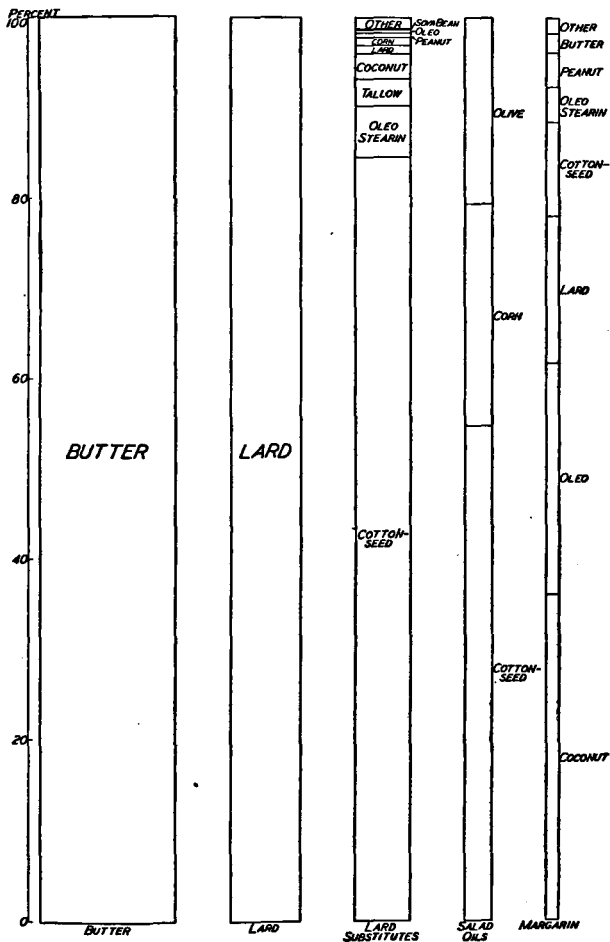
III. Oils Applied to Salad, Mayonnaise, and Packing Uses

Oil	Million Pounds	Percentage of All Oils Devoted to Salad Uses	Percentage of Total Consumption of Given Oil
Cottonseed	200.0	54.9	21.6
Corn	90.0	24.7	84.1
Olive	74.1	20.4	100.0
Total	364.1	100.0	5.5*

* Percentage applied to salad, mayonnaise, and packing uses of the total consumption of all fatty oils.

made among the principal food uses. Butter accounts for 45.8 per cent of the entire food-oil consumption, and lard for 23.2 per cent. The remaining 31 per cent is distributed among margarin, lard substitutes and salad-oil uses as shown in the tables on pages 91 and 92, and in the chart on page 93.

DISTRIBUTION OF OILS AMONG THEIR PRINCIPAL FOOD USES *



* Vertical distances show percentages. Areas proportional to quantities used.

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Cottonseed oil is by far the most important oil used in the manufacture of lard substitutes. It is also the most important salad oil, and appears, though in a minor rôle, as a margarin oil. The most important margarin oils are coconut and oleo oils. Peanut oil is used in the manufacture of both margarin and lard substitutes. Corn oil is preëminently a salad oil, but is used also in the manufacture of lard substitutes. Edible olive oil is used almost exclusively as a salad oil.

Returning to the major classes, the following oils may be set down as unquestionably soap oils: inedible tallow, the greases, palm oil, palm kernel oil, inedible olive oil, whale oil, and vegetable oil "foots" (chiefly of olive and cottonseed oils). Together they constitute 64.6 per cent of all the oils and fats used in soap making, and this use consumes the following percentages of the total consumption of each: inedible tallow, 100; the greases, 39.3; palm and palm kernel oils, 80.6; whale oil, 95.4; inedible olive oil and "foots," 67.2; other vegetable oil "foots," 100.

The following oils are unquestionably drying oils: linseed oil, Chinese nut oil. Together they constitute 89.4 per cent of all the oils used as drying oils and this use consumes the total domestic consumption of each of these oils.

A large percentage of each of the following oils is appropriated to uses other than food, soap making, and uses calling for a drying oil: castor oil, 94.8;

the greases, 60.7; palm oil, 19.4; coconut oil, 11.5; cottonseed oil, 5.8; whale oil, 4.6.²

Of the total consumption of oils and fats in the United States, butter accounts for 28.2 per cent; lard, 13.8 per cent; lard substitutes, 11.5 per cent; salad oil uses, 5.5 per cent; margarin, 2.7 per cent, making in all 61.8 per cent appropriated to food uses. Soap making stands next in importance with 18.1 per cent, then drying oil uses with 13.3 per cent, and finally miscellaneous uses with 6.8 per cent.

The oils and fats showing two or more uses can generally be relegated to one class as representing the predominant use. Such oils may be considered individually. Cottonseed, peanut, corn, and olive oils when of good quality are food oils. Inferior grades, however, are used for soap making, and corn oil is used also to a limited extent, as a drying oil. Omitting from present consideration the miscellaneous uses, only 1.2 per cent of the cottonseed oil and 2 per cent of the corn oil are used for other purposes than food. As to olive oil, the edible and inedible varieties are virtually different oils and are differently classed in the tariff. Hardly less marked is the distinction between edible and inedible peanut oil. When pressed from perfect peanuts, peanut oil is an edible oil hardly second to olive oil; when

²The table on p. 89 also shows large percentages of oleo oil, oleo stearin, inedible olive oil, and corn oil so consumed. It is probable that these figures are due largely to incompleteness in the available data and that for these oils the percentages in one or more of the major uses should be greater than those shown in the table.

pressed from culls, as is the case with the greater part of the domestic product, it is distinctly a soap oil. At present 60.8 per cent of domestic consumption, chiefly imported, is used as a food oil, and 39.2 per cent chiefly of domestic production, as a soap oil.

This leaves for classification coconut oil, soya bean oil, fish oil, and castor oil. Coconut oil is both a soap oil and a food oil. Its predominant use is in soap making (66.8 per cent of total consumption) but its use as a food oil is so important (21.7 per cent) and it is so indispensable to the manufacture of nut-margarin that to classify it simply as a soap oil would be inaccurate. A similar statement may be made with respect to fish oil, especially menhaden oil. It must be classed as both a soap oil and a drying oil, 44.5 per cent of the total consumption being used in soap making, and 55.5 per cent as a drying oil. Castor oil is sparingly used in soap making (5.2 per cent of total consumption) but its predominant uses are outside the three-fold classification. These are its uses as a lubricant and its uses in dyeing and in medicine.

The proper classification of soya bean oil calls for careful attention. It was made dutiable on the theory that it was a food oil competing dangerously with domestic food oils and fats—with butter in its use in making margarin and with cottonseed and peanut oils in its use in making margarin, lard substitutes, and salad oils. The apprehension of the domestic producers may be easily explained. It was

known that soya bean oil was being applied to the above-mentioned uses and during the five years preceding the Emergency tariff imports of soya bean oil had been very large, exceeding in fact by a wide margin those of any other oil or fat.

But however explicable the apprehensions of the domestic producers of food oils and fats there is good reason for believing that they were unwarranted. In the United States soya bean oil has never been regarded as a satisfactory food oil. All but a small portion of the imports were consumed in industrial uses. Of the 265 million pounds imported in 1917, 124 million pounds, or 47 per cent, were consumed in soap making and only 40 million pounds, or 15 per cent, in food uses—34 million pounds in lard substitutes, and 6 million pounds in margarin. The remaining 38 per cent went to industrial uses, of which the most important were uses calling for a drying oil and its use as a core oil. Looked at from another point of view its unimportance as a food oil is even more impressive. It constituted only 2.8 per cent of all the fatty oils used in the manufacture of lard substitutes, and 2.6 per cent of those used in the manufacture of margarin. Finally, even before it was made dutiable its use as a food oil was decreasing. From 56 million pounds consumed in the manufacture of lard substitutes in 1918 and 6 million pounds in the manufacture of margarin in the same year, its food uses had declined by 1920 to less than 18 million pounds for lard substitutes

and none at all for margarin. No data are available with respect to its use as a salad oil, but it is believed to have been negligible. A report of the Tariff Commission contains this comment: "Soya bean oil is not generally favored as a salad oil because of the difficulty in bleaching and permanently removing its characteristic taste."³

The reasons for the decline in its appropriation to food uses is found in certain properties which it possesses. (1) Its poor bleaching quality operates against its use in the production of lard substitutes and salad oil, the principal uses of cottonseed oil. (2) Being a semi-drying oil it has a tendency to absorb oxygen, giving it an odor and flavor resembling linseed oil. It is true that these offensive characteristics may be removed by careful refining but only at considerable expense. Hence it can be applied to food uses in competition with cottonseed oil only if it can be obtained at a considerably lower price. Moreover, it is said that even when its characteristic odor and flavor have been removed they are liable to return. (3) It has a low "titer"—22° F. This means that the fatty acids, the glycerides of which compose the oil, remain liquid until the temperature has fallen to 22°. Products of the oil are soft and "squashy." Artificial hardening is neces-

³ U. S. Tariff Commission, *Certain Vegetable Oils*, Part 2, p. 165. The writer, however, has been informed by one of the experts of the Tariff Commission, who had traveled for the Commission in Manchuria, that the Chinese make a "delicious" salad dressing from soya bean oil.

sary either by hydrogenation or by the addition of some harder fat. But when used with an oil or fat of higher titer it manifests a tendency to separate so as to form a white compound with brown flecks or spots. (4) It has poor spreading properties, a characteristic unfavorable to its use in margarin.

In the main the exact reverse of these characteristics are present in cottonseed oil. It is of good bleaching quality, possesses a bland flavor and a high titer (34°), and readily lends itself to compounds without tendency to separate.

The evidence thus points to the conclusion that even when admitted free of duty soya bean oil, at least in the United States,⁴ is hardly to be classed as an important food oil. The abundant supply of cottonseed oil leads manufacturers of food products to prefer using this oil to incurring the hazard of putting out an inferior product in which soya bean oil is an ingredient.

Since the duty has been imposed its price has shut it out from even the minor part which it formerly played in food uses. It has almost shut it out from its use as a soap oil also. It is still used as a core oil and in some other industrial uses, but its major use at present is as a drying oil.

The United States is in a strong competitive position with respect to the food and soap oils. Butter, constituting about 45.8 per cent of all the fatty oils

⁴Soya bean oil is much more popular as a food oil in Europe than in the United States.

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consumed in food uses, stands somewhat in a class by itself. Its position in the foreign trade of the United States will be considered in Chapter VI. Of the remaining 54.2 per cent of the domestic oils which have been used to an appreciable extent for food, lard, cottonseed oil, oleo oil, oleo stearin, corn oil, Philippine coconut oil, and edible tallow account for 51.8 per cent. All of these oils except Philippine coconut oil show an export surplus, and, judging by the experience of recent years, the output of Philippine coconut oil can be rapidly increased without any appreciable increase in price. The remaining 2.8 per cent is made up of soya bean oil, peanut oil, and olive oil. For these oils the United States is largely dependent on foreign sources to meet its needs. The domestic production of soya bean and olive oils is insignificant and the greater part of the domestic production of peanut oil serves other uses than food. Moreover, the evidence so far points to the futility of the tariff to strengthen our competitive position with respect to these oils. They have shown little or no tendency to increase in output in recent years even under greatly increased duties. This weakness in our competitive position, however, does not appreciably affect the strength of our position with respect to food oils in general. As has been shown, soya bean oil was never popular in the United States as a food oil and even before it was made dutiable its food use was decreasing. Its exclusion from food uses is of small consequence. While cot-

tongseed or coconut oil may be substituted for peanut and olive oil in most of their food uses, such substitution involves inconvenience if not hardship to consumers. To the extent that substitution is practicable the effect of the tariff is to diminish imports. When substitution is not practicable the effect of the tariff is to raise the price of these oils.

With respect to the soap oils the situation is similar, though the competitive position of the United States is not so strong as in the case of the food oils. Of the oils which are used to a greater or less extent in soap making, inedible tallow, the greases, and cottonseed and corn oils show an export surplus; the Philippine coconut oil, which may be classed as a soap oil as well as a food oil, is apparently capable of almost indefinite increase with little or no increase in price. These oils together with cottonseed oil "foots" constitute about 74 per cent of all the fatty oils used in soap. To this may be added about 4 per cent to account for fish oil and peanut oil of domestic production. For the remaining 22 per cent the United States is dependent on foreign sources of supply. The exclusion of all foreign soap oils would leave a deficit too great to be replaced by domestic soap oils of which we have an export surplus. If all foreign soap oils were excluded the tariff would undoubtedly become effective in raising the price and stimulating the production of domestic oils. Two important foreign soap oils, palm and palm kernel, are still admitted

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free of duty. So long as these oils remain on the free list the possibility of replacing any other foreign soap oils, which may be excluded, by these oils or by domestic oils showing an export surplus greatly limits the effectiveness of the tariff on the price or output of any domestic soap oils. Soya bean oil is an example in point. As noted, previous to 1921 it was predominantly a soap oil. More of it was imported for this purpose than of any other foreign oil. The effect of a duty was simply to induce soap makers to import more palm, palm kernel, and Philippine coconut oil and to use more tallow and grease. This possibility of substitution practically nullified any effect of the tariff on either the output or price of cottonseed or peanut oil in their use as soap oils.

The United States is dependent on foreign sources for a large portion of its supply of drying oils. Linseed oil and Chinese nut oil together account for nearly 90 per cent of all oils consumed in these uses. Dependence is complete in the case of Chinese nut oil and partial in the case of linseed oil. No domestic oil showing an export surplus can be substituted for these oils. Hence the tariff may be effective in raising the price or stimulating the production both of the oils and of their raw materials. The effects which have in fact resulted from an increase in the duties on certain drying oils will be discussed in later chapters. It may be stated here that the duties have been effective.

Each of the chief groups includes uses that can be best served only by an oil possessing certain special qualities. It is important to note, however, that it is the *best service* which requires the special qualities. The use may be served in a way by any of several varieties of oil, but the service will not be so good when the variety adopted lacks the peculiar quality preferred in that use.

It is scarcely necessary to analyze the groups so as to show what qualities are best adapted to each of the almost innumerable uses. A few examples will suffice to show that distinctive varieties of oil are needed for particular uses.

The varied tastes of domestic consumers are served by many oils. Butter, lard, cottonseed oil, and other oils of domestic origin now furnish 97 per cent of all the oil required to meet these varied tastes. Without doubt the remaining 3 per cent could be served, though in a less satisfactory manner, by the same domestic varieties; and if they were, there would be less lard, cottonseed, corn, and other domestic oils left for export. The only foreign oils of importance which would be excluded by such substitution are butter, olive oil, and peanut oil. But the domestic varieties lack the flavor, consistency, or some such quality, that would enable them to render in salad dressing, sardine packing, margarin, or lard substitutes service as good as is rendered by the peanut oil or olive oil excluded. Domestic butter may be as "good" as the Danish butter.

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and cottonseed oil as "good" as olive oil but they have not the same flavor. Therefore many Americans who can afford to gratify their tastes prefer to buy Danish butter, olive oil, and other foreign oils, and the exercise of this preference leaves considerable quantities of lard and cottonseed oil for export.

Again, some years ago soya bean oil and Cochin oil were excluded from use as soap oils by means of duties. Their place was taken by a further use of domestic oils and of foreign oils still admitted free of duty. Substitution was possible but it involved no little inconvenience and cost to industrial consumers of the excluded oils. Moreover, soya bean oil may be mixed in moderate quantities with linseed, and the mixture will serve as a drying oil virtually as well as linseed alone. However, it is no better, and the mixture will not be made unless the soya bean oil can be obtained at a lower price. In this case the substitution of soya bean oil for a part of the linseed oil means a saving in expense. Finally, lubrication of a sort is possible with many oils. But where friction is so intense as to develop an extreme degree of heat, lubricating is best done with an oil that possesses special qualities. In this use castor oil leads all others, and for that reason much of it is imported even though there are available great quantities of lubricating oils of domestic production.

These illustrations make it clear that close as is the similarity of the fatty oils they cannot be freely interchanged without some loss of satisfaction, some

inconvenience, or some burden in the form of a higher price.

This chapter has shown that, looked at in the large, the United States produces a sufficient quantity of the animal and vegetable oils to supply all its needs, but that since the oils are only partially interchangeable its needs will be best served by exporting a portion of its supply and importing other oils whose qualities are such as to adapt them to uses which the exported oils serve less satisfactorily or not at all.

It has further been shown that for tariff purposes the fatty oils may be classified as food oils, soap oils, drying oils, and oils serving miscellaneous industrial purposes, and, that with respect to the food oils the domestic supply is so superabundant and the possibility of substitution so great as to limit the effect of a duty upon any one of these oils to rather narrow bounds.

With respect to the soap oils and the drying oils, however, it has been shown that the country still relies upon foreign sources for a considerable portion of its supply, and that the export surplus which exists for some of these oils is not sufficient to replace all of the foreign oils if the latter were excluded. The possibilities of an effective tariff with respect to these oils are therefore greater than with respect to the food oils.

While, therefore, the partial interchangeability of

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the fatty oils limits the power of the tariff, it by no means precludes the possibility of its having an effect in specific cases. Each case must be studied on its own merits. In the next three chapters, therefore, an attempt will be made to find out what has in fact been the effect of recent tariff changes on the price, output, and imports of each of the fatty oils.

CHAPTER V

OILS DUTIES IN RECENT ACTS: THEIR OBJECTS AND EFFECTS

IN preceding chapters it has been shown that because of the partial interchangeability of the fatty oils the power of the tariff either as a benefit or a burden is limited. The oils were classified as food oils, soap oils, and drying oils, and it was shown that the effects of tariff changes were likely to be greatest for the drying oils and least for the food oils.

However, since the interchangeability is only partial, the evidence so far advanced by no means proves that recent changes in the tariff have had no effect even in the case of the food oils. In this and the two following chapters it is proposed to examine in some detail price, production, and trade data with a view to ascertaining just what have been the effects of such tariff changes and whether the objects sought in making the changes have in fact been attained as shown by the actual results.

To this end it is necessary to know what the duties were before the changes were made, what the changes were, and what were the objects sought in making them.

RATES OF DUTY ON PRINCIPAL FATTY OILS, UNDER TARIFF ACTS FROM 1909 TO 1922 INCLUSIVE

Oil or Fat	1922. Rate of Duty		1921. Rate of Duty		1913. Rate of Duty		1909. Rate of Duty	
	As Provided in Act	In Cents per Lb.	As Provided in Act	In Cents per Lb.	As Provided in Act	In Cents per Lb.	As Provided in Act	In Cents per Lb.
Butter	8¢ lb. ^a	8 ^a	6¢ lb.	6	2½¢ lb.	2½	6¢ lb.	6
Butter substitutes	8¢ lb.	8	6¢ lb.	6	2½¢ lb.	2½	6¢ lb.	6
Castor	8¢ lb.	8	—	—	12¢ gal.	1½	35¢ gal.	4½
Chinese nut	Free	0	—	—	Free	0	Free	0
Coconut, crude	2¢ lb.	2	20¢ gal.	2½	Free	0	Free	0
Coconut, refined	2¢ lb.	2	20¢ gal.	2½	3½¢ lb.	3½	3½¢ lb.	3½
Corn, n.s.p.f.	20%	—	—	—	15%	—	25%	—
Cottonseed	3¢ lb.	3	20¢ gal.	2½	Free	0	Free	0
Fish, n.s.p.f.	20%	—	—	—	8¢ gal.	¾	8¢ gal.	1½
Grease	20%	—	—	—	Free	0	Free	0
Hempseed	1½¢ lb.	1½	—	—	8¢ gal.	¾	10¢ gal.	1½
Lard	1¢ lb.	1	—	—	Free	0	1½¢ lb.	1½
Lard substitutes	4¢ lb.	4	—	—	Free	0	Not provided for	—
Linseed	3.3¢ lb.	3.3	—	—	10¢ gal.	1½	15¢ gal.	2
Menhaden	5¢ gal.	¾	—	—	8¢ gal.	¾	8¢ gal.	1½
Oleo oil	1¢ lb.	1	—	—	15%	—	25%	—
Oleo stearin	1¢ lb.	1	—	—	Free	0	Free	0
Olive, inedible ^b foots	Free	0	—	—	Free	0	Free	0
Olive, in small containers ^c	7½¢ lb.	7½	50¢ gal.	6½	30¢ gal.	4	50¢ gal.	6½
Olive, in bulk ^c	6½¢ lb.	6½	40¢ gal.	5½	20¢ gal.	2½	40¢ gal.	5½
Palm	Free	0	—	—	Free	0	Free	0
Palm kernel	Free	0	—	—	Free	0	Free	0
Peanut	4¢ lb.	4	26¢ gal.	3½	Free	0	Free	0
Perilla	Free	0	—	—	6¢ gal.	¾	Free	0
Poppy seed	Free	0	—	—	Free	0	25%	—
Rapeseed	2¢ lb.	2	—	—	6¢ gal.	¾	15¢ gal.	2
Seal	6¢ gal.	¾	—	—	6¢ gal.	¾	10¢ gal.	1½
Sesame	6¢ gal.	¾	—	—	8¢ gal.	¾	8¢ gal.	1½
Sod, herring	Free	0	—	—	1¢ lb.	1	Free	0
Sod, herring	5¢ gal.	¾	—	—	8¢ gal.	¾	8¢ gal.	1½
Soya bean	2½¢ lb.	2½	20¢ gal.	2½	Free	0	Free	0
Tallow	½¢ lb.	½	—	—	Free	0	½¢ lb.	½
Whale sperm	10¢ gal.	1½	—	—	8¢ gal.	1½	8¢ gal.	1½
Whale, other	6¢ gal.	¾	—	—	5¢ gal.	¾	8¢ gal.	1½

^a Increased to 12 cents per pound by Presidential proclamation March 6, 1926, under the flexible provision.

^b "Rendered unfit for use as food or for any but mechanical or manufacturing purposes."

^c Act of 1909. "In bottles, jars, kegs, tins, or other packages, containing less than 5 gallons each." Acts of 1913 and

RATES OF DUTY ON SPECIFIED RAW MATERIALS OF VEGETABLE OILS IN THE ACTS OF 1909 TO 1922
INCLUSIVE

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Raw Materials	1922 Duty	1921 Duty	1913 Duty	1909 Duty
Castor beans	½¢ lb.	15¢ bu. of 50 lbs.	25¢ bu. of 50 lbs.
Copra	Free	.....	Free	Free
Cottonseed	¼¢ lb.	.....	Free	Free
Flaxseed	40¢ bu. of 56 lbs.	30¢ bu. of 56 lbs.	20¢ bu. of 56 lbs.	25¢ bu. of 56 lbs.
Hempseed	Free	.....	Free	Free
Palm nuts	Free	.....	Free	Free
Palm nut kernels	Free	.....	Free	Free
Peanuts, shelled	4¢ lb.	3¢ lb.	¾¢ lb.	1¢ lb.
Peanuts, unshelled	3¢ lb.	3¢ lb.	¾¢ lb.	½¢ lb.
Perilla seeds	Free	.....	20¢ bu. of 56 lbs.*	25¢ bu. of 56 lbs.*
Rapeseed	Free	.....	Free	Free
Sesame seeds	Free	.....	20¢ bu. of 56 lbs.*	25¢ bu. of 56 lbs.*
Soya beans	½¢ lb.	Free	45¢ bu. of 50 lbs.
Tung nuts	Free	1¢ lb.*	1¢ lb.*

* Not specially provided for.

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I. PRINCIPLES IN RECENT TARIFF ACTS WITH RESPECT TO THE OILS DUTIES

The duties on the fatty oils and on their raw materials in recent acts are shown in the tables on pages 108 and 109.

A study of the duties in the Acts of 1909 and 1913 indicates a general principle to admit free of duty oils that were raw materials of important domestic industries and to impose duties on those that were suitable for direct consumption or which were of minor importance. On this principle Chinese nut oil, crude coconut oil, cottonseed oil, the greases, oleo stearin, inedible olive oil, palm oil, palm kernel oil, and soya bean oil were admitted free; while butter, butter substitutes, and edible olive oil, together with a number of oils of relatively minor importance, such as hempseed, poppyseed, and rapeseed oils, were dutiable.

This general principle was not consistently followed. Castor oil, the fish and marine animal oils, and linseed oil, though raw materials of important industries, were dutiable in both Acts. In the Act of 1913 lard and lard substitutes and tallow, though edible, were admitted free of duty, while in 1909 lard and tallow were dutiable and lard substitutes were not provided for. However, it is to be noted that so far as the animal fats are concerned, any duty was purely nominal. They were exported in quantities so great that the effect of a duty was negligible.

Where oils which were raw materials were made dutiable, as were castor, linseed, and the fish and marine animal oils, it was because protection for the industries producing the oils was held to be as important as encouragement to the industries using them. Where duties were imposed on such oils it was often because duties were also imposed to protect the industries producing the raw materials of which the oils were made. Thus, duties were put on flaxseed and castor beans to encourage the domestic production of them. In such cases a compensatory duty was levied on the oil. Peanuts were an exception. They were dutiable in the Act of 1909, but peanut oil was then so unimportant that it was not even mentioned in the Act.

In the main, the Act of 1913 in its oils duties was a revision downward of the Act of 1909. For the most part the items that were admitted free in 1909 remained free in 1913, and the items that were dutiable in 1909 remained dutiable in 1913, but at reduced rates.

With the Acts of 1921 and 1922, however, a marked change of policy is to be noted. The duties on butter and butter substitutes, and on certain vegetable oils and their raw materials, were greatly increased, while others previously on the free list were made dutiable for the first time. Among the oils so affected will be found coconut, cottonseed, linseed, olive, and soya bean oils, and among the raw materials cottonseed, flaxseed, peanuts, and soya

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beans. The change in policy suggested by these changes in duties calls for explanation.

Acute agricultural depression in 1920 and 1921 led to a demand for increased duties on agricultural products. During the war and for about a year thereafter the prices of farm products were high and farmers prosperous. In the period of readjustment that followed farmers suffered more from falling prices than did any other important class. The situation was acute. Farmers turned to Congress for relief and among other measures sought to find the aid of which they were in need in the tariff. They asked for increased duties on agricultural products and the free admission of articles important to agriculture. The Emergency Tariff of 1921 was a direct response to this appeal and the policy adopted in this Act was in the main continued and extended in the agricultural features of the Act of 1922.

So far as the vegetable oils were concerned the fight for higher duties was led by the dairy interests. These interests have always recognized in the manufacturers of margarin their most dangerous competitors and they viewed with great apprehension the enormous imports of Oriental oils, especially soya bean oil. As one of their representatives put it, they saw in every pound of imported soya bean oil a potential pound of oleomargarin. Moreover, in the general fall of prices the decline in the price of butter had not been nearly so great as that of many

other agricultural products¹ and some of the more far-sighted dairymen feared an invasion of their field by farmers in general with a consequent over-production of butter and a slump in its price. To forestall this disaster they felt that it would be wise to relieve the pressure of competition by excluding foreign butter, at least, from the market.

The dairy interests were well organized. Without great difficulty they enlisted the aid of the farmers engaged in the production of cottonseed and peanuts, and many of the crushers engaged in converting these raw materials into oil and cake, by pointing out to them that the imports of Oriental oils were a menace to their interests as well as to their own. The producers of menhaden oil were also brought into the alliance on the ground that their interests were menaced by the competition of foreign whale oil.

The Acts of 1921 and 1922 not only increased the duties on the fatty oils but also developed a new policy based on their interchangeability. These two Acts agreed in levying duties much above those in the Act of 1913 though the rates were not in all cases identical. Thus duties on flaxseed,² peanuts, and butter, and on cottonseed, olive, and peanut oil, though much increased by the Act of 1921 above their former level, were still further increased in

¹See p. 139.

²The increase in the duty on flaxseed because of a change in drawback provisions, was not so great as would appear on the surface. See pp. 183-184.

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1922. Linseed oil, apparently overlooked in 1921 when the duty on flaxseed was raised, was given a high rate in 1922. Only on coconut and soya bean oils were the duties slightly lowered in 1922 from the 1921 level. On the whole the differences between the two Acts are of minor importance. The essential fact is that the rates both on the oils and their raw materials were not only higher than in the pre-war acts but also more systematic. That is, they were adjusted so as to recognize the possibility of substituting one oil for another.

The object in view was to aid farmers: specifically dairy farmers, flax growers, and cottonseed, peanut, and olive growers. This was the purpose of the duties on butter, olive oil, linseed oil and flaxseed, cottonseed oil and cottonseed, peanut oil and peanuts. It was also the principal purpose of the duties on coconut oil, soya bean oil, and soya beans. These last-named duties, as has been explained, were levied not so much for the protection of domestic interests concerned with the production of coconut and soya bean oil, as because it was thought that these oils were competing with butter and with cottonseed and peanut oils.³

The principle, however, was not consistently carried out. The following oils which undoubtedly

³The following resolution adopted by the National Boll Weevil Convention, held in New Orleans, October 25 and 26, 1923, is significant in this connection: "Resolved, That this convention endorses a tariff on all vegetable oils that come in competition in any shape or form with cottonseed oil." *Southern Tariff Advocate*, October, 1924, p. 5.

compete to some extent with domestic oils were left on the free list: Chinese nut oil, perilla oil, palm oil, palm kernel oil, inedible olive oil, and sesame oil. In this connection it should be remembered that coconut oil imported from the Philippine Islands was not affected by the duty on foreign coconut oil. These oils together constituted over a fourth of the total imports of vegetable oils in 1920, and their continued free admission obviously tended to diminish the effectiveness of the duties on the other oils.

II. EFFECTS OF THE CHANGES IN 1921 AND 1922

The object in view, therefore, in increasing the duties on the fatty oils and their raw materials was protection. When freed from a smoke screen of conventional phrases, the primary purpose of a tariff, from a protective point of view, is to impede imports, and thus, by mitigating the severity of foreign competition to improve prices and increase profits in the favored industry. Incidentally the tariff, if effective, should normally operate to maintain the size or stimulate the growth of the protected industry, though this end, like some others frequently attributed to it, may or may not be present in the minds of advocates in any specific case.

To judge, then, of the effectiveness of the increased oils duties in accomplishing their avowed purpose of aiding farmers and also to determine

what effects the change in duties may have had on other interests, a careful study must be made of production, import, export, and price data. But before proceeding to such a study a word should be said about the popular method of estimating the effects of a duty by comparing output, imports, or prices before the duty is imposed with those that follow its imposition. Such a comparison is usually inconclusive. It is true that if supply and demand conditions remain unchanged, except for such changes as are due to the duty itself, the normal effect of a duty is first to impede imports, thus bringing about a deficit in the country imposing the duty and a surplus in the foreign country. The deficit should cause a rise in the domestic price and the surplus a fall in the foreign price, and when equilibrium has been restored it should be found that imports had declined, and that the foreign price was lower than the domestic price by just the amount of the duty. However, supply and demand conditions seldom do remain constant. Hence a change in imports and prices is quite as likely to be a result of some other cause as a result of the duty. A strengthening of domestic demand would tend to increase imports, and this increase in imports may follow an increase in the duty. But the increase in imports would not be due to the duty; it would have come in spite of it. Likewise, if at the same time that the duty is imposed, there is a notable improvement in domestic methods of production, a

fall in price is not unlikely to follow its imposition; but it would be illogical to argue that the fall in price is caused by the duty. However, since the normal effect of a duty when there is no change in supply and demand conditions is to decrease imports, raise prices, and increase domestic production, when such changes do in fact follow an increase in duty, this circumstance does afford some presumptive evidence that the increase in duty may have been a contributory factor.

A. Effects on Production, Imports, Exports, and Revenue

Having in mind the caution suggested in the last paragraph, we may now proceed to a study of data in order to find out just what have been the effects of the tariff changes in 1921 and 1922, attention being first directed to the effects on production imports, exports, and revenue.

The non-drying oils, partially excluded by the tariff, have been replaced by other oils, but not by those in whose behalf the duties were raised. The non-drying oils most affected by the Acts of 1921 and 1922 were coconut (0 to 2 cents per pound), cottonseed (0 to 3 cents per pound), olive (2½ to 6½ cents per pound), peanut (0.8 to 4 cents per pound), and soya bean (0 to 2½ cents per pound).⁴ The significant changes to be noted in the imports, production, and consumption of these and certain

⁴Soya bean oil is also used as a drying oil. It will here be discussed only in its non-drying uses.

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other oils and fats which are to a greater or less extent interchangeable with them are shown in the table below:

IMPORTS, EXPORTS, AND PRODUCTION OF CERTAIN OILS AND FATS FOR THE YEAR 1920 AS COMPARED WITH 1925

(Figures in millions of pounds)

Oil or Fat	Imports			Exports			Production		
	1920	1925	In- crease (+) De- crease (-)	1920	1925	In- crease (+) De- crease (-)	1920	1925	In- crease (+) De- crease (-)
Coconut (foreign) . . .	68	—	- 63	—	—	—	119	46	- 73
Coconut (Philippine) . .	153	232	+ 79	26	18	- 8	12	162	+ 150
Corn	—	—	—	12	4	- 8	99	104	+ 5
Cottonseed	9	—	- 9	185	62	- 123	1,143	1,511	+ 368
Olive (edible)	31	88	+ 57	—	—	—	1	1	—
Olive (inedible)	9	52	+ 43	—	—	—	—	—	—
Palm and palm kernel	44	192	+ 148	—	—	—	3	1	- 2
Peanut	95	8	- 87	1	—	- 1	13	16	+ 3
Soya bean	113	16	- 97	44	1	- 43	—	1	+ 1
Hog and beef fats ^b . . .	42	13	- 29	780	925	+ 145	2,202	2,583	+ 381
Marine animal and fish	17	61	+ 44	3	1	- 2	66	101	+ 35

^a Produced in United States from imported copra.
^b Including greases, lard, oleo oil, oleo stearin, tallow.

While the effects due to the change in duty cannot be segregated from those due to other causes, it is significant that the decrease in imports of certain oils on which the duty was increased, namely, foreign coconut, cottonseed, peanut, and soya bean oils and the animal fats, aggregating 290,000,000 pounds, was nearly offset by increase in imports of other oils which remained free of duty and which were more or less capable of substitution for the excluded oils, namely, Philippine coconut,⁵ inedible olive, palm,

⁵ For the purposes of this study, since commodities entering the United States from the Philippine Islands are admitted free

and palm, kernel oils, aggregating 270,000,000 pounds. If to the above we add the increased imports of whale oil, on which the increase in duty was only $\frac{2}{15}$ of a cent per pound, the total is brought to 323,000,000 pounds—a figure considerably larger than the loss of imports of the oils on which the duty was increased.

The increased oils duties have not resulted in increased production of cottonseed, peanut, soya bean, and olive oils. This is a logical inference from the facts brought out in the last paragraph. The excluded oils were in the main replaced by other imported oils and probably to some extent by domestic animal fats. Hence their exclusion had little or no effect in stimulating a greater production of the domestic vegetable oils mentioned above. For some years the production of cottonseed oil actually declined, as did also the production of peanut and soya bean oil. However, in the present case, failure to expand would not be regarded by advocates of the oils duties as a failure of the tariff. The duties were imposed primarily to improve the money incomes of farmers engaged in producing cottonseed, peanuts, soya beans, and olives. "Expansion of a domestic industry" was at best a secondary purpose. It was probably present to some extent in the case of peanuts, flaxseed, and soya beans, in the interest of a of duty, Philippine coconut oil has been regarded as a domestic product. In official publications of the United States Government, however, receipts from the Philippine Islands are classed as imports.

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more diversified agriculture, but not in the case of cottonseed. The purpose of increasing the duty on olive oil was twofold. The purpose was partly to aid olive growers, alarmed at that time by the botulinus scare, in establishing the oil extracting side of their industry on a firm basis; but the dominant motive was aid to the cottonseed oil interests. By excluding some of the imports of olive oil, it was thought that the market for cottonseed oil as a salad oil would be extended. To what extent this purpose of the olive oil duty was realized it is impossible to say. It is certain that cottonseed oil is increasingly used as a salad oil, but so also is olive oil. In spite of the increased duty imports of olive oil have increased from 31 million pounds in 1920 to 78 million pounds in 1926. The taste for salads has been surprisingly cultivated in the United States in recent years. The increased duty on olive oil had no appreciable effect on the domestic olive oil industry. Production was 634,000 pounds in 1920, 532,000 pounds in 1925, and 1,402,000 pounds in 1926.

The duties were also increased on lard and tallow, but these commodities are for the most part so strongly on an export basis that the duty, whether high or low, is merely nominal.

The only domestic, non-drying oil industry—if it can be called a domestic industry—whose production was substantially augmented by the tariff was the coconut oil industry in the Philippine Islands.

Production increased from 12 to 162 million pounds between 1920 and 1925. The exclusion of soya bean oil and foreign coconut oil resulting from the tariff affords reason for believing that some part of this enormous increase was due to the tariff.

In addition to the possibility of substituting other oils not subject to duty, a further explanation for the impotence of the tariff to affect the output of the oils discussed in this section is to be found in the fact that these oils are all by-products whose output is chiefly determined by the conditions affecting the supply of and demand for the principal products.

The increased duties are alleged to have had a depressing effect on the oils export trade. A notable falling off in the exports of certain oils followed the increase in duties. Comparing the average for 1922 and 1923, the two years following the emergency tariff, with the average for 1919 and 1920, the two years preceding it, the falling off was: for coconut oil, from 72,153,000 pounds to 14,767,000 pounds; for cottonseed oil from 188,943,000 pounds to 62,425,000 pounds; for peanut oil from 2,883,000 pounds to 583,000 pounds; and for soya bean oil from 35,618,000 pounds to 1,907,000 pounds. In the case of cottonseed oil the chief cause of this decline was probably the decline in cotton production, but in this case and in all other cases the tariff was undoubtedly a contributing factor.

During the period of free oils, with the added im-

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petus given by war conditions, the United States had virtually become the center of the world's oil trade. The crushing of domestic seed, the buying and refining of foreign oils, and the exporting of refined oils or oil products had become a great American industry. Seattle had developed facilities more modern than those of any European port. Oil tankers were being used for this vegetable oil trade, and bulk handling developed in the place of the former methods of handling in barrels or casks. Then came a general crash. The American Cotton Oil Company, one of the largest concerns with a score of plants, went under and its units were sold. The Southern Cotton Oil Company, another great exporter, went into bankruptcy, entailing the abandonment of its foreign connections, and the Capitol Refining Company closed its doors, as did several others. Such failures practically destroyed all *organized sales effort* in foreign countries.

The connection between this disaster to the oil refining and oil exporting industries and the tariff is alleged by the interests themselves to have been as follows.

Keen competition existed between American and European refiners in placing their products in European markets, and success was based on a narrow margin of profit. The increased duties resulted in the partial withdrawal of Americans as purchasers of crude oils in the Orient, and this partial withdrawal of an important body of purchasers resulted

in depressing the price of these oils to the advantage of European competitors. True, it was possible for American refiners to refine such oils for export and avail themselves of the drawback on all crude oils imported for this purpose. The refiners, however, claimed that this was impracticable. They could not afford to pay the duty on these oils and refine them for the American market, and the margin of profit was so narrow that they needed both markets to do a satisfactory business. They could not tell so far in advance of the time of selling the refined product as the time of negotiating for the purchase of the raw oil in the Orient, just where that product could be marketed to the greatest advantage. The only practicable method of conducting their business, they maintained, was to make purchases in the Orient when conditions in the crude oil market were favorable, refine the oils without reference to destination, and then sell them indifferently in the domestic or foreign market as conditions were most favorable.

The above line of reasoning would not, of course, apply to cottonseed oil, which, as well as the oriental oils, had been refined in large quantities for export. On this oil no duty had to be paid. Why could it not continue to be exported as before? The failure to continue exports of refined cottonseed oil on the previous scale was attributed in part to the shortage of the domestic cotton crop and in part to the withdrawal of American purchasers of crude oils in the

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Orient. The former factor (since the American crop constitutes roughly half the world output) tended to increase the world price of crude cottonseed oil, and the latter to reduce the price of crude oriental oils. As a result oriental oils came to be increasingly substituted for cottonseed oil in European markets. American refiners were forced to pay a relatively higher price than before for their raw material and European refiners could obtain their raw material at a relatively lower price.⁶ In a few years the cotton crop recovered to an output greater than that in the years preceding the Acts of 1921 and 1922, but by this time the elaborate sales machinery had broken down.

Such is, in brief, the explanation given by the refiners themselves. In corroboration it may be stated that in the years following the increase in the American tariff European imports of oriental oils did in fact greatly increase. This is shown by the table on page 125.

It would be too much to attribute the collapse in the oils export trade solely to the tariff. American dominance in the oil trade was in large measure due to abnormal war conditions. As recovery proceeded European refiners were bound to become more aggressive, and European countries in the interest of self-sufficiency in both oil and oil cake were bound to assert themselves. It is significant,

⁶ Soya bean oil appears to be more acceptable as a food oil in European than in American markets.

OILS DUTIES IN RECENT ACTS

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IMPORTS OF CERTAIN ORIENTAL OILS AND THEIR RAW MATERIALS
INTO WESTERN EUROPE, 1921 AND 1923 *

(In thousands of pounds)

Kind of Oil	1921	1923
Coconut oil	60,659	71,780
Coconut oil and copra (in terms of oil)	470,690	533,537
Peanut oil	37,759	74,166
Peanut oil and peanuts (in terms of oil)	394,682	499,382
Soya bean oil	39,112	78,321
Soya bean oil and soya beans (in terms of oil)	62,507	135,679

* U. S. Tariff Commission, *Certain Vegetable Oils*, 1926, pp. 111, 114, 117.

however, that with free access to oriental oils the refiners themselves asked no tariff favors. They believed themselves abundantly able to meet their European competitors in the European market and to retain their export trade.

In this connection, an alleged indirect result of the increased duties injurious to the export trade should be mentioned. It is alleged that France and Italy enacted retaliatory duties against American cottonseed oil because of the increased duties on certain oils which these countries exported, especially peanut and olive oil.

Shortly after the enactment of the Emergency Tariff, Italy did in fact double her duty on cottonseed oil, and in France the duty on all oils was raised threefold. The French increase in rate was an indirect consequence of the falling value of the franc. The customs duties were paid in paper francs, and as the value of the franc declined the revenue received from the tariff necessarily decreased in

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purchasing power. To remedy this situation an order was issued fixing 3 as the coefficient to be applied to all duties when paid in paper francs. As this coefficient was applied to all oils its effect was not discriminatory against cottonseed. In Italy the rate was not increased on soya bean oil but was increased on cottonseed oil from 24 to 50 lire per 100 kilos. It was, therefore, in fact discriminatory against cottonseed oils in its competition with soya bean and other oriental oils. It has also been asserted that it was not only discriminatory but also retaliatory. The Emergency Tariff—May 27, 1921—increased the duty on olive oil, an important import from Italy. The order changing the Italian import duty on cottonseed oil was issued in June and became effective in July. Italians deny that the act was retaliatory. In the report of the Italian Tariff Commission to the Chamber of Deputies, May 9, 1923, it is stated that the change was part of a general upward revision of the tariff, and that in this instance it was made to develop the domestic crushing industry. It afforded a proper compensatory duty for the duty of 5.75 lire per 100 kilos on cottonseed and some net protection. It was thought wise to develop the crushing industry not only on the general lines of protecting a domestic industry but in this case also for creating a sufficient domestic supply of the by-products, oil cake and meal.

Whether retaliatory or not, the Italian duty was a blow to the American cottonseed oil interests. Ex-

ports to Italy which had been increasing (9,552,000 pounds in 1919; 22,976,000 pounds in 1920; and 23,286,000 pounds in 1921) fell to 208,000 pounds in 1922 and 6,000 pounds in 1923. The only importance of raising the question of retaliation is that if the act were retaliatory it may be cited as an injury to cottonseed oil interests directly attributable to the Emergency Tariff. If not retaliatory but merely a feature of Italian customs policy, such a claim cannot be sustained.

The increased oils duties were followed by a considerable increase in revenue from this source. The changes were made with little or no regard to revenue. Nevertheless they did incidentally affect the revenue, in some cases increasing and in others diminishing it. The net result was an increase. The total revenue derived from the fatty oils, which had been less than \$4,000,000 before the duties were imposed, has increased to over \$8,000,000 in recent years. Not all of this increase is due to the changes in the tariff. The normal expansion of trade would doubtless have resulted in an increase in revenue even if there had been no change in the rates of duty. Nevertheless, the higher rates were an important contributing factor.

Rate changes were made on a considerable number of the fatty oils, but the discussion will be confined to the few which are of importance from a revenue standpoint.

The increased duties on olive and whale oil were

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successful as revenue measures. From a revenue standpoint by far the most important of the oils is olive oil. About three-fourths of the entire revenue derived from oils and fats is derived from this oil alone. The duty on bulk imports was increased from 2½ cents per pound in 1913 to 5½ cents per pound in 1921, and again to 6½ cents per pound in 1922.⁷ The increase in duty appears to have had little effect in checking imports. In spite of the higher rates imports and revenue steadily and rapidly increased until 1926, when there was a slight setback. Expressed in millions of dollars the revenues received were: 1920, 1.0; 1921, 2.5; 1922, 3.8; 1923, 5.2; 1924, 5.5; 1925, 6.2; 1926, 5.8. As a revenue measure the increase in the duties on olive oil was an unqualified success.

A similar statement may be made with respect to whale oil. The duty was increased in 1922 from 5 to 6 cents per gallon. With a slight setback in 1923, the first year after the increase in duty, imports and revenue increased every year until 1926, when there was a considerable decline. Revenue, expressed in thousands of dollars, has been: 1920, 4.3; 1921, 18.3; 1922, 214.2; 1923, 230.8; 1924, 300.2; 1925, 428.5; 1926, 314.0. It will be noted that the revenue in 1925 was nearly one hundred times that of 1920.

The increase in duty in most cases was too great

⁷The duties on oil in small containers are uniformly higher, and were increased in about the same ratios.

to secure the maximum yield of revenue. The revenue received is the product of the imports by the duty. As the duty increases the imports tend to decrease. Between the points of no duty and a prohibitory duty, at both of which points there will be no revenue, some rate can be found which will yield a maximum revenue. Either an increase or a decrease from this rate will decrease the revenue. Just what this rate is can only be found by experiment, but in the case of coconut, cottonseed, peanut, and soya bean oils there can be no doubt that the present duty is above the maximum revenue rate. Coconut, cottonseed, and soya bean oils were previously on the free list and hence any rate short of a prohibitory rate would increase the revenue. Peanut oil was previously dutiable at a low rate and yielded a considerable revenue. Under the increased duty the revenue was greatly reduced. In all of the oils just mentioned the falling off in imports was noteworthy. The situation for these and some other oils is shown in the table on page 130.

In every case a falling off in imports for the three-year average, 1923-1925, as compared with the two-year average, 1919-1920, will be noted, and in every case except butter and linseed oil the falling off is precipitous. Moreover, in the cases of butter, coconut oil, and linseed oil the falling off is greater in 1926 than in the three-year average 1923-1925, suggesting that the duties on these oils are becoming more nearly prohibitory. Imports of cottonseed oil,

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DUTY, IMPORTS, AND REVENUE FOR CERTAIN OILS FOR YEARS SPECIFIED

Oil	Average for 1919-1920			Average for 1923-1925			1926	
	Duty Cents per Pound	Im-ports Million Pounds	Reve-nue Thou-sand Dollars	Duty Cents per Pound	Im-ports Million Pounds	Reve-nue Thou-sand Dollars	Im-ports Million Pounds	Reve-nue Thou-sand Dollars
Butter	2½	22.3	607.3	8	16.6	1,352.0	8.0	676.2
Coconut	0	71.4	0.0	2	.6	12.0	.3	6.5
Cottonseed	0	18.6	0.0	3	.008	.2	6.7	200.3
Linseed	1½	25.6	341.4	3.3	23.4	772.3	9.6	317.0
Peanut	%	124.5	995.9	4	5.2	166.5	5.9	237.2
Soya bean	0	154.1	0.0	2½	23.3	502.8	26.4	659.3

which had disappeared for several years, were resumed on a considerable scale in 1926.

For several years the increased duties on linseed oil and butter were successful revenue raisers. Imports of linseed oil actually increased while those of butter showed no great tendency to decline until 1925. The revenues year by year in thousands of dollars were as follows:

	1919-20	1921	1922	1923	1924	1925	1926
Linseed oil	341.4	801.2	1,987.8	1,410.1	448.0	458.9	317.0
Butter	507.3	664.4	508.3	1,664.8	1,542.3	548.9	676.2

As stated, the maximum revenue rate can only be found by experiment and the results of experiment are by no means conclusive, as the maximum revenue rate for one year may not be that for another. The volume of imports, in fact, is determined by many other factors than the rate of duty, among which are quality, strengthening demand due to growth of population and improved

business conditions, weather conditions affecting the domestic output, and changing conditions of supply and demand in foreign countries. However, as a rough approximation to the maximum revenue rate, it may be assumed that the decrease in imports is proportional to the increase in duty. Under this assumption the maximum revenue rates for the above oils would be: butter, 5.2 cents per pound; coconut oil, 1 cent per pound; cottonseed oil, 1½ cents per pound; peanut oil, 2 cents per pound; soya bean oil, 1.4 cents per pound. The decided falling off in the imports of linseed oil in 1926 indicates that the duty of 3.3 on this oil is also beyond the maximum revenue rate.

B. Effects on Prices

The discussion so far has shown that the increased duties resulted in a change in character rather than in the total quantity of oil imports; that they had little or no effect upon the production of our principal non-drying vegetable oils; that they had a depressing effect on our oils export trade; and that they resulted in a considerable increase in revenue. However, none of these results is pertinent to the primary purpose for which the duties were imposed. That purpose was aid to farmers and such aid was to result from improved prices. From this point, therefore, the discussion will bear primarily on prices, other factors being introduced only as they have a bearing on the main point at issue.

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While the price bond shown in earlier chapters to exist between interchangeable oils undoubtedly restricts the power of the tariff to effect their prices, it does not preclude the possibility of any effect whatever. The expense involved in making new blends and the disinclination of consumers to change their habits when they have become accustomed to a certain article of diet, permit considerable departures from the normal price relationship of two interchangeable oils. Certainly the first impression derived from a comparison of "before and after" prices is to the effect that the duties accomplished their purpose in raising prices. This is shown by the following table:

RISE IN PRICE (IN CENTS PER POUND) OF THE SPECIFIED FATTY OILS

From June, 1921, to December, 1923, and to December, 1925.

Oil	To December, 1923		To December, 1925	
	Rise	Rank	Rise	Rank
Olive	-2.17 ^a	1	3.80	9
Coconut	-.01 ^a	2	2.73	3
Palm .....	.21	2	2.24	2
Lard	2.05	4	7.21	13
Whale	2.30	5	3.04	5
Tallow	2.35	6	3.68	8
Cottonseed	3.12	7	1.81	1
Corn	3.51	8	3.66	7
Menhaden	3.56	9	3.57	6
Soya bean	3.81	10	4.54	11
Linseed	2.17	11	4.30	10
Peanut	7.27	12	3.02	4
Butter	10.36	13	4.98	12

^a Decrease in price.

A word of explanation should be made in regard to the method employed in obtaining the figures in the table. The prices, by monthly averages, of the principal oils and fats are tabulated in Appendix A, pp. 278-285. As will be seen by inspection of the table there given, the prices were subject to considerable fluctuation. To compare simply the average price for June, 1921, with the average price for December, 1923, would give undue emphasis to what might be only a temporary fluctuation on one or both of those dates. It was thought to be more indicative of the general tendency of prices during the period intervening between the two dates to use trends. A straight line trend was fitted to the price data, and the rise in price shown in the table was taken as the difference between the first point and the last point of the trend.

The prices of oils and fats that could not have been affected by the tariff rose in common with the others. Palm oil remained on the free list, and lard, tallow, cottonseed oil, and corn oil all show an annual export surplus. Their prices would therefore tend to be fixed in the international market and could hardly be appreciably affected by changes in the American tariff. Indeed, the exports of lard constitute so important an item in the world supply as to be a dominating factor in the world price. Yet the prices of all these oils and fats rose during both periods covered by the table, and during the period ending with December, 1925, of all the oils and fats

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listed, lard shows the greatest rise in price. Other forces than the tariff, therefore, must have been at work to cause the rise in price in these oils, and to the extent that they may be substituted for other domestic oils the power of the tariff to raise the price of such domestic oils would tend to be limited to a rise in price not greater than that of the oils mentioned.

The rise in price of cottonseed and peanut oils during the period ending with December, 1923, was not well sustained. Cottonseed oil rose rapidly in price for some months, standing seventh in rank by the end of 1923; but by the end of 1925 it had fallen to the lowest place of all. Similarly peanut oil fell from the next to the highest place to fourth place.⁸ So long as cottonseed oil maintains its low rank in the scale of prices, the power of the tariff to raise the price of any oil for which cottonseed oil may be substituted will be limited.

The general rise in oils prices throws little or no light on the effects of the tariff. Factors other than the tariff were obviously responsible for the rise in price of the oils which remain on the free list or which continue to show a substantial export surplus. There is no reason for supposing that these factors were absent in the case of the others. Their observed rise in price may have been due to the tariff and it may have been due to the other factors. The

⁸The prices of peanut oil are for the domestic product. The statement in the text does not apply to imported peanut oil.

most that can be said for the evidence afforded by the table (page 132) is that the high rank either in 1923 or 1925 shown by the import oils (butter, linseed, olive, peanut, and soya bean), upon all of which duties were raised, is suggestive of tariff influence.

In order to ascertain the part played by the tariff in effecting the general rise in the prices of the fatty oils a detailed study must be made oil by oil. Such a study will be the subject matter of the two following chapters.

CHAPTER VI

EFFECTS OF RECENT TARIFF CHANGES ON PRICES, PRODUCTION, AND TRADE

IN this and the following chapter the effects of changes in duties in recent tariff acts on the prices, production, imports, and exports of the fatty oils will be considered. Butter is by far the most important of the fatty oils. For this reason and also because it stands somewhat in a class by itself the butter duty and its effects will form the entire subject matter of the present chapter.

The inconclusiveness of results based simply on a comparison of data before and after the change in duty has already been pointed out. It is necessary, in applying any statistical method, to segregate as far as possible the effects of the duty from those due to other causes. Moreover, any statistical method should be supplemented by whatever inferences may be drawn from an intimate knowledge of the industry and the market conditions surrounding it.

In estimating the effect of a duty on price, considerable information may be gained by comparing domestic and foreign prices. If for a considerable period of time the price movements have roughly paralleled one another, separated by an interval which may be accounted for by transportation and

selling costs, and then after the duty has been imposed they continue to parallel one another but with the interval increased by some part of the duty, this increase may fairly be attributed to the duty. This method, however, does not reveal how much of the increased interval is due to an increase in the domestic price and how much is due to a fall in the foreign price.

This last information can be obtained with certainty only when we have an accurate knowledge of domestic and foreign output and consumption and domestic and foreign elasticities of supply and demand.¹ The data, unfortunately, are seldom available.

BUTTER

The duty on butter which had been fixed at 6 cents a pound in the Tariff Act of 1897 remained unchanged until October, 1913, when it was reduced to 2.5 cents. It was restored to 6 cents in May, 1921; raised to 8 cents in September, 1922; and still further increased to 12 cents by proclamation of the President in March, 1926.

The tariff was a minor factor in determining the price changes that followed the Act of 1913. The futility of attempting to estimate the effect of a duty on prices by a simple comparison of prices before and after the duty was imposed is well illustrated by the course of prices of butter during the

¹For a discussion of the method referred to in the text, its possibilities and its limitations, see Appendix B.

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continuance of this act. The act lowered the duty and the effect normally to be expected would have been a decrease in price. Nevertheless, the price received by butter producers during the autumn and winter following the reduction in duty showed not only the usual seasonal rise but for four months was in fact higher than it had been in the corresponding months of any previous year. The customary spring decline in 1914 was a little greater than in the preceding year and recovery during the autumn was somewhat less than usual, but taking 1914 as a whole together with the last three months of 1913 (the first 15 months under the lower tariff) the price actually averaged nearly a cent higher than it had averaged during the entire period of the Act of 1909.² During the next five years without change in duty the price of butter like that of all other commodities went up, reaching 60.6 cents in December, 1919, and then, still without any change in the tariff, rapidly fell, reaching the lowest point (29.2 cents) in June, 1921.

These price fluctuations are not difficult to account for. A short crop was the factor mainly responsible for the price increase following the lower tariff; war and early post-war conditions, for the rapid rise during the next five years; and the general world-wide depression for the subsequent fall. The point here made is that whatever the effect of the tariff was, it was such a minor factor that its

²U. S. Department of Agriculture, *Yearbook*, 1925, p. 1092.

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effect was completely obscured by that of other factors.

The phenomenal drop in prices in 1921 was responsible for the aroused activity of the dairy interests, referred to in the last chapter, which led to the increase in the oils duties in 1921. It is true that the depression in butter prices was not so great as that for agricultural products in general.³ Nevertheless, it was severe and the alarm of the dairy interests is not surprising. In 18 months the price of their product had been cut in two. It is little wonder that they sought relief, and in seeking relief that they turned to the tariff. Imports reached their highest level of 37.6 million pounds in 1920, foreign prices as well as domestic prices were falling, and the prospect of ruinous competition seemed imminent. But however explicable or even justifiable was the appeal for a higher duty the question of the effectiveness of this form of relief still remains.

The first question that arises is as to an earlier application of the tariff. Had the 6-cent rate or some higher rate been in effect in December, 1919, when the price was highest, would the disastrous fall in prices have been arrested or at least moder-

³The average price received by producers during the four years preceding the war was 25.2 cents per pound. The average price for 1920 was 54.3 cents; for 1921, 37 cents; and in 1922 it reached its lowest point of 35.3 cents. This was more than 40 per cent higher than the pre-war average of 25.2 cents, whereas the index number of prices for all groups of farm products, when at its lowest point since the war, was less than 25 percent above the pre-war average.

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ated? In theory such a result would be expected, but the best available data point to the conclusion that the effect would not have been great. Had the rate been high enough to exclude imports completely, and had production and exports remained unchanged, then the improvement in price should have averaged about 2 cents per pound. This is appreciable but still small compared with the actual fall in price. (See page 149 for method used in making the estimate).

Following each increase in duty (in 1921, 1922, and 1926) the New York price of butter rose. Producers' prices followed, though somewhat irregularly.⁴ Wholesale prices, of course, must first receive the impact of any effect of imports, and therefore will show most clearly any influence which may be exercised by a protective duty.

The wholesale price in New York in April, 1921, was 32.2 cents per pound, the lowest it has reached since the war. In the following month the duty of 2.5 cents a pound was raised to 6 cents, and in July, the month in which butter is commonly cheapest, the price was higher than in April by more than 7 cents. The duty was further increased to 8 cents in September, 1922, and within two months, at a season when the price of butter usually shows

⁴The difference between average annual producers' price and the annual wholesale price of 92 score creamery butter varied during the four years preceding the war between 6.3 cents in 1911 and 4.1 cents in 1913. The average difference for the four years was 4.8 cents.

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little change in price, the price rose by more than 10 cents a pound. The average wholesale price throughout the year 1922 was 40.6 cents and under the higher duty in 1923 it was 46.8 cents.

No immediate rise in price followed the increase in duty to 12 cents in March, 1926. In fact for 5 months the price was not only lower than in March of that year, but even lower than it had been for the corresponding months of the preceding year. However, in the late autumn and winter the price rose rapidly reaching a peak in December of 54.9 cents, a price higher than any attained since the first increase in duty in 1921. Moreover, though for some months the price declined the average price under the 12-cent duty to November, 1927, was slightly higher than the average under the 8-cent duty—0.5 of a cent. To what extent was the tariff responsible for these changes in price?

Data throwing light on this question are afforded by the table on page 142 and the chart on page 144, showing foreign and domestic prices by months from 1920 to 1927, inclusive.

The comparison is made between 92 score creamery butter and Danish butter. These butters are of approximately the same grade, and during the greater part of the period covered by the table Denmark was our principal foreign competitor. In studying the table the New York price may be compared with either the Copenhagen price plus 2 cents to cover transportation and other costs to New York

NEW YORK, COPENHAGEN, AND LONDON, MONTHLY AVERAGE PRICES OF BUTTER, 1920-1927*
(In cents per pound, with foreign quotations converted at current rates of exchange)

Month.	1920			1921			1922			1923		
	New York	Copenhagen	London	New York	Copenhagen	London	New York	Copenhagen	London	New York	Copenhagen	London
January	65.2	48.9	42.5	53.0	42.4	56.1	37.6	31.1	32.9	51.6	40.5	44.9
February	66.6	42.1	41.4	46.9	39.3	53.8	37.3	31.0	35.8	50.1	41.3	44.4
March	66.4	49.2	50.5	48.8	40.4	52.1	38.7	32.9	35.4	49.7	41.0	45.6
April	71.4	49.8	53.3	46.7	43.9	49.4	37.8	33.8	38.7	47.1	34.5	39.9
May	61.2	44.2	52.1	32.2	33.5	38.4	36.9	33.5	37.2	41.8	29.5	38.3
June	58.2	44.8	52.2	33.4	32.4	35.9	36.9	37.0	40.4	39.0	29.8	32.4
July	56.7	42.4	45.9	39.6	33.3	39.6	36.1	39.4	44.3	39.5	30.7	32.3
August	55.4	42.9	45.3	42.2	41.1	43.3	35.2	39.1	42.5	44.3	34.7	37.4
September	59.4	43.6	47.6	43.1	36.4	40.1	40.8	41.1	44.0	45.9	40.3	41.5
October	60.5	45.7	52.1	46.7	33.3	40.8	46.1	40.7	45.0	47.6	38.9	42.5
November	62.5	44.7	51.6	45.3	39.9	43.9	51.1	39.9	44.1	52.4	39.4	42.7
December	54.5	44.0	52.4	43.6	31.8	37.2	54.2	39.7	43.2	54.6	41.1	44.7
Average.....	61.5	45.2	48.9	43.4	38.1	44.2	40.6	36.6	40.3	46.8	36.8	40.1

Month	1924			1925			1926			1927		
	New York	Copenhagen	London	New York	Copenhagen	London	New York	Copenhagen	London	New York	Copenhagen	London
January	53.1	40.0	44.0	39.4	42.0	44.1	44.5	36.5	40.2	49.7	36.4	39.2
February	50.6	39.5	42.8	40.4	45.4	47.7	44.3	40.2	42.8	51.3	39.3	41.5
March	47.3	36.9	41.0	47.6	46.1	48.5	42.9	38.8	42.3	50.3	36.8	39.6
April	38.9	31.8	35.4	45.0	40.6	41.8	39.6	36.2	40.6	50.9	35.2	38.8
May	39.1	36.4	40.0	42.7	36.9	39.6	40.7	34.8	39.5	43.6	32.9	35.5
June	41.5	33.4	36.8	42.5	39.4	42.4	40.9	35.7	38.8	42.5	33.2	35.8
July	40.0	37.8	39.4	43.1	40.5	42.4	40.5	35.4	38.0	41.6	32.2	35.0
August	38.8	41.1	43.3	43.3	44.2	45.5	41.8	36.1	39.5	41.7	35.0	37.2
September	37.8	42.3	43.8	48.1	45.7	48.0	44.6	36.6	40.0	46.5	39.6	41.6
October	38.4	46.1	49.4	50.6	46.5	49.2	46.8	36.8	40.2	48.8	39.4	41.9
November	42.9	44.2	47.5	50.6	44.6	47.0	50.7	34.9	38.7	50.0	41.2	43.6
December	44.8	46.8	50.3	49.4	37.8	41.5	54.9	37.1	39.5	51.9	38.0	40.8
Average	42.7	39.6	42.8	45.4	42.5	44.8	44.4	36.6	40.0	47.4	36.6	39.2

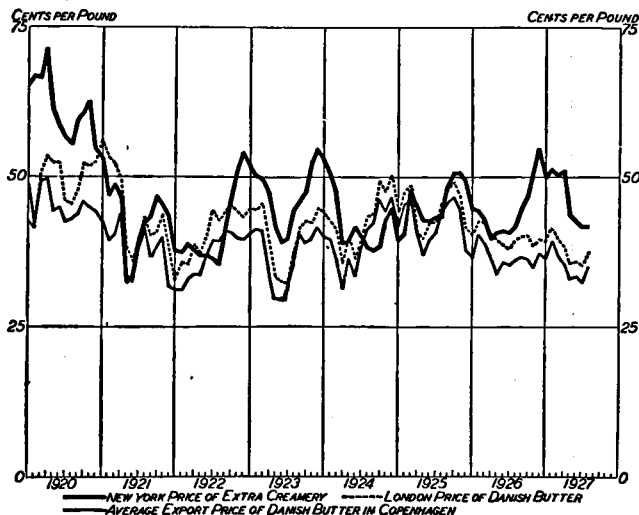
* New York prices are for extra creamery, as given in Bulletin, U. S. Bureau of Labor Statistics, Wholesale prices. Copenhagen prices are average export prices in Copenhagen, and from 1920 to 1924 are from U. S. Department of Agriculture, *Yearbook*, 1924, p. 885; and for 1925-1926 are from U. S. Department of Agriculture, Bureau of Agricultural Economics.

London prices: 1920-1924, are for No. 1 quality imported and are from Great Britain Ministry of Agriculture and Fisheries, Agricultural Statistics; 1925-1926 are for Danish butter in London and are from U. S. Bureau of Agricultural Economics, converted from quotations in *London Grocer*. Prices of butter imported into Great Britain were under government control through March, 1921.

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or with the price of Danish butter in London. The results will be approximately the same.

DOMESTIC AND FOREIGN PRICES OF BUTTER, 1920-1927 *



* See table on pp. 142 and 143.

The higher duties were in part responsible for the higher prices of butter. During the continuance of the 6-cent duty the New York price averaged 1.4 cents per pound above the price of Copenhagen butter delivered in New York. Under the 8-cent duty the differences between the averages was 3.7 cents; and under the 12-cent duty, 7.6 cents. The increasing difference under each increase in rate certainly suggests the duty as a cause. The case

becomes stronger when instead of comparing averages for the whole period of each duty we study the price differences more in detail. During no less than 16 months of the period from May, 1921, to the end of 1927 the price of Copenhagen butter delivered in New York was actually higher than the New York price. In such months, of course, the duty was nominal: it was without effect on price. In other months, however, the difference was very great, in some cases considerably greater than the duty. For example, in December, 1922, the difference was 12.5 cents: in December, 1923, 11.5 cents, and in December, 1926, 15.8 cents. During those months when the difference was great there would seem to be no reasonable doubt that the duty was a factor in maintaining that difference.

The effect of the duties on the domestic price was much less than would be inferred from the differences between the New York and Copenhagen prices. In the first place it is obvious that the effect on price attributable to the duty cannot exceed the duty. In those months when the difference was in excess of the duty plus cost of delivery in New York that excess must have been due to causes other than the duty. That the effect of these other factors in maintaining a difference between the New York price and the price of Copenhagen butter delivered in New York may be considerable is shown by the experience of 1920. During that year with a duty of only $2\frac{1}{2}$ cents the difference averaged 14.3 cents,

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in one month it reached 22.5 cents and in no month was it less than 8.5 cents. It would seem reasonable to infer that during the years following a considerable part of the difference was due to factors other than the tariff.⁵ Again when the difference between the New York price and the price of Danish butter delivered in New York is less than the duty, this actual difference represents the maximum effect on price which can be attributed to the duty. In only 2 months during the 16 months of the Act of 1921 was this difference so great as 6 cents, while in 9 months it was less than the previous duty of 2½ cents. During the 42 months of the 8-cent duty provided for in the Act of 1922, the difference was 8 cents or more during 12 months, and less than 2½ cents during 18 months. Even during 21 months of the 12-cent duty there were 9 months when this difference did not exceed 6 cents—the rate under the Emergency tariff. From this it appears that while at no time could the effect attributable to the duty have been greater than the duty, during nearly half of the months from June, 1921, to March, 1926, New York prices would not have been lower than

⁵ Some of these factors are differences in quality, established trade connections, outstanding contracts, lapse of time between shipment and receipt. Probably the most important factor arises from the sluggishness of imports to respond to a price difference. The importer, of course, endeavors to market his goods at the going New York price, and imports may for a time not be large enough appreciably to depress that price. It is suggestive in this connection to note that every month during the period under consideration, whatever the duty and whatever the price difference, showed exports as well as imports.

they actually were had the 2½-cent duty continued. Since the 12-cent duty went into effect the effect of the duty on the New York price appears to have been much greater. During no less than 8 of the 21 months from April, 1926, to December, 1927, the preceding duty of 8 cents would have been insufficient to account for the difference. Inspection of the chart on page 144 indicates that the periods when the tariff was most effective and the periods when it was least effective have followed one another in waves. A period of low effectiveness in the summer of 1922 was followed by a period of high effectiveness from the autumn of 1922 to the spring of 1924. This was followed by a period of low effectiveness lasting until the late summer of 1926. Since that time to the present writing (January, 1928), the duty appears to have been more effective than during any preceding period.

In the second place the normal effect of a duty is to raise the domestic price and to depress the foreign price. Hence the effect of a duty on the domestic price is not to be measured by the difference between the domestic and foreign prices after the duty has been imposed; but, if no other factors enter into the problem, it may be measured by the difference between the domestic price before and the domestic price after the imposition of the duty (see Appendix B); or, if other factors do influence the result, it may be measured by the difference between the actual domestic price after the duty has been

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imposed, and the domestic price as it would have been had there been no duty.

Price is determined by the conditions of supply and demand and a duty can affect the price only through its effect on imports. A change in the volume of imports, changing the total stock on hand, affects the offerings of sellers in response to varying prices; that is, it affects supply conditions. If we could ascertain how much imports had been curtailed and to what extent market offerings had thereby been affected, and if in addition we knew the elasticity of demand, we could estimate the effect of the duty. It is, of course, impossible to ascertain directly from data how much any of these factors have been affected. We can compare the imports before and after the duty is imposed, but such a comparison is of little or no value, for the same reason that "before and after" price comparisons are of little or no value. What we want is a comparison between imports as they are and imports as they would have been if the duty had not been imposed. Such data, of course, can never be obtained, but in the present instance a rough estimate is possible.

The chief inducement to import, assuming the domestic and foreign articles are comparable in quality, is the difference between the domestic and foreign price. As this difference decreases, the inducement to import decreases. Now we have just seen that in 1920 under a 2½-cent duty the excess

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of the New York price of butter over that of Copenhagen butter delivered in New York averaged 14.3 cents and on one occasion reached 22.5 cents. During no period of equal length since that year has this excess been so great either in its average or its maximum. The 12 month period of greatest excess since 1920 was that from September, 1926, to August, 1927, when the average was 10.1 cents and the peak 15.8 cents. The normal inference is that, even had the 2½-cent duty continued, under this smaller inducement, imports should have been smaller in the latter than in the former period. But assume that they had been as great, that is 37,000,000 pounds. The actual imports under the 12-cent duty were 10,974,299 pounds and domestic consumption about 1,900,000,000 pounds. Hence, had the 2½-cent duty continued it may be inferred that the domestic consumption would have been increased by about 27,000,000 pounds or about 1.4 per cent and (assuming 47.4 as the average price and 0.6 as the elasticity of demand)⁶ the price would have been decreased by 2.3 per cent or about 1.1 cents per pound.⁷

Too much weight should not be attached to the

⁶ See Appendix B, p. 316.

⁷ The computation follows: $\frac{\text{percentage increase in consumption}}{\text{percentage decrease in price}}$
 $\frac{1.4}{0.6}$

= elasticity of demand. That is, $\frac{1.4}{0.6} = 2.3$. Hence the percentage decrease in price = 2.3. The average price during the 12 months was 47.4 cents. Hence the decrease in price would have been $47.4 \times .023 = 1.1$ cents.

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figure 1.1 cents. The data are too conjectural. However, even allowing for a considerable margin of error, it is believed that the conclusion is warranted that the effect on the New York price attributable to the duty is far less than would be inferred from the difference between the New York and Copenhagen prices. In this connection it may be noted that the price difference during this period was due fully as much (if not more) to a fall in Copenhagen prices as to a rise in New York prices. Referring to the diagram on page 144, it will be seen that from the beginning of 1925 to the autumn of 1927 New York prices show a distinct upward and Copenhagen prices a distinct downward trend. During the period under consideration New York prices averaged 2 cents higher and Copenhagen prices 3.3 cents lower than in 1925. The fall in Copenhagen prices may have been due in part to the increased duty in 1926. Other factors undoubtedly were the English coal strike and a falling off in the German demand.

During the 63 months covering the periods of the acts of 1921 and 1922, no 12 consecutive months showed a difference so great as that during the period under consideration. During 16 of those months the price of Danish butter delivered in New York was actually higher than the New York price, and during 43, a six-cent duty would have fully covered the price difference. It would seem, therefore, that during these 63 months the effect of the

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tariff must have been less than during the period for which the computation was made.

Imports are insignificant compared with total consumption and hence exert but little influence on price. The preceding analysis has shown that during 16 months of the period under investigation, the tariff could have had no effect on the New York price and has given reason for believing that even when most effective the effect was not great. The reason lies in the insignificance of imports. As has already been noted the only manner in which a duty can raise the price of a commodity is through its effect on imports. Price, under competition, is of course determined by the familiar law of supply and demand. A tariff by cutting down imports may decrease the supply and hence, if demand conditions continue as before, raise the price. Now in the case of butter even under the low duty of $2\frac{1}{2}$ cents a pound, imports never exceeded 2.6 per cent of the total consumption and in most years were very much less. Clearly, therefore, even if imports were entirely excluded, the effect on total consumption and hence on price would be small and in many years negligible. The unimportance of imports is clearly shown in the figure on page 152.

It will be seen that the difference between the total quantity offered for sale (production + imports — exports) and the total domestic production is almost negligible, and this is true whether the duty were $2\frac{1}{2}$ cents (1910-1921), 6 cents (1921-

BUTTER PRODUCTION COMPARED WITH NET IMPORTS OF BUTTER AND OLEOMARGARIN PRODUCTION



1922), or 8 cents (1922-1925). The production of margarin shown on the same diagram is also small relatively to that of butter, but even the fluctuations of margarin production from year to year have more influence on the total quantity offered for sale and hence, presumably, on the price of butter, than do the entire additions or deductions resulting from foreign trade.

It has been objected to this line of reasoning that the term "total consumption" as here used includes a large quantity of butter produced on the farm for home consumption, and furthermore that even of the butter that enters into commerce a large part is produced and consumed in regions outside the great dairy area in which there is a close price bond and in which the impact of foreign competition is first felt. In short, the claim is that in estimating the effect of imports on price they should be compared not with the total quantity of butter consumed in the United States but with the quantity of butter which enters into commerce in the great dairy zone and which alone is affected in price by foreign competition. As compared with this quantity of butter imports though still small would be relatively much greater than when compared with total consumption and hence their effect on price would be much greater than would be inferred from their ratio to total consumption.

This argument undoubtedly has weight, though just how much weight it is impossible to say. For

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it must not be assumed that the butter produced for home consumption and the butter produced outside the dairy zone have no influence on the price of butter entering into commerce within it. For if this butter did not exist, farmers now producing butter for their own use and persons residing outside the dairy zone would become purchasers of the butter produced within it and the strengthened demand would increase the price. They might not purchase so much as they now consume, but it is safe to say that the greater part of the quantity which they consume is in latent competition with the butter entering into commerce within the dairy zone and hence is an important factor in fixing its price.

Another objection which may be raised is that, while it may be admitted that imports since 1921 have been insignificant as compared with consumption, but for the duty they would have been much greater and hence would have formed a much greater part of the total consumption with a correspondingly greater effect on price. The objection is valid. The only question is just how much greater imports would have been. It is impossible to give a definite answer to this question. The only evidence we have is found in the actual imports under the 2½-cent duty. These never exceeded the figure for 1920, and, as has been pointed out, in no year since 1920 has the inducement to import been as great as it was in that year. Even in that year imports constituted only about 2½ per cent of a

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smaller consumption than in any of the years since the duties were increased.

The reasoning just advanced applies only to average prices. For reasons which will be given presently, the duty is much more effective in the winter than in the summer months. There may have been days, perhaps weeks, when the effect of the eight-cent duty was to increase the price by several cents above what it would have been under a $2\frac{1}{2}$ -cent duty. Roughly speaking, it may be said that had the duty remained at $2\frac{1}{2}$ cents peak prices during the winter months would have been considerably lower, but that prices during the spring, summer, and autumn would not have differed greatly from those which in fact prevailed.

Foreign trade is affected by other factors than price. Price comparisons do not tell the whole story. If they did there would be no imports when the domestic price is less than the foreign price plus the duty and transportation costs, and no exports when the foreign price is less than the domestic. Yet in every month in the entire period covered by the table on page 142 there were both imports and exports. Some of this trade is to be accounted for by differences in quality and by established trade connections. Danish butter is somewhat different in its composition and flavor from 92 score creamery and is imported in substantial quantities even when its price is higher. Exports consist partly of canned butter for the tropics.

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Moreover, both in domestic and foreign markets prices show fairly wide short-time fluctuations, and since these are not always concurrent alert traders find a profit in shipping butter to New York during some months when the *average* price for the month or year would indicate a loss. Thus, in 1924, though the average New York price was only 1.1 cents higher than the average price of Danish butter delivered in New York, and in spite of an 8-cent duty, imports of butter amounting in all to 19.3 million pounds were received.

These fluctuations in price show a marked seasonal trend in both markets. This is clearly shown in the table below, and in the diagram on page 157.

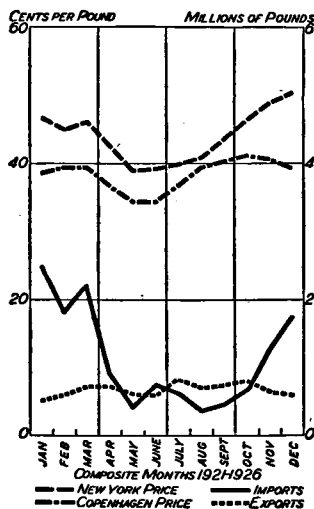
NEW YORK, LONDON, AND COPENHAGEN PRICES, AND IMPORTS AND EXPORTS, OF BUTTER AVERAGED FOR ALL THE JANUARIES, ALL THE FEBRUARIES, ETC., FROM 1921 TO 1926

Composite Months	Prices (in cents per pound)			Foreign Trade (in thousands of pounds)	
	New York	London	Copenhagen	Imports	Exports
January	46.7	43.7	38.5	2,452	502
February	45.0	44.5	39.3	1,807	587
March	46.0	44.0	39.3	2,165	705
April	42.5	41.0	36.7	915	708
May	39.0	38.0	34.3	383	600
June	39.2	37.5	34.3	743	578
July	39.8	39.2	36.8	605	822
August	40.7	41.8	39.3	355	532
September	43.5	43.0	40.3	465	583
October	46.2	44.3	41.0	685	797
November	48.8	44.0	40.5	1,283	477
December	50.3	42.8	39.2	1,730	420

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As will be seen, the New York price commonly begins to rise in midsummer, attains its highest point in early winter, and then declines. The average difference between the June and December prices during the years 1921 to 1926, inclusive, was over 11 cents, which means a rise of nearly 30 per cent. The London seasonal variation is somewhat similar, but probably owing to imports in England of butter from the Southern Hemisphere it is not so

SEASONAL VARIATION IN PRICES, IMPORTS, AND EXPORTS OF BUTTER *



* See table on p. 156.

wide nor does it run parallel with the New York trend from October to February. As a consequence

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of these divergences of price the difference between the New York and London or Copenhagen price is commonly much greater in winter than in summer, and hence whatever benefit the dairy industry receives from the tariff is likely to come in the winter. This is not always true. In 1924 the London price was the higher in winter, while the New York price was the higher in summer.

Finally, it is asserted that, owing to the technic of marketing operations and especially to the relation of the New York price to prices in other markets, imports have a much greater influence on price than would be inferred from a simple comparison of their magnitude with that of the total quantity of butter consumed. The argument runs as follows: the price, it is said, is adjusted in the New York market from day to day on the basis of the steadily inflowing supplies, and of the current demand. Part of the demand is for immediate consumption and part for cold storage. Now suppose that on a given day shipments of domestic butter amounting to 750,000 pounds are received. Perhaps half of this will go into cold storage. Word comes that a shipment is expected from New Zealand or Denmark. A single shipment often contains 300,000 pounds. That is, the supply on the market would be nearly doubled. The result of this rumor is a marked falling off in price, sometimes as great as three or four cents.

New York, it is said, is the dominant market, and

the New York price, thus determined, is quickly reflected in other markets, extending even to the price received by farmers for cream delivered to their local creameries. Afterwards, it is admitted, there is likely to be a reaction, but it is maintained that the net result is not only a wider fluctuation of prices but also a lower average than could be accounted for by a statistical application of the theory of supply and demand.

In order to test the truth of this theory, the files of the New York publication, *Producers' Price Current*, were consulted, and daily receipts, daily prices, and all imports and expected imports were tabulated for the months from November to April, 1924-1927. The winter months were chosen because it was believed that whatever influence imports might have on prices, it would be most noticeable in the winter season because of the greater relative importance of imports at that season.

The conclusions derived from this study are as follows:

1. Receipts from domestic sources vary greatly from week to week and even from day to day. The receipts on two successive days or for two successive weeks sometimes differ by as much as a million pounds. Imports for an entire week are generally less than the daily fluctuations in receipts from domestic sources.

2. The daily fluctuations in price are very much less than the daily fluctuations in receipts from

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either domestic or foreign sources, and appear to have little or no connection with them. That is, an increase in receipts is about as likely to be followed by an increase in price as by a decrease. The reason for this independence is to be found in the fact of cold storage. If the price shows a tendency to decline because of large receipts, butter goes into cold storage; if the price shows a tendency to rise because of small receipts, butter comes out of cold storage and appears on the market.

3. The dominance of the New York market is not so great as is contemplated in the theory. Other markets, especially Chicago, have an independent price-determining influence. Frequent references were noted showing the influence of conditions in the Chicago market in fixing the New York price.

4. The fluctuations in price are not based simply on conditions of supply and demand in the New York market but are based on the varying estimates of New York dealers, estimates which take into account many factors—reports as to production, actual and prospective, in creameries; prices in Chicago and in foreign markets; the quantity in cold storage; receipts, immediate and prospective from domestic and foreign sources; stocks in the hands of the "trade"; and the normal seasonal demand. In short, the New York price comes nearer to being determined by the conditions of supply and demand for the country as a whole than by the conditions of supply and demand in New York City.

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5. The last statement should be somewhat qualified. Instead of saying the conditions of supply and demand in the country as a whole, it would be more accurate to limit the statement to the great dairy region lying eastward from Nebraska. This region accounts for from three-fourths to four-fifths of the entire consumption of the country, and constitutes in a sense a single great market. Prices in centers outside this region are determined by conditions of supply and demand somewhat independent of the conditions which adjust the price within it.

6. Close inspection of the data yields little evidence that receipts from foreign sources ordinarily exercise a disproportionate effect on prices as compared with those from domestic sources. Dealers in foreign butter are as eager to maintain a good price for their product as dealers in domestic butter, and they use the same methods for preventing their shipments from depressing the market. The market is apprised days and often weeks in advance of expected arrivals and preparations are made to discount any effect which they might have in depressing price. Statements are frequent to the effect that such and such a shipment is expected; in fact during the winter months hardly a week passes without several such statements. Foreign shipments are not ordinarily heralded by vague rumors calculated to have an exaggerated psychological effect on the market. Advance knowledge

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in regard to them is generally about as definite as is the advance knowledge in regard to shipments from domestic sources. When a shipment of New Zealand, Argentine, or Danish butter arrives it is not infrequently noted that such butter has been "withdrawn from the market" or "put into cold storage," and later it is often noted that it is "being worked off in small lots at satisfactory prices."

Finally, a graph on which were plotted the course of daily prices, daily receipts from domestic sources, weekly imports, and reports of foreign shipments, failed to reveal any close correlation between either arrivals or reports of shipments of foreign butter and depression in prices. Such a correlation did show itself in some instances, but in general an arrival or report of a shipment of foreign butter was quite as likely to be followed by an increase as by a decrease in price.

7. As just noted, instances were found where reports of shipments of foreign butter did appear to depress the price by an amount quite disproportionate to the depression which would seem to be warranted by the actual quantity of foreign butter involved. Such instances ordinarily occurred when the market was in an abnormally nervous or sensitive condition. Two cases, illustrative of the statement, will be described in some detail.

During the week ending December 18, 1926, the price of 92 score creamery butter, which had remained for nine successive days at 56 cents, sud-

denly dropped 4 cents in two successive days. It then began to rise and before the end of another week had reached a point only 1 cent lower than the price just mentioned. During the week when the fall occurred shipments of foreign butter amounting to nearly 1.5 million pounds were received. It was stated in *Producers' Price Current*, and the statement seems reasonable, that these imports of foreign butter were an "important element in the break." Other factors, however, contributed. During the week preceding the break receipts of domestic butter amounted to about $4\frac{3}{4}$ million pounds, which was nearly $1\frac{3}{4}$ million pounds greater than they had been the week before and was greater than the receipts in any succeeding week until nearly the middle of February. Moreover, the price of 56 cents proved to be the peak price for the winter. A downward trend set in which continued, irrespective of imports, until the latter part of January. It is significant that, during this downward trend, in the week ending January 8, another drop of 4 cents occurred, though during this week imports were negligible—less than 7,000 pounds. The latter drop in price was attributed to falling prices in Chicago, and illustrates the point that New York and Chicago are co-ordinate markets. New York is not always the dominant market in price adjustments. After the first break most of the foreign butter was withdrawn from the market, and there was a rapid recovery to 55 cents the fol-

lowing week in spite of considerable imports—about 680,000 pounds.

This case illustrates the effect of heavy imports following closely upon heavy domestic receipts at a time of peak prices. The next case illustrates the effect of rumors of imports on a sensitive market even though actual imports are not large. During the nine days from March 9 to March 18, 1927, the New York price of 92 score creamery butter fell from 52 cents to 46 cents, a drop of 6 cents. During this entire period imports were not unusually large, about 492,000 pounds, but the market was affected by "exaggerated rumors" of large foreign shipments and a weak London market. The effect of these rumors, however, was greatly increased by the fact that the market was highly sensitive. Receipts of domestic butter had been large during the week of the break and the four weeks preceding, averaging over 5 million pounds; the price when the break began was 8½ cents higher than on the same day of the preceding year; and the market was approaching the "grass season," and a decline in prices in the near future was anticipated as in the normal order. It is a curious illustration, however, of the behavior of a sensitive market that, during the nine days following the break, the price recovered to a point even higher than when the break began, though during this period imports of over 1½ million pounds were received.

Domestic production of butter has increased and

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imports have declined since 1920. To the decline in imports the tariff was undoubtedly a contributory factor. To the increased production it may have been a minor contributory factor. The facts are shown in the table below.

PRODUCTION, IMPORTS, EXPORTS, AND CONSUMPTION OF BUTTER FOR 1914 AND 1919-1925

Year	Production		Imports		Exports		Con- sump- tion
	In Millions of Pounds	As a Percent- age of Con- sump- tion	In Millions of Pounds	As a Percent- age of Con- sump- tion	In Millions of Pounds	As a Percent- age of Con- sump- tion	In Millions of Pounds
1914	1,706	99.8	7	.4	4	.2	1,709
1919	1,559	101.8	7	.5	35	2.3	1,531
1920	1,442	98.6	38	2.6	17	1.2	1,462
1921	1,650	99.4	18	1.1	8	.5	1,660
1922	1,778	100.2	7	.4	11	.6	1,775
1923	1,862	99.0	24	1.3	6	.3	1,880
1924	1,956	99.4	19	1.0	8	.4	1,967
1925	1,890	99.9	7	.4	5	.3	1,892

As has been noted, imports of butter at the best are insignificant in comparison with domestic production. In 1920, however, though even in that record year they were equal to only 2.6 per cent of domestic output, they were nevertheless substantial—37,626,000 pounds. In 1921 the duty was increased to 6 cents per pound and imports were reduced to less than half the 1920 figure. The falling off continued in 1922 to a total of only 7,111,000

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pounds. Under the increased duty of 8 cents per pound, however, imports actually increased in 1923 and 1924 to 23,741,000 and 19,279,000 pounds respectively, but again dropped (without change in duty) to 7,212,000 pounds in 1925. In 1926, in spite of an increase in duty to 12 cents a pound in March of that year, imports for the year as a whole remained nearly constant. On the whole, however, the trend of imports since 1920 has been decidedly downward and there is no reason for doubting that the tariff has been an important factor in this downward movement.

The increase in imports in 1923 and 1924 came in spite of the tariff. The factor chiefly responsible was the improvement in general business conditions in those years. This led to a strengthening of demand, a stiffening of prices, and hence to increased imports to supplement the domestic output.

The general downward trend was not due solely to the tariff. An important contributing factor is to be found in improving market conditions abroad, especially in Germany, leading to an increased sale in those markets of foreign butters previously exported to the United States, and a consequent falling off of such exports after 1924. A reversal of this European market situation, due chiefly to the English coal strike, was responsible for the increased imports in the last months of 1926 and the early months of 1927, in spite of the increase in duty in the spring of the former year.

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Exports also, after 1919, show a distinct downward trend. For this there is no reason for supposing the tariff to have been directly responsible. Indirectly, to the extent that it was responsible for a greater spread between domestic and foreign prices, it tended to make the domestic market relatively better than the foreign and hence attract sales which otherwise would have been made abroad. The main cause was doubtless the great strengthening of domestic demand as shown by the rapid increase in consumption in spite of a generally upward price trend. The striking thing about exports, however, is their persistence in substantial quantities in spite of the excess of domestic over foreign prices. During the entire period since the increase in duty in 1921, not a month has passed without exports, even in months when the New York price exceeded the Copenhagen price by more than the duty and transportation costs. Some grades of butter apparently were selling at prices not higher than those of comparable foreign grades. Geographical considerations, however, established trade connections, and doubtless other factors played a part, but the persistence of exports in substantial quantities contemporaneously with imports, also in substantial quantities, coming in over a high duty is one of the curious features of the butter-tariff problem.

The increased duties, by inspiring confidence in dairymen, may have been a psychological factor in

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the increased production during the years following their enactment, but that they could have been anything but a minor factor is evidenced by the fact that the actual increase was vastly more than a mere substitution of domestic for foreign supply. The year 1920 broke all records for imports, yet had the increased duty cut off imports completely, and could it be shown that but for the tariff the imports in all years following 1920 would have been as great as for that record year, it would have created a vacuum of only 37,626,000 pounds to be filled by domestic production. The actual increase in domestic production in excess of that of 1920 was 208,000,000 pounds in 1921; 336,000,000 pounds in 1922; 420,000,000 pounds in 1923; and 514,000,000 pounds in 1924.*

The conclusions arrived at in the preceding analysis are necessarily somewhat conjectural. The conclusion that the increased duties were effective in affording producers a higher price than they would have received without the duties was based on the differences, sometimes large, between the New York and Copenhagen price. The conclusion that the price gain was small was based first on the fact that during a considerable part of the time the excess of the New York price was either nil or much smaller

*The object of the duty was not to stimulate production. It was rather, by cutting down imports, to diminish the quantity available to consumers, and hence to increase the price; but in a study of this kind it is important to trace out the actual effects of a duty whether desired or not.

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than the duty, and second on the comparative insignificance of imports even under a strong inducement to import. A numerical estimate of the price gain was made, based on the theory that imports roughly followed the inducement to import and that the inducement to import could be measured by the difference between the New York and Copenhagen price, and on an estimate made in Appendix B that the elasticity of demand could be expressed by the fraction 0.6. Because of the questionable character of the data, all that can be claimed for the numerical value 1.1 as representing price gain is that the method by which it was obtained is logical and that it indicates that even in the year of greatest price difference between domestic and foreign prices the price gain to the domestic producers was small. This conclusion is further fortified by the fact that during every month of the period under consideration exports left the country in substantial quantities, affording evidence that some grades of butter at least were meeting foreign competition on even terms. The final conclusion is that the duties were effective in making the New York price of butter higher than it would have been without them, and that at times, particularly in the winter months, this gain was considerable, but that taking the period as a whole the gain has been small.

In a nutshell, the conclusions are that the domestic output is so vast that prices have been determined chiefly by the conditions of domestic supply

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and demand, but that the tariff has enabled domestic producers, in times of strong demand, which, of course, may be created by superior marketing methods, to obtain a somewhat better price for their product than would otherwise be possible.

CHAPTER VII

EFFECTS OF RECENT TARIFF CHANGES ON PRICES, PRODUCTION, AND TRADE (CON- TINUED)

In the preceding chapter the effects of the increased duties on butter were shown to have been small, either as a benefit to the dairy industry or as a burden on consumers. In the present chapter the study will be continued by considering the effects of the increased duty on other fatty oils, namely: coconut oil, corn oil, cottonseed oil, linseed oil and flaxseed, the marine animal and fish oils, olive oil, peanut oil and peanuts, soya bean oil, and the animal fats.

I. COCONUT OIL

Copra has always been admitted to the United States free of duty. Coconut oil was likewise admitted free until 1909, when a duty of 3.5 cents a pound was levied on refined oil. This duty was retained in the Act of 1913 but the rate was reduced to 2½ cents in 1921 and to 2 cents in 1922. Crude coconut oil was on the free list until 1921 and was then made, and has since remained, dutiable at the same rate as refined oil.

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Imports of refined oil have never been important. Imports of crude oil, however, until a duty was imposed in 1921, were substantial, and consisted largely of Cochin and Ceylon oils—crude oils of a high grade nearly free from fatty acids.

The effect of the duties was to change the source of supply of crude oil rather than to raise its price. This was for the reason that the duties did not apply to oil coming from the Philippine Islands. In 1914 imports from this source were 26.2 million pounds, and from other countries 31.7 million pounds; in 1926 imports from the Philippines had grown from 245.1 million pounds, while from other countries they were only .3 of a million. In the meantime the quantity produced in this country from imported copra increased from 38.1 to 255.0 million pounds. Thus it will be seen that while imports of dutiable oil practically ceased, supplies of oil derived from the Philippine Islands and from duty-free raw material far more than made good the loss.

Referring to the table on page 132 it will be seen that coconut oil is among the oils showing the least rise in price following the levying of the duty. In fact from June 1, 1921, to December, 1923, it actually declined in price. However, the duty was not without effect. The foreign oil previously imported had been chiefly Cochin oil, an oil of a higher grade than the Philippine oil. Had this oil continued to come in over the duty in substantial quantities its

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price would have been raised. Instead, Philippine oil, an inferior product, was substituted, and partially refined to take the place of Cochin oil.

II. CORN OIL

None of the tariff acts has mentioned corn oil by name. It has been dutiable, therefore, at the rates levied on vegetable oils "not specially provided for." These rates were 25 per cent ad valorem in 1909, 15 per cent in 1913, and 20 per cent in 1922.

As there is no record of corn oil ever having been imported, while exports amount to several million pounds, the duties, of course, could have no effect on the price of it. The price did, indeed, rise after 1921, but the cause of the rise was the general improvement of business both here and abroad, following the severe deflation of 1920-1921.

III. COTTONSEED OIL

Cottonseed oil was admitted free of duty until 1921. A duty of $2\frac{2}{3}$ cents a pound in the Emergency Act of that year was changed to 3 cents a pound in the general Tariff Act of September, 1922.

The imposition of a duty was followed by a rise in the price of oil. Before the war the average annual price of crude cottonseed oil at the mill varied between 4.9 and 5.9 cents. The price went up during the war and reached 19.8 cents in January, 1920.

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It fell rapidly during that year and the following spring. By April, 1921, it had fallen to 5 cents. An upward trend then set in and the average price in 1922 was 8.5 cents; during the three following years it was a little over 9 cents. It reached a peak in June, 1926, at 13.7 cents, and then rapidly fell to 6.4 cents in December of the same year.

There was no connection between the duty and the rise in the price of oil. The reasons for arriving at this conclusion are based (1) on the insignificance and non-competitive character of imports, (2) on the fact that the prices of both cottonseed oil and its chief competitors are fixed in a world market, unaffected by the American tariff, and (3) on a statistical study of domestic and foreign prices.

(1) In comparison with the domestic output, imports of cottonseed oil were always inconsiderable in quantity (less than 2 per cent), and, moreover, consisted almost entirely of a very low-grade oil from the Far East, which was used for soap making. Little more than 1 per cent of the domestic oil is taken for this use and even that small quantity is of the poorest quality. In consequence imports of cottonseed oil never really competed with the domestic oil.

However, the Acts of 1921 and 1922 in levying duties took account of the partial interchangeability of oils. More was expected by the cottonseed oil interests from the duties on soya bean, peanut, and coconut oils than from the duties on cottonseed oil

itself, and imports of soya bean and peanut oils did in fact greatly decrease.¹ But soya bean oil, before the duty was raised, was imported chiefly as a soap oil. As just noted only an insignificant percentage of the domestic output of cottonseed oil is devoted to this use, and even that small percentage must compete with tallow and the greases, the export surplus of which is so great as to make an increase of price either of these fats or an oil competing with them out of the question.

Soya bean oil was used to a limited extent in the production of lard substitutes and margarin, in both of which uses it competed with cottonseed oil, but for both of these uses it is so inferior to cottonseed oil and the quantity consumed in these uses was so small that its exclusion could have had no appreciable effect on the price of cottonseed oil.

Peanut oil may be appropriated to about the same uses as cottonseed oil, and had the situation been otherwise favorable its exclusion might have affected the price. As it was, it has been plausibly argued that its exclusion was positively injurious to the cottonseed oil interests. The argument is as follows: Cottonseed oil is used chiefly for lard substitutes. Popular prejudice requires that substitutes should be snow white. Much cottonseed oil is dark and

¹ Imports of peanut oil, averaging 124 million pounds in 1919 and 1920, fell to an average of 3.6 million pounds in 1922 and 1923. The corresponding figures for soya bean oil are 154.2 and 23.4. Imports of foreign coconut oil also fell off, but as has been shown the imports of Philippine coconut oil more than made good the loss.

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difficult to bleach. The securing of a light colored mixture can be most economically accomplished by blending with peanut oil. For this purpose foreign peanut oil is required, much of the American product being of poor quality and the supply being quite inadequate to the quantity needed. The high duty on peanut oil made this business unprofitable and it was discontinued. But for the duty on peanut oil the off-colored cottonseed oil, it is held, would have commanded a better price. Nor would this improvement in the price of off-colored oil have been offset to any appreciable extent, by a fall in the price of the better grades. The price of the latter is fixed in a world market, and the addition to the world supply resulting from making available for lard substitutes a certain quantity of off-colored oil would hardly have had a noticeable effect on its price.

(2) Cottonseed oil is essentially a food oil. It is used as a salad oil, in the manufacture of margarin, and especially in the manufacture of lard substitutes. These three uses account for about 93 per cent of the domestic output. As a salad oil it competes with corn oil, in the manufacture of margarin with lard, oleo oil, oleo stearin, and coconut oil, and in the manufacture of lard substitutes with all of the oils and fats just mentioned and with tallow. For reasons shown under their respective heads in this study none of these oils can be affected in their price by the tariff, and hence by the prin-

ciple of the elastic bond, binding together the prices of competing oils, no considerable permanent effect resulting from tariff changes is possible on the price of cottonseed oil.

The price bond, however, is a factor limiting rather than precluding the effectiveness of a duty on prices. Competing oils are not identical, and the expense of adjusting methods of manufacture to the use of the substitute, and, in the case of food oils, preferences based on quality or flavor, often permit a considerable departure in price of one of the competing oils from what had been its previous place in the price scale. This is shown very clearly in the chart on page 180. The predominant use of cottonseed oil is in the manufacture of lard substitutes, and lard substitutes compete with lard. Yet it will be noted that from July, 1924, till September, 1925, the price of lard maintained a difference above the price of cottonseed oil greatly in excess of the difference throughout 1922 and 1923, the last six months of 1921 and the first six months of 1924.

However, in the case of cottonseed oil we do not have to rely on competition with other oils and fats for evidence that the tariff can have little effect on prices. Cottonseed oil itself shows annually a substantial export surplus averaging for the last three years about 50 million pounds, or about 4 per cent of the domestic output. With so considerable an export surplus it is obvious that the tariff can have had no appreciable effect on the domestic price.

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The portion exported must have met foreign competition and the price in foreign markets could not, of course, have been raised by the American tariff. Any tendency of the domestic price to rise above the foreign price would have resulted in a diversion of supply from the foreign to the domestic market, thus tending to restore the domestic price to the foreign level.²

(3) Nevertheless, following the tariff Act of 1921 the price of cottonseed oil did in fact rise sharply and throughout the greater part of 1922 and 1923 maintained a price not only higher than its own previous level but also much higher than the London price. This is shown in the table on page 179 and in the chart on page 180. This price level, so much above the London price level must be accounted for. If the tariff was not responsible for it, what was?

In the first place American cottonseed oil is of a better quality than the oil made from Egyptian seed which is the basis of the London quotations. The latter is made from undecorticated seed and suffers a higher refining loss. Hence the American oil should normally maintain a somewhat higher price. But to understand the relatively high prices of 1922 and 1923 it is necessary to have in mind the short

²The statement here made has reference to present conditions. In recent years there has been a marked decline in the exports of cottonseed oil, even in the face of greatly increased production. Should the export surplus disappear, the possibility of raising the price of cottonseed oil by means of the tariff would be greatly increased.

ENGLISH AND AMERICAN PRICES OF CRUDE COTTONSEED OIL
BY MONTHS, 1920-1927.
(In cents per pound)

Month	1920		1921		1922		1923	
	Eng-lish	Ameri-can	Eng-lish	Ameri-can	Eng-lish	Ameri-can	Eng-lish	Ameri-can
January	18.0	19.8	5.2	6.1	6.5	7.2	8.0	9.6
February	17.9	18.5	5.3	6.0	6.9	8.7	8.1	9.8
March	17.9	17.5	5.2	5.1	7.7	10.0	8.1	10.3
April	15.9	17.4	5.0	4.3	7.8	9.7	8.5	10.1
May	15.5	16.6	5.8	5.2	8.4	9.9	8.5	9.8
June	12.6	15.8	6.0	5.8	8.1	9.7	7.9	9.7
July	10.4	12.8	6.5	6.6	8.1	8.8	7.6	8.6
August	11.3	10.2	6.8	6.8	7.4	7.7	7.1	9.0
September	11.1	10.2	7.5	7.8	6.3	6.5	7.4	10.0
October	9.9	10.2	7.8	7.5	6.8	7.2	7.6	9.2
November	8.2	7.2	6.6	7.0	7.0	8.2	7.6	9.7
December	6.7	6.4	6.6	7.0	7.5	8.5	8.1	9.4
Average.....	12.9	13.5	6.2	6.3	7.4	8.5	7.9	9.6

Month	1924		1925		1926		1927	
	Eng-lish	Ameri-can	Eng-lish	Ameri-can	Eng-lish	Ameri-can	Eng-lish	Ameri-can
January	8.3	9.4	10.0	9.6	7.5	9.7	7.1	6.8
February	8.6	8.7	9.3	9.0	7.5	10.0	7.6	8.0
March	8.0	8.2	8.7	9.8	7.8	11.0	7.5	7.7
April	7.9	8.6	8.6	9.8	7.8	11.0	7.4	7.8
May	7.7	8.0	8.9	9.2	7.9	12.2	7.8	7.6
June	7.5	8.7	9.1	9.6	8.7	13.7	7.7	8.0
July	8.0	10.2	9.3	9.5	8.3	13.0	7.4	8.4
August	8.6	11.3	9.6	9.4	8.3	10.8	7.6	8.6
September	8.6	8.3	9.1	9.1	7.5	8.8	—	9.2
October	9.0	8.8	8.7	8.4	7.1	7.4	—	9.4
November	9.8	8.8	8.2	8.8	7.2	6.8	—	9.1
December	9.8	9.6	7.9	8.8	6.8	6.4	—	8.6
Average.....	8.5	9.0	8.9	9.2	7.7	10.0	—	9.2

The English prices are for "Egyptian crude—naked ex-mill," and were obtained from the *London Grain, Seed, and Oil Reporter*. They were computed by taking a simple average of the daily quotations at London and Hull. Conversions were made on the basis of current exchange rates as given in the *Federal Reserve Bulletins*.

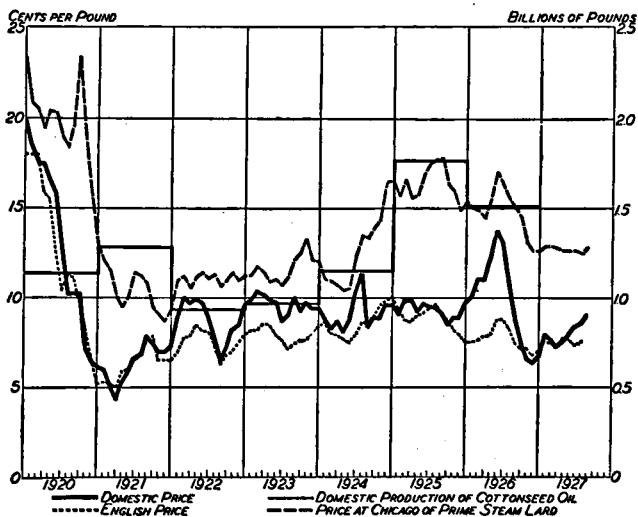
The American prices for September, 1922, to date, were obtained by taking a simple average of the daily quotations for three grades of crude oil, namely, Southeast, Valley, and Texas. Only actual sales were used as a basis of comparison. Where a "nominal" or "asked" price was quoted, the quotation was assumed to be $\frac{1}{2}$ cent per pound less. Prior to September, 1922, no quotations are available for the Valley and Texas oil. The prices, therefore, from January, 1920, to September, 1922, are for the Southeastern grade. It was observed that the monthly average for this grade, on the basis of daily quotations, was much the same as an average of the high and low prices for the month. For the years 1920 and 1921, therefore, the prices given represent an average of the high and low quotation in each month. The source has been the *New York Journal of Commerce* except for 1920 and 1921 when the *Oil, Pains, and Drug Reporter* was used.

The crude cotton oil prices in this country are all naked prices, that is, they are f.o.b. buyer's tank at the crude mill. The expense of pumping the oil into the tank cars is so small it cannot be recorded. As previously stated, the English prices are naked ex-mill so there is an exactly comparable situation.

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crops of those years and the change in the destination of exports. The output of cottonseed oil dropped from about 1.3 billion pounds in 1921 to considerably less than a billion pounds in 1922 and

DOMESTIC AND FOREIGN PRICES OF COTTONSEED OIL, PRODUCTION OF COTTONSEED OIL, AND LARD PRICES, 1920-1927.*



* See table on p. 179.

1923. It rose again to over a billion pounds in 1924 and to 1.5 billion pounds in 1925. The average for 1922 and 1923 was 27 per cent below the average for 1921, 1924, and 1925. The relatively high prices in 1922 and 1923 were only the normal effect of the short crops of those years. In 1921 and again in 1924 and 1925 when the output was more nearly

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normal, American prices followed London prices very closely.

But even in the years of shortage there was a substantial export surplus—75 million pounds in 1922 and 50 million pounds in 1923. Hence, even in these years the American oil must have been competing with English oil. It was, however, competing chiefly in neutral markets, not in the London market. This is seen in the change in destination of exports. Previous to 1922 large quantities of American cottonseed oil were shipped to Europe. After that date this trade greatly fell off. This is shown by the following figures giving the exports of cottonseed oil in millions of pounds and percentages of totals.

DESTINATION OF COTTONSEED OIL EXPORTS, 1920-1925 INCLUSIVE
(In millions of pounds and percentages of totals)

Year	Western Continent		Europe		All Other		Total
	Millions of Pounds	Percent- age of Total	Millions of Pounds	Percent- age of Total	Millions of Pounds	Percent- age of Total	
1920..	57.3	31.1	114.0	61.6	13.4	7.3	184.7
1921..	59.6	23.6	181.4	71.9	11.5	4.5	252.5
1922..	49.1	65.3	16.3	21.6	9.9	13.1	75.3
1923..	40.9	82.5	3.5	7.0	5.2	10.5	49.6
1924..	29.0	66.8	11.0	25.5	3.3	7.7	43.3
1925..	47.0	75.3	7.9	12.8	7.5	11.9	62.4

It will be seen that after 1921 the exports going to Europe constituted a much smaller percentage of a much smaller total. The great bulk of the ex-

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ports in fact went to Canada. These exports could hardly be affected in price by the American tariff. They might, however, considering their superior quality, differ much more in price from the Egyptian oil than they could on the London market.

For reasons pointed out in Chapter V, after 1921 the Americans lost the European market. An elaborate sales machinery which had been built up for selling American oils was broken down. But for this it is possible that after 1923 sales in Europe might have somewhat relieved the pressure on the American and Canadian markets brought about by the rapidly increasing output, and the American oil have brought a somewhat better price. At any rate there is no reason for thinking that the tariff Acts of 1921 and 1922 have increased the price of cottonseed oil.³

³To the statement in the text an exception should be made for the summer of 1926. Beginning with November, 1925, when the price was only slightly above the English price, the price rose rapidly, not only absolutely but relatively to the English price, reaching a peak in June, 1926, when it stood 5 cents above the November price and also 5 cents above the English price. During the summer months exports sank to insignificance, and these small exports were nearly all to Canada and Mexico. On the other hand, imports which had entirely disappeared in 1924 and 1925 were resumed. Imports for 1926 approached 7 million pounds, a greater quantity than had been received in any year since 1920. There is every reason for believing that for several months the duty was fully effective in raising the domestic price of cottonseed oil. With the appearance of the new crop the price rapidly fell until by the end of the year it was about on a level with the English price. American cotton growers received little or no benefit: during the months of high prices they had no cottonseed to sell, and with the new crop the price promptly declined. It is interesting to note that during these summer months the price of lard and peanut oil also rose, quite in

IV. LINSEED OIL: FLAXSEED

The Act of 1909 left the duty on flaxseed at 25 cents a bushel, where it had been fixed in 1897, but reduced the duty on linseed oil from $2\frac{2}{3}$ cents a pounds to 2 cents. In 1913 the duty on seed was put at 20 cents a bushel and the duty on oil at $1\frac{1}{3}$ cents a pound. The Emergency Act in 1921 raised the duty on seed to 30 cents a bushel and left the duty on oil unchanged. In the general tariff revision of 1922 the duty on seed was further increased to 40 cents and the duty on oil was put at 3.3 cents a pound.

These rates, however, do not tell the whole story. Manufacturers of linseed oil produce linseed oil cake also as a by-product. The Eastern mills use imported seed almost exclusively. They export large quantities of cake and avail themselves of whatever drawback may be allowed by the government on the duty paid for the imported seed. Drawbacks when allowed at all are allowed in proportion to the values of the several products arising from the imported article. In the case of linseed oil the drawback for exported cake amounts to about 25 per cent of the duty paid on the imported seed. The Acts of 1897, 1913, and, by implication, the Act of 1921 contained a provision to the effect that no drawback would be allowed on the export of a by-product made from im-

harmony with the idea of an elastic bond between the prices of these oils. See pp. 14, 105.

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ported material when the by-product was on the free list. This provision is not found in the Acts of 1909 and 1922. Since oil cake was on the free list in all of these Acts it follows that no drawback was allowed under the Acts of 1897, 1913, and 1921, but that a drawback was allowed under the Acts of 1909 and 1922. The Western crushers can easily avail themselves of the drawback on such seed as they import—almost exclusively from Canada—but they seldom do so; the reasons being that in exporting to Europe, the principal foreign market, they are not only obliged to pay ocean freight but also transportation charges to the seaboard, and the fact that they have a good domestic market for their cake among the farmers of the Middle West. In spite of this, the drawback is a factor of considerable importance as affecting the benefit which domestic growers receive from the duty.

If full allowance be made for drawback, the duties on flaxseed under the several Acts become: 1897, 25 cents a bushel; 1909, 18½ cents; 1913, 20 cents; ⁴ 1921, 30 cents; 1922, 30 cents.

However, the duty, with or without the drawback, is only one of the factors which fix the price that domestic growers receive for their seed. In order to estimate its true effect it is necessary to make allowance for the other factors and to enter in some detail into the competitive situation.

⁴Inasmuch as the Act of 1913 made no allowance for impurities in Argentine seed, the duty in terms of clean seed was really a little more than 20 cents—nearly 21.

The growing of flaxseed in the United States is confined to a few states in the Middle West. It is also grown across the border in Canada, and is imported in substantial quantities from that country. It is imported in much larger quantities from Argentina. The only use of flaxseed of any importance is in the manufacture of linseed oil.

The crushing of flaxseed for oil is virtually in the hands of a few great concerns, each of which has mills both in the East and the West.⁵ Hence they have it in their power to divert business to their Eastern or Western plants in accordance as price conditions are most favorable. In a general way, the Eastern plants crush Argentine seed; the Western plants, domestic and Canadian seed; and the Buffalo plants seed from all three sources. Competition therefore tends to bring the prices of all three kinds of seeds to a parity at Buffalo. Domestic seed seldom moves east of Buffalo, and Argentine seed, only sparingly, moves west of that point.

Obviously the cost of Argentine seed delivered at points west of Buffalo would be greater than the cost at Buffalo and the costs of domestic and Canadian seed less than their costs at Buffalo.

⁵The following concerns crush about 85 per cent of the flaxseed crushed in the United States: American Linseed Oil Company with mills in New York, Buffalo, Minneapolis, and San Francisco; Spencer Kellogg and Sons, with mills in New York, Buffalo, Duluth, and Minneapolis; Archer-Daniels-Midland, with mills at New York, Buffalo, Toledo, and Minneapolis; The Pittsburgh Plate Glass Co., with mills at Newark, New Jersey, and Redwing, Minnesota; and the National Lead Company with mills at Philadelphia, Brooklyn, and Chicago.

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Hence it would seem that there could be little competition between Argentine and domestic seed and that in estimating the effects of the tariff it would only be necessary to compare prices of domestic and Canadian seed. This is true, but it must not be supposed that the presence of Argentine seed is of no significance. Because of the consolidation of ownership in the Eastern and Western mills, whenever the prices of domestic and Canadian seed rise above their normal relation to the price of Argentine seed, the crushers can divert business to their Eastern or Buffalo plants and hence by weakening the demand for seed in their Western plants bring down the prices of domestic and Canadian seed. Whenever the prices of domestic and Canadian seed fall relatively to Argentine seed, a reverse process may take place. It follows that the price of Argentine seed, allowance being made for transportation, duty, and drawback, tends to fix the price of both domestic and Canadian seed.

As just stated the effect of the tariff on the price of flaxseed may be best estimated by using the domestic and Canadian seeds as a basis of comparison. But such a comparison will be of little value unless the actual facts in regard to marketing be taken into account. The domestic and Canadian crops are both harvested in the fall months. Growers are now very generally equipped with radio apparatus, and sell, some to agents of the crushers and some to elevator companies, at prices, which, for the domestic grow-

EFFECTS OF RECENT TARIFF CHANGES 187

ers, are based on Minneapolis quotations, and for the Canadian growers on Winnipeg quotations, these quotations being broadcast from the centers just mentioned. A few farmers hold their seed for a better price but the great bulk of the crop, estimated at about 85 per cent, leaves the hands of the growers, both in the United States and Canada, before the end of the year. During this period, as will presently be shown, competition among American farmers to dispose of their crop so lowers the price that the duty is prohibitive with respect to the Western mills. Winnipeg quotations, however, are for seed laid down at Fort William or Port Arthur, and while navigation is open some Canadian seed is shipped by water to Buffalo. Some also enters the United States at Portal and is shipped in bond to Duluth and thence by water to Buffalo. By the time navigation closes in December the greater part of the domestic crop has left the hands of the growers and a large portion of it has been consumed by the Western crushers. During the winter and early spring, in order to meet the needs of these crushers, considerable quantities of Canadian flaxseed move back from Port Arthur and Fort William, the Minneapolis price now being high enough to permit importation. When navigation opens later in the spring the movement of Canadian flaxseed to Buffalo is resumed.

Thus during the winter and until the next harvest the Minneapolis price is often higher than the

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Winnipeg price by the full amount of the duty or even more, both prices being roughly determined by the price of Argentine seed in the manner already described. But during this period only those growers who have been able to store their seed obtain the benefit of this higher price.

The great bulk of the domestic crop is sold by growers at a time when, so far as their market is concerned, the duty is prohibitive. Hence the price is determined solely by conditions of domestic supply and demand. A large crop therefore will tend to bring about a low Minneapolis price, which may exceed the Winnipeg price by an amount much less than the duty. On such occasions it would appear that the benefit received by the growers, in whose behalf the duty was increased, is also much less than the duty.

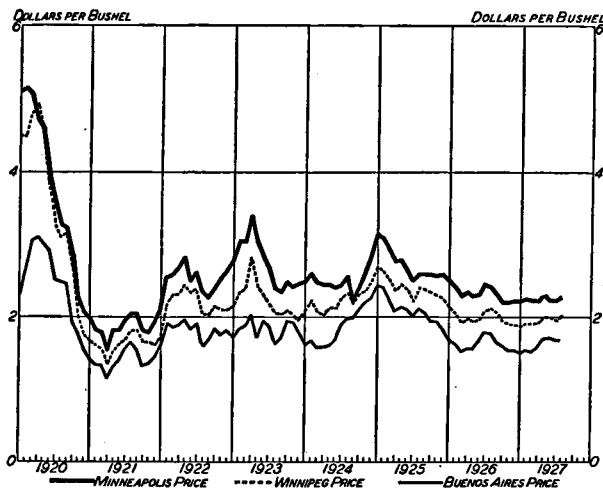
The results of the foregoing analysis are verified by the table on page 190 and the accompanying chart on page 189. The chart shows the close relationship between Argentine, Canadian, and domestic prices, and also the tendency of domestic prices to approach nearer the foreign prices in the fall months. This tendency is made more manifest by taking averages.

The difference between Minneapolis and Buenos Aires prices for the years covered by the table averaged:

	1920	1921	1922	1923	1924	1925	1926
January to July	\$1.78	\$.45	\$.67	\$1.12	\$.79	\$.62	\$.75
July to December...	.70	.44	.67	.61	.48	.60	.66

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FLAXSEED PRICES AT MINNEAPOLIS, WINNIPEG, AND BUENOS AIRES, 1920-1927.*



* See table on pp. 190 to 193.

and the difference between Minneapolis and Winnipeg prices for the same period averaged:

	1920	1921	1922	1923	1924	1925	1926
January to July	\$.24	\$.24	\$.31	\$.60	\$.34	\$.37	\$.37
July to December ...	.21	.18	.35	.38	.20	.25	.29

About 85 per cent of the domestic crop leaves the hands of the growers by the end of December. Over 70 per cent is marketed during the three months, September, October, November. The average differences between the Minneapolis and Winnipeg prices for these months has been:

PRICES OF FLAXSEED

I. Minneapolis and Winnipeg Prices, by Months, 1920-1927

(In dollars per bushel, with Canadian prices converted at current rates of exchange.)

Month	1920			1921			1922			1923		
	Minneapolis	Winnipeg	Difference	Minneapolis	Winnipeg	Difference	Minneapolis	Winnipeg	Difference	Minneapolis	Winnipeg	Difference
January	5.11	4.50	.61	1.96	1.65	.31	2.10	1.71	.39	2.80	2.15	.65
February	5.15	4.48	.67	1.81	1.60	.21	2.53	2.17	.36	3.05	2.31	.74
March	5.06	4.82	.24	1.77	1.54	.23	2.56	2.28	.28	3.04	2.39	.65
April	4.71	4.94	-.23	1.53	1.33	.20	2.65	2.29	.36	3.39	2.80	.59
May	4.59	4.43	.16	1.81	1.61	.20	2.80	2.42	.38	3.03	2.43	.60
June	3.92	3.81	.11	1.81	1.61	.20	2.47	2.32	.15	2.83	2.30	.53
July	3.46	3.28	.18	1.94	1.67	.27	2.60	2.37	.23	2.65	2.18	.47
August	3.28	3.10	.08	2.03	1.80	.23	2.34	2.03	.31	2.38	2.05	.33
September	3.22	3.18	.04	2.02	1.80	.22	2.25	2.02	.23	2.34	2.04	.30
October	2.84	2.68	.16	1.80	1.63	.17	2.38	2.13	.25	2.47	2.08	.39
November	2.25	2.04	.21	1.77	1.63	.14	2.49	2.09	.40	2.41	2.04	.37
December	2.06	1.75	.31	1.91	1.60	.31	2.62	2.06	.56	2.45	1.95	.50
Average	3.80	3.58	.22	1.85	1.61	.24	2.48	2.16	.32	2.74	2.23	.51

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Month	1924			1925			1926			1927		
	Minneapolis	Winnipeg	Difference	Minneapolis	Winnipeg	Difference	Minneapolis	Winnipeg	Difference	Minneapolis	Winnipeg	Difference
January	2.48	2.08	.40	3.14	2.68	.46	2.50	2.14	.36	2.21	1.87	.34
February	2.59	2.22	.37	3.07	2.68	.44	2.42	2.05	.38	2.24	1.90	.34
March	2.47	2.07	.40	2.92	2.50	.42	2.28	1.92	.36	2.21	1.90	.31
April	2.45	2.02	.43	2.76	2.35	.41	2.34	1.96	.38	2.21	1.92	.29
May	2.45	2.12	.33	2.78	2.44	.34	2.29	1.93	.36	2.31	2.00	.31
June	2.41	2.11	.30	2.64	2.37	.27	2.31	1.95	.36	2.23	1.99	.24
July	2.45	2.26	.19	2.49	2.22	.27	2.45	2.08	.37	2.22	1.95	.27
August	2.57	2.34	.23	2.59	2.40	.19	2.42	2.11	.31	2.27	2.02	.25
September	2.24	2.20	.04	2.59	2.37	.22	2.32	2.05	.27	—	—	—
October	2.41	2.33	.08	2.58	2.33	.25	2.20	1.94	.26	—	—	—
November	2.62	2.35	.27	2.56	2.29	.27	2.20	1.91	.29	—	—	—
December	2.87	2.48	.39	2.58	2.26	.32	2.22	1.88	.34	—	—	—
Average	2.50	2.22	.28	2.72	2.40	.32	2.33	1.99	.34			

-- Minneapolis prices are for Flaxseed No. 1 as given in U. S. Bureau of Labor Statistics Bulletin 1920-1926.

Winnipeg prices are for No. 1, Northwestern Canada, and for 1920-1924 are from Prices and Price Indexes, Canada, Dominion Bureau of Statistics; and for 1925-1926 are from Dominion Bureau of Statistics, Monthly Bureau of Agricultural Statistics.

II. Minneapolis and Buenos Aires Prices by Months, 1920-1926

(In dollars per bushel, with Buenos Aires prices converted at monthly average rates of exchange.)

Month	1920			1921			1922			1923		
	Minneapolis	Buenos Aires	Difference	Minneapolis	Buenos Aires	Difference	Minneapolis	Buenos Aires	Difference	Minneapolis	Buenos Aires	Difference
January	5.11	2.30	2.81	1.96	1.40	.56	2.10	1.62	.48	2.80	1.72	1.08
February	5.15	2.64	2.51	1.81	1.33	.48	2.53	1.91	.62	3.05	1.83	1.22
March	5.06	3.05	2.01	1.77	1.33	.44	2.56	1.86	.70	3.04	1.87	1.17
April	4.71	3.09	1.62	1.53	1.15	.38	2.65	1.89	.76	3.39	2.02	1.37
May	4.59	3.01	1.58	1.81	1.30	.51	2.80	1.96	.84	3.03	1.72	1.31
June	3.92	2.92	1.00	1.81	1.40	.41	2.47	1.84	.63	2.83	1.94	.89
July	3.46	2.52	.94	1.94	1.56	.38	2.60	1.91	.69	2.65	1.86	.79
August	3.26	2.48	.78	2.03	1.65	.38	2.34	1.68	.76	2.38	1.62	.76
September	3.22	2.46	.76	2.02	1.55	.47	2.25	1.69	.56	2.84	1.70	.64
October	2.84	1.93	.91	1.80	1.33	.47	2.38	1.84	.54	2.47	1.94	.53
November	2.23	1.77	.51	1.77	1.36	.41	2.49	1.77	.72	2.41	1.93	.48
December	2.06	1.54	.52	1.91	1.44	.47	2.62	1.82	.80	2.45	1.78	.67
Average.....	3.80	2.48	1.32	1.85	1.40	.45	2.48	1.81	.67	2.74	1.83	.91

Month	1924			1925			1926			1927		
	Minneapolis	Buenos Aires	Difference	Minneapolis	Buenos Aires	Difference	Minneapolis	Buenos Aires	Difference	Minneapolis	Buenos Aires	Difference
January	2.48	1.62	.86	3.14	2.44	.70	2.50	1.67	.83	2.21	1.50	.71
February	2.59	1.66	.93	3.07	2.41	.66	2.42	1.61	.81	2.24	1.54	.70
March	2.47	1.58	.89	2.92	2.25	.67	2.28	1.51	.77	2.21	1.52	.69
April	2.45	1.58	.87	2.76	2.09	.67	2.34	1.55	.79	2.21	1.58	.63
May	2.45	1.60	.85	2.78	2.14	.64	2.29	1.55	.74	2.31	1.70	.61
June	2.41	1.68	.73	2.64	2.11	.53	2.31	1.66	.65	2.23	1.71	.52
July	2.45	1.88	.57	2.49	2.02	.47	2.45	1.78	.67	2.22	1.68	.54
August	2.57	1.93	.59	2.59	2.12	.47	2.42	1.77	.65	2.27	1.69	.58
September	2.24	1.99	.25	2.59	2.06	.53	2.32	1.64	.68	—	—	—
October	2.41	2.12	.29	2.58	1.94	.64	2.20	1.59	.61	—	—	—
November	2.62	2.21	.41	2.56	1.94	.62	2.20	1.58	.62	—	—	—
December	2.87	2.26	.61	2.58	1.83	.75	2.22	1.58	.69	—	—	—
Average.....	2.50	1.84	.66	2.72	2.11	.61	2.33	1.62	.71			

Minneapolis prices are for Flaxseed No. 1 as given in U. S. Bureau of Labor Statistics Bulletin, 1920-1927.

Buenos Aires prices are for Flaxseed allowing 4 per cent for extraneous matter, and, for 1920 to 1925, are from U. S. Department of Agriculture, *Yearbook*, 1925, p. 841; and, for 1926-1927, from Bureau of Agricultural Economics.

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	1920	1921	1922	1923	1924	1925	1926
September, October, and November ...	\$.20	\$.18	\$.33	\$.35	\$.13	\$.25	\$.26

It costs about 80 cents including the duty to deliver Argentine seed in Buffalo, and considerably more than this to deliver it in Minneapolis. Hence, since the difference between Minneapolis and Buenos Aires prices seldom equals 80 cents, even during the months when the difference is greatest, it will seldom pay the Western crushers to use it. Transportation costs must also be added to the Winnipeg quotations to find the price at which Canadian seed can be laid down in Minneapolis, that is, the differences in price attributable to the duty between American and Canadian flaxseed are in reality even less than those shown.⁶ But the differences shown, during the period when farmers are marketing the bulk of their crops, are much less than the duty, even if allowance be made for the possibility of obtaining a drawback on imported seed.

The difference between the Minneapolis and the Winnipeg price is therefore a very liberal measure of the benefit which domestic growers are receiving from the tariff.⁷ When the difference is great the

⁶The freight charge from Winnipeg to Minneapolis is 14 cents a bushel. But all Winnipeg quotations are for seed laid down in Fort William or Port Arthur. Under the existing duty, as already explained, the chief movement of Canadian seed is through these points for shipment by water. If the duty were substantially lower, the movement might be direct from Canadian points to Minneapolis.

⁷It would be unsafe to make a more positive statement than that made in the text. The uncertainty lies in the potential competition of Argentine seed. It is true that Argentine seed

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benefit is great; when the difference is small the benefit is small. The differences vary greatly in different years. In 1923 during the three months, September, October, and November, it was nearly the full amount of the duty—35 cents. During the same period in the following year it was only 13 cents.

This is the gist of it: the foreign seed being virtually excluded from direct competition during these months the Minneapolis price is fixed solely by conditions of domestic supply and demand, until the price rises high enough to permit foreign competition to make itself felt. The supply depends on the size of the crop, and the demand largely on booms or depressions in building operations; the size of the crop depends on acreage and yield per acre; and finally yield per acre depends chiefly on the weather, and acreage on the relative profits per acre as between flaxseed and spring wheat the preceding year. As all of these factors are subject to change, it is clear that the effect of the duty on price—that is, the difference between the actual price and the price

does not come into direct competition with domestic seed in its chief market. But indirectly it exercises an effect on the prices of both domestic and Canadian seed. It is quite possible that a substantial reduction of the duty would lead crushers to divert business to their Eastern plants, thus weakening the demand for seed in their Western plants and lowering the price. It is a question of the relative cheapness of seed as compared with distribution costs of oil. Another element of uncertainty lies in the fact that the difference in price is quite as likely to be due, at least in part, to a lowering of the Canadian price as to a raising of the American price. See Appendix B.

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which would have prevailed had there been no duty—must vary from year to year.

From the foregoing it appears that, while the duty on flaxseed has been effective in maintaining a domestic price higher than the foreign price, the effect has been much less than the full amount of the duty. In marked contrast is the effect of the tariff on the price of linseed oil. The domestic price has been maintained above the foreign price by an amount considerably in excess of the duty. This is shown by the table on page 198 and the chart on page 197.

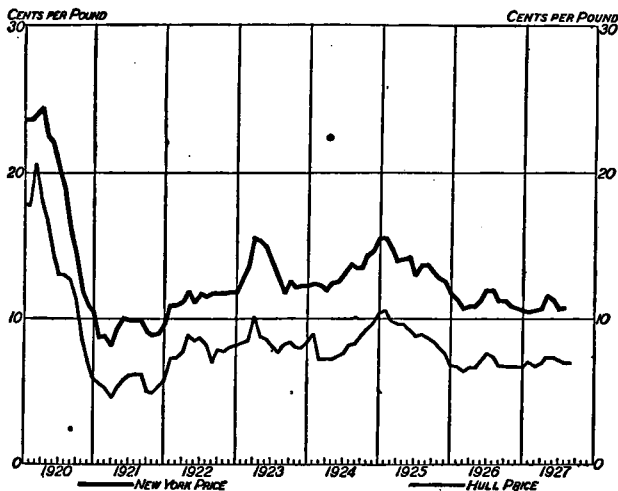
During all of 1920 and 1921, and until September 21, 1922, the duty on linseed oil was $1\frac{1}{3}$ cents a pound. During this period the difference between the New York and Hull price averaged 4.2 cents a pound, the range being from 7.5 cents in June, 1920, to 2.6 cents in June, 1922. Since September 22, 1922, the duty has been 3.3 cents a pound, and the difference in price (through December, 1926) has averaged 4.6 cents. A part of this excess may be accounted for by costs of transportation, about $\frac{1}{2}$ cent a pound in bulk and 1.3 cents, barreled.* But even with allowance made for transportation the foreign and domestic averages differ by more than

*The U. S. Tariff Commission figures are 2.7 cents a gallon in bulk and 7 cents a gallon in barrels. It is maintained in the brief for the Applicants for a reduction in the linseed oil duty that these figures neglect leakage and other costs and that the true figures should be 4.1 cents a gallon in bulk and 9.7 cents a gallon in barrels. U. S. Tariff Commission, *Summary of Information on Linseed Oil*, p. 35; *Brief on Behalf of Applicants for a Reduction in the Duty on Linseed Oil*, pp. 36, 37.

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the duty, and in some months the excess has been over two cents. This excess of the domestic price above the foreign price plus duty and transportation costs is due to the control exercised by the domestic

PRICES OF CRUDE LINSEED OIL AT NEW YORK AND HULL, 1920-1927.*



* See table on pp. 198 and 199.

crushers over the distribution of oil within the United States.⁹

The tariff, therefore, supplemented by the marketing control exercised by the domestic crushers is re-

⁹The domestic crushers have developed a comprehensive system for oil distribution within the United States and very little foreign oil penetrates beyond the seaboard, unless imported by the crushers themselves. See *Brief on Behalf of the Applicants for a Reduction in the Linseed Oil Duty*, pp. 17-21.

NEW YORK AND HULL PRICES OF LINSEED OIL, BY MONTHS, 1920-1927.
(In cents per pound.)

Month	1920			1921			1922			1923		
	New York	Hull	Difference	New York	Hull	Difference	New York	Hull	Difference	New York	Hull	Difference
January	23.6	17.8	5.8	10.4	5.9	4.5	9.6	5.8	3.8	11.8	8.2	3.6
February	23.6	17.7	5.9	8.7	5.6	3.1	10.9	7.3	3.6	12.6	8.3	4.3
March	24.0	20.6	3.4	8.8	5.2	3.6	10.9	7.3	3.6	13.6	8.5	5.1
April	24.4	18.1	6.3	8.1	4.4	3.7	11.1	7.7	3.4	15.5	10.1	5.4
May	22.5	16.7	5.8	9.3	5.3	4.0	11.9	8.9	3.0	15.3	8.8	6.5
June	22.0	14.5	7.5	10.0	5.8	4.2	11.1	8.5	2.6	14.9	8.6	6.3
July	20.3	13.0	7.3	9.9	6.1	3.8	11.7	8.7	3.0	13.8	8.1	5.7
August	18.8	13.0	5.8	9.9	6.2	3.7	11.5	8.2	3.3	12.8	7.7	5.1
September	16.2	12.7	3.5	9.9	6.2	3.7	11.7	7.0	4.7	11.8	8.2	3.6
October	14.3	11.4	2.9	9.1	5.0	4.1	11.7	7.8	3.9	12.6	8.4	4.2
November	11.9	8.7	3.2	8.9	4.9	4.0	11.7	7.7	4.0	12.1	8.1	4.0
December	10.9	7.0	3.9	9.0	5.3	3.7	11.8	8.0	3.8	12.2	8.0	4.2
Average.....	19.4	14.3	5.1	9.3	5.5	3.8	11.3	7.7	3.6	13.2	8.4	4.8

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Month	1924			1925			1926			1927		
	New York	Hull	Difference	New York	Hull	Difference	New York	Hull	Difference	New York	Hull	Difference
January	12.2	8.4	3.8	15.5	10.4	5.1	11.7	6.8	4.9	10.5	6.8	3.7
February	12.4	8.9	3.5	15.5	10.6	4.9	11.8	6.7	4.6	10.4	7.0	3.4
March	12.8	7.2	5.1	14.8	9.9	4.9	10.7	6.4	4.3	10.5	6.7	3.8
April	12.0	7.2	4.8	13.9	9.6	4.3	10.8	6.6	4.2	10.6	6.9	3.7
May	12.5	7.2	5.3	14.0	9.6	4.4	10.8	6.6	4.2	11.5	7.8	4.2
June	12.6	7.4	5.2	14.1	9.2	4.9	11.2	7.1	4.1	11.2	7.8	3.9
July	13.1	7.6	5.5	13.0	8.8	4.2	11.9	7.6	4.3	10.6	7.1	3.5
August	13.7	8.2	5.5	13.6	8.9	4.7	11.9	7.4	4.5	10.7	6.9	3.8
September	13.5	8.8	4.7	13.7	8.7	5.0	11.2	6.8	4.4	10.4	6.9	3.5
October	13.5	8.9	4.6	13.2	8.4	4.8	11.2	6.7	4.5	—	—	—
November	14.3	9.8	4.5	12.8	8.0	4.8	10.8	6.7	4.1	—	—	—
December	14.7	9.7	5.0	12.6	7.6	5.0	10.7	6.7	4.0	—	—	—
Average	13.1	8.2	4.9	13.9	9.1	4.8	11.2	6.9	4.3	—	—	—

New York prices are for raw oil (carload lots) as given in U. S. Bureau of Labor Statistics, *Wholesale Price Bulletins*. Hull prices are for naked, spot (converted at current rates of exchange), as given in *London Grain, Seed, and Oil Reporter*.

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sponsible for a price of oil to American consumers even greater than the duty imposed.¹⁰

The increased duties on flaxseed and linseed oil in the Act of 1922 have been followed by an increased domestic production of both flaxseed and linseed oil. For reasons given on page 243 the Act of 1921 tended to encourage imports of linseed oil rather than to encourage the domestic production of either the seed or the oil. Imports of oil increased from 35 million pounds in 1920 to 60 million pounds in 1921, and 144 million pounds in 1922, while imports of seed and production of both oil and seed in 1922 were all below the corresponding figures in 1920. In 1923, however, with a slightly increased duty on flaxseed¹¹ and a greatly increased duty on linseed oil the production of both seed and oil greatly increased, and imports of oil fell off.

The conditions referred to in the last paragraph are shown in tabular form in the table on page 201.

Production of flaxseed increased from 10,375,000 bushels in 1922 to 31,547,000 bushels in 1924, and has since steadily declined to 19,459,000 in 1926. Production of oil increased from 456 million pounds in 1922 to 764 million pounds in 1925 with a falling

¹⁰ It would be more accurate to say that the domestic price has been maintained above the foreign price by an amount greater than the duty. The removal of the duty might result in an increase in the foreign price as well as a decline in the domestic price to an equilibrium price somewhere between. The effect of the duty so far as American consumers are concerned is the difference between the domestic price and this equilibrium price. See Appendix B.

¹¹ See p. 183.

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PRODUCTION AND TRADE DATA RELATING TO FLAXSEED AND LINSEED OIL FOR THE YEARS 1920 TO 1926, INCLUSIVE

(Flaxseed in thousands of bushels; linseed oil in millions of pounds)

Year	Flaxseed			Linseed Oil		
	Production	Imports	Exports	Production	Imports	Exports
1920..	10,752	24,617	24	485	35	5
1921..	8,029	12,323	17	483	60	4
1922..	10,375	14,913	16	456	144	3
1923..	17,060	24,332	..	654	43	3
1924..	31,547	16,589	..	706	13	2
1925..	22,424	16,510	..	764	14	2
1926..	19,459	22,316	..	720	10	3

off to 720 million pounds in 1926. Imports of oil, on the other hand, have steadily fallen off since 1922 from 144 million pounds in that year to only 10 million pounds in 1926.

The changes in the tariff on oil and seed in 1922 were undoubtedly the chief factors responsible for the increased production and decreased imports of oil, and were also contributory factors to the increased production of seed. That they were not the sole factors, in the case of the seed, is suggested by the subsequent decline in production without any change in duty. Other causes are found in the fact that flax is still largely a "pioneer crop," and in the close correlation between flax acreage in a given year and the relative profits per acre on flax and spring wheat in the previous year. Flax is an alternative crop with spring wheat and when the profits per acre on spring wheat are large the acreage sown to flax in the following year is likely to decline and

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vice versa. The abnormally low price of spring wheat in 1923-24 was undoubtedly an important factor in the bumper flax crop of 1924, while the recovery in the price of spring wheat in the two years following was the main factor responsible for the declining flax crop in 1925 and 1926.¹²

In this connection it should be noted as significant of the importance of factors other than the tariff, that in 1923, the year following the increase in duty, imports increased from 15 to 24 million bushels and then, after a sharp decline in 1924 and 1925 to about 16 million bushels, again increased in 1926 to 22 million bushels, though during these years no change had been made in the duty.

Even in the years immediately following 1922, the changes in the tariff were not the sole causes of the increased domestic production of seed. A coordinate cause was the boom in building operations, strengthening the demand for linseed oil and in consequence the demand for flaxseed. The importance of this factor is shown by the fact that not only was there an increase in production in 1923, which indeed might be accounted for by the increased duty, but also by the fact that there was a notable increase in imports, entering the country in spite of it.

¹² The slump in the price of spring wheat in 1923-24 was world-wide as was also the subsequent recovery. The increased duty on spring wheat by Presidential proclamation in 1924 may have augmented in the United States the general world conditions which led to the recovery in price in the following years, and hence may have been in part responsible for the decreased acreage in flaxseed.

V. MARINE ANIMAL AND FISH OILS

The duties on these oils were raised in the tariff Act of 1922 as follows: Cod, herring, and menhaden oil from 3 cents to 5 cents a gallon; sperm oil from 8 to 10 cents a gallon and other whale oil from 5 to 6 cents; seal oil from 3 to 6 cents. On all other fish oils the rate was changed from 3 cents a gallon to 20 per cent ad valorem.

The price of these oils has not been appreciably raised by the tariff. Menhaden oil is produced only in the United States, hence a duty on it is purely nominal. As whale oil continues to be imported in large quantities the duty has undoubtedly been effective in raising its price. The increase in price resulting from this source, however, would not be greater than the increase in duty— $2/15$ of a cent per pound.

The actual rise in price of both these oils, however, was much greater than this. From a low level in 1921 whale oil had risen, by the end of 1923, 2.3 cents and menhaden oil 3.56 cents; and by the end of 1925 whale oil had risen 3.04 cents and menhaden oil 3.57 cents. The question arises whether, though the duty on the oils themselves could not have been responsible for so great a rise, it might not have been due to the increased duties on other oils with which these oils compete. This could hardly have been the case with whale oil, since it is an important article of international trade whose price is fixed in

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a world market. Any tendency of the American price to rise to a figure higher than the world price by more than the duty plus transportation costs would be quickly counteracted by increased supplies on the American market reducing the price to its normal relation to the world price. The American tariff could hardly be expected to raise the world price.

Since menhaden oil, however, is a purely domestic product, the possibility of affecting its price by duties on competing oils is greater. Its most important uses are as a soap oil and as a drying oil. As a soap oil it competes with whale oil, the greases, inedible tallow, palm oil, palm kernel oil, inedible olive oil, and coconut oil. None of these oils, except whale oil, was affected in price by the increased duties; and whale oil, as has just been noted, could not have been raised more than $\frac{2}{15}$ of a cent. Both whale oil and menhaden oil in order to be adapted to soap making must be hydrogenated. As this process involves some expense they can compete with the other oils mentioned only at a lower price. As a soap oil the price of menhaden oil is tied very closely to that of whale oil. Between these oils and other soap oils there is probably some "slack" to be taken up before a rise in their prices would lead to a substitution of other soap oils for them. It is possible that a further advance in the duty on whale oil might be effective in raising its price and in carrying with it the price of menhaden oil before the sub-

stitution of other oils prevented a further rise in price. The most that can be claimed for the tariff as it is, is that it probably raised the price of whale oil $2/15$ of a cent a pound and may have raised the price of menhaden oil by a like amount.

Were it not that the output of menhaden oil is greatly in excess of the quantity that can be disposed of as a drying oil, the tariff might have had the effect of raising the price of menhaden oil when used for this purpose as it undoubtedly raised the price of soya bean oil. Both soya bean and menhaden oils are fairly satisfactory paint oils though inferior to linseed oil. Hence in competing with linseed oil they must sell at a lower price. In the case of menhaden oil, since in order to dispose of the entire output at least a third of it must be sold to soap makers, this price will be the price which it will fetch as a soap oil.

What has been said of menhaden oil can also be said with but slight variation of the other fish oils. Hence it would seem that the considerable rise in price of this entire class of oils which has taken place since 1921 was due in the main to causes other than the tariff.

VI. OLIVE OIL.

The duty on edible olive oil was reduced from 40 cents to 20 cents a gallon in 1913; restored to 40 cents in 1921; and raised to 6.5 cents a pound in 1922. The existing duty is more than double the duty levied in 1913, as 20 cents a gallon is equal to

FOREIGN AND DOMESTIC PRICE OF OLIVE OIL, BY MONTHS, 1920-1927.
(In cents per pound)

Month	1920		1921		1922		1923	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	43.2	33.6	45.3	34.5	21.3	21.1	23.9	16.0
February	45.3	31.5	36.7	38.4	24.3	20.5	24.0	15.9
March	48.1	34.5	33.3	26.3	24.0	20.4	24.0	16.0
April	46.2	33.5	26.7	25.6	24.0	19.7	24.0	16.3
May	46.5	35.2	26.7	24.8	24.0	20.8	24.0	16.3
June	47.4	43.5	23.3	22.3	24.0	19.9	24.0	16.3
July	51.7	48.5	30.0	22.5	24.0	19.5	23.0	16.0
August	50.5	47.7	30.0	21.5	24.0	19.2	22.7	15.1
September	51.7	40.1	23.3	20.7	24.0	19.5	22.7	15.2
October	46.2	41.5	23.3	18.7	24.0	18.4	22.7	15.1
November	44.4	45.9	23.3	19.3	24.0	17.1	22.7	16.1
December	43.3	43.3	21.3	19.2	24.0	17.1	22.7	14.8

Month	1924		1925		1926		1927	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	23.5	15.4	28.7	16.9	26.7	19.6	26.7	20.5
February	26.2	15.2	27.2	17.4	26.2	17.9	27.7	20.5
March	26.7	15.3	26.7	18.7	24.7	17.6	28.5	21.3
April	26.7	16.2	26.7	17.4	24.7	17.7	28.7	22.9
May	26.7	17.3	26.7	17.1	24.7	17.3	28.7	24.5
June	26.7	17.1	26.7	16.8	24.7	17.5	28.7	24.9
July	26.7	16.6	26.7	16.2	24.7	16.7	28.7	25.8
August	26.7	16.6	26.7	16.2	24.7	16.4	31.9	24.7
September	26.7	16.8	26.7	17.8	25.1	16.4		
October	28.7	16.6	26.7	17.5	26.7	18.0		
November	28.7	19.0	26.7	18.2	26.7	19.0		
December	28.7	16.6	26.7	18.0	26.7	20.5		

Domestic prices are for olive oil in barrels, New York, as given in U. S. Bureau of Labor Statistics, *Wholesale Price Bulletin*.

Foreign prices are computed and averaged from the quantities and values of olive oil imports as given in the *Monthly Summary of Foreign Commerce*.

FOREIGN AND DOMESTIC PRICE OF OLIVE OIL, BY MONTHS, 1920-1927.
(In cents per pound)

Month	1920		1921		1922		1923	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	43.2	33.6	45.3	34.5	21.3	21.1	23.9	16.0
February	45.3	31.5	36.7	38.4	24.3	20.5	24.0	15.9
March	48.1	34.5	33.3	26.3	24.0	20.4	24.0	16.0
April	46.2	33.5	26.7	25.6	24.0	19.7	24.0	16.3
May	46.5	35.2	26.7	24.8	24.0	20.8	24.0	16.3
June	47.4	43.5	23.3	22.3	24.0	19.9	24.0	16.3
July	51.7	48.5	30.0	22.5	24.0	19.5	23.0	16.0
August	50.5	47.7	30.0	21.5	24.0	19.2	22.7	15.1
September	51.7	40.1	23.3	20.7	24.0	19.5	22.7	15.2
October	46.2	41.5	23.3	18.7	24.0	18.4	22.7	15.1
November	44.4	45.9	23.3	19.3	24.0	17.1	22.7	16.1
December	43.3	43.3	21.3	19.2	24.0	17.1	22.7	14.8

Month	1924		1925		1926		1927	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	23.5	15.4	28.7	16.9	26.7	19.6	26.7	20.5
February	26.2	15.2	27.2	17.4	26.2	17.9	27.7	20.5
March	26.7	15.3	26.7	18.7	24.7	17.6	28.5	21.3
April	26.7	16.2	26.7	17.4	24.7	17.7	28.7	22.9
May	26.7	17.3	26.7	17.1	24.7	17.3	28.7	24.5
June	26.7	17.1	26.7	16.8	24.7	17.5	28.7	24.9
July	26.7	16.6	26.7	16.2	24.7	16.7	28.7	25.8
August	26.7	16.6	26.7	16.2	24.7	16.4	31.9	24.7
September	26.7	16.8	26.7	17.8	25.1	16.4		
October	28.7	16.6	26.7	17.5	26.7	18.0		
November	28.7	19.0	26.7	18.2	26.7	19.0		
December	28.7	16.6	26.7	18.0	26.7	20.5		

Domestic prices are for olive oil in barrels, New York, as given in U. S. Bureau of Labor Statistics, *Wholesale Price Bulletin*.

Foreign prices are computed and averaged from the quantities and values of olive oil imports as given in the *Monthly Summary of Foreign Commerce*.

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about $2\frac{2}{3}$ cents a pound. These figures are the rates for the oil when imported in bulk; the rates when the oil is imported in small containers are from 1 cent to $1\frac{1}{2}$ cents per pound higher. See table on page 108. There has never been any duty on inedible olive oil.

*After the duty was raised imports of olive oil increased.*¹⁸ Before the war the annual imports averaged about 40 million pounds a year. In 1920, the last year under the lower duty, they were 30.5 million. They increased in every subsequent year and reached 87.7 million pounds in 1925. In comparison with imports the domestic output is negligible. In only two years since the war, 1924 and 1926, has it exceeded a million pounds.

As practically the whole supply of olive oil is imported, the price in this country should exceed the price abroad by the full amount of the duty, the transportation costs, and the importers' profits. Foreign and domestic prices are shown in the table on page 206, and the chart on page 209.

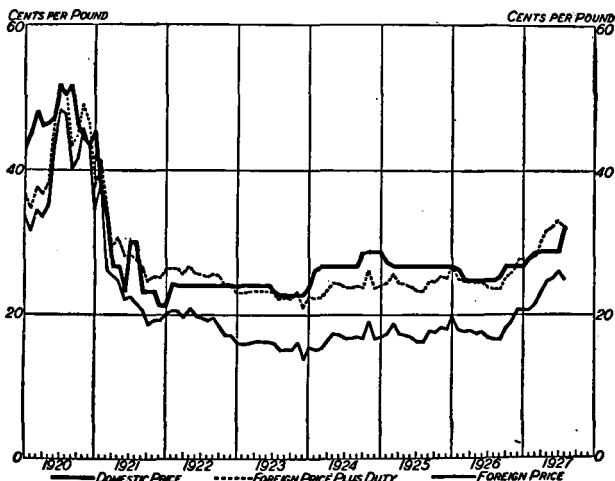
The constancy of domestic prices over considerable periods of time will be noted. Thus the domestic price remained at 26.7 cents per pound from March, 1925, to January, 1926. This suggests the possibility of price control of some sort; or it may be that the quoted prices are in the nature of "list prices" which are "shaded" by dealers in making actual sales.

¹⁸ See table on p. 262.

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The sharp decline in foreign prices in 1922 and 1923, while domestic prices remained comparatively stable, suggests that for a time the effect of the

DOMESTIC AND FOREIGN PRICES OF OLIVE OIL, 1920-1927.*



* See table on pp. 206 and 207.

increased duty was to depress the foreign, rather than to raise the American price. Beginning with 1924, and thereafter, a comparison of the domestic and foreign price levels suggests a rise in the American price.

VII. PEANUT OIL: PEANUTS

The Act of 1913 lowered the duty from 1 cent to three-fourths of a cent per pound on shelled pea-

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nuts, and from one-half of a cent to three-eighths of a cent on unshelled peanuts. The duty was raised to 3 cents on both shelled and unshelled in 1921 and to 4 cents a pound on shelled peanuts in 1922. Peanut oil, admitted free in 1909, was made dutiable at the rate of four-fifths of a cent per pound in 1913, $3\frac{7}{15}$ cents in 1921, and 4 cents in 1922.

The changes in 1913 were too small to show any appreciable effect on production or prices. It is significant, however, that the Act of 1913—an act characterized by a general reduction of duties—placed a duty on peanut oil which had previously been admitted free of duty. The reason for this was that peanut oil was at that time first promising to become an important domestic product. The increase in duties, on peanuts in 1921 and 1922 and on peanut oil in 1922, was substantial.

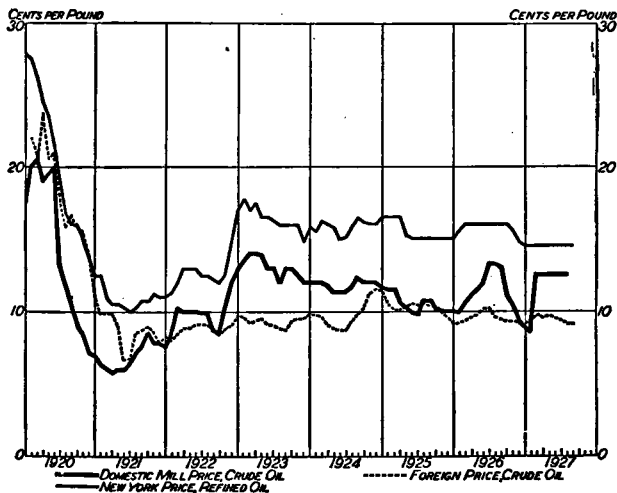
Imported peanut oil and edible domestic peanut oil were increased in price by the increased duties; industrial domestic oil was not affected. As has been noted elsewhere the bulk of the domestic output is a by-product resulting from crushing the culls and is of inferior quality. It is a soap oil and as such comes in competition with animal fats and greases, which are on a strong export basis, and with palm, palm kernel, inedible olive, and Philippine coconut oils, all of which are admitted free of duty. It is not regularly listed but is generally sold on sample to the soap trade. While, therefore, no data are available to indicate whether its price has been af-

EFFECTS OF RECENT TARIFF CHANGES 211

ected by the tariff, the competitive situation makes any such effect highly improbable.

Some domestic peanut oil, however, is of edible grade, and on such the evidence points to an increase

DOMESTIC AND FOREIGN PRICES OF PEANUT OIL, 1920-1927.*



* See table on pp. 212 and 213.

in price following as a result of the increased duties. This is shown in the chart above and in the table on page 212.

For domestic prices the "crude, f.o.b. mills" are taken, and for foreign Hull prices "crushed, extracted." The New York prices for refined peanut oil are also shown. It will be seen that for the years

DOMESTIC AND FOREIGN PRICES OF CRUDE PEANUT OIL, 1920-1927
(In cents per pound)

Month	1920		1921		1922		1923	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	*	17.5	6.9	11.0	7.5	8.3	13.0	9.7
February	22.0	20.1	6.3	9.9	8.3	8.0	13.5	9.6
March	20.5	20.6	6.0	9.9	10.3	8.5	14.0	9.2
April	19.0	23.7	5.7	9.8	10.0	8.9	14.0	9.3
May	*	20.5	6.0	9.0	10.0	8.9	13.9	9.5
June	20.0	21.0	6.0	6.6	10.0	9.1	13.0	9.1
July	13.0	17.6	6.4	6.7	9.9	*	13.0	9.0
August	*	15.8	7.3	8.5	9.9	9.1	12.0	8.8
September	10.4	16.7	7.6	8.7	8.7	8.8	13.0	8.7
October	9.0	15.8	8.5	9.0	8.5	8.4	13.0	9.3
November	8.4	15.5	7.8	8.6	10.3	8.8	12.5	9.5
December	7.1	13.7	7.8	7.9	12.0	9.1	12.0	9.5
Average	14.4	18.2	6.9	8.8	9.6	8.7	13.1	9.3

Month	1924		1925		1926		1927	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	12.0	9.8	11.6	11.4	10.0	9.1	8.8	9.1
February	12.0	9.8	11.5	10.6	9.9	9.2	8.5	9.4
March	12.0	9.6	11.5	10.1	10.6	9.4	12.5	9.7
April	11.8	9.0	10.6	10.1	11.1	9.6	12.5	9.5
May	11.3	8.8	10.2	10.3	11.5	9.8	12.5	9.7
June	11.3	8.7	9.9	10.5	12.0	10.2	12.5	9.5
July	11.3	8.7	9.8	10.4	13.3	10.2	12.5	9.4
August	11.6	9.3	10.7	10.5	13.3	9.6	12.5	9.1
September	12.3	9.8	10.7	10.3	13.0	9.4	12.5	9.1
October	12.0	10.2	10.1	10.3	11.0	9.3		
November	12.0	11.2	10.0	9.9	10.3	9.3		
December	12.0	11.5	10.0	9.5	9.1	9.2		
Average	11.8	9.7	10.6	10.3	11.3	9.5		

Domestic prices are for crude peanuts f.o.b. mills as given in Bureau of Labor Statistics, *Wholesale Price Bulletin*.

Foreign prices are for crushed, extracted, Hull, as given in *London Grain, Seed, and Oil Reporter*.

* No quotation.

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1920 and 1921 the domestic prices averaged lower than the foreign prices by 3.82 and 1.91 cents per pound respectively. Since 1921 the domestic prices have averaged higher than the foreign—1922, 0.89 cents; 1923, 3.83 cents; 1924, 2.10 cents; 1925, 0.28 cents. A striking feature of the chart is the sharp rise in price of domestic crude oil from October, 1922, to April, 1923, both absolutely and relatively to the foreign price, and the general tendency to decline since the latter date, until in 1925 the price of the domestic oil differed but little from that of the foreign oil and during several months was actually below it.

The New York prices of refined oil also rose rapidly following the tariff Act of 1922, but although they suffered some decline after the spring of 1923, they have maintained their high level much better than have the prices of the crude oil. Apparently the duty has been fully effective in maintaining the price of the imported oil, but has been less effective in maintaining the price of the domestic oil, perhaps because of its inferior quality. It is to be noted, however, that during 1926 the domestic oil rose rapidly in price, reached a peak, and then as rapidly declined. In this rise and fall it followed very closely a similar price movement of cottonseed oil and lard, illustrating the elastic price bond connecting interchangeable oils.¹⁴

The duty on peanuts has been partially effective

¹⁴ See p. 182, footnote.

in raising the price. The increase in the duty in 1921 appears to have had little or no effect on the price of peanuts. The difference in price between domestic and Chinese peanuts, which had been declining, continued to decline. Following the Act of 1922, however, the price difference increased, but since August, 1924, it has tended to decline. The price has certainly not been raised by the full amount of the duty. The indication is that for the last two years the price increase due to the duty has not been more than half a cent a pound, allowance being made for costs of transportation. This conclusion is based on the foreign and domestic prices shown in the table on page 216.

The effect of the duty on peanuts is difficult to estimate. Imports constitute only a small part of domestic consumption (about 6 per cent) and are highly seasonal. Three-fourths of the imports are received during the four months from March to June, inclusive—the months preceding the appearance of a new crop. Those that enter during the remaining eight months are relatively insignificant in quantity and of a much greater value per pound. They are imported in the main because of their quality rather than their price. Imports appear to supplement rather than to compete seriously with the domestic crop. Judging by the differences between the domestic and foreign prices since 1924 the duty could be considerably reduced without any injury to the domestic industry.

DOMESTIC AND FOREIGN PRICES OF PEANUTS BY MONTHS, 1920-1927
(In cents per pounds)

Month	1920		1921		1922			1923		
	Domestic	China	Domestic	China	Domestic	China	London	Domestic	China	London
January	9.9	7.8	4.4	2.3	8.6	8.0	—	5.9	3.6	3.9
February	10.5	7.9	4.1	2.5	4.0	3.2	—	6.5	3.6	4.2
March	11.2	6.5	4.0	2.3	4.3	3.3	—	6.7	3.7	4.4
April	10.9	6.0	3.5	2.0	3.9	3.5	—	7.1	3.7	4.4
May	11.2	4.9	3.4	2.1	3.9	3.8	—	7.1	3.8	4.2
June	11.2	4.0	3.8	2.3	4.2	3.6	—	7.3	3.8	4.0
July	11.0	3.9	3.8	2.6	4.4	3.5	—	6.9	3.8	4.1
August	8.5	3.9	3.9	2.4	4.4	3.5	—	6.7	3.8	3.9
September	8.0	3.7	4.0	3.1	4.7	3.5	3.4	6.7	3.8	3.9
October	5.8	3.6	4.0	3.2	3.6	3.3	3.4	7.0	3.8	4.0
November	5.3	3.1	3.7	2.9	5.2	3.1	3.5	6.8	3.4	4.0
December	4.7	2.5	3.5	3.1	5.0	3.2	3.7	6.2	3.4	4.1
Average.....	9.0	4.8	3.8	2.6	4.3	3.4	—	6.7	3.7	4.1

Month	1924			1925		1926		1927	
	Domestic	China	London	Domestic	London	Domestic	London	Domestic	London
January	6.4	3.3	4.1	5.4	4.7	4.5	4.2	4.9	3.9
February	6.7	3.3	4.0	5.5	4.5	4.7	3.9	5.4	4.2
March	6.5	3.2	3.8	5.9	4.4	4.6	4.1	5.6	4.1
April	6.7	3.1	3.7	5.7	4.5	5.1	4.1	5.7	4.1
May	6.4	3.2	3.8	6.2	4.8	5.0	4.3	5.9	4.2
June	6.5	3.1	3.6	6.2	—	4.7	4.4	5.8	4.2
July	6.5	3.5	3.9	5.4	4.6	5.3	4.2	6.4	4.1
August	6.6	3.9	4.5	5.2	4.6	5.3	4.0	—	3.9
September	6.4	—	4.5	5.7	4.6	5.1	3.9	—	—
October	6.4	—	4.6	4.7	4.4	4.9	3.9	—	—
November	6.3	—	4.8	5.1	4.4	4.6	3.8	—	—
December	5.6	—	4.7	4.4	4.3	4.7	3.8	—	—
Average.....	6.4	—	4.2	5.4	4.5 ^a	4.9	4.1	—	—

^a Eleven months only.

Domestic prices are farm prices as given in the Department of Agriculture Yearbook.

Chinese prices are for shelled peanuts, Tsingtao, as given in *Certain Vegetable Oils*, Part 2, p. 155, U. S. Tariff Commission, 1926.

London prices are for Chinese peanuts, L.o.b. London, landed, as given in *London Grain, Seed, and Oil Reporter*.

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VIII. SOYA BEAN OIL

Soya bean oil, previously on the free list, was made dutiable in 1921 at the rate of $2\frac{2}{3}$ cents per pound, which was reduced in 1922 to $2\frac{1}{2}$ cents per pound. Imports of this oil vastly exceed domestic production. They were 196 million pounds in 1919 and 113 million pounds in 1920, while production in those years was negligible. The duty had little effect in stimulating domestic production, hence except for a possible lowering of the foreign price by cutting down the American demand, the price in the United States would necessarily be increased by the full amount of the duty. That such a rise in price actually took place is shown by the table on page 132. Among the oils listed in that table soya bean oil stood tenth in rank with respect to rise in price in 1923 and eleventh in rank in 1925, the rise at the former date being 3.81 cents per pound, and at the latter date, 4.54 cents per pound. Previous to the increase in duty soya bean oil had been imported chiefly as a soap oil and more sparingly as a food and drying oil. The rise in price brought about by the duty was sufficient nearly to exclude it from its soap and food uses, but when the duty on linseed oil was increased in 1922 the increased price of linseed oil permitted the continued use of soya bean oil as a substitute even at a higher price. Hence, imports of soya bean oil have continued, but greatly reduced in volume, for use as a drying oil.

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IX. THE ANIMAL FATS (EXCEPT BUTTER)

In connection with the general policy of increasing the duties on the fatty oils in the Acts of 1921 and 1922, duties were either levied for the first time or increased on lard, tallow, the greases, oleo oil, and oleo stearin. Average production, imports, and exports of these oils and fats expressed in millions of pounds and covering the five-year period from 1922 to 1926, inclusive, were as follows:

Items	Greases	Lard	Oleo Oil	Oleo Stearin	Tallow
Production	381	1,762	156	101	440
Imports	14	0	0	1	6
Exports	70	860	99	14	26

It will be seen that imports are insignificant as compared with production and small as compared with exports. There would seem to be no question that the prices of all these oils and fats are fixed in a world market and hence that the changes in duty can have had no effect.

CHAPTER VIII

WHAT SHALL WE DO WITH THE OILS DUTIES?

IN the preceding chapters an attempt has been made to lay the oils tariff situation before the reader. Attention was directed first to the composition of the oils and fats which lies at the basis of their classification and partial interchangeability, and then to their sources and methods of production, to their uses and their absolute and relative importance in commerce and industry. The tariff treatment which in the past has been applied to them was described and the effects were pointed out which have followed and which may be expected to follow various tariff changes.

The object of the foregoing analysis was to make available a body of accurate information with respect to the fatty oils, information which should afford a basis for an intelligent judgment as to the tariff policy which ought to be applied to them. Uncertainty as to what the policy ought to be springs from two causes. The first and more important is ignorance as to the actual results accomplished by protective duties; the other is disagreement as to whether a particular result is desirable from the

standpoint of public welfare. For when viewed from this point of view it will ordinarily be found that a protective duty brings in its train both desirable and undesirable results. Differences in emphasis will necessarily affect the judgment of persons called on to make a decision. For example, there may be perfect agreement as to the benefits and burdens of the duties on flaxseed and linseed oil, yet some will still render a verdict in favor of retaining, and others a verdict in favor of abandoning, the duties.

The most serious differences, however, arise from lack of knowledge. Emphatic and often repeated assertions in regard to the potency of the tariff have led the American public to expect from protective duties results that they fall far short of attaining. The preceding chapters have attempted to remove this false expectation so far as the oils duties are concerned by showing what the results have actually been. From this some estimate of tariff benefits and burdens may be made for the near future. It remains to compare benefits with burdens and thus afford the reader a basis for forming a judgment whether a net gain to the public welfare justifies a continuance of the duties.

The primary purpose of the oils duties was to increase the prosperity of certain agricultural industries. Of course in the passage of the Acts of 1921 and 1922 through Congress individual members were influenced by a variety of motives and beliefs. They were doubtless influenced by their attitude

toward such generalizations in respect to national policy as free trade and protection and by considerations of revenue. But the particular occasion for the oils duties arose from the demoralized condition into which American agriculture was thrown during the readjustment following the war. It was felt that there was an emergency situation. The Act of 1921, in which the increase in oils duties played a prominent part, recognized this situation and is officially known as the "Emergency Tariff." Farmers and their spokesmen in Congress felt that in the past the manufacturing sections of the country had been the chief beneficiaries of the tariff, while they themselves had borne the burden in the form of higher prices for what they bought. There was strong pressure, therefore, "to equalize the benefits of protection" by imposing duties on farm products—often without sufficient inquiry whether such duties would prove effective. "Equalizing the benefits of protection" meant in the case of the oils duties raising the incomes of farmers engaged in the production of oil-yielding raw materials. In addition to this primary purpose there was the further object of expanding the domestic production of some of the oils and oil-yielding materials and thereby providing alternative crops to farmers and making the United States more nearly self-sufficing with respect to those oils in which it was still dependent on foreign sources of supply.

Two questions arise in the case of each important

oil or fat: does the duty in fact attain the objects aimed at, and, whether it does or not, does it draw in its train undesirable consequences which outweigh any benefit which the attainment of the objects may confer?

I. BUTTER

The objects for which duties on butter were increased have been attained, partly as a result of the increased duties and partly as a result of other causes. Imports have diminished, production has increased, and New York wholesale prices have been for the greater part of the time since 1920 higher than foreign prices. Since the prices received by dairy farmers for their cream are tied closely to the New York price of butter, incomes of such farmers have been increased and to this extent the benefits of tariff protection have been "equalized." However, to these results the tariff was only a contributory factor. The upward trend of prices and the increased domestic production were due primarily to those improving business conditions which were responsible for the increasing prices of all the oils and fats in the years following 1921. In Chapter VI reasons were given for believing that except in the winter months New York prices would not have been very different from what they were had the 2½-cent duty continued, and even in the winter months that the benefit to the dairy interests was less than would be suggested by uncritical observation of the

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difference between New York and foreign prices.

In arriving at conclusions as to what shall be done with the butter duty, attention should be given not only to past conditions but also to present tendencies in their bearing on the future.

The first of the tendencies deserving consideration is the changing sources of imports.

Until recently Denmark was the most important source of imports. During the five-year period, 1920-1924, out of an annual average of 21,223,000 pounds, 48.1 per cent was received from Denmark; 21.7 per cent from Canada; 11.0 per cent from New Zealand; 9.6 per cent from Argentina; and 3.6 per cent from Australia. Recently, however, imports from Denmark have declined both absolutely and relatively. From 66 per cent of a total of 17 million pounds in 1921 they declined to only 7 per cent of a total of 7 million pounds in 1925. This change in the source of imports is shown more in detail in the table on page 225.

Clearly on the basis of the showing made in this study the butter duty is not of great importance either as an aid to dairymen or as a burden to consumers. The question remains whether in the light of the changes shown in the table this conclusion must be modified when looking forward to the future. Is the duty likely to become an increasingly important factor in price? Denmark is a comparatively small country and has probably about reached its limit of production. What may be said of the

OILS DUTIES

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other sources of imports, Canada, New Zealand, Australia, Argentina, and other countries?

IMPORTS OF BUTTER INTO THE UNITED STATES FOR THE YEARS
1920-1926, BY SOURCES

(Thousands of pounds)

Calendar Year	Denmark	Canada	New Zealand	Australia	Argentina	All Other	Total
1920	19,935	9,236	645	3	4,049	3,586	37,454
1921	12,238	2,846	969	1,434	696	375	18,558
1922	2,805	2,151	995	641	202	163	6,957
1923	8,822	5,931	4,708	137	2,001	2,142	23,741
1924	7,192	2,807	4,313	89	3,189	1,815	19,405
Average 1920-24 ...	10,198	4,594	2,326	461	2,027	1,616	21,223
1925	502	3,626	2,396	90	355	243	7,212
1926	1,496	340	2,088	456	1,024	2,625*	8,029
Average 1925-26 ...	999	1,983	2,242	273	689	1,434	7,620

* Of this quantity 2,273,000 was from the United Kingdom and represents chiefly reshipments of New Zealand, Siberian, Danish, and other butters. If these butters could be segregated the proportion from New Zealand would probably be increased.

Attention may be first directed to New Zealand. Conditions of production in Canada are so similar to those in the United States that Canadian competition while active can never be "ruinous." Imports from Argentina and Australia are still comparatively small and do not as yet show any marked tendency to increase. Imports from New Zealand on the other hand for the last two years have averaged greater than those from any other source, and have shown a steady upward trend from less than 2 per cent of the total imports in 1920 to nearly 30 per cent for the years 1925 and 1926. New Zealand

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1926	1,496	340	2,088	456	1,024	2,625*	8,029
Average 1925-26 ...	999	1,983	2,242	273	689	1,434	7,620

* Of this quantity 2,278,000 was from the United Kingdom and represents chiefly reshipments of New Zealand, Siberian, Danish, and other butters. If these butters could be segregated the proportion from New Zealand would probably be increased.

Attention may be first directed to New Zealand. Conditions of production in Canada are so similar to those in the United States that Canadian competition while active can never be "ruinous." Imports from Argentina and Australia are still comparatively small and do not as yet show any marked tendency to increase. Imports from New Zealand on the other hand for the last two years have averaged greater than those from any other source, and have shown a steady upward trend from less than 2 per cent of the total imports in 1920 to nearly 30 per cent for the years 1925 and 1926. New Zealand

butter, moreover, is of a high grade, selling in the New York market at prices closely approximating those of Danish butter and 92 score creamery butter. Finally, it is to New Zealand that the dairy interests themselves look for the most serious competition, at least for the next few years.

In justice to the dairymen it may be said at once that some facts in regard to butter production in New Zealand would seem to warrant their apprehensions. New Zealand is by nature admirably adapted to dairying, and the industry there is most intelligently and aggressively conducted. The cost of production is considerably lower in New Zealand than in the present great dairy region of the United States. This advantage in cost is due to the mild climate rather than to lower land values or wages.¹ The latter do not differ greatly from those prevailing in the United States. But in New Zealand stock may be pastured throughout the year with some supplementary feeding in the winter months. Hence the costs involved in providing and storing feeds and in providing shelter are greatly reduced. In addition to this natural advantage it is stated that the New Zealanders have developed more efficient methods of production than prevail generally in the United States. Producers have adopted large scale

¹The most important part of the present dairy region is found in the northern tier of states where the expense of wintering is great. Some students of the dairy industry think that it is not unlikely that as the dairy industry develops it may move southward, say, into Kentucky and Tennessee, where winters are milder.

methods. More than half the cows are milked by machines, with the aid of which a man and a boy can handle 40 to 50 cows. The fact that the flush of the New Zealand season comes in the winter months when the difference between New York and foreign prices is greatest also has a bearing on the situation. Were the tariff removed, imports would tend to be greatest and to depress prices most at the one season when the domestic industry gets its chief benefit from the duty. Finally, in spite of the great distance, transportation costs to the New York market differ but little from those from Minnesota.

On the other hand, it should not be forgotten that New Zealand is a small country with an area a little more and a population a little less than those of the single state of Nebraska. The present number of dairy cows is about $1\frac{1}{3}$ million as against over 22 million in the United States. It is estimated that about half the area suitable for dairying has already been appropriated to this use. At present about 95 per cent of the exports are shipped to England. Other European countries as well as Great Britain are dependent for a part of their butter supply on New Zealand. A shortage in these markets resulting from any considerable diversion of their customary supplies to the United States would be met by a higher price.

Other sources of supply are Argentina and Russia. The possibilities of the latter country are uncertain, but it should be said that some students of the dairy

industry believe them to be greater than those of any other country. Weighing the probabilities it would seem that while there is little immediate prospect that the change in the source of imports will seriously affect the conclusions already reached, the time may come when this could not be said. There is undoubtedly a possibility that the expanding output, but for the duty, would so alter supply conditions as seriously to affect the New York price. Since one of the major factors is Russia and since the future of Russia is highly problematical, any prediction as to the imminence of such a contingency is highly speculative. No opinion will be expressed.

More important is the recent tendency in prices. Up to the late autumn of 1926 the tariff, though undoubtedly a factor in increasing prices, particularly in the winter months, was distinctly a minor factor. It was of no considerable benefit to producers and no considerable burden to consumers. A recommendation for its retention or reduction would depend chiefly upon whether the person rendering the judgment was disposed to give "the benefit of the doubt" to protection or free trade. Since November, 1926, however, the domestic price has been maintained at so great a difference above the foreign price, even through the summer months, that the question of policy involved in the retention or reduction of the duty becomes of greater importance.

All of the evidence points to the conclusion that the price of butter has been determined chiefly by

the conditions of domestic supply and demand, and that in the past imports have played a minor part. When demand has been strong relative to production the price has gone up and producers have been able to gain some benefit from the duties. When the output has increased disproportionately to the demand the price has gone down to, or even below, the foreign price, and the tariff has ceased to be a factor. Moreover, it is probable that these alternating conditions are not disconnected. The periods of relatively high prices tend to stimulate production, and the increased production tends to depress the price. The period from the spring of 1924 to the summer of 1926, following the seventeen-month period of relatively high prices, was a period of relatively low prices. It has been followed by a period of relatively high prices, which at the present writing (January, 1928) is still continuing. Whether it will be followed by a period of relatively low prices cannot be foretold.

Under these circumstances a conclusion as to what should be done with the butter duty depends on whether or not the public welfare is best served by retaining the duty and thus affording at times, particularly in the winter months, a somewhat larger income to dairy farmers at the expense of a somewhat higher price of a necessity of life to all consumers. It is clearly a case of the character referred to in the Directors' Preface (page viii). The investigation made in this book can only serve to clarify

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the situation. The decision itself must be based on the economic, political, and social ideals of the person making it, and also on his estimate of the future. One who views the present rate of 12 cents per pound with approval or at least with complacency argues as follows:

Although the actual competition of Denmark, New Zealand, Russia and minor butter exporters is to-day by no means a desperate menace to our butter industry, there is a clear possibility of substantial expansion in several of these countries which might, when favorable seasons in two or more important countries chanced to synchronize, exert a cumulative effect of serious character upon our market. Our sensitiveness to such a danger is enhanced by the fact that our own industry has in recent years expanded to dimensions which have required aggressive exploitation of the consumer demand of the domestic market, and which threaten rather drastic price declines should the purchasing power of our own consumers be materially curtailed through business recession or a general movement toward falling prices and wages. Inasmuch as agriculture as a whole still faces serious problems of readjustment with an apparent tendency toward further reduction of our agricultural population, it would seem that the nation might well bear for the present such burden as is involved in giving this quite limited protection to an important branch of the nation's agriculture. With present urban wage levels, and

with the possibilities of substituting oleomargarin or of entering foreign butter even over a tariff barrier when price advances threaten to become inordinate, there would seem to be no pressing reason for organizing an attack on this particular schedule.

Those who did not view with complacency the recent increases in the butter duty give the following reasons for advocating its reduction:

The evidence of the foregoing analysis indicates that a substantial reduction could now be made without any considerable disturbance to the dairy industry. Up to the present time the increased duties have been of no great benefit to the dairy industry and no great burden on consumers. Still, the retention of the present rate is not a matter of indifference. For even if protection is granted, the rate should not be higher than is necessary to insure a healthy development of the industry; and they point out that under both the six and eight cent duties the industry did in fact expand rapidly.

If a reduction is to be made at all, an early reduction is desirable. The industry will adapt itself to the rate, whatever it is, but the higher the rate the greater will be the proportion of high-cost producers dependent on the tariff, and hence the longer the reduction is delayed the greater will be the shock to the industry.

It is very generally held on theoretic grounds by economists, on practical grounds by consumers generally and by manufacturers whose products are on

an export basis, and on grounds of international good-will by students of international relations, that it is desirable to make, from time to time, judicious downward revisions of the tariff with a view, perhaps, to ultimate free trade. The lower the duties in force when such revision is begun the easier the transition.

The increased duties on butter and certain other farm products was widely defended on the ground that the situation warranted special aid to agriculture. It is questionable whether such aid is afforded when it is remembered that farmers who cannot be aided by a duty on their products are more numerous than those who can and that such farmers suffer from the higher prices resulting from the increased duties in common with other consumers.

It will be seen that those who object to the present duty on butter do so largely because they regard this duty as merely one thread in a web of public policy which they regard as unwise. Hence, in a book of this kind their reasons can be only suggested. The whole subject will be adequately discussed in a forthcoming study on agricultural protection which is now in course of preparation by the Institute of Economics.

II. THE FOOD OILS

The duties on cottonseed, coconut, peanut, and soya bean oils have failed to accomplish the purposes for which they were imposed or have done more

harm than good. The only way in which a duty can benefit an industry is by creating and maintaining a difference between the foreign and domestic price of the commodity on which the duty is levied. It has been shown in Chapter VII that the increased oils duties of the Acts of 1921 and 1922 have maintained no such price difference in the case of either cottonseed or coconut oil. Neither have they done so for the bulk of the domestic peanut oil, that part of the product, that is, which is made from culls and spoiled peanuts and marketed as a soap oil. For that part of the domestic peanut oil which is edible the duty would appear to have increased the price difference, but the increase has not been well maintained and the amount of oil affected is a negligible by-product of peanut growing.

In the case of soya bean oil, however, the price difference has been increased by virtually the full amount of the duty, and to this extent domestic crushers of soya beans have doubtless benefited. But it is very doubtful whether this benefit has extended to growers. In the United States soya bean oil is a relatively unimportant by-product. As was noted in Chapter II the soya bean is grown in large quantities in the United States but chiefly as a forage crop and for introducing nitrogen into the soil. The great bulk of the beans harvested are kept for seed and for this purpose they command a better price than crushers can afford to pay for them at the present prices of oil. Hence no great quantity

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of these beans is raised for the definite purpose of extracting the oil, but out of the total quantity produced, primarily for seed, a certain proportion is always found unfit for this use and is crushed for oil.

The oil so produced sells at a higher price than it could without the duty and doubtless the crushers benefit by this higher price. But as will be seen from the situation just described the growers are not in a position to benefit. Nor is it likely that they could benefit from a higher duty. Of the soya bean oil consumed in the United States only about 10 per cent is of domestic origin. It may seem as though a higher duty might exclude imports and raise the price of the domestic oil to a point where farmers would find it profitable to grow soya beans directly for the oil. Were such a result possible the duty would not only aid individual growers but would develop the growing of soya beans for oil as an important domestic industry. Such a result, however, would not be likely to follow a higher duty. Imports might indeed be excluded; but the chief present use of soya bean oil is as a drying oil, in which use it must compete with linseed oil. Hence, an increase in the duty would not necessarily raise the price of soya bean oil; it would be more likely to lead to the discontinuance of its use as a drying oil, just as the present duty has led to the near discontinuance of its use as a soap oil and a food oil.

Under present conditions it would seem to be im-

possible by means of the tariff to develop the growing of soya beans for oil as a great domestic industry. To develop such an industry the price must be high enough to make the industry profitable and also low enough to attract buyers, the most important of which are soap manufacturers. These necessary conditions appear to be incompatible.

Nor has the duty on soya bean oil been of appreciable benefit to producers of other domestic oils or their raw materials. As was shown in Chapter IV the fear of the competition of soya bean oil in its food uses, felt by the dairy and cottonseed oil interests, appears to have been without substantial foundation. Even before the duty was imposed the great bulk of the imports had been appropriated to industrial uses while the appropriation to food uses had been declining. As was shown by the price analysis in Chapter VII the prices of cottonseed oil and of butter were not in fact affected by the higher price of soya bean oil resulting from the duty. Yet it was this fear more than any other cause which led to the high duties on soya bean oil in the Acts of 1921 and 1922.

To sum up: the duty on soya bean oil has been of little or no direct benefit to growers of soya beans; it has not been instrumental in building up any important domestic industry; and its indirect benefit to dairymen and cotton growers has been inappreciable. There is no immediate likelihood that such a duty whether at the present rate or at any other

rate will be of benefit. On the other hand, soap makers and others needing soya bean oil for industrial uses have felt the duty to be a distinct hardship. For the most effective development of their industries they need the freest access to all kinds of crude oils.

The duty on crude coconut oil has benefited no domestic oil-producing industry in the continental United States. It has, however, been of benefit to producers of coconut oil in the Philippine Islands, since virtually its sole effect was to substitute imports of Philippine coconut oil for imports from other sources. This duty also was a hardship to those soap manufacturers who had built up a business on the cold process of soap making, a process for which the Cochin and Ceylon oils formerly imported were suitable, but not the Philippine oil.

There is reason to believe that the duty on peanut oil has hurt more farmers than it has helped. It has helped such farmers as grow peanuts for manufacture into an edible oil. But, as has been shown, the great bulk of the peanuts grown in the United States are not grown for oil at all, and of those used for oil only a small proportion are used for making an edible oil. Peanuts and cotton are grown for the most part in the same agricultural region, and very generally by the same farmers. Whatever benefit as peanut farmers they may derive from the duty on peanut oil is probably more than offset by the injury which as cotton farmers they

receive from impeding the imports of peanut oil for use as a blend in improving the off-color cottonseed oil. (See page 175.)

The case against duties on these oils is stronger than that against the duty on butter. The excluded oils are raw materials. They were the basis of an important domestic refining industry, which asks no protection and which under favorable conditions would do a large export business. They were raw materials of soap; they served other industrial uses. All these industries were handicapped when limitations were imposed on their choice of raw materials. If, as is here contended, there is no benefit to any group sufficient to offset this damage, it is obvious that these duties should be removed.²

The removal of the duty on peanut oil does not necessarily imply the removal of the duty on peanuts. It will be remembered that the great bulk of the domestic peanut crop is grown for other purposes than oil. The price study made in Chapter VII showed that the peanut duty is at least partially effective and of some benefit to growers. So long as protection remains the dominant note in the American tariff there appears no adequate reason

²This statement is based on data up to and including 1926. The declining exports of cottonseed oil even under greatly increased production point to their disappearance in the near future. Should exports cease altogether the duty on cottonseed oil may become effective in raising its price. It is true that in its principal use in the manufacture of lard substitutes it competes with lard, and there is no immediate prospect that the tariff can affect the price of lard; but as shown by the chart on page 180, the price bond between lard and cottonseed oil is rather elastic.

why peanut growing should be made an exception, especially as a present "overtone" to the dominant note is aid to farmers. It is thought that pending a change in general public policy the duty on peanuts may properly be retained.

The increase in duty on olive oil has been of some, though of very little, aid to the olive growers. Its first effect as shown in Chapter VII was to reduce the foreign price of olive oil rather than to raise the domestic price, but since the end of 1923 the domestic price has risen and now persists at a level above the foreign price by an amount even greater than the duty. If the duty were now removed it is probable that the domestic price would fall and the foreign price rise, attaining equilibrium somewhere between the present levels. As a result of the duty the price of imported olive oil is substantially higher than it would be had the duty not been increased. Owing to this higher price of imported oil the domestic oil likewise sells at a higher price, and hence the duty has been of some benefit to domestic growers.

The improvement in the price of oil, however, has not been sufficient to stimulate the domestic industry to increased production. The output in 1925 was actually less than in any year since 1920. The explanation of this is that oil is a relatively unimportant by-product of the domestic industry. In 1925 only 0.6 of 1 per cent of domestic consumption consisted of domestic oil. Olive growers conduct

their industry for the fruit, and their prosperity is not appreciably affected by the price of oil. The increased price has been borne by consumers, a large part of whom are men and women of southern European extraction: people of moderate means by whom olive oil is regarded as a necessity and to whom the increased price is a distinct burden.

To what extent the duty has been successful in opening a wider market for cottonseed and peanut oil for use as salad dressing it is impossible to say. It certainly has not decreased the use of olive oil. Imports have increased annually and are now nearly three times those of 1920. Of course, they might have been even greater and the use of domestic oils, as substitutes less, had the duty not been increased. But even if the duty has tended to open a wider domestic market for domestic oils, for reasons given in Chapter VII it can hardly have affected their price, or have been of appreciable benefit to the interests concerned.

When it is noted that imports constitute over 99 per cent of domestic consumption of olive oil and are increasing, it is clear that as a revenue measure the duty has been successful. Under it receipts have increased from \$975,825 in 1920 to \$6,217,547 in 1925. If the duty were removed no important domestic industry would be seriously affected but the Treasury would suffer a considerable loss. The proper disposition of the olive oil duty is, therefore, chiefly a fiscal question in which the needs of the

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Treasury for revenue are to be weighed against the burden on consumers.

III. THE DRYING OILS

The most important drying oils are linseed, Chinese nut, menhaden, and soya bean oils. Other drying oils are perilla, hempseed, and poppyseed oils. Of these, Chinese nut and perilla oils are on the free list. The others are dutiable. The situation in regard to soya bean oil has already been discussed (pages 233-236), and the conclusion reached that little or no benefit is derived by any American industry from the duty on this oil, while considerable hardship has resulted to important domestic industries which could use this oil as a raw material with advantage.

Menhaden, like soya bean oil, is desirable both as a drying oil and a soap oil. Since it is produced only in the United States the duty on it is of no importance either for good or ill. It is possible that the duty on whale oil, with which it competes as a soap oil, may be of some benefit to the domestic industry. Whale oil is imported in large quantities and its price is presumably affected by the duty. The higher price of whale oil may carry with it a higher price for its competitor, menhaden oil. Both whale and menhaden oils, however, compete with so many other soap oils which are either admitted free or show an export surplus and hence cannot be af-

fectured by the tariff, that no considerable aid to the menhaden oil industry can be looked for from this source. Of more importance to the menhaden oil industry is the duty on linseed oil. The most important use of menhaden oil is that of a drying oil, and in this use it competes with linseed oil, though being inferior, it must compete on a lower price level. The duty on linseed oil unquestionably raises its price, and the higher price of linseed oil may make possible a higher price of menhaden oil. This would certainly be the case if the demand for menhaden oil in its drying oil use were strong enough to absorb the entire output. But as production is greatly in excess of the quantity that can be so consumed and as a large proportion of the output must be marketed as a soap oil, it is more probable that the price which it can command in the latter use determines the price for the entire output. However this may be, the problem of public policy still remains. The wisdom of the duty on linseed oil is open to question and will be discussed presently. As to duties which might enhance the price of menhaden oil in its use as a soap oil, it may well be questioned whether such duties are in the line of the best public policy even if they could be effective. The soap industry, even though somewhat handicapped by duties on some of its raw materials, is able to meet foreign competition and does in fact export its products in large quantities—83,000,000 pounds in 1926. It would seem, except

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perhaps from the point of view of an extreme doctrinaire protectionist, that the national welfare, in the sense of affording employment to labor, opportunities for investment of capital, and the securing of so necessary a product as soap at the lowest production cost, would be promoted by encouraging the expansion of the soap industry through affording it the widest choice of raw materials, rather than by hampering it on the dubious chance of enhancing the price of one or more of these raw materials for the benefit of an industry (namely, the production of menhaden oil), which, in comparison, is of minor importance.

Chinese nut and perilla oils are on the free list and no agricultural or other interest would be served by making them dutiable. Nor is there any important interest served by retaining the duty on hempseed and poppyseed oil. None of these oils, except Chinese nut oil, is of major commercial importance. The consumption of perilla oil, hempseed oil, and poppyseed oil taken together constituted less than 1 per cent of the consumption of drying oils in 1926. But these oils serve certain specific uses for which no other oils are so well adapted, and in the absence of any benefit arising from making them dutiable it would seem that they should all be on the free list.

Linseed oil, of which the raw material is flaxseed, is by far the most important of the drying oils. The increase in the duty on flaxseed was for the purpose of aiding the farmers in Minnesota, the Da-

kotas, and Montana, and, by encouraging flax growing, to make the United States more nearly self-sustaining in its supply of drying oils. The increase in the duty on linseed oil was to compensate the crushers for the increased price of their raw material, but the present duty is in fact more than compensatory.

The combined duties on flaxseed and on linseed oil³ have been of some aid to a relatively small part of the farm population. The price of linseed oil has been maintained above the foreign price by the full amount of the duty; the flax growers have been aided by the higher price of flaxseed; and production for some years greatly increased, though recent years have witnessed a tendency to decline.⁴ In achieving these results, however, other factors were operating in addition to the tariff. The tariff alone could account for an increase in domestic output only equal

³Neither the duty on flaxseed alone nor that on linseed oil alone is of benefit to flax growers. A duty on flaxseed alone might indeed keep out foreign flaxseed but would not keep out foreign oil; hence the domestic crushers might be put out of business, thus destroying the demand for American flaxseed. A duty on oil alone would still permit the importation of foreign flaxseed, which the crushers would buy in preference to domestic seed if it were cheaper. The duty most beneficial to domestic flax growers is a duty on flaxseed sufficient to shut out foreign seed and a duty on oil only sufficient to compensate crushers for the increased cost of their raw material and to permit them to compete with foreign crushers. Any duty higher than this might be injurious to flax growers in that it would encourage monopoly on the part of the crushers, restrict the output, and so lessen the demand for seed. The oil duty should be low enough so that any attempt at monopoly would be promptly checked by importations of oil.

⁴Trade and production figures in millions of pounds are:

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to the decrease in imports. But the increase in output of both oil and seed was in fact greatly in excess of the decrease in imports.⁵ Such increases can only be accounted for by a notable strengthening of the domestic demand, which even in the absence of any change in the tariff would have tended to stiffen the price and stimulate output. It may be granted, however, that without the duties the price would not have gone as high as it did, and domestic production would not have increased as much as it did. The conclusion is justified, therefore, that the duties helped materially to accomplish two of the purposes for which they were levied.

But although the objects of the tariff were at least partially attained they were not worth what they cost the public. If the duty is fully effective in raising the price of linseed oil by an amount equal to itself, it entails an expense of about \$24,000,000 on the American people, as will be shown in the following paragraph.

	1920	1921	1922	1923	1924	1925	1926
Flaxseed							
Production	602	450	581	955	1,776	1,256	1,090
Imports	1,379	690	835	1,363	929	925	1,250
Linseed Oil							
Production	485	483	457	654	706	764	720
Imports	35	60	144	43	14	14	10

Falling off in imports of seed, 1920-1925, 454,000,000 pounds.
 Increase in production of seed, 1920-1925, 630,000,000 pounds.
 Falling off in imports of oil, 1920-1925, 21,000,000 pounds.
 Increase in production of oil, 1920-1925, 279,000,000 pounds.

As flaxseed is virtually all consumed in the manufacture of linseed oil, the increase in the price of flaxseed due to the duty on seed reappears in the increased price of oil. Hence in estimating the burden of the combined duties it is sufficient to ascertain the burden caused by the increased price of linseed oil alone. This increase in price is taken as equal to the duty on linseed oil.⁶ As the duty is 3.3 cents per pound and the annual consumption in 1926 was 730 million pounds, the cost of the duty to the public in that year was about 24 million dollars.

But comparatively little of this goes to the farmers for whose benefit the duty was increased. Save in 1923, the year following the increase of duty, that part of the increase in the farm price of flaxseed which may be attributed to the tariff has every year been much less than the duty. As was shown

⁶As shown in Appendix B such an assumption is not ordinarily safe. The imposition of a duty tends to raise the domestic price and lower the foreign price and its removal to have the reverse effect. Hence the "burden" is the difference between the domestic price under the duty and the foreign price under free trade. In the case of butter reasons were given for believing that the removal of the duty would not greatly affect the domestic price. The case of linseed oil, however, is essentially different and the assumption of a burden equal to the duty is probably much nearer the truth than it would be in the case of butter. No data are available which will show incontestably what would be the effect on price of the removal of the duty. The estimate is frankly based on an assumption. It should be noted in this connection that while the reasoning just given would tend to make the burden less than the duty, the fact that the increased price is undoubtedly "pyramided" before the oil reaches the final consumer in the form of paint, varnish, or linoleum, would tend to make it more than the duty.

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in Chapter VII, 70 per cent of the domestic seed leaves the hands of the farmers during the months of September, October, and November; and the difference between the Minneapolis and Winnipeg prices during these months was 13 cents a bushel in 1924, 25 cents in 1925, and 26 cents in 1926. The complete removal of the duty would not result solely in lowering the domestic price. A part of the result would be an increase in the Canadian price. Moreover, some protection would remain owing to a greater transportation cost of the Canadian flaxseed. Hence the benefit to the domestic grower on the great bulk of his crop is less than the figures given above. But accepting the highest estimate there given (26 cents for 1926) the addition to the growers' receipts on their crop of 19,459,000 bushels would be only about \$5,000,000. The combined flaxseed and linseed oil duties, after deducting drawback paid on linseed oil cake, yielded the government in revenue about \$8,000,000. The remainder of the 24 million dollar tax borne by the general public was absorbed by crushers and middlemen. In other words consumers paid 24 million dollars in order that certain farmers might get 5 million dollars.

This aid, such as it is, goes to a small part of the farm population, for flaxseed growers constitute only nine-tenths of one per cent of the farmers. The assistance rendered to this fraction imposes a considerable expense on the other 99.1 per cent of those en-

gaged in agriculture. Farmers are large users of drying oils, particularly in the form of paint. Their wooden buildings and their farm equipment urgently need good paints as protection against weather; and raising the price of such necessary materials adds appreciably to the cost of farming. In consequence it is a mistake to suppose that American agriculture taken as a whole is aided by high duties on flaxseed and linseed oil.

Viewed from the standpoint of the general welfare, the burdens imposed by the duties on flaxseed and linseed oil would seem greatly to outweigh the benefits. Yet in the face of the showing just made, many will uphold the duties; perhaps even ask for their increase. It will be said that the duties were helpful as an emergency measure in affording an alternative crop in the regions of surplus wheat acreage; it will be said that so great was the emergency that any aid that could be extended to farmers by means of the tariff was in the line of sound public policy; it will be pointed out, and this is undoubtedly true, that the burden could be considerably relieved by lowering the duty on oil without disturbing the duty on seed. Many also are so constituted that they experience a thrill of patriotic satisfaction from the consciousness that because of these duties we are less dependent on foreigners for our supply of linseed oil. The tariff has so long been a controversial issue that many would feel themselves traitors to a great "cause" to render a

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judgment on the oils duties contrary to that dictated by their political or economic affiliations. And of course it is to be expected that all who receive pecuniary benefit from the duties, the flax growers, the crushers, and their lobbyists, will advocate the retention of them and defend their position on grounds of national welfare. These people are aggressive and well organized; and they are likely to have their way. Those who bear the burden of the duty are poorly organized, and perhaps to a great extent are not conscious that an unnecessary burden has been imposed on them. They grumble a little at the high price of paint, decide to postpone painting for another year, and suffer in silence the consequent loss from rust and decay.

What has been here said of the duties on flaxseed and linseed oil will in large measure apply to all the other oils and fats treated in this book. The greatest service that can be rendered consists in assembling, organizing and presenting all the facts pertinent to the situation.

In the case of the duties on flaxseed and linseed oil these facts briefly summarized are as follows. Flax growers have been benefited and are likely to continue to be benefited by a higher price for their seed, though the advance in price on the bulk of their crop generally falls far short of the duty. They are also benefited by having an alternative crop to spring wheat made somewhat more profitable. The oil mills benefit to the full amount of the duty on

their oil. The United States is made more nearly self-sufficient in its supply of drying oils. The crushing of flaxseed for oil and the marketing of oil, both the imported and domestic, is in the hands of a few great concerns, each of which has a mill in the East, the West, and at some point between. These crushers appear to be in a position to exercise considerable control over prices, a control which is greatly aided by the tariff. The duties increase the price of paint, varnish, lineoleum, and printers' ink to every consumer. Of these consumers a large part are farmers. The farmers who are burdened by an increased price of paint are more numerous in the ratio of 99 to 1 than those who are benefited by the increased price of flaxseed; and the emergency which was largely responsible for the increased duties applied as well to the vast body of farmers who could not be aided by the tariff as to the small number who could. A study based on figures collected by the United States Tariff Commission shows that the conversion cost of producing linseed oil is only slightly greater in the United States than in England.⁷ If the duty on flaxseed were removed, the duty on the oil could be greatly reduced, if not entirely removed, without serious disturbance to business.

The duty on castor oil has completely failed to accomplish the purpose for which it was imposed. Experience has shown the futility of efforts to stimu-

⁷See Appendix D.

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late the growing of castor beans on a commercial scale. Since farmers will not grow castor beans, and national self-sufficiency is therefore impracticable, no protective purpose whatever is served by retaining the duty on the seeds. It is desirable that so important an industrial oil as castor oil should be admitted free of duty. With seeds on the free list the domestic crushers would be in a much better position to meet foreign competition, and the duty on the oil might well be removed or at least greatly reduced.

IV. OTHER OILS AND FATS

Other oils and fats mentioned in this study may be dismissed with a few words.

Foreign margarin is subject to an internal revenue tax of 15 cents per pound in addition to the duty of 8 cents per pound. This tax excludes imports. Even without the tax it is doubtful if imports would be important. That the domestic industry is abundantly able to meet foreign competition may be judged by the substantial exports of over $1\frac{1}{2}$ million pounds. The internal revenue tax on foreign margarin would seem to be unnecessary. Since margarin competes with butter, the logical rate would appear to be the rate imposed on butter, whatever it is, though the export surplus indicates that any rate would be nominal.

The oils and fats mentioned below also show a substantial export surplus and hence the several duties imposed on them are practically ineffective. If they were removed no domestic industry would be appreciably injured; neither would consumers be benefited: Corn oil (20 per cent); lard (1 cent per pound); tallow ($\frac{1}{2}$ cent per pound); oleo oil and oleo stearin (each 1 cent per pound); the greases (20 per cent). From the standpoint of the doctrinaire free trader the duties on these oils should be removed: though innocuous now, they may do harm later. From the standpoint of the doctrinaire protectionist, they should be retained: though useless now they may do good later.

The following oils, some dutiable and some free, are raw materials used in soap making and in other domestic industries: fish oils other than menhaden oil (20 per cent); menhaden oil (5 cents per pound); whale oil (6 cents per pound); rapeseed oil (6 cents per gallon); inedible olive oil (free); palm oil (free); palm kernel oil (free). There would seem to be no adequate reason for pursuing different tariff policies with respect to these oils. In addition to soap making they find other industrial uses as drying oils, as lubricants and illuminants, in tanning and leather dressing, and in tin-plate and steel-plate manufacture. If it is good public policy to encourage these lines of industry by affording them the freest possible choice of materials, then all these oils together with other industrial oils now showing an

export surplus should be on the free list. If, on the other hand, an isolationist policy is to prevail even at the expense of hampering important industries competent to meet world competition without tariff favors, then they should all be dutiable. If all of the foreign industrial oils were excluded, then, as shown in Chapter IV, the supply of domestic oils and fats suitable for soap making and other uses would be less than the quantity now consumed, and hence the tariff would be effective in raising the prices of such oils and fats to the benefit of domestic producers. As it is, with some of these oils dutiable and some of the most important of them free, the tariff can have little power to benefit domestic producers of the oils, but does have considerable power to injure industrial consumers of them.

Sesame oil is imported in moderate quantities for food use and also for use in the process of extracting odors from flowers for perfumery. It is now admitted free, and except from the standpoint of the extreme isolationist there would seem to be no good reason for making it dutiable.

SUMMARY

It may be here stated that the conclusions arrived at in this study with respect to the several oils and fats are as follows:

The duty on butter is only partially effective; it is beneficial to the dairy industry and burdensome

to consumers but by an amount much less than the duty.

The duty on olive oil is of little importance for protection but has some revenue value. Its magnitude would appear to be chiefly a fiscal problem.

The duties on flaxseed and on linseed oil benefit oil manufacturers by the full amount of the duty on the oil, and benefit flax growers by an amount much less than the duty on flaxseed. All consumers of paint, lineoleum, and other products of linseed oil are burdened by the full amount of the duty on the oil. As the purpose of the combined duties was to benefit farmers and as the flax growers who have benefited constitute less than 1 per cent of all farmers, while all other farmers are burdened, it would appear that the burden even to farmers outweighs the benefit.

The duty on castor oil beans appears to be devoid of benefit to anybody. If it were removed, the duty on castor oil could be either greatly reduced or removed altogether to the great benefit of all industrial uses of this oil.

The duties on the fish oils and on the animal fats (lard, tallow, the greases) are nominal. They have practically no effect upon prices or domestic production, and their retention or repeal would appear to be a matter of indifference. It is possible, though doubtful, that the duty on whale oil may be of some benefit to the domestic producers of menhaden oil.

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Finally, the benefit to the dairy interests and to cottonseed and peanut growers—the interests chiefly responsible for the changes in the oils duties—from the duties on cottonseed, peanut, coconut, and soya bean oils, has been at best small, while the burden on oil refiners and soap manufacturers has been considerable. In the case of these oils the burden would seem greatly to outweigh the benefit.

APPENDICES

APPENDIX A

TABLES ON PRODUCTION, TRADE, REVENUE, AND PRICES

THE tables in Appendix A are for the most part self-explanatory. Two matters, however, call for additional comment.

I. In this study the Philippine Islands are regarded as United States territory. Hence, under the head of domestic production is included all coconut oil produced in the Philippine Islands as well as all coconut oil produced in the continental United States from copra from whatever source imported. See Chapter II, page 27.

II. The figures for production, imports, and exports are taken from the government sources indicated in the tables themselves without change. These sources do not always make it clear whether the figures are for crude oil, refined oil, or part crude and part refined. It is known, however, that the figures for production and imports are for the most part in terms of crude oil and those for exports are for the most part in terms of refined oil. The figures for domestic consumption are computed by the simple process of subtracting exports from the sum of production and imports as given in the tables. The figures for consumption, therefore, are not strictly accurate. Since in the case of most oils the refining loss is about 10 per cent of the crude oil, to obtain accurate re-

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sults the exports to the extent that they are expressed in terms of refined oil should be increased by 11.1 per cent before subtracting from the sum of production and imports. If this were done we should have the figures for consumption in terms of crude oil and they would be somewhat less than those given in the table. However, since not all the exports are in terms of refined oil, such a treatment if made indiscriminately might not be any more accurate than the figures given. For the purposes of the present discussion it is believed that the figures given are sufficiently near the truth. If corrected figures for consumption had been used in the discussion on page 84, they would show the United States to be slightly more self-sufficient in its production of fatty oils than is there shown, but the difference would not be great.

PRODUCTION AND TRADE DATA

I. DOMESTIC PRODUCTION OF THE PRINCIPAL OILS AND FATS, 1914 AND 1919-1926 *
(In thousands of pounds)

Oil or Fat	1914	1919	1920	1921	1922	1923	1924	1925	1926
VEGETABLE									
Castor	20,423	24,637	24,187	20,595	31,467	37,383	37,434	45,050	46,652
Chinese nut	—	—	—	—	—	—	—	—	—
Coconut	64,500	416,853	284,399	277,160	409,679	416,619	415,992	440,103	505,841
Corn, crude	91,810 ^a	97,400	98,619	87,481	111,509	111,343	117,065	104,153	120,041
Cottonseed, crude ..	1,789,777	1,429,948	1,142,671	1,277,300	934,628	973,753	1,154,434	1,510,802	1,760,530
Hempseed	—	—	—	—	—	—	—	—	—
Linseed	507,422	452,928	485,272	482,918	456,514	653,564	705,586	763,822	720,110
Olive, edible	1,128	439	643	974	585	574	1,509	532	1,383
Olive, inedible and foots	— ^b	102	8	74	—	— ^c	24	—	19
Palm	—	—	—	—	—	—	—	—	—
Palm kernel, crude.	402 ^a	2,517	2,671	1,327	— ^d	— ^d	— ^d	— ^d	6,556
Peanut, crude and virgin	1,006 ^a	87,607	13,085	33,234	22,644	5,359	6,691	15,156	10,644
Perilla	—	—	—	—	—	—	—	—	—
Poppyseed	—	—	—	—	—	—	—	—	—
Rapeseed	19	1,237	409	128	58	—	30	—	173
Sesame	30	—	—	—	—	—	—	—	—
Soya bean, crude...	2,764 ^a	— ^e	— ^e	— ^e	751	1,404	950	2,520	2,846
Total vegetable..	2,479,281	2,513,668	2,051,964	2,181,191	1,967,855	2,199,999	2,439,715	2,882,138	3,174,595

ANIMAL AND FISH										
Butter	1,706,000	1,558,900	1,442,458	1,650,000	1,778,515	1,862,214	1,956,080	1,951,526	1,925,389	
Fish, menhaden	16,265	12,828	27,573	46,953	53,270	55,960	29,429	46,619	30,517	
Fish, other ^c	3,239	10,731	12,278	4,788	8,893	17,668	30,334	45,383	42,561	
Greases, all	229,517 ^a	278,590 ^b	345,534 ^b	340,888 ^b	377,718 ^b	409,141 ^b	396,263 ^b	359,393 ^b	365,534	
Lard, all	938,883 ¹	1,174,068 ¹	1,335,148 ¹	1,517,965 ¹	1,625,072 ¹	2,005,823 ¹	2,002,869 ¹	1,553,521 ¹	1,625,348	
Oleo oil	142,367	129,863	132,112	147,683	164,780	158,610	156,334	141,366	161,427	
Oleo stearin	100,810 ^b	88,625 ¹	87,407 ¹	82,191 ¹	95,714 ¹	100,193 ¹	103,573 ¹	100,058 ¹	102,485	
Tallow ¹	227,339	288,360	301,343	368,143	411,926	436,969	439,971	428,687	483,495	
Whale, sperm	2,495	650	3,126	1,265	2,881	1,579	759	1,090	75	
Whale, other	632	8,712	23,052	2,658	13,973	10,098	8,563	8,071	9,495	
Total animal and fish	3,367,547	3,551,327	3,710,029	4,162,534	4,532,742	5,058,255	5,124,175	4,635,714	4,746,326	
GRAND TOTAL.	5,846,828	6,064,995	5,761,993	6,343,725	6,500,597	7,258,254	7,563,890	7,517,852	7,920,921	

^a Generally in terms of crude oil, see explanation, page 257.
^b Figure represents total production of edible and inedible oil.
^c Not separately stated.
^d Less than 500 pounds.
^e Crude not available.
^f Data not available.
^g Includes cod and cod liver oil, herring oil, and miscellaneous fish oils.
^h Includes bone, garbage, wool, recovered, and miscellaneous greases.

ⁱ Includes white, yellow, brown, bone, tankage, garbage, wool, recovered, and all other greases.
^j Includes edible and inedible products.
^k Includes neutral and other edible.
^l Includes animal, lard, tallow, and oleo stearin.
^m Includes animal, stearin, edible and inedible.

Source: 1914, from *Supplement to Bulletin No. 769*, U. S. Department of Agriculture; 1919-1928, from Bureau of the Census, U. S. Department of Commerce.

II. IMPORTS OF THE PRINCIPAL ANIMAL AND VEGETABLE OILS AND FATS FOR THE YEARS SPECIFIED *
(In thousands of pounds)

Oil or Fat	1914	1919	1920	1921	1922	1923	1924	1925	1926
VEGETABLE									
Castor	1,513 ^a	3,000	1,372	151	864	1,019	293	330	450
Chinese nut	30,137	53,853	67,962	27,249	79,089	87,292	81,582	101,555	83,004
Coconut (except Philippine)	31,784	79,752	63,146	24,729	3,167	1,182	135	453	327
Corn	—	—	—	—	—	—	—	—	—
Cottonseed	16,017	27,806	9,458	669	20	25	—	—	6,679
Hempseed	3 ^a	1,379	458	— ^b	120	38	—	2	152
Linseed	4,350	16,018	35,201	60,089	143,886	42,729	13,577	13,906	9,610
Olive, edible	50,857	62,264	30,533	49,337	61,594	73,577	76,900	87,683	80,777
Olive, inedible and foots	18,654	8,698	9,459	19,029	27,259	42,565	33,024	52,431	50,703
Palm	49,092	41,818	41,948	23,155	57,517	128,495	101,780	139,179	130,747
Palm kernel	21,089	1,929	1,694	2,383	2,179	2,566	4,739	52,624	74,980
Peanut	7,365	153,907	95,076	3,070	2,386	4,876	5,076	2,540	5,930
Perilla	118 ^a	4,743	7,582	652	2,208	6,441	3,016	6,017	7,401
Poppyseed	60 ^a	2	5	10	12	16	19	64	176
Rapeseed	11,172	8,375	12,908	7,152	10,861	15,932	17,362	12,676	20,768
Sesame	1,390 ^a	4,722	807	89	64	8,702	7,843	4,295	8,862
Soya bean	12,555	195,808	112,549	16,711	13,634	33,222	11,210	15,905	26,370
Total vegetable..	256,156	664,074	490,158	234,475	404,860	448,677	356,556	489,660	506,936

ANIMAL AND FISH									
Butter ^a	7,201	6,962	37,626	17,735	7,111	20,810	19,279	6,861	6,727
Fish, menhaden	—	—	—	—	—	—	—	—	—
Fish, other ^a	25,142	14,734	15,616	20,941	18,728	26,773	30,749	27,514	47,986
Greases, all	11,665 ^a	33,817 ^f	26,191 ^f	22,321 ^f	25,126 ^f	9,431 ^f	12,744 ^f	10,183 ^f	11,797
Lard, all ^a	126 ^a	3,846	14	5	35	6	131	63	401
Oleo oil	—	—	—	—	—	6	—	—	—
Oleo stearin	4,030	2,358	963	419	293	216	1,009	901	1,960
Tallow	3,372 ^a	12,096	14,875	1,870	1,831	10,823	2,440	1,828	13,647
Whale, sperm	— ^b	936	748	23	482	960	529	1,937	1,030
Whale, other	— ^b	3,908	651	2,748	32,112	28,853	37,518	53,558	39,249
Total animal and fish	51,536	78,657	96,684	66,062	85,718	97,884	104,409	102,845	122,797
GRAND TOTAL.	307,692	742,731	586,842	300,537	490,578	546,561	460,965	592,505	629,733

* These figures are for calendar years, and represent the *imports* of fats and oils for consumption. In 1914 imports for consumption are not available, hence, with the exceptions noted *general imports* are used. Generally in terms of crude oil, see explanation, p. 257.

^a Figure for fiscal year ending June 30, 1914, and represents amount imported for consumption.

^b Less than 500 pounds.

^c Includes butter and substitutes for.

^d Includes cod, cod liver, and other fish oils.

^e Listed as "all other grease and oils, n.e.s."

^f Includes all other grease and oils, n.e.s. and miscellaneous greases.

^g Includes lard, lard compounds, and lard substitutes.

^h Not separately stated.

Source: 1914, *Monthly Summary of Foreign Commerce*; 1919-1925, *Foreign Commerce and Navigation of the U. S.*

III. EXPORTS OF THE PRINCIPAL ANIMAL AND VEGETABLE OILS AND FATS, 1914 AND 1919-1926 *
(In thousands of pounds)

Oil or Fat	1914	1919	1920	1921	1922	1923	1924	1925	1926
VEGETABLE									
Castor	—	—	—	—	—	—	—	—	—
Chinese nut	—	—	—	—	—	—	—	—	—
Coconut	—	118,612	25,695	7,498	12,972	16,562	17,961	17,901	15,952
Corn	16,199	6,415	12,059	4,400	5,733	4,361	3,679	3,847	1,324
Cottonseed	216,309	193,133	184,754	252,549	75,303	49,608	43,343	62,415	40,901
Hempseed	—	—	—	—	—	—	—	—	—
Linseed	1,993	11,266	5,366	3,512	2,703	3,013	2,387	2,487	2,567
Olive, edible	—	—	—	—	—	—	—	—	—
Olive, inedible and foots	—	—	—	—	—	—	—	—	—
Palm	—	—	—	—	—	—	—	—	—
Palm kernel	—	—	—	—	—	—	—	—	—
Peanut	—	4,342	1,425	1,708	963	203	39	—	—
Perilla	—	—	—	—	—	—	—	—	—
Poppyseed	—	—	—	—	—	—	—	—	—
Rapeseed	—	—	—	—	—	—	—	—	—
Sesame	—	—	—	—	—	—	—	—	—
Soya bean	—	27,715*	43,512	1,944	2,458	1,356	2,264	520	1,567
Total vegetable..	234,501	361,483	272,811	271,611	100,132	75,103	69,673	87,170	62,311

ANIMAL AND FISH									
Butter	3,688	34,556	17,488	8,015	10,938	5,846	8,257	5,343	5,483
Fish, menhaden	—	—	—	—	906	—	—	—	—
Fish, other	1,164	8,142	3,212	805	4,249	1,000	777	614	809
Greases, all	—	—	—	—	57,472 ^b	61,416 ^b	79,394 ^b	81,264 ^b	72,640
Lard, all ^c	523,170	908,822	667,539	941,100	803,733	1,066,962	978,842	721,774	727,668
Oleo oil	85,145	75,585	74,368	127,978	109,387	98,955	99,380	91,972	96,902
Oleo stearin	3,239 ^d	20,855 ^d	17,513 ^d	32,696 ^d	19,121 ^e	15,148 ^e	11,782 ^e	12,446 ^e	10,758
Tallow	9,980	38,954	20,692	13,798	31,376	35,129	33,962	17,514	10,628
Whale, sperm	—	—	—	—	—	—	93	—	—
Whale, other	—	—	—	—	583	723	—	—	—
Total animal and fish	626,386	1,086,914	800,812	1,124,392	1,037,765	1,285,179	1,212,487	930,927	924,888
GRAND TOTAL.	860,887	1,448,397	1,073,623	1,396,003	1,137,897	1,360,282	1,282,160	1,018,097	987,199

* Generally in terms of refined oil, see explanation, page 257.

^a July 1 to December 31.

^b Listed as "other animal greases, oils, and fats, including soap stock."

^c Includes lard, neutral lard, lard compounds and other substitutes for lard.

^d Listed as "stearin from animal fats."

^e Includes stearin, lard stearin, edible grease stearin, steric and other fatty acids.

Source: 1914, *Monthly Summary of Foreign Commerce*; 1919-1925, *Foreign Commerce and Navigation of the United States*.

IV. DOMESTIC CONSUMPTION OF THE PRINCIPAL ANIMAL AND VEGETABLE OILS AND FATS, 1914 AND 1919-1926*
(In thousands of pounds)

Oil or Fat	1914	1919	1920	1921	1922	1923	1924	1925	1926
VEGETABLE									
Castor	21,936	27,637	25,559	20,746	32,351	38,402	37,727	45,380	47,102
Chinese nut	30,137	53,853	67,962	27,249	79,089	87,292	81,582	101,555	83,004
Coconut	96,284	377,993	321,850	294,391	399,874	401,239	398,166	422,655	490,216
Corn	75,611	90,985	86,560	83,081	105,776	106,982	113,386	100,306	118,717
Cottonseed	1,589,485	1,264,621	967,375	1,025,420	859,345	924,170	1,111,091	1,448,387	1,726,308
Hempseed	3	1,379	458	—	120	38	—	2	152
266 Linseed	509,779	457,680	515,107	539,495	597,697	693,280	716,776	775,241	727,153
Olive, edible	51,985	62,703	31,176	50,311	62,179	74,151	78,409	88,215	82,160
Olive, inedible and foots	18,654	8,800	9,467	19,103	27,259	42,565	33,048	52,431	50,722
Palm	49,092	41,818	41,948	23,155	57,517	128,495	101,780	139,179	130,747
Palm kernel	21,491	4,446	4,365	3,710	2,179	2,566	4,739	52,624	81,536
Peanut	8,371	237,172	106,736	34,596	24,067	10,032	11,728	17,696	16,574
Perilla	118	4,743	7,582	652	2,208	6,441	3,016	6,017	7,401
Poppyseed	60	2	5	10	12	16	19	64	176
Rapeseed	11,191	9,612	13,317	7,280	10,919	15,932	17,392	12,676	20,941
Sesame	1,420	4,722	807	89	64	8,702	7,843	4,295	8,862
Soya bean	15,319	168,093	69,037	14,767	11,927	33,270	9,896	17,905	27,449
Total vegetable..	2,500,936	2,816,259	2,269,311	2,144,055	2,272,583	2,573,573	2,726,598	3,284,628	3,619,220

ANIMAL AND FISH									
Butter	1,709,513	1,531,306	1,462,596	1,659,720	1,774,688	1,877,178	1,967,102	1,953,044	1,926,633
Fish, menhaden	16,265	12,828	27,573	46,953	52,364	55,960	29,429	46,619	30,517
Fish, other	27,217	17,323	24,680	24,924	23,372	43,447	60,306	72,283	89,738
Greases, all	241,182	312,407	371,725	363,209	345,372	357,156	329,613	288,312	304,691
Lard, all	415,839	269,092	667,623	576,870	821,374	938,867	1,024,158	831,810	898,081
Oleo oil	57,222	54,278	57,744	19,705	55,393	59,661	56,954	49,394	64,525
Oleo stearin	101,601	70,128	70,857	49,914	76,886	85,261	92,800	88,513	93,687
Tallow	220,731	261,502	295,526	356,215	382,381	412,663	408,449	413,001	486,514
Whale, sperm	2,495	1,586	3,874	1,288	3,363	2,539	1,288	3,027	1,105
Whale, other	632	12,620	23,703	5,406	45,502	38,228	45,998	61,629	48,744
Total animal and fish	2,792,697	2,543,070	3,005,901	3,104,204	3,580,695	3,870,960	4,016,097	3,807,632	3,944,235
GRAND TOTAL.	5,293,633	5,359,329	5,275,212	5,248,259	5,853,278	6,444,533	6,742,695	7,092,260	7,563,455

* The figures for domestic consumption were obtained by deducting the exports (Table III) of each oil or fat from the domestic production (Table I) and adding imports (Table II). As production and imports are in terms of crude oil, while exports are largely in terms of refined oil, the results so obtained are not strictly accurate. A normal refining loss is about 10 per cent. See page 267.

V. DATA INDICATING THE EXTENT TO WHICH THE UNITED STATES IS SELF-SUFFICIENT IN THE PRODUCTION OF THE FATTY OILS

(In millions of pounds and in percentages of consumption)

A. 1920

Oil or Fat	From Domestic Raw Material		From Imported Raw Material		Imports		Exports		Con- sumption
	Quantity	Per Cent	Quantity	Per Cent	Quantity	Per Cent	Quantity	Per Cent	Quantity
VEGETABLE									
Castor	—	—	24.2	94.8	1.4	5.4	—	—	25.6
Chinese nut	—	—	—	—	68.0	100.0	—	—	68.0
Coconut	167.0	51.9	117.4	36.5	63.1	19.6	25.7	8.0	321.8
Corn	98.3	113.6	.2	.3	—	—	12.1	13.9	86.4
Cottonseed	1,135.4	117.3	7.3	.8	9.5	1.0	184.8	19.1	967.4
Hempseed	—	—	—	—	.5	100.0	—	—	.5
Linseed	147.6	28.6	337.7	65.6	35.2	6.8	5.4	1.0	515.1
Olive, edible .....	.8	1.9	—	—	30.5	98.1	—	—	31.1
Olive, inedible and foots	—	—	—	—	9.5	100.0	—	—	9.5
Palm	—	—	—	—	41.9	100.0	—	—	41.9
Palm kernel	—	—	2.7	61.2	1.7	38.8	—	—	4.4
Peanut	11.4	10.7	1.6	1.5	95.1	89.1	1.4	1.3	106.7
Perilla	—	—	—	—	7.6	100.0	—	—	7.6
Poppyseed	—	—	—	—	—	—	—	—	.0
Rapeseed .....	.4	3.1	—	—	12.9	96.9	—	—	13.3
Sesame	—	—	—	—	.8	100.0	—	—	.8
Soya bean	—	—	—	—	112.5	163.0	43.5	63.0	69.0
Total vegetable..	1,560.7	68.8	491.1	21.6	490.2	21.6	272.9	12.0	2,269.1

ANIMAL AND FISH									
Butter	1,442.5	98.6	—	—	37.6	2.6	17.5	1.2	1,462.6
Fish, menhaden	27.6	100.0	—	—	—	—	—	—	27.6
Fish, other	12.3	49.8	—	—	15.6	63.2	3.2	13.0	24.7
Greases	345.6	93.0	—	—	26.2	7.0	—	—	371.8
Lard	1,335.1	200.0	—	—	—	—	667.5	100.0	667.6
Oleo oil	132.1	228.9	—	—	—	—	74.4	128.9	57.7
Oleo stearin	87.4	123.3	—	—	1.0	1.4	17.5	24.7	70.9
Tallow	301.3	102.0	—	—	14.9	5.0	20.7	7.0	295.5
Whale, sperm	3.1	81.6	—	—	.7	18.4	—	—	3.8
Whale, other	23.1	97.5	—	—	.6	2.5	—	—	23.7
Total animal and fish	3,710.1	126.6	—	—	96.6	3.2	800.8	26.6	3,005.9
GRAND TOTAL.	5,270.8	99.9	491.1	9.3	586.8	11.1	1,073.7	20.3	5,275.0

V. DATA INDICATING THE EXTENT TO WHICH THE UNITED STATES IS SELF-SUFFICIENT IN THE PRODUCTION OF THE FATTY OILS—Continued

B. 1926

Oil or Fat	From Domestic Raw Material		From Imported Raw Material		Imports		Exports		Con- sumption
	Quantity	Per Cent	Quantity	Per Cent	Quantity	Per Cent	Quantity	Per Cent	Quantity
VEGETABLE									
Castor	—	—	46.7	99.2	.4	.8	—	—	47.1
Chinese nut	—	—	—	—	83.0	100.0	—	—	83.0
Coconut	402.0	82.0	103.8	21.1	.3	.1	15.9	3.2	490.2
Corn	120.0	101.1	.1	.1	—	—	1.3	.1	118.8
Cottonseed	1,754.2	101.6	6.3	.4	6.7	.4	40.9	2.4	1,726.3
Hempseed	—	—	—	—	.1	100.0	—	—	.1
Linseed	335.4	46.1	384.7	52.9	9.6	1.3	2.6	.3	727.1
Olive, edible	1.4	1.7	—	—	80.8	98.3	—	—	82.2
Olive, inedible and foots	—	—	—	—	50.7	100.0	—	—	50.7
Palm	—	—	—	—	130.7	100.0	—	—	130.7
Palm kernel	—	—	6.5	8.0	75.0	92.0	—	—	81.5
Peanut	10.0	60.6	.6	3.6	5.9	35.8	—	—	16.5
Perilla	—	—	—	—	7.4	100.0	—	—	7.4
Poppyseed	—	—	—	—	.2	100.0	—	—	.2
Rapeseed .....	.2	1.0	—	—	20.7	99.0	—	—	20.9
Sesame	—	—	—	—	8.9	100.0	—	—	8.9
Soya bean	2.6	9.5	—	—	26.4	96.3	1.6	5.8	27.4
Total vegetable..	2,625.8	72.6	548.7	15.2	506.8	14.0	62.3	1.8	3,619.0

ANIMAL AND FISH									
Butter	1,925.4	99.9	—	—	6.7	.4	5.5	.3	1,926.6
Fish, menhaden	30.5	100.0	—	—	—	—	—	—	30.5
Fish, other	42.6	47.5	—	—	48.0	53.4	.8	.9	89.8
Greases	365.5	120.0	—	—	11.8	3.8	72.6	23.8	304.7
Lard	1,625.3	181.0	—	—	.4	—	727.7	81.0	898.0
Oleo oil	161.4	250.2	—	—	—	—	96.9	150.2	64.5
Oleo stearin	102.5	109.4	—	—	2.0	2.1	10.8	11.5	93.7
Tallow	483.5	99.4	—	—	13.6	2.8	10.6	2.2	486.5
Whale, sperm .....	.1	9.1	—	—	1.0	90.9	—	—	1.1
Whale, other	9.5	19.5	—	—	39.2	70.5	—	—	48.7
Total animal and fish	4,746.3	120.3	—	—	122.7	3.1	924.9	23.4	3,944.1
GRAND TOTAL.	7,372.1	97.5	548.7	7.3	629.5	8.3	987.2	13.1	7,563.1

EXPORTS										
Corn	bushels	15,626	11,193	17,761	128,975	163,609	42,188	18,366	12,762	23,064
Cottonseed	pounds	10,966	1,919	5,270	2,827	3,638	.	.	.	.
Flaxseed	bushels	24	17	16	b	2	.	.	.	.
Peanuts	pounds	6,737	19,778	9,366	14,493	12,621	4,806	3,127	3,489	4,232

* Production figures are from *U. S. Department of Agriculture Yearbooks*, and from *Crops and Markets*. Those for 1926 are preliminary estimates. The figures for imports and exports are from *Foreign Commerce and Navigation*, and from *Monthly Summary of Foreign Commerce of the United States*.

¹ *Fourteenth Census of the U. S.*, Vol. V., p. 777.

² *Ibid.*, p. 873.

³ Imports for consumption when available, otherwise general imports.

⁴ Census year, 1909.

⁵ Less than 500 bushels.

⁶ Data not available.

⁷ Conversion, to bushels, at the rate of 50 pounds per bushel.

VII. REVENUE DERIVED FROM IMPORTS OF THE PRINCIPAL ANIMAL AND VEGETABLE OILS AND FATS,
1914 AND 1919-1926

Oil or Fat	1914 ^a	1919	1920	1921	1922	1923	1924	1925	1926
VEGETABLE									
Castor	\$ 23,067	\$ 45,004	\$ 20,578	\$ 2,270	\$ 17,465	\$ 30,582	\$ 8,804	\$ 9,914	\$ 13,488
Chinese nut	—	—	—	—	—	—	—	—	—
Coconut, from Philippines	—	—	—	—	—	—	—	—	—
Coconut, other	—	—	—	12,797	50,848	24,186	2,695	9,060	6,535
Corn	—	—	—	—	—	—	—	—	—
Cottonseed	—	—	—	4	613	751	4	2	200,358
Hempseed	35	5,518	1,830	—	480	570	—	5	2,281
Linseed	20,088	213,571	469,341	801,181	1,987,771	1,410,066	448,035	458,909	317,128
Olive, edible	1,902,669	1,766,546	975,825	2,469,265	3,831,872	5,190,630	5,463,745	6,217,547	5,766,419
Palm	—	—	—	—	—	—	—	—	—
Palm kernel	—	—	—	—	—	—	—	—	—
Peanut	46,449	1,231,257	760,605	71,946	86,626	195,045	203,024	101,619	237,202
Perilla	—	—	—	—	—	—	—	—	—
Poppysseed	644	16	43	77	151	312	389	1,275	3,520
Rapeseed	100,204	67,002	103,260	57,215	86,886	127,460	137,897	101,407	166,142
Sesame	10,204	47,225	8,069	891	482	—	—	—	—
Soya bean	—	—	—	11,344	354,135	830,539	280,249	397,618	659,246
Total vegetable..	\$2,103,360	\$3,376,139	\$2,339,551	\$3,426,990	\$6,417,329	\$7,810,141	\$6,545,842	\$7,297,376	\$7,372,319

ANIMAL AND FISH									
Butter	\$ 202,562	\$ 174,048	\$ 940,651	\$ 664,391	\$ 508,352	\$1,664,787	\$1,542,346	\$ 548,915	\$ 676,206
Fish, menhaden	—	—	—	—	—	—	—	—	—
Fish, other	22,068	16,263	17,275	5,111	10,766	37,697	39,454	36,677	105,455
Greases, all	65,945	21,025	57,732	28,925	48,564	52,761	71,933	57,038	65,481
Lard, all	19	—	—	—	2	58	256	142	256
Oleo oil	—	—	—	—	—	63	—	—	4
Oleo stearin	—	—	—	—	—	2,155	10,095	8,914	19,602
Tallow	1,827	—	—	—	1,679	54,117	12,202	9,082	68,237
Whale, sperm	12,571	9,980	7,983	247	5,895	12,796	7,049	25,826	13,731
Whale, other	14,537	26,052	4,339	18,319	214,183	230,823	300,227	428,467	313,993
Total animal and fish	\$ 319,529	\$ 247,368	\$1,027,980	\$ 716,993	\$ 789,441	\$2,055,257	\$1,983,562	\$1,115,061	\$1,262,965
GRAND TOTAL.	\$2,422,899	\$3,623,507	\$3,367,531	\$4,143,983	\$7,206,770	\$9,865,398	\$8,529,404	\$8,412,409	\$8,635,284

¹ Figures are for fiscal year ending June 30, 1914.

VIII. BUTTER PRODUCTION IN THE UNITED STATES, 1899-1926 *

Year	Total Production, in Pounds	Farm Butter		Factory Butter	
		In Pounds	As a Percentage of Total	In Pounds	As a Percentage of Total
1899.....	1,491,753,000	1,071,626,000	71.8	420,127,000	28.2
1909.....	1,621,797,000	994,761,000	61.3	627,146,000	38.7
1919.....	1,581,573,000	707,666,000	44.7	873,907,000	55.3
1923.....	1,864,118,000	610,000,000	32.7	1,254,118,000	67.3
1924.....	1,956,080,000	600,000,000	30.7	1,356,080,000	69.3
1925.....	1,951,526,000	590,000,000	31.2	1,361,526,000	69.8
1926.....	1,925,389,000	580,000,000	30.1	1,345,389,000	69.9

* U. S. Tariff Commission, *Preliminary Statement*, p. 19, and Bureau of Agricultural Economics.

PRICE DATA

IX. PRICES OF THE PRINCIPAL OILS AND FATS, BY MONTHS,
(All prices expressed

	Lard	Tallow		Grease		Whale Oil
		Edible	Prime Packers	White	Yellow	
1920						
January	23.4	18.8	17.6	17.0	15.0	14.0
February	20.8	17.1	16.0	14.6	13.5	14.0
March	20.5	17.0	16.1	15.5	14.0	14.0
April	19.4	16.2	15.6	14.4	13.5	14.0
May	20.4	15.0	13.9	13.4	12.0	14.0
June	20.3	13.0	12.0	11.4	9.9	14.0
July	19.0	13.2	12.4	11.5	10.6	13.2
August	18.4	13.1	12.8	11.8	9.5	11.7
September	19.6	14.4	13.8	13.0	9.9	11.9
October	23.4	12.5	11.2	12.6	7.8	10.9
November	19.2	9.6	8.2	10.1	6.0	6.3
December	15.1	7.1	6.5	7.1	4.8	5.5
Average	20.0	13.9	13.0	12.7	10.5	12.0
1921						
January	13.0	7.4	6.8	6.1	5.0	5.0
February	12.0	7.0	6.2	5.5	4.2	5.0
March	11.5	6.4	5.9	5.5	4.0	5.0
April	10.0	6.2	5.8	5.4	4.0	5.0
May	9.4	6.6	6.1	5.5	4.0	5.0
June	10.0	6.0	5.5	5.1	3.6	4.7
July	11.4	6.4	5.6	5.4	3.6	4.0
August	11.2	7.2	6.6	6.0	4.4	4.0
September	10.8	8.2	7.2	6.6	4.4	4.3
October	9.4	7.8	7.2	6.6	4.5	5.0
November	9.1	7.2	6.8	6.5	4.5	5.0
December	8.6	7.0	6.6	6.2	4.6	5.0
Average	10.5	7.0	6.4	5.9	4.2	4.8

* Sources of data are as follows:

For the years, 1920-1924.

Coconut oil, Manila; corn oil, refined; grease, white, Chicago; grease, yellow, Chicago; lard, prime steam, Chicago; menhaden oil; palm oil, Lagos; peanut oil, refined; soya bean oil, crude; tallow, edible; tallow, prime packers, Chicago; and whale oil. U. S. Tariff Commission, *Certain Vegetable Oils*, 1926, Part 2, pp. 141-143.

Oottonseed oil, crude. See table on p. 179 for source, and method of compilation.

Corn oil, crude; and peanut oil, crude. U. S. Bureau of Labor Statistics, wholesale price bulletina.

JANUARY, 1920, TO SEPTEMBER, 1927, INCLUSIVE*
in cents per pound)

Men- haden Oil	Cot- ton- seed Oil, Crude	Peanut Oil		Corn Oil		Soya Bean Oil, Crude	Palm Oil, Lagos	Coco- nut Oil, Manila
		Re- fined	Crude	Re- fined	Crude			
12.3	19.8	27.8	—	23.5	20.5	19.2	17.6	19.2
11.8	18.5	27.5	22.0	23.5	19.3	19.1	17.0	18.9
11.5	17.5	26.2	20.5	22.0	17.8	18.9	15.9	18.5
11.9	17.4	24.5	19.0	20.2	17.4	18.4	15.9	18.6
10.4	16.6	23.5	—	20.0	17.4	17.6	14.8	18.4
7.5	15.8	21.5	20.0	19.8	16.6	17.0	12.2	17.9
7.9	12.8	19.0	13.0	19.0	13.9	15.4	10.8	16.4
7.7	10.2	16.8	—	15.8	11.1	14.4	10.4	15.5
6.9	10.2	16.0	10.4	15.2	11.8	13.6	10.4	15.5
5.6	10.2	16.0	9.0	16.3	12.4	13.0	10.5	15.8
5.6	7.2	15.2	8.4	15.4	10.3	11.4	9.9	14.6
3.8	6.4	—	7.1	13.9	10.5	9.5	8.4	12.8
8.6	13.6	21.3	13.5	18.7	15.0	15.6	12.8	16.8
4.1	6.1	12.5	6.9	12.0	8.8	8.5	7.9	11.8
3.7	6.0	12.5	6.3	11.5	8.5	7.8	7.6	10.9
3.0	5.1	11.0	6.0	10.2	8.0	7.2	7.0	9.1
3.1	4.3	10.5	5.7	9.8	7.7	7.4	6.9	9.1
3.1	5.2	10.5	6.0	10.2	7.6	7.5	7.4	10.1
3.1	5.8	10.2	6.0	9.8	7.8	7.8	7.2	10.4
2.8	6.6	10.0	6.4	9.1	7.7	8.0	6.8	9.8
3.2	6.8	10.2	7.3	10.2	8.4	8.5	7.1	9.9
3.7	7.8	10.8	7.6	10.8	9.6	8.8	7.6	9.9
3.9	7.5	10.8	8.5	11.2	9.4	8.9	7.8	9.9
4.1	7.0	11.2	7.8	11.2	9.1	9.1	7.8	9.4
4.1	7.0	11.0	7.8	10.9	8.7	9.1	7.1	9.2
3.5	6.3	10.9	6.9	10.6	8.4	8.2	7.4	10.0

For the years, 1925-1927.

Coconut oil, Manila; corn oil, refined; lard, city steamed; menhaden oil, crude, f.o.b., Baltimore; palm oil, Lagos; peanut oil, refined; and whale oil, crude, number 1, coast tanks. *Oil, Paint, and Drug Reporter*. Average of high and low quotations.

Cottonseed oil, crude. See table on p. 179 for source, and method of compilation.

Corn oil, crude; peanut oil, crude; and soya bean oil, crude. U. S. Bureau of Labor Statistics, wholesale price bulletins.

Grease, white, Chicago; grease, yellow, Chicago; tallow, edible, Chicago; and tallow, prime packers, Chicago. *National Provisioner*. Average of high and low weekly quotations.

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IX. PRICES OF THE PRINCIPAL OILS AND FATS, BY MONTHS,

	Lard	Tallow		Grease		Whale Oil
		Edible	Prime Packers	White	Yellow	
1922						
January	9.3	7.4	6.6	6.5	4.8	5.1
February	11.0	8.0	6.9	7.0	5.2	5.1
March	11.2	8.0	7.0	7.4	5.5	5.1
April	10.6	7.2	6.9	7.0	5.5	5.1
May	11.2	7.2	6.6	7.1	5.5	5.1
June	11.4	7.6	6.5	7.1	5.5	5.1
July	11.1	7.9	6.6	7.0	5.6	5.5
August	11.3	8.1	6.9	7.1	5.8	6.0
September	10.7	7.6	6.9	7.1	5.9	6.0
October	11.0	8.1	7.5	7.5	6.6	6.0
November	11.4	8.5	8.2	8.4	7.6	6.0
December	11.0	8.8	8.4	8.5	7.6	6.0
Average	10.9	7.9	7.1	7.3	5.9	5.5
1923						
January	11.2	9.5	9.0	8.9	8.4	6.8
February	11.2	9.3	8.7	9.1	8.6	6.9
March	11.7	9.8	9.5	9.3	8.9	6.9
April	11.4	10.0	8.9	8.6	8.2	7.3
May	10.9	8.8	8.1	7.9	7.0	7.0
June	11.0	8.2	7.2	7.1	6.1	6.4
July	10.7	7.6	6.9	7.0	5.9	6.0
August	11.2	8.1	7.5	7.4	6.0	6.0
September	12.1	9.2	8.1	8.5	6.6	6.0
October	12.6	9.5	8.5	9.0	5.5	6.0
November	13.3	9.6	8.5	9.0	6.2	6.0
December	12.1	9.2	8.1	8.8	6.4	6.0
Average	11.6	9.1	8.3	8.4	7.0	6.4

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JANUARY, 1920, TO SEPTEMBER, 1927, INCLUSIVE—Continued

Men- haden Oil	Cot- ton- seed Oil, Crude	Peanut Oil		Corn Oil		Soya Bean Oil, Crude	Palm Oil, Lagos	Coco- nut Oil, Manila
		Re- fined	Crude	Re- fined	Crude			
4.7	7.2	11.1	7.5	10.8	8.4	8.9	7.9	8.9
5.2	8.7	11.2	8.3	10.4	9.1	8.9	7.9	8.9
5.1	10.0	12.0	10.3	11.8	11.4	10.2	8.1	9.0
4.5	9.7	13.0	10.0	13.1	11.3	11.4	7.9	9.0
4.7	9.9	13.0	10.0	12.4	11.3	11.4	7.5	8.8
4.6	9.7	13.0	10.0	—	11.2	11.8	7.1	8.8
5.2	8.8	12.5	9.9	12.5	10.5	12.2	7.1	8.8
5.4	7.7	12.5	9.0	12.5	9.7	12.5	7.1	8.6
5.3	6.5	12.2	8.7	11.6	9.2	11.5	6.9	8.5
5.3	7.2	12.0	8.5	10.9	8.8	10.6	7.1	8.6
6.2	8.2	12.5	10.3	11.2	9.7	10.6	7.1	8.8
6.2	8.5	14.5	12.0	11.5	10.2	10.8	7.2	9.0
5.2	8.5	12.5	9.6	11.7	10.1	10.9	7.4	8.8
6.5	9.6	17.0	13.0	12.2	11.0	11.3	7.6	9.2
6.5	9.8	17.8	13.5	13.0	11.2	11.8	7.9	9.4
7.3	10.3	17.0	14.0	13.1	11.9	12.3	8.4	9.7
7.0	10.1	17.5	14.0	13.6	12.5	12.9	8.6	10.1
7.0	9.8	16.5	13.9	13.1	12.3	13.2	7.9	9.9
6.7	9.7	16.5	13.0	12.8	12.1	12.8	7.4	9.8
6.7	8.6	16.2	13.0	12.1	12.1	11.8	7.1	9.5
5.3	9.0	16.0	12.0	11.0	11.5	11.3	6.8	9.4
5.7	10.0	16.0	13.0	12.8	10.5	11.8	7.4	9.4
6.3	9.2	16.0	13.0	13.0	10.6	11.0	7.6	9.4
6.3	9.7	16.0	12.5	14.0	11.7	11.0	7.6	9.6
6.3	9.4	14.9	12.0	13.8	11.8	11.0	7.9	9.8
6.5	9.6	16.4	13.1	12.9	11.6	11.8	7.7	9.6

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IX. PRICES OF THE PRINCIPAL OILS AND FATS, BY MONTHS,

	Lard	Tallow		Grease		Whale Oil
		Edible	Prime Packers	White	Yellow	
1924						
January	12.0	9.3	8.5	8.4	6.6	7.2
February	11.0	9.2	7.8	7.5	6.6	7.2
March	10.9	8.8	8.1	7.5	6.9	7.2
April	10.7	8.2	7.6	7.2	6.6	7.2
May	10.4	8.2	7.4	6.9	6.4	7.2
June	10.5	8.2	7.1	6.7	6.1	7.2
July	12.3	9.8	7.6	7.2	6.2	7.2
August	13.5	10.9	8.6	8.4	7.2	7.2
September	13.4	10.1	9.1	8.9	7.4	7.2
October	14.0	9.7	9.1	9.1	8.1	7.2
November	14.3	10.1	9.9	9.8	8.8	7.2
December	16.4	10.5	10.2	10.8	9.0	7.2
Average	12.5	9.4	8.4	8.2	7.1	7.2
1925						
January	16.6	10.7	10.4	11.6	9.4	7.2
February	15.6	9.6	9.4	9.8	8.5	7.2
March	16.6	10.2	9.6	11.9	9.1	7.2
April	15.5	9.7	9.4	11.7	8.5	7.2
May	15.7	9.4	9.2	11.2	8.5	7.2
June	16.9	10.2	9.3	11.1	8.6	7.2
July	17.5	10.8	9.8	13.1	9.0	7.2
August	17.7	11.1	10.0	13.9	9.0	7.2
September	17.8	10.6	9.8	13.7	9.0	7.2
October	16.3	10.7	10.0	12.4	9.0	7.2
November	15.9	10.4	10.1	10.3	9.0	7.2
December	14.8	10.3	10.0	10.0	8.8	7.2
Average	16.4	10.3	9.7	11.7	8.9	7.2

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JANUARY, 1920, TO SEPTEMBER, 1927, INCLUSIVE—Continued

Men- haden Oil	Cot- ton- seed Oil, Crude	Peanut Oil		Corn Oil		Soya Bean Oil, Crude	Palm Oil, Lagos	Coco- nut Oil, Manila
		Re- fined	Crude	Re- fined	Crude			
6.5	9.4	15.8	12.0	13.5	11.8	11.3	8.0	9.8
6.5	8.7	15.5	12.0	13.1	11.8	11.6	8.1	9.9
7.2	8.2	16.2	12.0	12.5	11.2	12.0	8.0	9.6
7.2	8.6	16.0	11.8	12.0	11.1	12.0	7.5	9.5
7.2	8.0	15.8	11.3	12.1	10.9	12.0	7.4	9.2
6.0	8.7	15.0	11.3	11.9	10.4	12.0	7.2	9.2
5.7	10.2	15.1	11.3	12.8	11.3	12.1	7.6	9.8
6.7	11.3	15.8	11.6	14.8	13.7	12.8	8.4	10.4
6.8	8.3	16.4	12.3	14.2	12.9	12.8	8.4	10.5
7.0	8.8	16.1	12.0	13.1	12.4	13.2	8.9	10.5
7.5	8.8	16.0	12.0	13.2	12.6	13.5	9.6	11.5
7.7	9.6	16.0	12.0	13.5	12.5	13.3	9.4	11.4
6.8	9.0	15.8	11.8	13.1	11.9	12.4	8.2	10.1
7.3	9.6	16.5	11.6	13.9	12.8	13.7	9.9	11.4
7.3	9.0	16.5	11.5	13.5	12.1	13.8	9.5	11.0
7.3	9.8	16.5	11.5	13.0	12.1	13.4	9.5	10.4
7.3	9.8	16.5	10.6	13.2	12.4	12.9	9.2	10.1
7.3	9.2	15.2	10.2	12.8	11.8	12.9	9.0	10.2
7.3	9.6	15.0	9.9	12.8	11.6	12.9	9.0	10.4
7.0	9.5	15.0	9.8	13.1	12.1	13.0	9.2	10.8
6.8	9.4	15.0	10.7	13.2	12.1	13.0	9.2	11.0
6.8	9.1	15.0	10.7	13.6	12.5	13.2	9.2	12.1
7.2	8.4	15.0	10.1	13.5	12.2	13.3	9.2	13.4
6.9	8.8	15.0	10.0	13.0	12.0	13.3	9.2	14.1
7.0	8.8	15.0	10.0	12.8	11.8	13.3	9.2	12.6
7.2	9.2	15.5	10.6	13.2	12.1	13.2	9.3	11.5

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IX. PRICES OF THE PRINCIPAL OILS AND FATS, BY MONTHS,

	Lard	Tallow		Grease		Whale Oil
		Edible	Prime Packers	White	Yellow	
1926						
January	15.4	10.6	10.1	10.1	9.0	7.2
February	15.1	10.4	9.8	10.1	8.7	7.2
March	14.9	10.1	9.5	9.4	8.4	7.2
April	14.4	9.3	8.6	8.7	8.0	7.2
May	15.5	9.7	8.8	9.8	8.0	7.2
June	17.0	11.2	9.3	11.2	8.2	8.0
July	16.2	10.6	8.7	9.9	7.7	8.0
August	15.5	9.6	8.6	8.9	7.4	8.0
September	15.0	9.5	8.7	9.0	7.3	8.0
October	14.5	8.9	8.2	8.8	7.1	8.0
November	13.1	7.9	7.6	9.0	6.3	8.0
December	12.6	7.8	7.4	9.6	6.1	8.0
Average	14.9	9.6	8.8	9.5	7.7	7.7
1927						
January	12.6	7.9	7.5	9.0	6.5	8.0
February	12.8	8.7	8.0	9.1	7.0	8.0
March	12.8	8.6	7.9	8.8	6.9	8.0
April	12.7	8.0	7.7	8.1	6.6	7.8
May	12.6	8.2	7.8	8.2	6.7	7.5
June	12.6	8.3	7.9	8.3	6.9	7.5
July	12.6	8.2	7.8	7.6	6.8	7.3
August	12.4	8.6	8.0	8.0	6.9	7.2
September	12.9	9.9	8.6	8.9	7.4	7.2
October	12.7	10.4	9.2	9.5	7.4	7.2
November	12.4	10.2	9.2	9.3	7.4	7.2
December	12.0	9.3	8.9	9.1	7.3	7.2
Average	12.6	8.9	8.2	8.7	7.0	7.5

APPENDIX A

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JANUARY, 1920, TO SEPTEMBER, 1927, INCLUSIVE—Continued

Men- haden Oil	Cot- ton- seed Oil, Crude	Peanut Oil		Corn Oil		Soya Bean Oil, Crude	Palm Oil, Lagos	Coco- nut Oil, Manila
		Re- fined	Crude	Re- fined	Crude			
7.0	9.7	15.0	10.0	12.5	11.6	13.3	9.0	11.7
7.0	10.0	15.5	9.9	13.0	11.3	13.2	8.8	10.9
7.0	11.0	16.0	10.6	13.0	11.3	12.8	8.7	11.1
—	11.0	16.0	11.1	13.0	11.4	12.5	8.6	11.0
—	12.2	16.0	11.5	14.0	12.7	12.5	8.8	10.9
6.3	13.7	16.0	12.0	15.5	14.0	12.8	8.9	11.4
6.3	13.0	16.0	13.3	16.0	14.0	12.5	8.4	11.1
6.3	10.8	16.0	13.3	15.2	13.0	12.5	8.2	10.6
6.2	8.8	16.0	13.0	14.0	12.9	12.5	8.7	10.7
6.0	7.4	16.0	11.0	12.5	11.2	12.5	8.6	9.8
6.0	6.6	15.5	10.3	11.8	10.6	12.3	8.2	9.4
5.7	6.4	14.8	9.1	11.4	10.4	12.1	8.2	9.3
6.4	10.0	15.7	11.3	13.5	12.0	12.6	8.6	10.7
5.3	6.8	14.5	8.8	11.0	10.0	12.0	8.4	9.4
6.2	8.0	14.5	8.5	11.0	9.9	12.0	8.7	9.7
6.5	7.7	14.5	12.5	11.0	9.8	12.1	8.7	9.5
6.5	7.3	14.5	12.5	11.0	9.8	12.0	8.3	9.6
6.5	7.6	14.5	12.5	11.0	9.9	12.1	8.2	9.9
6.5	8.0	14.5	12.5	12.0	11.0	12.0	8.0	9.8
6.2	8.4	14.5	12.5	12.0	11.0	12.0	7.6	9.8
5.8	8.6	14.5	12.5	12.0	11.3	12.0	7.6	9.8
6.1	9.2	14.5	12.5	12.0	11.7	12.0	7.8	10.0
6.0	9.4	14.5	11.4	12.0	11.8	12.0	7.9	10.0
5.9	9.1	14.5	10.5	12.5	12.0	12.2	7.9	9.9
5.9	8.6	13.5	9.6	12.0	12.0	12.3	7.8	9.9
6.1	9.2	14.4	11.4	11.6	11.6	12.1	8.1	9.8

APPENDIX B

EFFECTS OF A DUTY ON PRICE AND OUTPUT WITH SPECIAL REFERENCE TO BUTTER AND FLAXSEED

I. FORMULAE FOR ESTIMATING THE EFFECT OF A DUTY

In levying a duty on any article it is desirable to be able to estimate with some accuracy the price, output, and import changes which are likely to follow its enactment. If it is levied for revenue the question of first importance is the amount of revenue it will yield, and this is dependent both upon the magnitude of the duty and its effect upon imports. If it is levied for protection the important considerations are (1) to what extent may it be expected to expand the domestic industry, that is, to increase the domestic production of the taxed article, and (2) to what extent will the price of this article be raised.

If we had complete knowledge of the following nine factors all of these questions could be answered with mathematical precision: (1) The magnitude of the duty, T_f ; the elasticities (2) of the domestic supply, e_d ; (3) of the foreign supply, e_f ; (4) of the domestic demand, η_d ; (5) of the foreign demand, η_f ; (6) the domestic output, o_d ; (7) the foreign output, o_f ; (8) the domestic consumption, c_d ; and (9) the foreign consumption, c_f .

If P represents the international price established under free trade and ΔP the increase in price which will follow the imposition of the duty T_z , then

$$(A)^1 \quad \Delta P = T_z \frac{1}{1 + \frac{e_d O_d - \eta_d C_d}{e_r O_r - \eta_r C_r}}$$

¹A simple demonstration of the formula for ΔP from which the others are derived, follows:

Let θ , φ , α , and β be the angles respectively which tangents to the domestic supply, foreign supply, domestic demand, and foreign demand curves make with a horizontal line. Let P be the international price established under free trade, and c , k , m , and n , be constants, then

$c + P \cot \theta$ = the domestic output and $k + P \cot \varphi$ = the foreign output,

$m + P \cot \alpha$ = the domestic consumption and $n + P \cot \beta$ = the foreign consumption, and (I) $c + P \cot \theta + k + P \cot \varphi = m + P \cot \alpha + n + P \cot \beta$ (since world output = world consumption). Now let P' = the domestic price resulting from the duty and $P' - T_z$ = the foreign price resulting from the duty. Then (under the duty T_z)

$c + P' \cot \theta$ = the domestic output and $k + (P' - T_z) \cot \varphi$ = the foreign output,

$m + P' \cot \alpha$ = the domestic consumption and $n + (P' - T_z) \cot \beta$ = the foreign consumption, and (II) $c + P' \cot \theta + k + (P' - T_z) \cot \varphi = m + P' \cot \alpha + n + (P' - T_z) \cot \beta$

$$\text{From (I), } P = \frac{m + n - c - k}{\cot \theta + \cot \varphi - \cot \alpha - \cot \beta}$$

$$\text{and from (II) } P' = \frac{m + n - c - k + T_z (\cot \varphi - \cot \beta)}{\cot \theta + \cot \varphi - \cot \alpha - \cot \beta}$$

$$\text{Hence } P' - P = \Delta P = \frac{T_z (\cot \varphi - \cot \beta)}{\cot \varphi - \cot \beta + \cot \theta - \cot \alpha}$$

$$= T_z \frac{1}{1 + \frac{\cot \theta - \cot \alpha}{\cot \varphi - \cot \beta}} = T_z \frac{1}{1 + \frac{e_d O_d - \eta_d C_d}{e_r O_r - \eta_r C_r}}$$

[Since, in general, elasticity = cotangent of the slope $\frac{\text{price}}{\text{output}}$]

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The increase in the domestic production will be

$$(B) \quad \Delta o = \frac{\Delta P}{P} e_d o_d$$

and the decrease in imports and domestic consumption will be

$$(C) \quad \Delta i = \frac{\Delta P}{P} (e_d o_d - \eta_d c_d) \quad (D) \quad \Delta c = \frac{\Delta P}{P} \eta_d c_d$$

Other consequences of the duty, such as the effect upon foreign price and foreign production, may be derived from the above data, as may also the lowest duty which will be prohibitive. If the lowest prohibitive rate be denoted by T_p , we shall have

$$(E) \quad T_p = P(c_d - o_d) \left(\frac{1}{e_d o_d - \eta_d c_d} + \frac{1}{e_r o_r - \eta_r c_r} \right)$$

The value of ΔP depends on the value of the fraction $\frac{e_d o_d - \eta_d c_d}{e_r o_r - \eta_r c_r}$. Since η is negative both numerator and denominator of this fraction are positive. The fraction

Pigou's formula is $AP = \frac{e_r o_r}{e_r o_r + e_d o_d - \eta_w (o_d + o_r)}$, η_w being the elasticity of the world demand. See "The Known and Unknown in Mr. Chamberlain's Policy," *Fortnightly Review*, June, 1904, p. 44; or "Economics of Welfare," page 942. It is believed that the formula here given, because of its symmetry, is more convenient than Pigou's. It is also from the standpoint of theory more accurate. When the duty is imposed the domestic price rises and the foreign price falls. These changes in price affect the quantity which will be taken and the quantity which will be forthcoming both at home and abroad. Pigou's formula does not take into account the lowering of foreign price in connection with the quantity taken abroad. When allowance is made for this difference the two formulae become identical.

may have all values from 0 to $+\infty$; if 0, $\Delta P = 1$, if $+\infty$, $\Delta P = 0$. In general the larger the domestic factors (e_d , o_d , η_d , c_d) as compared with the foreign, the greater will be the value of the fraction and hence the less the effect of the duty (ΔP).

From (A) and (B) it may be shown that, other factors remaining constant, as e_d increases ΔP decreases and Δo_d increases.

From (A) and (D) it may be shown that, other factors remaining constant, as η_d increases numerically ΔP decreases and Δc_d increases.

It thus appears that high elasticity of domestic supply tends to lessen the effect of a duty on price and increase its effect on output, and that high elasticity of domestic demand tends to lessen the effect of a duty on price and increase its effect in diminishing consumption.

Before proceeding to the statistical problem of ascertaining from existing data the values of the constants appearing in the formulae, a word may be said about their meaning. T_r is the duty, which, in order to be adaptable to the formula, must be fully effective, that is, result in a domestic price higher than the foreign price by the full amount of the duty,² and must be a specific duty—so many cents per pound, cents per bushel, or dollars per ton as the case may be. The outputs, o_d and o_r , and the consumption, c_d and c_r , are the total number of pounds, bushels, gallons, tons, etc., of the article in question produced and consumed in the United States and in all foreign countries, respectively. All of these quantities are perfectly definite and present no problems calling for discussion. Either the data are available or they are not.

² In practice this condition is seldom perfectly realized.

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The elasticities, e and η , call for more extended explanation. In a general way these terms have reference to the responsiveness of buyers or sellers to changes in price. As an economic concept the picture is that of a "market" made up of an indefinite number of competing buyers and an indefinite number of competing sellers, the latter holding in their possession an indefinite quantity of a certain article. Under the concept of *demand* it is believed that if at a given instant of time the sellers had thrown on the market a definite portion of their stock, that portion would all have been taken at a certain definite price. If, however, *at the same instant*, they had offered more, the price would have been less, and, if less, the price would have been more. That is, for an offering of any portion of the stock there is, *at that instant*, a definite price at which that portion will be absorbed. Likewise, with reference to *supply* it is supposed that at a given price a definite quantity will be forthcoming from sellers. If, at that instant, the price had been higher more would have been forthcoming; if lower, less. To give mathematical definiteness to the concept, the coefficient of elasticity may be defined as the ratio of the percentage change in quantity to the percentage change in price, and may be represented by the expression:

$$e \text{ [elasticity of supply]}^* \text{ or } \frac{\Delta x}{x} \\ \eta \text{ [elasticity of demand]}^* = \frac{\Delta y}{y}$$

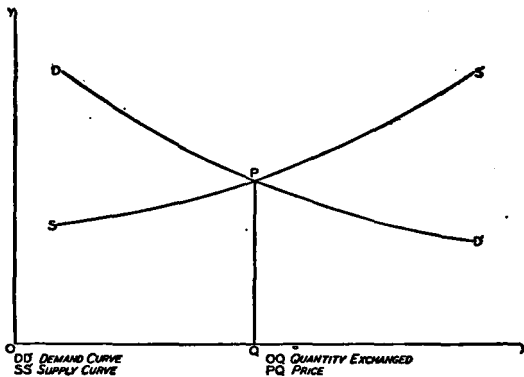
Since, with reference to supply, an increase in price is accompanied by an increase in quantity, $\frac{\Delta x}{x}$ and $\frac{\Delta y}{y}$

* In this expression Δx (read delta x) means the increase or decrease in quantity; Δy , the increase or decrease in price.

will have the same sign and hence e will be positive. With reference to demand, however, since at an increase in price a smaller quantity will be taken, $\frac{\Delta x}{x}$ and $\frac{\Delta y}{y}$ will have opposite signs and hence η will be negative.

From what has been said it is obvious that supply conditions at any instant of time may be represented by

FIGURE 1. TYPICAL SUPPLY AND DEMAND CURVES.



an ascending, and demand conditions by a descending, curve. The point where the curves intersect determines the price and quantity exchanged at that instant. This is shown in Figure 1.

The economic concept of elasticity supposes different experiments with prices in the same market at a single instant of time. Obviously such experiments cannot be made. Actual observations must be made at different times and during the period between observations conditions both of supply and demand may change. Indeed,

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they not only may change, but one of them must change, if any estimate is to be made of elasticity. For if they remained constant then every observation would show the same output and the same price, and while it might be imagined that at a higher price a smaller quantity would be taken or a greater quantity forthcoming no evidence of this would be afforded by the data.

Moreover, for the purposes under discussion, a concept of the supply curve quite different from that based primarily on the psychology of sellers must be formed. Instead of an indefinite stock in the hands of sellers the picture becomes that of a flow of goods coming into the market from producers. Now, different producers produce at different unit costs; indeed, the same producer generally produces different parts of his output at different costs, hence the units constituting this flow are produced at different costs. But it may be assumed that every producer is producing every unit of his output at as low a cost as he can and it may be further assumed that he will not intentionally produce any part of his output at a loss. Hence the units making up the flow that comes into the market in a given period of time may be arrayed with respect to their costs of production beginning with the lowest and increasing up to a cost which is equal to the price. The *cost* curve constructed from this array will resemble in some respects the *supply* curve, above described, and is the type of supply curve whose elasticity e is called for in the formula.

It will resemble the first mentioned type of supply curve in this respect: at a higher price a greater output will be forthcoming and at a lower price the output will fall off. For, as was noted, since no producer will intentionally produce at a loss, the costs will ascend to a

point where they become equal to the price. At that point the cost enables the producer incurring it just to "break even." It may be called the *marginal cost*. But if the price increases producers can profitably increase their output up to a point where the new marginal cost equals the new price.

From what has been said it is clear that if a true cost curve could be constructed the value of the expression $\frac{\Delta x}{x} \div \frac{\Delta y}{y}$ for any point on that curve would be the elasticity of supply at that point and could be substituted for e in the formula.

The United States Tariff Commission has made cost studies for a considerable number of industries. Unfortunately for the present purpose, these studies were made by establishments. The average cost per unit for each establishment was ascertained. But it may be safely assumed that each establishment was producing units of output at varying costs up to a cost approximating the marginal cost, otherwise a low cost producer would already have increased his output, thus lowering the price and squeezing out one by one the higher cost producers until the price was reduced to his own cost. Hence, when the price rises it will not be merely one producer at the margin who will find it profitable to increase his output, but all of the low cost producers as well, and therefore, the response in output to an increase in price will be in fact much greater than would be indicated by the cost curve constructed from the Commission's data.* The true value of e cannot be less than the

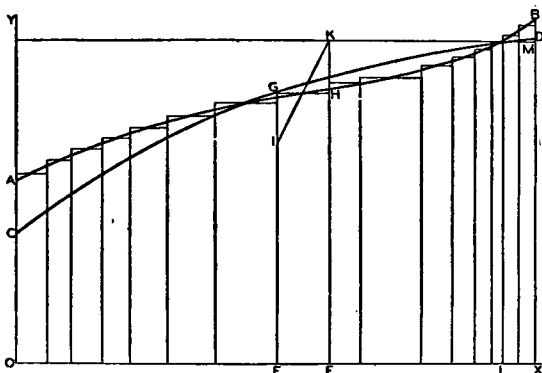
*The diagram, Figure 2, will help to make clear the above statement. The "steps" AB, smoothed into the curve AB, are typical of the Commission's cost curves, when costs are taken by establishments. Consider the producer whose output is

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value derived from one of the Commission's cost studies but it may be much greater.

Aside from the Commission's cost studies, which are open to the objection specified, price, output, and consumption data, and such factors as may be supposed to influence supply and demand conditions are our only resource. As was noted, unless supply or demand conditions are known, it is clear that a "true" cost curve would show a much greater part of the output produced at or near the marginal cost, and would assume some such form as AD. From the Commission's cost curve we should have $e = \frac{LX}{\frac{OL}{BM}}$; from the "true" cost curve $e = \frac{LX}{\frac{OL}{DM}}$. Obviously the latter value is much the greater.

FIGURE 2. COST CURVES BY UNITS OF OUTPUT AND BY ESTABLISHMENTS.



greater part of the output produced at or near the marginal cost, and would assume some such form as AD. From the Commission's

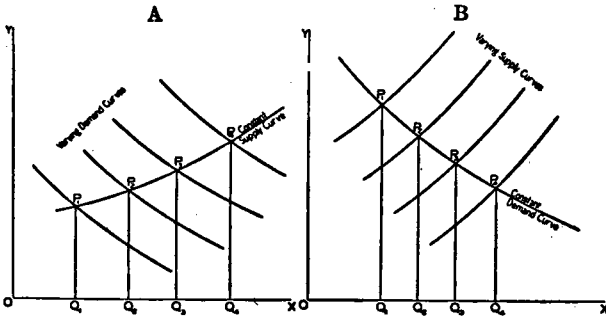
cost curve we should have $e = \frac{LX}{\frac{OL}{BM}}$; from the "true" cost

curve $e = \frac{LX}{\frac{OL}{DM}}$. Obviously the latter value is much the greater.

tions change, no information with respect to elasticity can be obtained from such data. However, this limitation need give us little concern, because as a matter of fact both conditions do change greatly from year to year, from month to month, and even from day to day. Demand is said to strengthen when a greater quantity will be taken at the same price. This will be shown graphi-

FIGURE 3. PRICE-OUTPUT DATA REVEAL—

- (A) SUPPLY CURVE
(B) DEMAND CURVE



cally by a bodily shifting of the demand curve to the right. Supply conditions are said to move toward lower costs when a greater quantity will be forthcoming at the same price. This also will be shown graphically by a bodily shifting of the supply curve to the right. A weakening of demand or a movement toward higher costs will be shown by a shifting of the curves to the left.

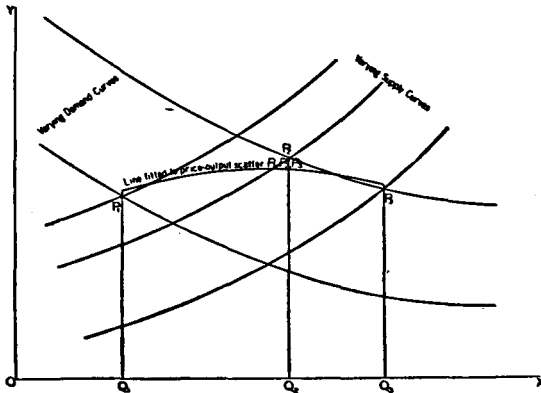
If it can be shown that during a period of time covered by two or more observations either curve remains fixed while the other moves to right or left, price-output data

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will reveal points on the curve that remains fixed. This should be obvious from the analysis given above but may be illustrated by a diagram. (Figure 3.)

If both supply and demand conditions change, price-output data yield no direct information as to either curve. (Figure 4.)

FIGURE 4. PRICE-OUTPUT DATA FAIL TO REVEAL EITHER SUPPLY OR DEMAND CURVE.



Unfortunately for our problem, the case represented by Figure 4 is the more common, and even if either curve does remain fixed during the period covered by the observations there is no certain way of knowing this fact in advance.⁵

It may be said at once that the numerical results obtained for the elasticity of supply or demand can be at best but estimates based upon a reasonable agreement

⁵ For a fuller discussion of the point here made see Working, E. J., "What Do 'Statistical Demand' Curves Show?" *Quarterly Journal of Economics*, February, 1927, Vol. XLI, p. 212.

of results obtained by different tests and upon such *a priori* evidence as may be available.

Such estimates may be made, but before proceeding further it is well to emphasize the conclusion so far reached. Aside from estimates based on cost studies, such as those undertaken by the Tariff Commission, the estimate must be based on the principle that price-output data afford evidence with respect to the supply or demand curves only on the condition that one of the curves is constant while the other varies, and the problem consists in so handling the data as to have a reasonable assurance that that condition is realized.

II. EXPLANATIONS AND QUALIFICATIONS

In order to avoid confusion several explanations and qualifications have been purposely omitted. These must be disposed of before approaching the problem of estimates.

Elasticity may remain constant through bodily shiftings of the supply and demand curves. The question naturally arises whether through the constantly changing conditions of supply and demand there is any reality corresponding with the term elasticity. Is it not one thing to-day and another to-morrow? Doubtless the elasticities of supply and demand do change, but there is reason for believing that they are at least relatively constant. Suppose demand conditions change. It can easily be shown that if the ratio of the quantity now taken to the quantity formerly taken at a given price is constant, whatever the price, the elasticity of demand at that price remains unchanged,⁶ and similarly under the

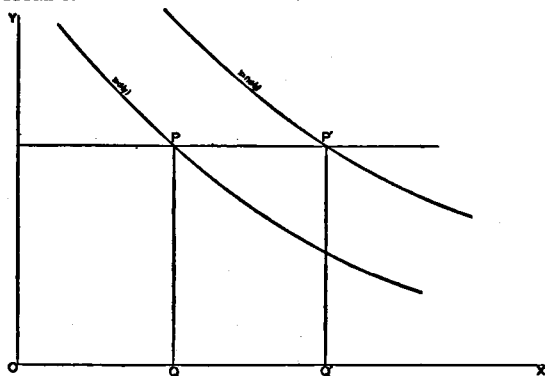
⁶Let $x = \varphi(y)$ [Figure 5] be the demand curve in its first position, and $x = n\varphi(y)$ the demand curve in its second posi-

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same conditions the elasticity of supply may be shown to remain unchanged. Such a condition is believed to be, on the whole, normal. For example, if under the new conditions the quantity which would be taken at 10 cents is doubled, it is probably approximately true that the quantity which would be taken at 5 cents, at 8 cents, or at 12 cents would also be doubled.⁷

tion. Then η (the elasticity of demand in the first position) = $\frac{y}{x} \frac{dx}{dy} = \frac{y}{\varphi(y)} \varphi'(y)$ and η' (the elasticity of demand in the second position) = $\frac{y}{x} \frac{dx}{dy} = \frac{y}{n\varphi(y)} n\varphi'(y) = \frac{y}{\varphi(y)} \varphi'(y) \therefore \eta = \eta'$.

FIGURE 5. SHIFTING DEMAND CURVE: CONSTANT ELASTICITY.



⁷This does not mean that the elasticity of demand, in any of the positions of the demand curve, is necessarily the same for 10 cents as for 5 cents or 8 cents or 12 cents. The demand curve which does have the same elasticity for any price or any output must be of the form $xy^\eta = n$, where η is the elasticity and n a constant determining the position of the curve with reference to the origin. Thus, by definition, $\eta = -\frac{dx}{dy} \cdot \frac{y}{x}$ or $\frac{dx}{x} = -\eta \frac{dy}{y}$

$\therefore \log x = \log n - \eta \log y = \log \frac{n}{y^\eta} \therefore xy^\eta = n.$

Similarly, the equation of the cost curve of constant elasticity is $x = ny^\eta$.

The data must be handled intelligently with respect to time intervals in estimating the elasticity of supply. Attention has been called to the distinction between the supply curve and the cost curve, the former depending solely on the responsiveness of sellers holding an indefinite stock to changes in price, the latter depending on the increase in marginal cost resulting from an increase in output. If the immediate effect of the tariff is in question, the elasticity of supply should be obtained from the supply curve as defined above. Ordinarily the long-run effect of the tariff is what is desired, and for this the elasticity of supply should be obtained from the cost curve.

Price is the only evidence available of marginal cost but, at the time of any specific observation, may differ widely from it. However, as the desire for profit is always urging producers to expand their output up to the point where some part of it is produced at marginal cost, while the impossibility of long continuing to produce at a loss is tending to curtail parts of the output produced at a higher cost, it would seem that forces were at work tending always to adjust output to demand in such a manner that the price would equal the marginal cost. An average of prices over a considerable period of time should approximate the marginal cost of producing the average output.

In the case of an agricultural product the process of adjustment may extend over several years. At the close of harvest the quantity available for sale is fixed until the next harvest. Prices may be expected to fluctuate throughout the year calling from sellers varying portions of the existing stock, but the average price for the year should be the price at which the market would absorb

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the entire stock. Suppose this price to be above the cost of producing all except an inappreciable portion of the crop. Production will be stimulated and the next crop will be likely to be so large that, at the reduced price at which it will sell, much of it will be produced at a loss. The next year will therefore show a small crop and a high price, and so on, with a tendency, however, if demand conditions remain constant, to adjust the price to the marginal cost.* It may require a period of four or five years to affect the adjustment. Since there is no way of telling just how many years are required, it is well in practice to make several computations; one, say, with a period of four years; another of five years; and another of six years. The average value of e obtained from such computations is probably safer than that obtained from any one of them.

Marginal cost was provisionally defined as the cost which just enables the producer who incurs it to "break even." This definition implies identity between price and marginal cost. In the light of what has been said such an identity can be accepted only as a long-run tendency. A more precise definition of marginal cost would be the cost equal to the equilibrium price determined by existing cost and demand conditions.

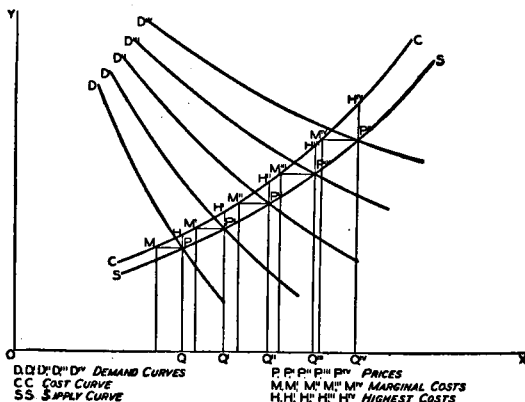
Since no producer would intentionally produce any

*The statement in the text calls for some qualification. The entire stock is not necessarily absorbed. There may be a hold-over and the hold-over may differ from year to year. Nor is the supply absolutely inelastic. With a given stock the quantity which will be offered for sale will vary somewhat with the price. With a very low price some part of the stock will never come to market at all. The *annual* supply curve for an agricultural crop will be a curve whose elasticity approaches zero. Finally, the possibility of increasing or diminishing the stock available as a result of the harvest, by increasing or diminishing imports, must be taken into account.

part of his output at a loss, the marginal cost and price would also tend to be equal to the highest cost. But because of accident, fallibility in the estimates of producers, and the constantly changing conditions of demand, it is usually found that some portion of the crop is annually produced at a loss. However, economic forces are always tending to bring price, marginal cost, and highest cost together whenever they depart from a common level.⁹

⁹The cost studies undertaken by the Tariff Commission indicate that even in equilibrium the price and marginal cost are less than the highest cost, that is, that some portion of the output is normally produced at a loss. If this is true, the long-time supply curve instead of being identical with the cost curve would lie somewhat below it. Suppose that 10 per cent of the marketed output is normally produced at a loss. This situation is represented in Figure 6.

FIGURE 6. SUPPLY CURVE MAY DIFFER FROM COST CURVE.



D, D^I, D^{II}, D^{III}, etc.—demand curves
 CC—cost curve
 SS—supply curve
 P, P^I, P^{II}, etc.—prices
 M, M^I, M^{II}, etc.—marginal costs
 H, H^I, H^{II}, etc.—highest costs.

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The equilibrium prices, even when imports and exports exist, should be also marginal costs, and, taken in connection with domestic output, should determine the cost curve. Hitherto no account has been taken of imports and exports. It has been assumed that domestic production was also domestic consumption. If, however, there are imports or exports or both, the price will be the ordinate to the demand curve from the point indicating the total consumption. This follows from the definition of the demand curve. Moreover, the price, if an equilibrium price, will also by definition equal the marginal cost and should determine that point on the cost curve whose abscissa is the domestic output. (Or, if n per cent production at a loss is normal, an abscissa n per cent less than the domestic output).¹⁰

The above principle is illustrated in Figure 7.

$D_1, D_2, \text{ etc.}$,—demand curves

CC' —cost curve

SS' —supply curve (production + imports — exports)

$P_1, P_2, P_3, \text{ etc.}$,—prices

$M_1, M_2, M_3, \text{ etc.}$,—marginal costs

$OO_1, OO_2, OO_3, \text{ etc.}$,—domestic outputs

$O_1S_1, O_2S_2, \text{ etc.}$,—imports

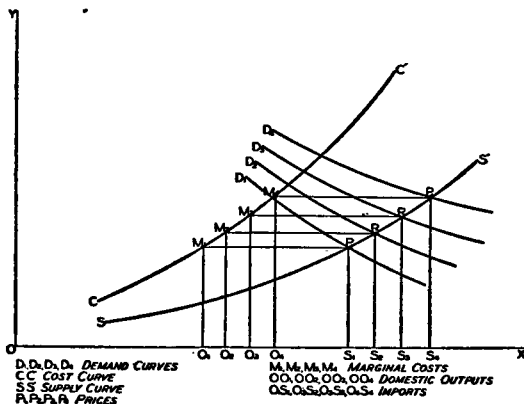
Footnote 9, continued.—The diagram shows the successive equilibria supposing cost conditions to remain constant and demand to strengthen from year to year. The prices are determined by the ordinates from the successive outputs to the successive demand curves ($D, D^I, D^{II}, \text{ etc.}$), the highest costs by the ordinates from the successive outputs to the cost curve (CC), and the marginal costs are ordinates to the cost curve equal to the successive prices.

It will be observed that the long-time supply curve lies a little below the cost curve. Price-output data reveal the long-time supply curve rather than the cost curve but as the two curves have virtually the same elasticity this circumstance need give no concern.

¹⁰ If from any point in a curve a vertical line be drawn to the line OX , shown in the diagram, the vertical line is called the *ordinate*, and the distance from its foot to O , the *abscissa* of the point.

Assume P_1S_1 , P_2S_2 , etc., to be prices, determined by the fixed total supply curve SS' and the moving demand curve D_1 , D_2 , etc. If these are equilibrium prices, they are also the marginal cost of producing the domestic outputs OO_1 , OO_2 , etc. [O_1S_1 , O_2S_2 , etc., are net imports] and hence determine the cost curve, CC' , assuming no part of the output to be produced at a loss.

FIGURE 7. ELASTICITY OF SUPPLY WHEN THERE ARE IMPORTS.



Increase in output may be forthcoming without necessarily implying improved methods of production or increase in price. On the assumption that each establishment is producing units of output at varying costs up to the marginal cost (see page 293) it would seem as though the only possibility of increased output would be either an increased price permitting increased output at a new and higher marginal cost, or improvements in methods of production permitting increased output at the same marginal cost, or some combination of these factors. The

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first alternative would be shown by a shifting of the demand curve to the right, the second by a shifting of the supply curve to the right. If conditions surrounding all other industries except the one under consideration remained constant, such a conclusion would be warranted. But if the cause of a strengthening demand is one which affects industry as a whole, as, say, growth of population, the result will be an automatic shifting to the right of both demand and supply curves without necessarily implying increase in price or improved methods of production in any of them. The strengthening demand will call forth increased output all along the line, and the same quantity of one commodity will tend to exchange for the same quantity of each of the others. Hence there will be no change in the *real* prices of any of them. Neither, if the quantity of money just keeps pace with the increasing volume of business, will there be any change in the *money* prices of any of them. It follows that in a normally expanding country there will be a close correlation between supply and demand conditions; for every industry both supply and demand curves should be steadily shifting to the right. Of course, there will be "perturbations" in this "cosmic drift" resulting from the special conditions peculiar to each industry.

III. THE HANDLING OF DATA

The preceding discussion reveals the extreme elusiveness of the cost and demand curves which lie embedded in any existing data. Estimates of their elasticities may be made, but any hope of obtaining numerical values comparable with results to be obtained in physical science must be abandoned.

Cost data, *if arrayed by units of output*, should yield the cost curve immediately. Such cost data never have been assembled and probably never will be. If arrayed by establishments, as are the cost studies of the Tariff Commission, they should yield a minimum value of e (see pages 293-294).

The only other data available are price quotations, statistics as to output and consumption, and factors which may affect demand and supply conditions. The one guiding principle to be kept in mind in handling such data is that if cost conditions remain fixed while demand conditions vary, prices will lie on the supply curves; if demand conditions remain fixed while cost conditions vary, prices will lie on the demand curve. As a secondary principle it may be assumed that preference should be given to interpretations which involve moderate rather than violent shiftings to right or left of the demand and cost curves, especially the latter.

In applying these principles no rule to be followed blindly can be laid down. Each case must be studied on its own merits, and success will depend largely upon the skill of the statistician. A few general suggestions may, however, be made.

Every industry is subject to the action of two antagonistic sets of forces, those tending to raise the marginal cost and those tending to lower it. Since the cost curve is an ascending curve, the mere strengthening of demand (shifting of the demand curve to the right) assuming that at the same time no change takes place in the position of the cost curve, tends to raise the marginal cost. (Figure 3-A.) This tendency is increased, if in conjunction with strengthening demand such factors as depletion of raw materials are tending to increase the costs of pro-

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duction all along the line, resulting in a shifting of the cost curve to the left. On the other hand, improvements in methods and machinery are always tending to lower marginal costs, which tendency would be evidenced by a shifting of the cost curve to the right. (Figure 3-B.)

When, as a net result of the action of these two sets of antagonistic factors, the marginal cost over a period of years trends upward, the industry may be said to be subject to increasing costs. When the trend is downward it may be said to be subject to decreasing costs. Every industry is of course subject at all times to tendencies in both directions, but it is the net result which is of chief concern, and on the nature of this net result, price, output, and net-import data may throw some light.¹¹

Suppose that, over the period of years covered by the investigation, the data are graphed so that price, output, and imports are shown on the same sheet as ordinates to successive time units, then if the trends of both prices and outputs are upward, it is evidence that the industry is subject prevailingly to the law of increasing costs. The demand curve has been moving progressively to the right, while the cost curve, if it has been moving to the right at all, has not changed its position

¹¹ "Increasing cost" and "decreasing cost" are here used in a sense somewhat different from that given to these terms in formal economic theory. As ordinarily understood an industry is said to be subject to the law of "diminishing returns" or "increasing cost" when, assuming that a given demand calls forth a certain output at a certain marginal cost, a stronger demand applied *at the same instant* would have called forth an increased output at a higher marginal cost. An industry is said to be subject to the law of "decreasing cost" when, owing to the economies of large-scale production, a stronger demand applied *at the same instant* would have called forth an increased output at a lower marginal cost. Obviously, under this concept it is implied that any shifting to the right of the demand curve automatically carries with it a shifting to the right of the cost curve also.

sufficiently to overcome the tendency to increasing marginal cost. If from a general knowledge of the industry there is reason to believe that demand has strengthened during the period under investigation, or at least has not weakened, and the graph still shows an upward trend of prices but a downward trend of outputs, the case for the industry's being subject to the law of increasing costs is even stronger. The cost curve has apparently been shifting to the left.

In either of these cases the imposition of a duty would be one factor added to those already tending effectively to raise marginal cost and price.

But now suppose that an upward trend of outputs is accompanied by a downward trend of prices. In this case the evidence points to progressive improvements in methods and machinery and relatively stationary demand conditions, a progressive shifting of the cost curve to the right and a relatively stationary demand curve. Here we have an industry subject prevalingly to the law of decreasing costs, and while the imposition of a duty would check the downward tendency of prices, it might not be sufficient to overcome it. Prices might continue to fall. Indeed, the stimulus given to the industry by the duty might accelerate improvements in methods and machinery and result in an even greater decline in prices and increase in output than would have occurred had the duty not been imposed. In this case the industry would have been one to which the familiar "infant industries" argument for protection was applicable.

Comparing production with imports, their relative magnitudes and their relative trends should be noted. Inferences of considerable tariff significance may be made from such a comparison. (1) Since price is determined

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by the interaction of demand with total supply—production plus imports—if imports constitute at best but an insignificant part of total supply, the tariff can have but little effect on either price or output. The effect of a duty will tend to increase with the relative importance of imports. (2) Provided demand conditions in the United States and in the country from which imports are received continue to occupy about the same relative position, it may be assumed that if imports show a tendency to increase more rapidly than domestic production the forces that tend to a lowering of costs in the foreign country are gaining on similar forces in the United States. Under these conditions foreign competition is tending to become more severe. From the standpoint of the industry a duty is needed, but from the standpoint of consumers, it simply shuts them off from sharing in the improved methods of production by which foreigners are profiting. If on the other hand domestic output is increasing more rapidly than imports, it is evidence that domestic producers are getting more and more into a position of competitive advantage, and a duty is of less consequence to either producers or consumers. If the process continues the United States will change from an importing to an exporting country and the duty will become purely nominal.

The inferences which have so far been pointed out as possible to be derived from inspection of the data are based on the evidence which the data afford of changes in the conditions of demand and supply, that is, of shiftings to right or left of the cost and demand curves. Nothing has yet been said to indicate how the data may be handled so as to give evidence of the shape and character of these curves from which the elasticities of demand and

supply may be computed. Yet the effects directly attributable to the tariff depend on these elasticities. The changes in demand and supply conditions so far discussed may afford some evidence as to the wisdom or unwisdom of imposing a duty, but they are not themselves caused by the duty. Presumably they would take place in much the same way whether the duty were imposed or not. The only effects directly attributable to the tariff are the effects which it can produce on price, production, and imports under the supposition that foreign and domestic demand and supply conditions undergo no change.¹²

The elasticities of supply and demand cannot be computed from price, output, and consumption data alone. The unknown quantities are too numerous for the equations. This statement is susceptible of algebraic demonstration, but the following graphical explanation is believed to be sufficient to make the point clear to the reader. (Figure 8.)

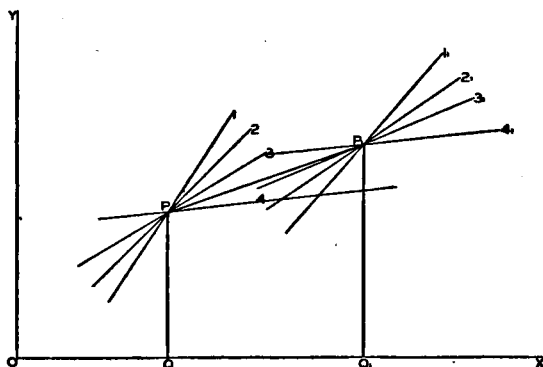
Suppose the data show that in two successive observations price changes from PQ to P_1Q_1 , and output from OQ to OQ_1 . This change must have been effected by a strengthening of demand, that is, by a shifting of the demand curve from a position passing through P to a position passing through P_1 . So long as it satisfies this condition, its shape does not matter. It may be straight or curved, its slope may be steep or gentle. If now we knew that while the demand curve was moving from P to P_1 the cost curve had not moved at all, we could at

¹² The one exception to this statement is to be found in the possibility that the duty may stimulate the accumulation of capital, and hence hasten the action of those forces which tend to lower costs—it may be a cause of a more rapid shifting of the cost curve to the right.

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once compute the elasticity of supply from the portion of the supply curve PP_1 . But the change in price and output can equally well be accounted for by supposing that while the demand curve moved from P to P_1 , the cost curve from a position P_1 moved to a position $P_{1,1}$, or from P_2 to $P_{1,2}$, or from P_3 to $P_{1,3}$, or from P_4 to

FIGURE 8. PRICE-OUTPUT DATA ALONE, INADEQUATE.



$P_{1,4}$. The possibilities are infinite. So far as evidence afforded by the data is concerned one supposition is as likely as another.

Similarly, if the slope of the line PP_1 had been downward instead of upward the change in output and price would necessarily have involved a movement to the right of the cost curve, while there might or might not have been a movement of the demand curve.

Elasticity of ^{supply} demand can be computed only when assurance is obtained that the ^{cost} demand curve remains fixed

while the *demand* curve is changing its position. Such assurance may come from an intimate knowledge of the industry or from statistical methods introducing additional data.

Obviously if it is known that over the period covered by the observations cost conditions have not appreciably changed while demand conditions have changed, the elasticity of supply can be computed directly from the trend of the price-output scatter, and similarly if it is known that there has been great improvement in methods while demand conditions have not changed the elasticity of demand can be computed from the trend of the price-consumption scatter.

The principle in the last paragraph may be extended further. If there is reason to believe that over a period of years the variability of demand conditions greatly exceeds that of supply conditions and furthermore that such variations of supply conditions as exist are as likely to be in one direction as the other, then the elasticity of supply may be computed in the following manner: From a price-output scatter select all the chronologically successive pairs of observations in which the line connecting them shows an up-slope and compute a value of e from each pair. The median of these values should approximate the true value of e . Similarly, when the variability of supply conditions greatly exceeds that of demand conditions, the median of the values η computed from the pairs of observations showing a down-slope should approximate the true value of η .

In the absence of intimate knowledge of demand and supply conditions, statistical methods for imputing fixity to one of the curves while the other changes its position

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must be based on the introduction of additional factors. Such additional factors may be factors which (A) affect demand conditions without affecting cost conditions or which (B) affect cost conditions without affecting demand conditions.¹³ An example of a factor of type A is the price or output of an important substitute for the article under investigation or some index of prosperity of an industry using that article as a raw material. An example of a factor of type B, in the case of an agricultural crop, is yield per acre or the price of the given article the preceding year.¹⁴

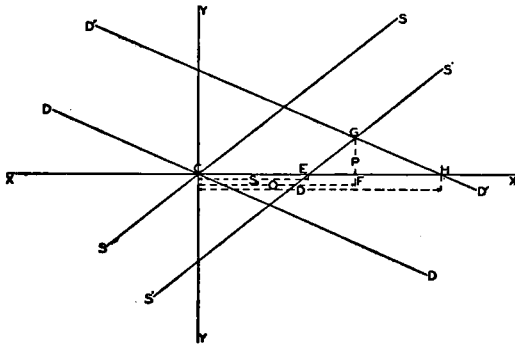
Suppose, now, that the problem is to compute the elasticity of supply (e). Price (P'), output (O'), and price of substitute (A') should be tabulated and the ratio of each observation to that preceding should be computed. This will give us a table of link relatives for price, output, and price of substitute. Then the deviation of each link relative from the mean link relative should be found and the results tabulated. We shall then have a table showing for each pair of successive observations the percentage deviation in the price of the substitute corresponding with the percentage deviation in output and also with the percentage deviation in price. Denote these percentage deviations from their means by A, O, and P. (Figure 9.)

¹³ A complementary process would obviously be to find the relation between output and price, after eliminating the effects of all factors (A) which affect cost conditions or after eliminating the effects of all factors (B) which affect demand conditions. This may be possible by the method of partial correlation.

¹⁴ This last-named factor does not affect cost conditions but it does affect supply conditions, that is, the quantity which will be forthcoming at a given price. The essential point is that it does *not* affect demand conditions, and all that is essential in order to compute elasticity of demand is to find different points on a stationary demand curve.

Through C draw the line SS so that the ratio of any abscissa to its ordinate shall be e , that is, the ratio of the percentage increase in output to the percentage increase in price. Similarly OD should be drawn so that the ratio of abscissa to ordinate will be η . Now suppose that one of the pairs of price-output deviations in the table is represented by a deviation of CF per cent in out-

FIGURE 9. TYPICAL PRICE-OUTPUT PERCENTAGE DEVIATION.



put and GF per cent in price. These deviations must obviously have been brought about by a change in supply conditions from those represented by the line SS to those represented by the line S'S' and a change in demand conditions from those represented by the line DD to those represented by the line D'D', the change in supply conditions being denoted by S_1 and that of demand condition by D_1 .¹⁵ Using symbols as indicated on the diagram we have:

¹⁵ In this investigation the supply and demand curves must be assumed to represent conditions of constant elasticity for all

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$$e = \frac{EF}{GF} = \frac{CF-CE}{GF} = \frac{O-S_1}{P} \text{ or } eP = O-S_1$$

Now multiply each term in this equation by A (the corresponding deviation in the price of a substitute) and we shall have:

$$eA.P = A.O - A.S_1$$

Suppose this multiplication to be performed for every pair of price-output deviations and the results added, then:

$$e\Sigma A.P = \Sigma A.O - \Sigma A.S_1 \text{ or } e = \frac{\Sigma A.O - \Sigma A.S_1}{A.P}$$

But A was a factor which did not affect supply conditions; hence it is uncorrelated with S_1 ; hence $\Sigma A.S_1 = 0$;

and hence $e = \frac{\Sigma A.O}{\Sigma A.P}$

Similarly if B is a factor, say, yield per acre, which does not affect demand conditions we shall have:

$$\eta = \frac{FH}{FG} = \frac{O-D_1}{P}; \eta P = O-D_1; \eta \Sigma B.P = \Sigma B.O - \Sigma B.D_1; \eta = \frac{\Sigma B.O - \Sigma B.D_1}{B.P}$$

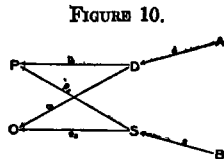
$$\text{But } \Sigma B.D_1 = 0 \text{ Hence } \eta = \frac{B.O}{B.P}$$

Success with this method depends on success in discovering factors of the type A and B. Several such factors of each type should be used if possible. Because of the slow adjustment of price to marginal cost five-year (or four-year or six-year) averages should be used for P' , O' ,

points on the curve, that is, they must be of the types $x = ny^*$ and $xy^* = n$ respectively (page 298). With such curves the elasticity at any point would be the ratio of the abscissa to the ordinate of any point on a straight line.

and A' in computing e instead of annual data. Since the price lies at the intersection of the demand and total supply curve (which may include imports) instead of at the intersection of the demand and cost curve, consumption data instead of output data should be used in computing η .

A more complete analysis of the method here suggested may be made by introducing the principles of path coefficients; for which see "Correlation and Causation," *Journal of Agricultural Research*, January 3, 1921, by Sewall Wright, and "The Theory of Path Coefficients," *Genetics*, May, 1923, by the same author. The analysis of this method is outlined as follows (symbols used with same meanings as above): (Figure 10.)



The path coefficients involved are d , s , p_1 , p_2 , o_1 , o_2 . The solution is based on the assumption that P and O are completely determined by S and D and that, as before, for all points on the curves representing supply or demand conditions the elasticity of supply or the elasticity of demand is constant. By the principles of path coefficients (1) $O = o_1D \frac{\sigma_o}{\sigma_D} + o_2S \frac{\sigma_o}{\sigma_D}$ and (2) $P = p_1D \frac{\sigma_P}{\sigma_D} + p_2S \frac{\sigma_P}{\sigma_D}$. If we divide (1) by (2) on the supposition that the conditions of supply are constant, that is, that $S = 0$, we have $\frac{O}{P} = \frac{o_1\sigma_o}{p_1\sigma_P}$. That is, for the observed percentage deviations of output and price, O and P, we find that their ratio, *under the condition that supply con-*

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ditions are constant, is given by the expression $\frac{O_1\sigma_O}{P_1\sigma_P}$. But this ratio is, by definition the elasticity of supply. Hence, $e = \frac{O_1\sigma_O}{P_1\sigma_P}$. Similarly if we divide (1) by (2), assuming

$$D = 0, \text{ we have } \eta = \frac{O_2\sigma_O}{P_2\sigma_P}.$$

Now by the principles of path coefficients we have $r_{AP} = p_1d$ and $r_{AO} = o_1d$ and hence $\frac{O_1}{P_1} = \frac{r_{AO}}{r_{AP}}$ and $e =$

$$\frac{r_{AO}\sigma_O}{r_{AP}\sigma_P}. \text{ Similarly } \eta = \frac{r_{BO}\sigma_O}{r_{BP}\sigma_P}. \text{ Finally, since } r_{AO} = \frac{\Sigma AO}{n\sigma_A\sigma_O}, r_{AP} = \frac{\Sigma AP}{n\sigma_A\sigma_P}, r_{BO} = \frac{\Sigma BO}{n\sigma_B\sigma_P} \text{ and } r_{BP} = \frac{\Sigma BP}{n\sigma_B\sigma_P}, \text{ we have}$$

$$e = \frac{r_{AO}\sigma_O}{r_{AP}\sigma_P} = \frac{\frac{\Sigma AO}{n\sigma_A\sigma_O}\sigma_O}{\frac{\Sigma AP}{n\sigma_A\sigma_P}\sigma_P} = \frac{\Sigma AO}{\Sigma AP} \text{ as before, and similarly } \eta =$$

$$\frac{r_{BO}\sigma_O}{r_{BP}\sigma_P} = \frac{\Sigma BO}{\Sigma BP}, \text{ as before.}$$

An attempt was made to compute the values of e_d and η_d for butter and flaxseed by the methods which have been described. By the method of segregating successive observations in which price and output change in the same direction from those in which they change in opposite directions the following values were obtained: for butter, $e_d = 1.65$, $\eta_d = -.53$; for flaxseed, $e_d = 1.88$; $\eta_d = -.81$. By the method of introducing external factors the results were: for butter, $e_d = 1.43$; $\eta_d = -.62$; for flaxseed $e_d = 2.39$; $\eta_d = -.80$. The only available data included the war period, when both supply and demand conditions were far from normal and when, moreover, money prices were greatly inflated. In all cases it is

desirable to use "real" prices rather than money prices: in this case it was imperative. But when the inflation and subsequent depression are so extreme as during the period under discussion, considerable doubt is necessarily cast on results obtained by any method of reducing money prices to real prices. Too much confidence should not be placed on the above numerical values, but it is believed that they may be accepted as affording strong evidence of elasticity of supply and inelasticity of demand for both butter and flaxseed.

This conclusion may be accepted with the more confidence as it agrees with *a priori* conclusions. Elasticity of output is to be anticipated for several reasons. (1) Both butter and flaxseed are in the nature of alternative crops. They may be produced by the same men and on the same land as are other crops in which we are now on an export basis. To increase the output it is not necessary to resort to inferior land or to inferior types of business management. Hence it is probable that increase in output would be forthcoming at but slight increase in marginal cost. (2) Dairy products and beef are all derived from cattle. There are considerable herds of dual-purpose animals in the United States. Hence a moderate increase in the price of butter would tend to lead owners of such dual-purpose animals to emphasize milk production and the output of butter would thereby be greatly increased at comparatively small increase in cost. (3) Butter is one of several dairy products. Milk may be marketed as such or it may be used to manufacture butter, cheese, or evaporated milk. A moderate increase in the price of butter would lead to the diversion of milk from other purposes. Condensed milk is on a strong export basis, and even taking dairy products as

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a whole, including fresh milk and cream, the difference between exports and imports is not great. Exports were in excess in 1924 and imports in 1925.¹⁶ The diversion would be expected to be accomplished without great increase in cost.

With respect to demand conditions the *a priori* case is not so clear. Butter is regarded as a necessity, and the demand for necessities is ordinarily inelastic. It may, however, be elastic if a ready substitute exists and margarin is a substitute for butter. However, in the United States the consumption of margarin is ordinarily only about 10 per cent of that of butter. People are reluctant to change their food habits. The presence of margarin tends to moderate the inelasticity of demand rather than to make it positively elastic.

In regard to the demand for flaxseed *a priori* reasoning is even more inconclusive. The products of linseed oil, which is the principal product of flaxseed, are less ob-

¹⁶The trade in dairy products is shown in the table below:

FOREIGN TRADE IN DAIRY PRODUCTS 1924-1925
(In millions of pounds)

Commodity	1924				1925			
	Im-ports	Ex-ports	Net Im-ports	Net Ex-ports	Im-ports	Ex-ports	Net Im-ports	Net Ex-ports
Fresh milk and cream	80.7	0.6	80.1	...	108.3	0.7	107.6	...
Condensed, evaporated, and powdered milk	8.5	211.8	...	203.3	12.4	151.4	...	139.0
Cheese	59.2	4.3	54.9	...	62.0	9.2	52.8	...
Butter	19.3	8.3	11.0	...	6.9	5.4	1.5	...
Total	167.7	225.0	...	57.3	189.6	166.7	22.9	...

viously necessities than butter. It is highly probable that the amount of painting done is influenced considerably by the price of paint. It will be noted that the values, $-.80$ and $-.31$, indicate that the demand for flaxseed is much less inelastic than is the demand for butter, for which the values are $-.62$ and $-.53$, but the statistical evidence that the demand is inelastic rather than elastic is strong. The value $-.80$ was the average of results obtained by six independent computations using different external factors. Four of the results were numerically less than 1, two slightly over 1.

Unfortunately data were not available for computing the elasticities of foreign demand and supply, but the domestic elasticities alone have an important bearing on the effectiveness of the tariff. Referring to formulæ B

and C, page 288, $\Delta o = \frac{\Delta P}{P} e_a o_a$ and $\Delta i = \frac{\Delta P}{P} (e_a o_a - \eta_a c_a)$

it will be seen that the large values of e_a , o_a , and c_a indicate that production is likely to respond generously and imports to fall off sharply as a result of whatever price increase is brought about by the tariff. Butter and flaxseed, therefore, are both in a favorable situation for the application of a duty from the standpoint of those who make national self-sufficiency an object. While the increase in price which a duty would entail cannot be computed without a knowledge of the foreign elasticities, there is no reason for supposing that they differ greatly from the domestic, and if not the important part played by American production in world production, gives assurance that the rise in price will be considerably less than the duty.

APPENDIX C

APPLICATION OF THE "EQUALIZING RATE" TO THE FATTY OILS

SECTION 315 of the Act of 1922 gave the President authority to change duties provided for in that Act in accordance with the principle of an equalizing rate; that is, the final rate was to equalize the costs of production as between the United States and its principal foreign competitor. Under the provision of this section the United States Tariff Commission endeavored to find the differences between the domestic and foreign costs of production of linseed oil and butter, and in accordance with the findings of a majority of the Commission the duty on butter was raised from eight to twelve cents a pound in March, 1926.

Many practical difficulties have arisen in ascertaining the equalizing rate, difficulties so great that the Commission has seldom been unanimous in its findings. Two of these difficulties call for discussion in this study, others will be dismissed with a bare enumeration. Of the latter class one of the most important arises when several joint products result from processes involving a common cost. By what principal shall that cost be apportioned among the products? The proper disposition of rent and interest is often a puzzling problem. Such also is the question of markets and transportation. For what market shall the cost be equalized—the foreign, the domestic seaboard, or some point in the interior?

The two difficulties which will be here discussed are those arising from production at varying costs and those which are especially applicable to agricultural products.

I. PRODUCTION AT VARYING COST

All investigations so far made by the Tariff Commission show that the cost of production for each establishment differs from that of other establishments. There are in fact ordinarily as many different domestic costs as there are domestic producers and as many foreign costs as there are foreign producers. Obviously a duty which would equalize costs between one pair of producers, domestic and foreign, would be too great or too small for another pair.

To meet this difficulty the solution adopted by the Commission is an average. Let us see, in the light of the formula given in Appendix B, the logic of applying an average. Assume, under free trade, the domestic and foreign costs ascertained by establishments, an average of each struck, and a duty imposed equal to the difference. After sufficient time had elapsed equilibrium would be brought about with a domestic price and marginal cost higher by ΔP than before and a foreign price and marginal cost lower by $T_1 - \Delta P$ than before. The introduction of new higher cost producers would raise the average domestic cost of production and the elimination of some of the high cost foreign producers would lower the foreign average cost of production. Hence, if a new investigation were made the difference would be found to be greater than before and it would be necessary to raise the duty. The process above outlined would be repeated with every increase in duty until it became prohibitory.

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Incidentally, in connection with the use of an average, a practical problem arises. Shall the average cover costs for a single year or for several years? The "equalizing rate" based on one year's experience often differs widely from that based on another or on an average of several. The equalizing rate cannot be retroactive; it can only look to the future. Hence, as cost conditions change among both domestic and foreign producers the computations may be out of date by the time the duty becomes effective.

Instead of average costs, marginal costs have been recommended as the basis of the equalizing rate. As was shown in Appendix B economic forces always tend to bring about an equilibrium with the domestic marginal cost just equal to the foreign marginal cost plus the duty. Hence, in this sense, any rate from zero to the prohibitory rate is an equalizing rate. Of course, as both foreign and domestic conditions are dynamic, they may not be in equilibrium at the time of the investigation, and the difference between the ascertained marginal costs may indicate a change in duty; and thereafter marginal costs will fluctuate about the new equilibrium point instead of the old. But that gives no warrant for asserting that the new rate is *the* equalizing rate.

The mere fact that a given foreign country shows a lower average cost than the United States does not prove that domestic producers cannot continue to compete even without protection. The analysis leading to the formula shows that when the equilibrium point is reached many producers will continue competing with one another whose costs are very different and the question arises: why do not the lower cost producers expand their output, lower their prices, and drive out one after another the

higher cost producers until the price is reduced to their own average cost? An answer was given to this question on page 293. It was there shown that the forces of competition would tend to bring about a condition in which each producer was expanding his output, with varying costs for different portions, up to a point where some units were produced at marginal cost, and that, at the existing price, he could not further expand his output without exceeding the marginal cost and hence producing some portion of his output at a loss.

What is true of individual producers may be true of regions or countries. In each region or country, under equilibrium conditions, a cost study should show costs ascending from those of the most favored producer to the marginal cost. The *marginal* costs in all competing regions and countries tend to become identical,¹ but the average costs may well be very different. Hence, since the marginal costs are the same, two regions may continue competing indefinitely however different the average costs. That facts bear out the above theory is shown in the table on page 324.

It will be seen that for these regions all competing in the same markets the average costs differ widely. The average cost of butter from Nebraska laid down in New York is 23 per cent greater than that from Michigan.

The principle of an "equalizing rate" tends logically to a constantly increasing rate. If economic adjustments were made with clock-like precision, each industry would show an array of costs for different establishments from the lowest up to the marginal, which would also be the highest cost; but as was noted in Appendix B, owing to

¹In this statement transportation costs to the common market are to be regarded as a part of the cost of production.

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AVERAGE COSTS OF PRODUCING BUTTER IN DIFFERENT REGIONS OF THE UNITED STATES *

(In cents)

Region	Farm Cost Per Pound of Butterfat	Reduced to Cost Per Pound of Butter Allowing 23.38% Overrun	Buying, Conversion, and Selling Costs	Cost of Delivery to New York	Total Delivered in New York
Minnesota .	62.8	50.9	8.0	1.8	60.7
Wisconsin .	58.2	47.2	9.4	1.0	57.6
Iowa	57.8	46.8	9.5	1.6	57.9
Michigan ..	55.4	44.9	7.8	.8	53.5
Nebraska ..	71.3	57.8	6.5	1.6	65.9
Indiana	68.3	55.3	9.2	.9	65.4
Ohio	62.7	50.8	9.6	.8	61.2

* Source: *Butter*, Report of the United States Tariff Commission to the President of the United States, 1926, pp. 92 and 106.

accident and to the fallibility of human judgment some of the output is always produced at a cost greater than the marginal. Producers whose cost is above the marginal feel themselves subjected to ruinous competition and ask for an increase in duty. As a higher duty normally leads to an increase in price, and an increase in price not only benefits the high cost producers by enabling them to live but also benefits the low cost producers by enabling them to make greater profits, the latter will join with the high cost producers in asking for an increase in duty. If the increased duty is granted an adjustment is in time effected with a higher price and a higher marginal cost. But the new price and marginal cost in no wise lessen the likelihood of accident and fallibility in judgment of those producers whose cost is near the new margin. A portion of the output will still be produced at a loss with a renewed demand for increased

protection and with as good evidence as before in favor of granting it. The logical outcome of an equalizing rate is therefore a prohibitory rate.

II. THE EQUALIZING COST APPLIED TO AGRICULTURAL PRODUCTS

The Tariff Commission study of the cost of producing butter would seem to show that about 74 per cent of the domestic output was produced at a loss. A recent study of the United States Tariff Commission shows, in the case of the establishments for which farm costs were collected, the percentage of the total output of butterfat produced at varying costs per pound.² The table and chart in which the Commission's conclusions are embodied show that the weighted-average price received was about 49 cents per pound of butterfat and that only about 26 per cent of the output was produced at a cost not exceeding this figure, that is, that some 74 per cent of the output was produced at a loss. The conclusions were based on cost studies covering 1,521,322 pounds of butterfat, or less than 0.1 of 1 per cent of the total domestic production, and on these conclusions a majority of the

² *Butter*: Report of the United States Tariff Commission to the President of the United States, 1926, pp. 102-103. The conclusions are embodied in a table and a chart. The following is an abridgment of the table.

Percentage of total	1	10	20	30	40	50	60	70	80	90	100
Produced at a cost											
per pound of but-											
terfat (in cents											
per pound) not											
exceeding	27	41	46	50	54	57.5	60	66	72	82	167

The above estimate is based on a total of 1,521,322 pounds of butterfat produced in seven states during the year from May 1, 1923, to April 30, 1924.

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Commissioners held that an increase in the then existing rate of duty (8 cents per pound) was called for in order to secure an equalizing rate. Two Commissioners entered dissenting opinions. For the arguments advanced by the majority and the minority the reader is referred to the Commission's report. The only matter which will here be discussed is the startling conclusion that 74 per cent of the domestic output of butterfat is produced at a loss and the implied conclusion that the percentage produced at a loss would be materially diminished if the duty were higher.

Agricultural cost figures are elusive and misleading. That nearly three-fourths of the output of a great staple industry could be produced year in and year out at a loss is absurd on the face of it. Production at a loss carried over a series of years must mean insolvency, unless the producers are men of independent fortunes conducting their business operations for pleasure—an unlikely supposition for the American farmer. Either the period chosen was highly exceptional (in which case it was unsuited to a comparative cost study) or else the method chosen for estimating costs was not adapted to the purpose in hand. It is true that in any great industry some "extra-marginal" production is to be expected every year. There is bound to be miscalculation, misfortune, and inefficiency. But no such theory of "extra-marginal" production can account for the Commission's findings.

A study of the Commission's report shows that in estimating the cost of producing butterfat a very considerable part of the outlay was in the nature of imputed costs, that is, costs involving no actual money outlay; such costs, for example, as those for feeds and roughage.

produced on the farm, and for the labor of the farmer himself and his family, and that most of these costs were of the nature of allocated costs, butterfat being on most farms one of several products involving joint costs which had to be apportioned among the products in accordance with some arbitrary principle. From an accountant's standpoint the method chosen may have been unexceptionable, but from an economist's standpoint it throws little light upon the actual marginal cost and the effect which tariff changes may be expected to have on the price, output, and imports of butter.

In truth, farming approaches primitive industry where both income and outgo are "in kind" rather than in money. The farmer's "costs" are largely his own labor and the labor of his family. This labor results in materials, some of which are consumed as "consumers' goods" by his household, and others as "capital goods" in producing other products of his farm, and others still are sold for money. His income is partly money, partly the products of his farm consumed by his household, partly the satisfaction of being independent rather than a "wage slave," and partly the hope of retiring on what, with some irony in this case, may be called the "unearned increment" of his land.

Now, however for bookkeeping purposes money values may be assigned to the numerous items where in fact there is no actual money outlay or income, such an imputation of costs and income has nothing to do with the farmer's own estimate, and it is the farmer's own estimate which in fact determines the marginal cost of his product and the price at which it will sell.

Marginal cost in farming implies a *money* income to the farmer just sufficient to meet his *money* obligations,

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and a *labor cost*, in the literal sense of mental and physical exertion, not quite burdensome enough to lead him to give it up and try something else.

If each farmer produced only one crop, its marginal cost of production would be the money outlay per unit of product for the farmer raising that crop who was just able to meet his money outlay from his money income and who under these conditions was willing to continue producing that crop. Farmers in fact produce many crops, and a "marginal farmer" might be considered as one who was just able to meet his money obligations from the income of all his crops and who under such conditions was willing to continue farming. But to allocate these money outlays among the several crops and thus determine the marginal cost of producing any one of them is impracticable, not only because of the inherent difficulty of allocating costs among joint products, but also because in this case the allocation even if practicable would not necessarily represent the marginal costs of the several crops which the marginal farmer raised. He might be favorably situated for the production of some crops and unfavorably situated for the production of others.

It was shown earlier in this discussion (page 299) that changes in demand and costs of production are perpetually throwing marginal cost and price out of adjustment, but that no sooner are they thrown out of adjustment than other economic forces are causing them to gravitate to congruence. They can never long remain far apart. It is believed that for agricultural products a nearer approach to actual marginal cost can be obtained from a careful price study than from a cost study. From such a study the difference in marginal costs between the

United States and its foreign competitor can be inferred, and it is comparative marginal costs and their tendency to change under varying outputs rather than comparative average costs which are important in estimating the effects of changes in the tariff upon imports and upon foreign and domestic prices and output. Under free trade, if transportation charges to the competitive market are included as a part of cost, marginal costs from all sources contributing to that market tend to equality. Under whatever duty, the difference between the foreign and domestic prices tends also to be the difference between the foreign and domestic marginal costs. When the duty is fully effective (up to the point where it becomes prohibitory) this difference in price tends also to be the full amount of the duty, but frequently as in the case of butter it is much less. It is significant that in the Tariff Commission's cost study the average cost of producing butterfat *where farm costs were estimated* was 61.5³ cents per pound, but that the *price obtained by farmers* for butterfat sold to creameries was 49.74⁴ cents. At this price, apparently, farmers were willing to continue producing butterfat; thus in the sense in which marginal cost has been defined it must have approximated this cost much more nearly than a cost *necessarily much higher than the average cost of 61.5 cents* which was obtained when farm costs were estimated.

Allowing an "overrun"⁵ of 23.14 per cent, 49.74 cents

³ *Butler*, p. 36.

⁴ Figures from *Preliminary Statement of U. S. Tariff Commission*, March 11, 1925, p. 16.

⁵ "Overrun" is the percentage excess of butter produced from a pound of butterfat. The Commission's estimate is 23.14 per cent for creamery territory in the United States and 20.48 per cent for Denmark.

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per pound for butterfat would equal 40.39 cents for the butterfat contained in one pound of butter. In Denmark co-operative creameries paid the farmers 40.38 cents per pound for butterfat or 33.51 cents for the butterfat in one pound of butter.⁶ It is probable that these figures (40.39 cents for the United States and 33.51 cents for Denmark) come much nearer to representing the marginal costs of producing the butterfat contained in a pound of butter in the United States and Denmark than can any results obtained by the method of direct cost investigation using imputed costs.⁷

Back of the imputation by accounting methods of money values to farm products and money wages to the farmer and his family as elements in costs of production, is often an ethical or social purpose. It is akin to such investigations as those of Rowtree and Booth in showing that a formidable percentage of workers are not receiving a "living wage" and thus of arousing attention to a bad social condition with a view to remedial social action. In this case of the farmers, by showing that at present prices 74 per cent of the output of butter is produced at a loss, the implication may be that the duty on butter should be increased in order that this most worthy and hardworking portion of the community may make a living. But if differences in costs obtained by this method throw little or no light on the main question at

⁶ Figures from *Preliminary Statement of the Tariff Commission*, March 11, 1925, p. 16.

⁷ The majority report of the Commission did not include in its comparison the "centralizer" costs of producing butter in the United States. It is, however, significant in this connection that computing as above, the price paid to farmers by centralizers for butterfat was only 34.12 cents per pound of butter.

issue, namely, what will be the effect of an increase in duty when imposed, the results of imposing such a duty are likely to be disappointing.

As has been shown, imports are now of such relative unimportance that any further restriction could have no appreciable effect upon the price, but even if imports were of much greater importance their restriction cannot greatly benefit farmers so long as they regard "independence," the hope of retiring on a competence, and a money income barely sufficient to meet money expenditures as a tolerable remuneration for a life of hard work and anxiety for themselves and their families. If the duty were prohibitory, competition would hold the price of farm products to a level just sufficient to realize this result. These remarks, of course, apply to the farmers at or near the margin. The farmers whose costs are far below the marginal are prosperous and will continue prosperous whether the duty on butter is high or low.

In this connection nothing could be more pertinent than the following words from a recent article by Edwin G. Nourse: "However equitable the institutional situation created for him [the farmer], however efficient the agencies for giving him adequate information and sound advice about the elements of his business, his final destiny is in his own hands. *The public will never give him a standard of living; he must make it for himself.*"

* *Journal of Farm Economics*, January, 1925, p. 20.

APPENDIX D

THE "EQUALIZING RATE" ON LINSEED OIL

DATA showing the costs of producing linseed oil in England and in the United States for the year 1922 and the first six months of 1923 were collected by the United States Tariff Commission and issued in the form of a mimeograph statement in March, 1924. These data were assembled for the purpose of computing the equalizing rate.

A careful study of Appendix C will make it clear that the idea of basing a tariff on an equalizing rate is founded on a misconception. The mental picture is that of a single domestic cost of production and a single foreign cost of production, with a duty equal to the difference. The object is to permit domestic and foreign producers to compete in the American market on even terms. In fact there is no single domestic cost of production and no single foreign cost of production, but in each country there is a series of costs from the lowest up to the marginal. In general some domestic producers produce at a lower cost than some foreign producers and some foreign producers produce at a lower cost than some domestic producers. Competition tends in time to bring about an adjustment with the marginal costs in the two countries differing by the amount of the duty. If the duty is increased the domestic marginal cost will rise and the foreign fall until the difference between them is

again the amount of the duty. Under the new conditions, however, a larger proportion of the total domestic consumption will be of domestic origin and a smaller proportion imported. Since an adjustment will always be effected, one rate may as logically be called an equalizing rate as another.

However, by a comparison of domestic and foreign costs, if averages are used, a rate may be obtained which tends to keep about the same relation between domestic and foreign supplies in the American market. So long as conditions of production in the two countries maintain the same relative position to one another as existed at the time of making the investigation, such a rate will insure ability to compete to all the existing American producers.

In the investigation referred to in the opening paragraph it was found that in the case of linseed oil for the first 6 months of 1923 the seed cost in the United States per ton of flaxseed crushed was \$95.42 and the conversion cost was \$9.77. The corresponding figures for England were \$81.08 and \$5.98. To ascertain the comparative costs per pound of oil it is necessary to allocate a part of the cost to the oil and a part to the oil cake, both of which products are derived from the flaxseed. It is also necessary to make allowance for transportation of the foreign oil to the United States, and to take into account the difference in the quantity of oil derived from a ton of seed in the two countries. A deduction must be made from the American costs because of the drawback allowed on exported cake, and some other details call for attention. A careful study of the Commission's data led the writer to the conclusion that, when due allowance had been made for all these factors,

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then in the United States the seed cost was 10.27 cents per pound of oil produced and the conversion cost 1.78 cents. The corresponding figures for England were 8.01 cents and 1.54 cents. On the basis of these figures the "equalizing rate" on oil would be 2.23 cents as compensatory duty and 0.24 of a cent for direct protection to the oil industry, making a total of 2.47 cents as against the existing rate of 3.3 cents. Figures were also assembled for 1922. A similar computation for this year gave 1.53 cents as compensatory duty, 0.18 of a cent direct protection, and 1.71 cents total duty.

It was shown in Chapter VII that while the duty on flaxseed was undoubtedly of some benefit to growers this benefit was greatly outweighed by the burden on farmers as a whole. If the duty on flaxseed were removed the duty which would permit crushers to continue without disturbance to their business is seen to be from a fifth to a fourth of a cent per pound. Even the removal of this duty would probably do little more than to stimulate them to greater efficiency.

APPENDIX E

OIL CONTENT OF OIL-BEARING SEEDS

THE oil content of oil-bearing seeds varies more or less widely with the source and variety. The figures given below are taken from *Foreign Crops and Markets*, April 6, 1925. They are in most cases based on a large number of determinations.

Name of Seed	Per Cent of Oil
Castor beans	42 - 58
Chinese nut kernels	50 - 53
Coconut (fresh kernel)	30 - 40
Copra	60 - 75
Corn germ	30 - 50
The germ is 10 per cent of kernel	
Cottonseed	17 ^a
Flaxseed	35 - 38
Hempseed	16 - 30
Mustard, black	31 - 33
Olive	35 - 65
Palm, pericarp	58 - 66
Palm nut	35 - 40
Peanut, decorticated	
Spanish	50 ^a
Virginia	41.7 ^a
Perilla seeds	34 ^a
Poppyseed	45 - 50
Rapeseed (Colza)	33 - 43
Sesame seed	50 ^a
Sunflower seed	45 - 50

^a Average.

APPENDIX F

USES OF THE ANIMAL AND VEGETABLE OILS AND FATS, CLASSIFIED BY OILS AND FATS

VEGETABLE OILS

- Castor:** medicine; alizarin assistant; soap (fine toilet, especially transparent soaps); lubricant for heavy machinery and airplanes; leather preservative; flypaper; illuminant.
- Chinese nut:** paint (inferior to linseed because of opacity and inelasticity of film, but desirable for enamel paint); varnish, especially spar varnish, as it does not turn white.
- Coconut:** soap (the Cochin oil is suitable for cold-process soap making. All coconut oil makes soaps of good lathering quality. Marine soaps that will lather in hard water may be made from it); "nut" margarin; lard substitutes; used by bakers and in the confectionery trade; emulsions; cosmetics; perfumes; ointments; salves.
- Corn:** salad oil; margarin; lard substitutes; alizarin assistant; soap; linoleum; leather dressing; vulcanized rubber; water-proof fabric; paint.
- Cottonseed:** lard substitutes; salad oil; margarin; sardine packing; cooking; medicinal emulsions; soap; washing powder; glycerin; waterproofing preparations; illuminant.
- Hempseed:** paint and varnish (inferior to linseed); soft soap.
- Linseed:** paint; varnish; linoleum; printers' ink and lithographic ink; patent leather; imitation leather; foundry cores; soap; glycerin; putty; vulcanizing; when cold pressed and refined it is edible.
- Olive:** salad oil; alizarin assistant; soap (Castile); wool spinning; sardine packing; lubricant; illuminant.
- Palm:** soap; candles; tin-plate ("palm oil grease," palm oil, mixed with cottonseed oil and mineral oil, preserves the surface of the heated plate till dipped in tin); in textile mills for softening and finishing cotton goods.
- Palm kernel:** (very similar to coconut oil) soap (especially cold-process soap); margarin.
- Peanut:** salad oil; margarin; sardine packing; cooking; medical emulsions; cosmetics; illuminant (for miners' lamps); kid gloves, wool, and silk manufacture; artificial leather; soap; putty.

- Perilla:** paint, linoleum.
Poppyseed: paints (especially artists' colors); soap (potash soaps and when added to olive oil stock makes the product less brittle); used as an edible oil in some countries.
Rapeseed: lubricant; illuminant; soap; quenching steel plates.
Sesame: margarin; cooking; enfleurage (extraction of perfume from flowers); soap (Marseilles mottled soap); lubricant; illuminant; rubber substitutes.
Soya bean: soap; glycerin; paint; varnish; linoleum; printers' ink; foundry cores; salad oil; lard substitutes; margarin.

ANIMAL OILS

- Butter:** used chiefly as butter but also used in the manufacture of margarin.
Greases: soap; lubricant.
Lard: used as lard and also in the manufacture of margarin and lard substitutes; ointments; salves; inedible grades used in making soap, lard oil, and lard stearin. Lard oil is an illuminant, a lubricant, and is used in oiling wool and dressing leather. Lard stearin is used for stiffening lard of low titer.
Menhaden and other fish oils: soap; paint (especially for painting smokestacks or other surfaces exposed to heat); linoleum; currying leather; tempering steel.
Oleo oil and oleo stearin: the former used primarily for margarin and to a minor extent for lard substitutes. The latter used for the same purposes but with the primary and secondary use reversed.
Tallow: lard substitutes; margarin; soap; ointments; salves; tallow oil; tallow stearin. Tallow oil is used as a lubricant and as an illuminant; tallow stearin is used by tanners for dressing leather, and by candle makers.
Whale: soap; leather dressing; tempering steel; illuminant.

USES OF THE ANIMAL AND VEGETABLE OILS
AND FATS, CLASSIFIED BY USES

<i>Alizarin Assistants</i>	<i>Cooking</i>	<i>Emulsions</i>
Castor	Cottonseed	Coconut
Corn	Peanut	Cottonseed
Olive	Sesame	Peanut
<i>Candles</i>	<i>Cosmetics</i>	<i>Flypaper</i>
Palm	Coconut	Castor
Tallow	Peanut	
Other oils containing stearin or palmitin	<i>Confectionery</i>	<i>Foundry Cores</i>
	Coconut	Linseed
		Soya bean

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<i>Glycerin</i>	<i>Linoleum</i>	Poppyseed (artists' colors)
Cottonseed	Corn	Soya bean
Linseed	Linseed	
Soya bean and other soap oils	Menhaden	<i>Perfumery</i>
	Perilla	Coconut
	Soya bean	Sesame (enfleurage)
<i>Illuminants</i>	<i>Lubricants</i>	<i>Printers' ink</i>
Castor	Castor (airplanes)	Linseed
Cottonseed	Greases	Soya bean
Lard oil	Lard oil	
Olive	Olive	<i>Putty</i>
Peanut (miners' lamps)	Rapeseed	Linseed
Rapeseed	Seal	Peanut
Sesame	Sesame	
Seal (lighthouses)	Sperm (light running machinery)	<i>Rubber substitutes</i>
Sperm	Tallow oil	Corn
Tallow oil		Linseed
Whale		Sesame
	<i>Margarin</i>	<i>Salad, mayonnaise</i>
<i>Kid-glove and silk manufacture</i>	Coconut	Corn
Peanut	Corn	Cottonseed
	Cottonseed	Olive
<i>Lard substitutes</i>	Lard	Peanut
Coconut	Oleo oil	Soya bean
Corn	Oleo stearin	
Cottonseed	Palm kernel	<i>Sardine packing</i>
Lard	Peanut	Cottonseed
Oleo oil	Sesame	Olive
Oleo stearin	Soya bean	Peanut
Soya bean		
Tallow	<i>Medicine</i>	<i>Soap</i>
	Castor (laxative)	Castor
	Cod liver	Coconut
<i>Leather</i>	<i>Ointments, salves</i>	Corn
Castor (softening)	Coconut	Cottonseed
Cod liver (currying)	Lard	Greases
Corn (dressing)	Tallow	Hempseed
Linseed (patent, imitations)		Lard (white grease)
Menhaden	<i>Paint</i>	Linseed
Peanut (imitation)	Chinese nut	Menhaden
Seal	Corn	Olive
Sod	Hempseed	Palm
Sperm	Linseed	Palm kernel
Tallow stearin	Menhaden (smoke-stacks)	Peanut
Whale	Perilla	Poppy seed (makes olive oil soaps less brittle)

APPENDIX F

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Rapeseed	Olive (wool spinning)	<i>Vulcanizing</i>
Seal	Palm (softening goods)	Corn
Sesame		Linseed
Soya bean		
Tallow	<i>Tin-plates</i>	<i>Washing powder</i>
Whale	Cottonseed	Cottonseed
	Palm	
<i>Steel plates</i>		<i>Waterproofing</i>
Menhaden	<i>Varnish</i>	Corn
Rapeseed	Chinese nut	Cottonseed
Whale	Hempseed	
	Linseed	<i>Wool spinning</i>
<i>Textiles</i>	Soya bean	Olive
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