Stabilizing Corn Supplies by Storage.

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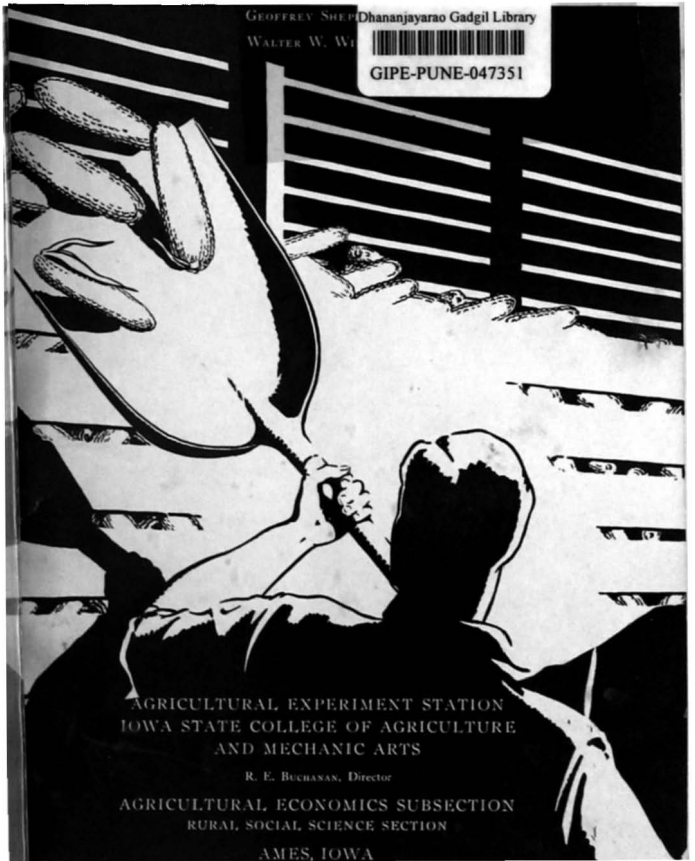

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CONTENTS

Page

Summary 295

The nature of fluctuations in the size of the corn crop 300

Georgraphical differences in corn crop fluctuations 304

Importance of corn as a feed crop 305

Individual storage in the past 307

Costs of storing corn 309
- Farm storage space 311
- Crib cost 313
- Interest cost 314
- Total storage costs 314

Effect of size of corn crop upon hog supplies 315

Effect of size of hog crop upon hog prices 318

Effect of size of hog crop upon the total value of the crop 320

Fluctuations depress average incomes 322

Effect of a corn storage program upon cash corn 323

Would a corn storage program stabilize corn prices? 326

Hog production costs are increasing by fluctuating corn supplies 327
- Effect of fixed costs 329
- Hog weights affect feed-converting efficiency 330

Fluctuations in the production of other kinds of livestock 332

Costs and benefits summarized 334

Appendix A 336
- Factors determining hog prices 336

Appendix B 339
- Factors determining corn prices 339

Appendix C 343
- Effect of corn loans on stability of total income 343

SUMMARY

Farmers, acting as individuals, ordinarily carry over some of their surplus corn from big crop years to small crop years. This storage has had the effect of reducing fluctuations in corn supplies, on the average, by one-fifth.

The best place to store the surplus corn from big crops is right on the farm where it was grown. The costs of this storage average about 3 cents per bushel per year.

EFFECT OF FLUCTUATIONS IN THE SIZE OF THE CORN CROP

Fluctuations in corn production directly cause corresponding fluctuations in hog production between 1 and 2 years later. A large corn crop soon shows up as a large hog crop, and a small corn crop soon shows up as a small hog crop. The change in the hog crop is about the same size as the change in the corn crop that caused it. A 10 percent change in the corn crop, for example, causes about a 10 percent change in the hog crop.

A change in corn supplies causes a greater change in the opposite direction in corn prices. The same thing is true of hogs. A large crop of corn is therefore worth less than a small crop; so is a large crop of hogs. The sequence of causation, then, is (1) a large corn crop causes (2) a large hog crop which (3) sells for less money than a small crop. A large corn crop, however bountiful and beneficial it appears at the time, soon shows up in reduced total income from hogs.

This means that when the corn crop is large, and corn prices and total incomes from corn are low, farmers as a group do not escape the effect of these low corn prices and incomes by feeding the corn to livestock more heavily; they merely translate it into lower hog prices and incomes a year or two later. The decrease in hog prices and total incomes is approximately equal to the decrease in corn prices and incomes.

BENEFITS FROM STABILIZATION

Stabilizing corn supplies, therefore, would stabilize hog (and other livestock) supplies, prices and total incomes and would slightly raise total incomes as well. Smoothing out livestock pro-

duction would also reduce livestock production, marketing and processing costs.

It is difficult to measure these two benefits accurately (the slight increase in total income and the decrease in costs) but preliminary calculations indicate that the benefits would be several times greater than the storage costs.

burdensome. Taken all together, the benefits appear to be several times greater than the costs.

APPENDIX A

FACTORS DETERMINING HOG PRICES

In analysing hog prices, a minimum of two explanatory causative series is required—the one representing changes in demand, and the other representing changes in supply.

The two most comprehensive and accurate series to represent hog supplies and prices are probably the "Total live weight of hogs slaughtered under Federal inspection in the United States," and the "Average cost to packers in the United States—dollars per 100 pounds" (i.e., the price to farmers) published monthly by the Bureau of Agricultural Economics.

The federally inspected slaughter is only about 65 percent of the total slaughter, but the total slaughter figures have some serious shortcomings. It is a question whether hogs slaughtered and consumed on farms have the same price determining influence as hogs slaughtered in commercial channels. Moreover, the total slaughter estimates are made only on the calendar year basis, and they are not available as currently as the federally inspected slaughter data; in the 1937 Agricultural Year Book, for example, they are given only up to 1933. Altogether, the federally inspected slaughter figures are more satisfactory for statistical analysis.

The choice of a series to represent changes in demand has been, until recently, a more troublesome matter. Various indexes have been available for some time—indexes of industrial production, industrial payrolls, etc.—but perhaps the most satisfactory series is the monthly estimates of total non-agricultural income in the United States recently published by the AAA.[23]

This series reflects changes in domestic demand, but the total demand for hogs consists of two elements: domestic demand and foreign demand. An additional series is needed, then, to represent changes in foreign demand. The amounts exported each year do not represent foreign demand; they

[23] Bean, L. H., Bollinger, P. H., Wells, O. V. Non-Agricultural Income as a Measure of Domestic Demand, AAA, BAE. June, 1937.

represent foreign consumption, which responds to changes in supplies (and therefore prices) as well as to changes in demand.

A rough and ready means of converting these foreign consumption data into foreign demand data is available, however. Increased exports accompanied by lower prices would not be evidence of increased foreign demand; but increased exports accompanied by constant or even higher prices would be definite evidence that foreign demand had increased. If the

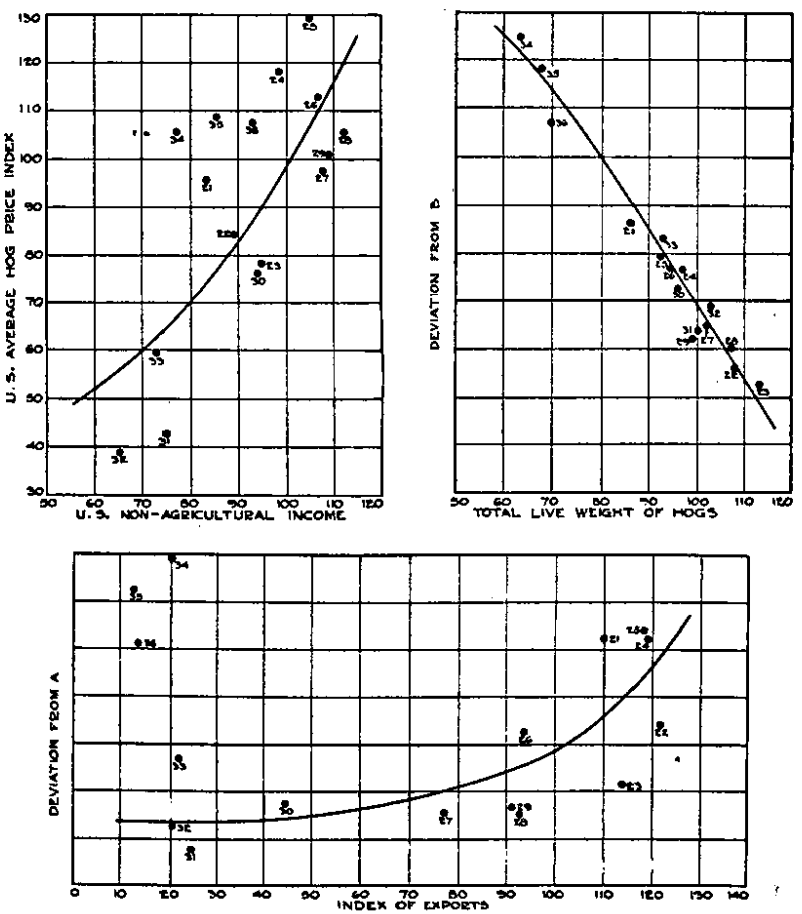

Fig. 19. (A, left—B, bottom—C, right). Average price of hogs, total non-agricultural income, value of hog products exports and total live weight of hogs slaughtered under federal inspection, United States, 1922 to 1936.

elasticity of the export demand were unity, a good index of foreign demand could be constructed by multiplying the amount exported each year by the price. The actual elasticity is unknown and is so difficult to ascertain that we merely assume an elasticity of unity and multiply the exports by the prices. The results are purely provisional, but serve a useful purpose until such time as a more accurate index of foreign demand is available.

The results of the use of these series are shown in table 5 and fig. 19. The data are all thrown into index form, base, 1921-1931=100, so that the charts show elasticity directly. Hog prices are first plotted against the index of non-agricultural income, to take changes in domestic demand into account. The residuals from this chart are then plotted against the index of export demand. The residuals from this chart are then plotted against the total weight of hogs slaughtered, to show the influence of production upon price.

There is nothing immutable about the relationships shown in these charts. It is as true of the graphic method of multiple correlation analysis as of the standard numerical method that Bxa is generally different from Bxa.b, and that Bxa.b is generally different from Bxa.bc. The use of an additional independent variable changes the relationships of x to the preceding variables whenever the additional independent variable is inter-correlated (accidentally or otherwise) with any of the preceding variables. It is seldom that any variable is completely free of some inter-correlation (accidentally or otherwise) with another, so that adding another variable generally affects the relationships of the others.

This consideration is methodologically important, but the effect in the case of the present study is probably small. The results obtained are reasonably accurate for practical purposes.

There is a second respect in which the results obtained here are only provisional. They describe past relationships, not future ones. The past relationships may or may not hold in the future. This subject is discussed in some detail in the next section of this Appendix, dealing with corn prices.

TABLE 5. INDEXES OF HOG PRICES, NON-AGRICULTURAL INCOME, EXPORTS AND HOG SLAUGHTER, 1921-1937

(Base equals 1921-1931 average)

	Average hog price	Total U. S. non-agricultral income	Index of exports times hog prices	Live weight of U. S. hog slaughter
	Oct.-Sept.	Oct.-Sept.	July-June	Oct.-Sept.
1921-22	95.7	83.3	110.0	86.8
1922	84.3	89.2	121.6	108.4
1923	78.3	94.8	113.6	113.8
1924	118.1	98.4	119.0	97.2
1925	129.5	104.8	118.4	92.6
1926	113.1	106.8	93.8	94.8
1927	97.6	107.8	77.3	102.5
1928	105.7	112.2	92.9	107.5
1929	101.1	108.9	91.4	99.8
1930	76.4	94.0	44.6	96.6
1931	42.8	75.0	24.6	100.7
1932	38.9	65.3	20.7	103.4
1933	59.6	73.0	22.2	93.5
1934	105.6	77.2	20.3	63.9
1935	108.9	85.4	12.8	68.1
1936-37	107.7	92.9	13.5	70.1

APPENDIX B

FACTORS DETERMINING CORN PRICES

Several series are available to represent the price of corn. One could use the price of corn at Chicago, the average farm price for the United States, for Iowa in the heart of the surplus area or still other series, and in each case the decision would need to be made whether to use December prices or average prices for the season or for some shorter period.

These series all yield similar results, except for slight differences in the elasticity of the demand curves. The series finally selected was the average farm price of corn for the United States for a period from December to May. (A shorter period, for instance 1 month, is likely to be affected by ephemeral forces, while a longer period is likely to include prices affected by the prospects for the next crop.) There would be some advantage in using an Iowa farm price or a western Corn Belt farm price, since that is where the bulk of the surplus would be stored, but the hog prices used in the hog section of this bulletin represent prices for the whole United States, and it is probably better to use a United States corn price, too.

Previous research has shown that one of the chief causes of year-to-year fluctuations in corn prices is fluctuations in the size of the United States corn crop plus the carryover of old corn from the previous crop, both on the farm and in commer-

cial channels. The Bureau of Agricultural Economics prepares estimates which take some other minor factors into account as well (exports, imports, etc.). Their series is accordingly used, to show changes in the production of corn from one year to the next.

The experience of the past few years has shown that changes in the demand for corn have a great effect upon the price of corn. What series should be used to represent the demand for corn? The index of the general price level is sluggish and in any case is an inaccurate index of demand. The index of the general price level may remain constant while the demand for corn is changing. During an industrial boom, for example the boom in 1928 and 1929, demand increased greatly, but the general price level did not rise. The index of total national income also is too sluggish to represent changes in the demand for a speculative, durable commodity such as corn. Indexes of employment or payrolls are moderately good measures of demand, but they measure only part of the demand and a non-constant part at that.

A different approach to the measurement of demand may be considered. The demand for corn is a result of two forces: the demand for farm products in general, as from changes in industrial activity and the demand for corn itself, as affected, for instance, by changes in livestock numbers.

That is, changes in the general demand for farm products may carry corn prices up or down with all other farm product prices; in addition, changes in the demand for corn alone may carry its price above or below other farm products prices. Both movements need to be measured.

Accordingly, we used the index of farm products prices as a measure of the general demand for farm products and the numbers of livestock as the measure of the particular demand for corn, fluctuating about the general demand. There are objections to these measures also, but they were considered not as weighty as those against the other measures discussed above.

Strictly speaking, the statistical analysis on which this bulletin is based merely describes the relations that existed during the period 1922-1936. There is no guarantee that these

relations will continue identically the same in the future as in the past. The price level may change, farming systems may change, substitute feeds may be developed, the composition of the livestock population that consumes the bulk of the corn may change, in fact is changing, and so on.

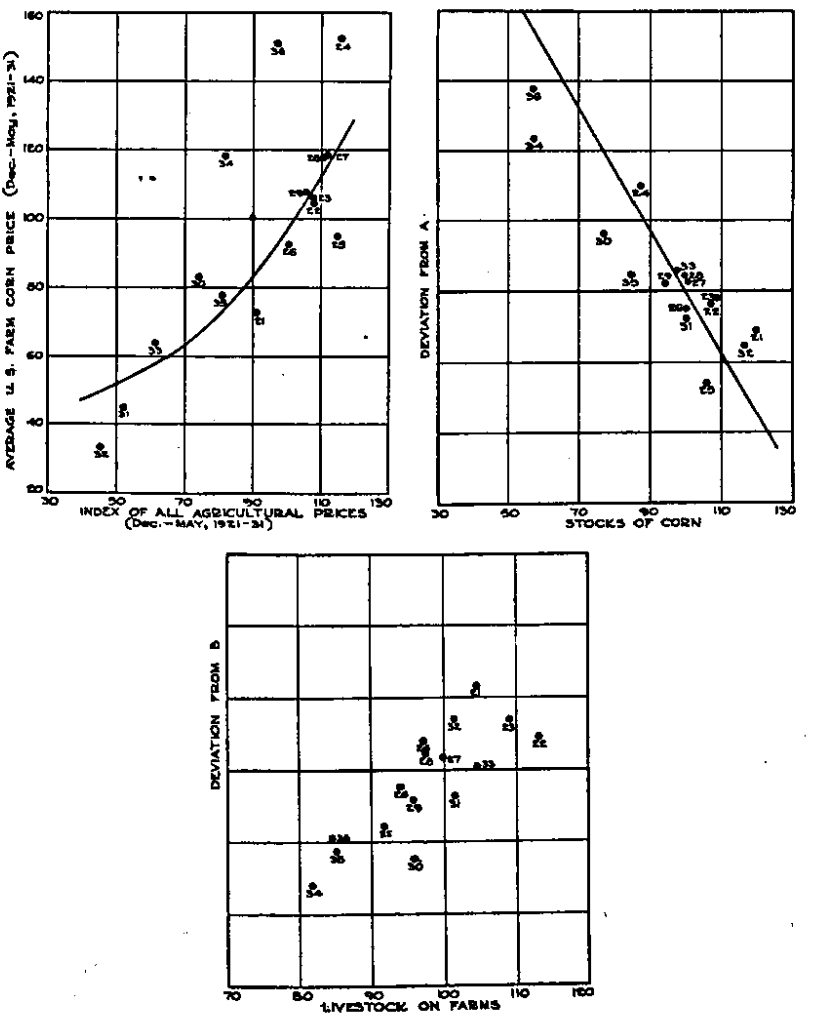

Fig. 20. (A, left—B, right—C, bottom). Average farm price of corn, December to May, prices of farm products December to May, total corn production and numbers of livestock on farms Jan. 1, United States, 1922 to 1930.

TABLE 6. AVERAGE FARM PRICE OF CORN DECEMBER TO MAY, AVERAGE PRICES OF FARM PRODUCTS DECEMBER TO MAY, TOTAL CORN PRODUCTION AND NUMBERS OF LIVESTOCK ON FARMS JAN. 1, UNITED STATES, 1921 TO 1936.

	Average U. S. farm price of corn	Index of all ag. prices	Numbers of livestock on farms	Corn production plus stock of old corn
	Dec.-May	Dec.-May	Jan. 1	Dec. 1
1921-1922	72.9	91.0	1044	1197
1922	104.8	108.1	1131	1068
1923	106.4	108.1	1094	1088
1924	152.9	115.7	971	872
1925	95.2	114.9	918	1060
1926	93.1	100.6	940	1001
1927	119.0	111.9	909	1006
1928	118.1	110.4	974	994
1929	108.1	105.9	957	942
1930	83.2	74.1	957	770
1931	45.4	52.2	1014	1000
1932	33.9	45.4	1013	1163
1933	64.0	61.3	1045	974
1934	118.5	81.6	818	577
1935	78.3	80.9	852	846
1936-37	151.3	96.8	845	572

In actual fact, however, the elasticity of the demand for corn has changed very little from decade to decade in the past. The elasticity of the demand for corn (based upon United States December average farm prices divided by the corresponding index of the general price level) has changed so little by decades since 1897 that in a three dimensional model made by the senior author the changes are imperceptible to the eye.[24] The elasticity of the demand for corn is likely to change in the future and keep on changing, but the changes are likely to be so small as to be negligible.

There is still a considerable amount of scatter about the regression line in fig. 17, indicating that the three factors used here (the demand for agricultural products, the size of the corn crop and the numbers of livestock on farms) do not explain corn prices completely. In a complete explanation of corn prices, additional factors would have to be considered.

The purpose of the analysis here, however, is to take into account enough factors to enable the price-quantity curve for corn to be determined with a reasonably high degree of ac-

[24] Henry Schultz found a considerable change in the elasticity of the demand for corn after the World War (from -.6982 before the War to -.4924 after it). But his analysis was based on United States farm prices, and his post-war period was only 8 years long, his results being affected (the elasticity reduced) by the runaway bull market in wheat and corn in the winter of 1924-25. See his article "The Shifting Demand for Selected Agricultural Commodities, 1875-1929." Journal of Farm Economics, Vol. XIV, No. 2, April, 1932.

curacy. The three factors used accomplish this purpose; a complete explanation would require more time than is available for the present study.

APPENDIX C

EFFECT OF CORN LOANS ON STABILITY OF TOTAL INCOME

It was shown in the main body of the bulletin that a change in the size of the corn crop causes a greater (opposite) change in price. A big corn crop, therefore, is worth less than a small crop. Fluctuations in corn production cause fluctuations not only in corn prices but in the total value of the crop. A national storage program that stabilized corn supplies would thereby stabilize, not only corn prices, but also total corn crop values.

But this stabilizing effect upon total values would follow only if the program were handled as a crop insurance program, with the premiums paid in and the benefits paid out in kind. In that case, the surplus corn in a big crop year would be "paid in" as a premium, and no income would be received from it until a short crop year, when it would be "paid back."

If the program were handled as a corn-loan program, total values would not be thus stabilized from year to year.[25] In a big crop year, the value of the loans made upon the surplus corn would be added to the total value of the crop that was not withheld. That is, the total value of the big crop would be 100 (that is, average) plus the value of the loans made on the surplus corn, which in the case of a 20 percent over-size crop would be 20. If farmers spent the proceeds of these loans during the big crop disposal year, the total value of the crop that year would be, not 100 percent, but 120 percent of average. Then if the next crop were only 80 percent of average size, the release of the surplus from the previous year would bring it up to 100 percent, and its price and total value would each be 100 percent. But as far as the farmer would be concerned, the proceeds of the sale of his 20 percent surplus carried over from the previous year would merely pay off the loan. The actual value of the crop to him would be only 80 percent of average, not 100 percent.

[25]This point was drawn to our attention by D. A. Fitzgerald, Hog Section, AAA.

If the corn storage program were put into effect by means of loans, therefore, it would stabilize the price of corn, the amount consumed and the total value of the amount consumed, but it would not stabilize farm incomes. If the value of the loans is included, it would increase the total value of the crop (meaning the total value of the crop plus the value of the loans) in big crop years and decrease it in small crop years. The total value would in fact fluctuate as much as the size of the crop fluctuated. A crop 120 percent of average size would have a total value (inclusive of loans) 120 percent of average size; a crop 80 percent of average size would have a total value 80 percent of average size and so on for all other size crops. This would be the reverse of the present situation, under which small crops are worth more than large crops.