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Chapter 12

Finished Goods Made from Agricultural Materials

Finished goods made from nonfarm raw materials are a fairly homogeneous group. Stocks move inversely during business cycles of ordinary length because production, while sensitive to changes in demand, responds only after a certain interval and at a certain rate. The group of products now to be reviewed—products fabricated from agricultural raw materials—does not present such a uniform picture. At bottom, the reason for their diverse behavior is that they approximate only loosely the group we wish to distinguish, namely, products whose production cycles are influenced more largely by fluctuations in conditions of supply than by those in conditions of demand. However, since many fabricated farm products do, in fact, meet this specification while others do not for identifiable reasons, a review of the group will go far toward clarifying the situation.

1 Conformity to Cycles in Business and Production

The relation of manufacturers' stocks of finished goods made from agricultural raw materials to business cycles is diverse. Of the ten full cycle indexes in Table 55, three have fairly substantial values with a negative sign, one indicates regular positive conformity; six indexes are low, and of these, three are negative, one is positive, and two are zero. But even among the group that apparently responds inversely to changes in business activity, reasons differ.

In marked contrast to the diverse behavior of this collection of inventories to business cycles is their response to production in their own industries (Table 56). Seven of the ten stock series seem to conform positively to production cycles as judged by the sign of the full cycle index, and six of the seven do so regularly, as evidenced

TABLE 55

Manufacturers' Stocks of Fabricated Agricultural Products
Conformity to Business Cycles

	NO. OF CYCLES	STAGES MATCHED WITH EXP.	INDEX OF CONFORMITY TO BUSINESS		
			Exp.	Contr.	Cycle
Evaporated milk, case goods, 1921-38	4	I-V	+50	0	−14
Shortenings, 1924-38*	3	VIII-V	+100	0	0
Cottonseed oil, crude, 1919-38*	5	I-IV	−100	−67	−100
Cottonseed oil, refined, 1919-38*	5	I-IV	−20	−33	−60
Linseed oil, 1919-38	5	I-V	−20	−60	−33
Inedible tallow, 1919-38	5	I-IV	−20	−20	−56
Beef & veal in cold storage, 1919-38*	5	I-V	−20	+67	+60
Pork in cold storage, 1919-38*	5	I-V	+20	+33	0
Lard in cold storage, 1919-38*	5	I-V	+60	0	+20
Finished cattle hide leather, 1924-38	3	I-V	−33	−33	−20

The period is that covered by the number of full cycles in the series measured from trough to trough. Asterisks indicate that the contraction and full cycle indexes cover an additional reference phase at the beginning or end.

by high indexes. It is interesting, moreover, that the stock series that conform positively to production cycles include the three that yielded high negative indexes of conformity to business cycles.

We can, therefore, say two things. First, the diverse responses of stocks of fabricated farm products to business cycles are found in association with similar response to cycles in production. Secondly, of the commodities that move inversely during business cycles some do so for reasons quite different from those that control the behavior of nonfarm products. In the latter group, stocks moved inversely to cycles in both business and production. Among farm products, however, some that behave inversely during business cycles still conform positively to cycles in production. To gain some understanding of this behavior, we consider these commodities in separate groups.

2 *Crude and Refined Cottonseed Oil*

Stocks of cottonseed oil may be said to be a classic example of the inventory category studied in this chapter. They represent an extreme case of a commodity whose rate of production is governed by changes in the supply of raw materials; and since the oil, whether crude or refined, is durable and staple, the behavior of cottonseed oil stocks is in striking contrast to that of the other durable commodities reviewed in the preceding chapter. It is convenient, therefore, to study cottonseed oil stocks first, then treat the other fabricated farm products as variants.

TABLE 56

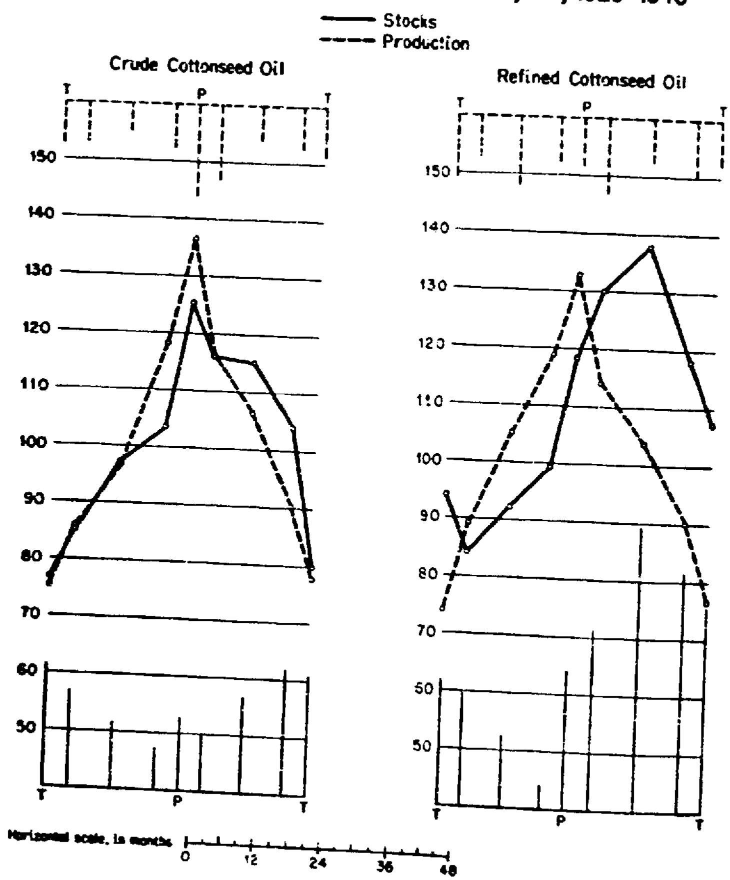
Manufacturers' Stocks of Fabricated Agricultural Products Conformity to Production Cycles

STOCKS	INDICATOR OF PRODUCTION	NO. OF CYCLES	STAGES MATCHED WITH EXP.	INDEX OF CONFORMITY TO PRODUCTION Exp.	Contr.	Cycle
Evaporated milk, case goods	Evaporated milk output, 1920-37	5	I-V	0	−20	+20
Shortenings	Shortenings output, 1923-40	3	I-V	+50	−100	0
Cottonseed oil, crude	Crude cottonseed oil output, 1920-40	5	I-V	+60	+100	+100
Cottonseed oil, refined	Refined cottonseed oil output, 1920-40	5	II-VI	+60	+100	+78
Linseed oil	Linseed oil output, 1922-38*	7	VIII-IV	−71	−75	−100
Inedible tallow	Inedible tallow output, 1919-37	5	I-V	+60	+20	+78
Beef & veal in cold storage	Beef, frozen & placed in cure, 1921-35	3	I-V	+100	+100	+100
Pork in cold storage	Pork, frozen & placed in cure, 1921-35	3	I-V	+100	+100	+100
Lard in cold storage	Lard output, 1925-37*	3	I-V	+100	0	+100
Finished cattle hide leather	Cattle hide leather output, 1921-40	7	I-V	−100	−14	−100

* 12-month moving average.

Stocks of crude and refined oil are not completely on a par. Refined oil stocks are larger and more surplus oil is stocked in refined than in crude form. Indeed, since a large part of refined oil output is made from crude oil produced by the same firms, and since the crude oil is usually refined promptly, stocks of crude oil have some characteristics of goods in process. Nor is refined oil a pure example of a 'finished' good in my definition, for it includes some oil held by industrial consumers, principally by manufacturers of vegetable shortenings. The latter difficulty, however, does not seem to have been sufficiently serious to obscure the essential facts of the case.

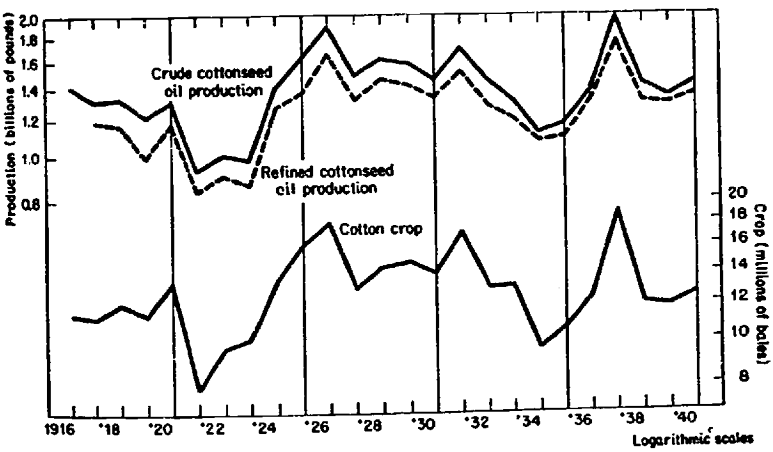
Chart 40
Cottonseed Oil Stocks and Production
Average Patterns during 5 Production Cycles, 1920-1940



Stocks of both commodities appear to move inversely to business cycles. The full cycle index of conformity for crude oil during five cycles is −100, that for refined oil, −60. In this respect the behavior of these commodities resembles the nonfarm products surveyed in the preceding chapter. Unlike the latter, however, stocks of crude and refined cottonseed oil respond positively to fluctuations in production (Table 56 and Chart 40).

To understand the tendency for stocks to conform positively to production cycles, we must consider the conditions influencing output. The output of cottonseed oil, both crude and refined, is controlled largely by the supply of cottonseed. Cottonseed, being cheap and bulky, can be stored much more economically after it has been reduced to oil. The production of crude oil, therefore, tends to rise and fall with the supply of seed. And since the oil, once compressed into its crude form, is usually promptly refined, the stock of crude oil acts, to a considerable degree, as an inventory of goods in process, rising and falling in close conformity with output (Chart 41).

Chart 41
Cotton Crop and Production of Crude and Refined Cottonseed Oil
Crop Years



The relation between the stocks and output of refined oil is based on a different principle. The supply of cottonseed and, therefore, the output of refined oil is governed by the size of the cotton crop (Chart 41); and the latter, in turn, is governed, in the short-run, mainly by weather conditions. Hence the output of refined oil rises and falls independently of movements in the demand for oil. Stocks of refined oil will tend to increase when output rises and to decline when output falls. They do not, however, typically rise as soon as output turns up, for usually some time will elapse before the rising trend of production outruns the rate of utilization of oil. Similarly, when output falls, some time will elapse before production drops below the rate of utilization. The peaks and troughs of stocks, therefore, tend to lag behind those of output (Chart 40). Moreover, if we assume that stocks and production fluctuate synchronously, the conformity indexes of refined stocks during 5 output cycles 1920-40 are +20, +20, +11. But if we assume that stocks typically rise between stages II and VI of output cycles, the indexes run +60, +100, +78.

This is not to say that the utilization of cottonseed oil is independent of its supply even in the short-run.[1] Refined cottonseed oil has many uses in common with lard, the other principal edible fat, and with other animal fats and vegetable oils. Other things being equal, when the supply of cottonseed oil rises in consequence of a large cotton crop, its price tends to drop and it tends to be substituted for competing fats and oils in the production of shortenings, salad oils, soaps, and many other commodities. That utilization and production of refined cottonseed oil tend to move together is evidenced by the conformity indexes for refined oil output during 7 cycles in the 'disappearance' of refined oil 1920-41 which run +100, +71, +100.[2] But as might be expected, when the price of oil declines, the oil tends to be stored in anticipation of a period of

[1] Some additional explanation of the distinction between *demand* and *utilization* may be helpful. Demand for cottonseed oil can rise because, say, national income increases, stimulating activity in industries using oil. Or it can rise because the supply of substitute oils and fats declines, compelling heavier dependence on cottonseed oil. Changes in demand are accompanied by changes in the utilization of cottonseed oil, but they are not regularly accompanied by changes in the output, since that is governed by the size of the cotton crop. As indicated in the text, however, utilization is correlated also with output, since a larger supply of cottonseed oil tends to reduce its price and to encourage substitution for competing fats and oils. Economists will recognize that demand means demand in the schedule sense, while utilization means the amount removed from the market for further fabrication or consumption.

[2] 'Disappearance' is a measure of the utilization of oil in further fabrication, computed by adjusting refined oil output for changes in stocks.

lower output and higher prices. Consequently, cotton crops, cottonseed oil production, the utilization of oil, and after an interval, stocks of oil, all move together and inversely to oil prices.

The production of cottonseed oil (and ultimately the size of the cotton crop) is probably the chief influence controlling cyclical changes in the volume of oil utilization. If it were the only significant factor we would expect the cycles in production and utilization to be so closely parallel that the conformity of stocks to both would be approximately the same.[3]

It is instructive to consider another simple case. If the utilization of cottonseed oil moved in cycles unrelated to its output, that is, if utilization were influenced only from the side of demand, an increase in utilization would tend to draw down stocks, at least after an interval in which utilization overtook and ran ahead of production. A decline in utilization would cause stocks to accumulate—again, after an interval. In short, under these simple assumptions stocks would tend to vary inversely to utilization, with a lag.

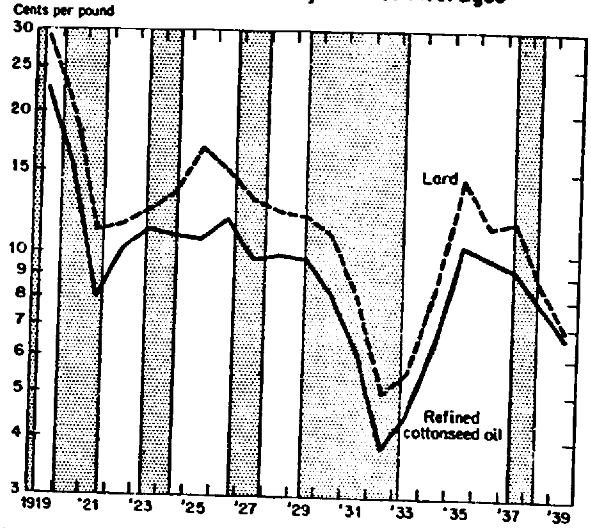
Neither model fits the case. The utilization of cottonseed oil is strongly influenced by its rate of production because of the competitive relation of cottonseed oil with other fats and oils. But utilization is influenced also by two factors on the side of demand: the supply of competing fats and oils, and the level of business or national income. I do not attempt to measure their importance directly, but it may be inferred by comparing the behavior of prices of cottonseed oil and its main competitor, lard, during business cycles (Chart 42).

The similarity in the price movements of the two commodities indicates that they are close substitutes. When the supply of lard is large, it is substituted for cottonseed oil which causes the price of oil to decline in about the same degree as the price of lard. The positive conformity of both price series with business cycles indicates that the demand for fats and oils rises and falls with the level of income.[4] No other inference is open since the output of neither

[3] Cases of this sort were typical among nonagricultural commodities. There the cyclical fluctuation in demand was the dominating influence on both shipments and production, and stocks tended to vary inversely to both.

[4] Conformity indexes for the wholesale price of refined cottonseed oil at New York (11 business cycles, 1891-1938) are +45, +45, +60; those for the wholesale price of lard (5 business cycles, 1912-38) are +100, +60, +100. The war cycles, 1914-21, are omitted from both measures.

Chart 42
Refined Cottonseed Oil and Lard
Wholesale Prices, Annual Averages



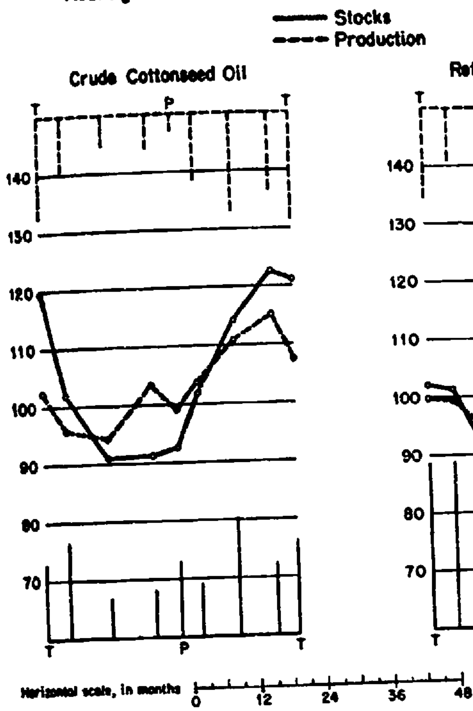
Specifications and sources:
Refined cottonseed oil: cents per pound, N.Y., prime, summer, yellow. 1919-33, Department of Agriculture; 1933-39, Bureau of Labor Statistics.
Lard: cents per pound, prime contract; Bureau of Labor Statistics.
Contractions (shaded) and expansions (unshaded) are marked off by the monthly reference chronology.

commodity is closely related to business at large.[5] The behavior of shortenings production, the principal consumer of cottonseed oil during the interwar period, supports our inference. The output of shortenings conformed positively to business cycles; its conformity indexes were +100, +50, +67 for 3 cycles, 1924-38. Moreover, its cyclical swings were substantial. The amplitude of shortenings production was 93.8 for 3 cycles, 1923-40; of cottonseed oil production itself, 114.8 for 4 cycles, 1922-40.

The variety of factors affecting the utilization of cottonseed oil causes the relation between stocks and utilization to be irregular. The factors influencing 'disappearance' from the side of demand, that is, the level of income and the supply of other fats and oils, would tend to produce an inverted relation, with stocks lagging. But disappearance also tends to rise and fall with cottonseed oil production. And the relation between production and stocks is

[5] The conformity indexes for lard production from federally inspected slaughter (5 cycles, 1919-38) are +20, −20, +11; those for refined cottonseed oil production (5 cycles, 1913-38) are −20, 0, −20.

Chart 43
Cottonseed Oil Stocks and Production
Average Patterns during 5 Business Cycles, 1919-1938



positive, with stocks lagging. This, of course, has its effect on the relation between oil utilization and stocks. The net result is a draw. Stocks do not exhibit any regular relation to cycles in utilization. Conformity indexes for stocks during 7 cycles in the disappearance of refined cottonseed oil, 1920-38, are 0, −14, 0. This, of course, does not prove that stocks are not systematically affected by fluctuations in the demand for oil. That could be true only if the demand for oil were always constant, an assumption contrary to fact, for the demand for cottonseed oil varies with both the level of business and the supply of competing fats. The difficulty is that demand acts on stocks only through its influence on the utilization of oil, and utilization is influenced strongly also by the supply of oil. The influence of demand is therefore obscured.

This analysis enables us to understand the behavior of production and stocks during business cycles. As might be expected, the patterns of production of both crude and refined oil are very similar (Chart 43). Neither responds markedly to business cycles, although during the five interwar cycles, production rose more during contractions, on the average, than during expansions. This, in turn, reflects similar movements in the cotton crop.

The patterns of stocks are again similar to those of production, but an inverted relation to business cycles is more distinct. For the 5 business cycles 1919-38, the indexes for crude oil were −100, −67, −100; for refined oil, −20, −33, −60. The utilization of oil was, then, regularly larger than output during business expansions and regularly lower during contractions due to the influence of the level of income on the use of oil. While utilization cycles resemble production cycles closely, for reasons already stated, changes in income must have been sufficient to keep use greater than output when income was rising and lower than output when income was declining.[6]

3 *Cold Storage Holdings of Pork, Lard, and Beef*

Inventories of pork, lard, and beef held in storage at slaughtering plants differ from those of cottonseed oil in a vital respect: the stocks of animal products are relatively perishable. Hence their primary function is to smooth out seasonal fluctuations in the marketing of hogs and cattle. Only necessary working inventory is carried over from seasons of slack to those of heavy marketings.[7] Cottonseed oil inventories also have a seasonal function, but, in ad-

[6] In ideal circumstances, the correlation of utilization with business activity should tend to produce reference cycles in stocks that are related to business inversely and with a lag, rather than with a lead, as seems to have been the case. This departure from expectations is probably partly due to the pattern of cottonseed oil production itself during the cycles covered by the data (Chart 43). It may be due in part also to the influence of changes in the supply of competing goods on the demand for cottonseed oil.

[7] In response to an inquiry about the character of cold storage stocks of meat, H. B. Arthur, Manager of the Commercial Research Department of Swift and Company, writes (June 24, 1942):

"Your inquiry as to what proportion of frozen meats are surplus and what proportion are in process of distribution: In one sense none of these meats are surplus and all of them are in process of distribution. That is, meats are put in frozen storage almost entirely for the purpose of carrying surplus supplies which result from the flush marketing periods over into the season when smaller livestock marketings would otherwise result in shortages. The answer to the inquiry is, therefore, that practically all of the frozen meats are 'surplus' dition, they serve to carry over supplies from years of relatively heavy production or light demand to years when these conditions are reversed.

Cold storage holdings of meat and lard must consequently move together with production (Table 56 and Chart 44), not because production outruns consumption when output is high but rather because the seasonal carryover is large in years of heavy animal slaughter.

To understand the behavior of these three kinds of inventory during business cycles, we must know how their output behaves. The production of all three products moves in close conformity to the rate of animal slaughter (Table 57 and Chart 45). The similarity between the three products, however, ends here. There is no firm evidence of a regular relation between pork and lard produc-

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only in the seasonal sense and that they are 'in process of distribution' in the annual sense. The amount of frozen meats carried over from one year to the next is extremely small, although the 'out of stock' condition may come at one date for one particular cut and at a little later date for another.

Beef is frozen in very small amounts compared with pork items. Frozen beef consists almost entirely of meat to be used in the manufacture of sausage, beef specialties and leaner types of certain cuts used in lower-priced restaurants and small institutions. Beef is frozen principally in the fall months when the so-called 'grass' cattle are marketed in large numbers. The only reason why this meat is frozen is that the cattle that produce this particular type of beef are marketed in the fall of the year in such numbers as to produce a surplus. In some other seasons this grade of beef is not produced currently in sufficient quantities to take care of the demand.

Beef is not placed in cure as a result of such market factors as a decline in the demand for beef, since the amount of beef that is cured is an insignificant part of the supply and consists principally of certain cuts, such as briskets and beef hams and rump butts. The briskets are put into cure throughout the year, depending on an anticipated demand for corned beef. The beef hams and rump butts come from lean cattle which are marketed in largest numbers in the fall. The rump butts make corned beef and the beef hams are usually cured to produce dried beef. There is, of course, a very considerable demand for all of these cuts in the frozen state, and the curing is not a matter of storing surpluses but rather of preparing the product to meet a particular demand for beef that has been cured in this way.

In the case of pork there is a large surplus produced during the winter and a comparatively small supply in the summer. As stated above there is very little pork held over from one year to the next. Storage is a matter of smoothing the seasonal flow to market. In the case of smoked meats such as hams and bacon, the season of large supply is in the winter, whereas the season of large demand is in the summer."

Chart 44

Frozen and Cured Meat Products and Lard, Cold Storage Holdings and Output
Average Patterns during Output Cycles

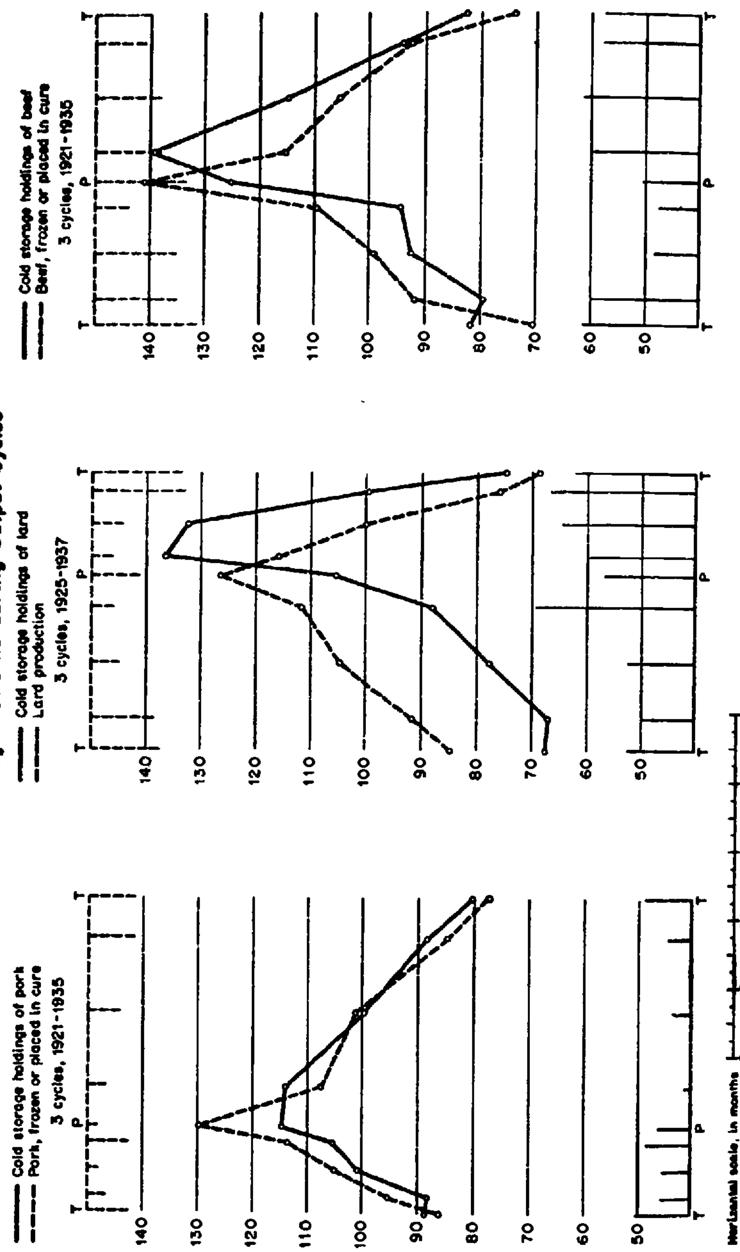


Chart 45
Frozen and Cured Meat Products and Lard
Average Patterns of Output during Slaughter Cycles

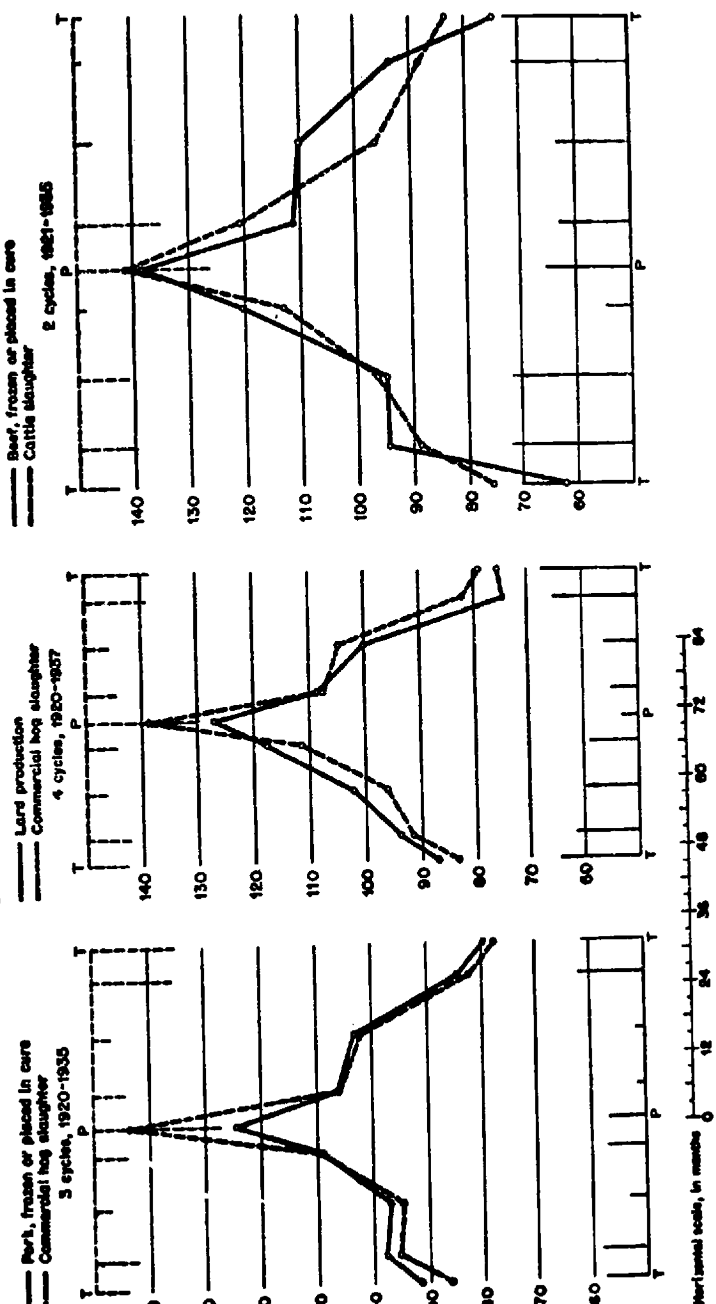


TABLE 57

Lard, Pork, and Frozen and Cured Beef Production
Conformity to Cycles in Animal Slaughter

	INDICATOR OF ANIMAL SLAUGHTER	NO. OF CYCLES	INDEX OF CONFORMITY TO SLAUGHTER Exp.	Contr.	Cycle
Pork, frozen or placed in cure	Commercial hog, 1920-35	3	+100	+100	+100
Lard production	Commercial hog, 1920-37	4	+100	+60	+100
Beef, frozen or placed in cure	Cattle under fed. inspection, 1921-35	2	+100	+100	+100

tion and business cycles. Beef production, though moving in longer cycles than general business, appears to be influenced to a marked degree by the fluctuations in demand that accompany business cycles (Table 58 and Chart 46). The apparently high positive conformity index for pork production is belied by the extremely irregular reference cycle patterns in Chart 46.

The causes of this disparate behavior go back to the conditions under which hogs and cattle are raised. Most hogs by far are slaughtered when they are 8-10 months old. With few exceptions it is unprofitable to slaughter younger or older hogs. As a result, the number of hogs slaughtered in a given season is governed largely by the number farmers considered it profitable to breed 12-

TABLE 58

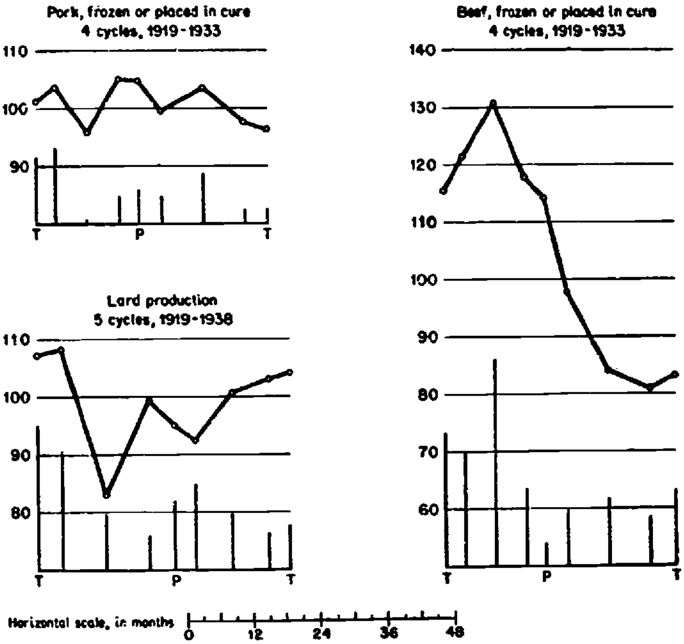
Lard, Pork, and Frozen and Cured Beef Production
Conformity to Business Cycles

	NO. OF CYCLES	STAGES MATCHED WITH EXP.	INDEX OF CONFORMITY TO BUSINESS Exp.	Contr.	Cycle
Pork, frozen or placed in cure, 1919-33	4	I-V	0	+50	+71
Lard production, 1919-38	5	I-V	+20	−20	+11
Beef, frozen or placed in cure, 1919-33	4	I-V	0	+100	+43
Beef, frozen or placed in cure, 1919-33	4	I-IV	0	+100	+100

16 months earlier (the normal period of gestation of pigs is four months). In part, of course, changes in the incentive to raise hogs depend upon demand. Increases in demand will tend to stimulate hog marketings, but only after 12-16 months. In part, however, the incentive to raise pigs depends upon the price of feed, in the United States chiefly corn. Since the price of corn moves inversely to the

crop and since the size of the corn crop is largely independent of business conditions, a large element of irregularity relative to business cycles is injected into the fluctuations of pig breeding and in turn into hog slaughter. As a first approximation, therefore, it seems valid to say that short-term fluctuations in hog slaughter are related only distantly to fluctuations in demand.

Chart 46
Frozen and Cured Meats and Lard
Average Patterns of Output during Business Cycles



The rate at which cattle are bred also depends partly on the demand for meat and partly on the cost of raising cattle. Except calves sold for veal, however, cattle are not marketed until they are several years old. The number of cattle on farms is, therefore, much larger relative to the annual rate of slaughter than is the number of hogs, and there is more flexibility in the age at which cattle can profitably be slaughtered. Hence cattle breeders can increase their marketings significantly when demand and price rise by selling their animals somewhat earlier and follow the opposite course when demand and price fall. In consequence, cattle slaughter tends to conform positively to business cycles.

The fluctuations of pork, lard, and beef inventories are consistent with these conditions in the animal breeding industry. As Table 55 indicated, cold storage holdings of pork and lard do not appear to be related to business cycles, while stocks of beef and veal conform positively. The full cycle indexes for the two hog products were 0 and +20; for beef and veal, the full cycle index was +60.

4 *Inedible Tallow*

The commodities reviewed above illustrated how the production of goods fabricated from agricultural raw materials is sometimes controlled, in the short-run, by the output of the raw materials rather than, as is more usual in manufacturing, by changes in demand. The use of agricultural raw materials, however, is not decisive in this respect. Indeed, it is neither necessary nor sufficient. Although farm products furnish the most important examples, the supply of a raw material may change independently of demand whenever it is a byproduct, whether of agricultural origin or not. On the other hand, the fact that the raw material fluctuates, in the short-run, independently of demand does not necessarily mean that the rate of output of the fabricated commodity will follow suit. The output of the fabricated commodity can be divorced from the independent cyclical variations in the supply of raw materials almost wholly, or in some degree, if one or more of several conditions supervene. (a) If the raw material is durable and can be stored economically, stocks can be drawn down in good times and allowed to accumulate in recessions, while the consumption of the raw material rises and falls with the fluctuations in demand for fabricated products. Cotton and rubber, reviewed in Chapter 10, are good examples. (b) If the material is a byproduct whose output, relative to the major product, is not invariant, its supply can be enlarged at special expense. Tallow, the next commodity to be studied, is an example. (c) If a considerable portion of the raw material supply comes from abroad, imports are likely to rise and fall in response to the demand for the fabricated commodity and to offset, at least in part, fluctuations in the domestic portion of the supply of materials. Linseed oil and leather production are examples we shall review below. As stated, the freedom from fluctuations in raw material supply that these conditions gain for manufacturing operations may be great or small, but when the conditions are present, the situation is worth separate notice and study.

Inedible tallow is a puzzling case in point.[8] Produced largely from the fatty wastes of slaughtered cattle and, to a much smaller extent, from those of sheep and lambs, it is a byproduct of meat production. Not all tallow, however, is produced by meat packers under true byproduct conditions. In large part it is manufactured by rendering plants which purchase fatty wastes from local slaughterers and convert them into tallow and grease. The production of the two divisions of the industry has been estimated by L. B. Zapoleon (Table 59).

TABLE 59

Inedible Tallow Produced by Meat Packers and Others

(millions of pounds)

	1914	*1919*	*1921*	*1923*	*1925*	*1927*
Packers	164	175	152	177	165	171
Others	34	77	175	207	214	234
Total	197	252	327	384	378	404

Inedible Animal Fats in the U. S., *Fats and Oils Studies, 3*, Stanford University, Food Research Institute, Dec. 1929, p. 107.

The United States Tariff Commission writes (*Report to the Congress on Certain Vegetable Oils, Whale Oil and Copra*, No. 41, 1932, pp. 222-4):

"Inedible tallow is derived principally from such fat of cattle and sheep as can not be utilized for food purposes. . . . Since 1914 the recovery [of tallow] has increased more than the total production of meat, evidencing a greater utilization of waste animal fats . . . the increase in production of inedible tallow was mainly by producers other than the packers . . . local rendering plants distributed in urban centers. . . . The bulk of the increase has come from the local renderers. . . .

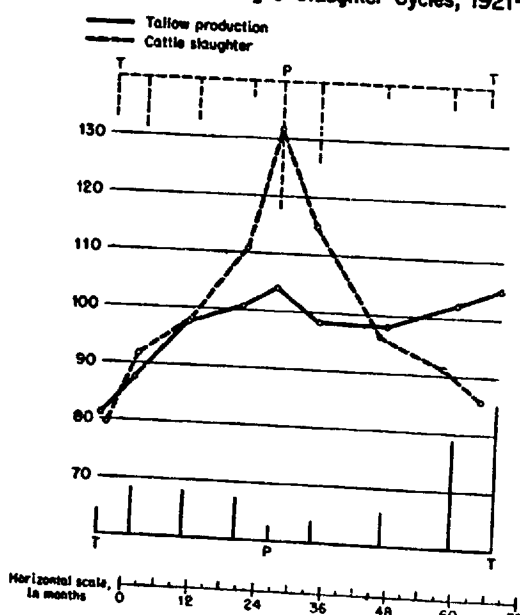
The two principal divisions of the industry stand on a different footing as far as expansion is concerned. Speaking broadly, the packers recover now about the maximum amount of inedible fats and will probably continue to do so irrespective of price so long as it covers the cost of recovery. Production by renderers, however, must be affected largely by price, for they are not in the position of utilizing a by-prod-

[8] The chief use of tallow is in the manufacture of soap, of which it is the principal raw material.

uct of their principal manufacture but of purchasing fatty wastes and converting them into tallow and grease as major products, along with their joint products, tankage and crackling. Manifestly, the price of tallow and grease will influence the volume of production, in particular the rate of erection of new rendering plants."

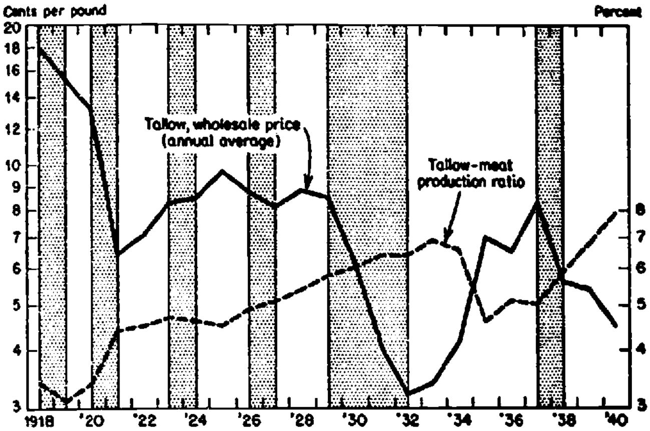
It is not, of course, surprising to discover some correlation between the rate of cattle slaughter and the output of tallow. When slaughter increases, the output of tallow in the large meat-packing plants must increase as a byproduct. And the more plentiful supply of animal wastes stimulates production in the specialized rendering plants. Although the patterns of tallow output and cattle slaughter exhibit many differences (Chart 47) they conform positively to each other if we allow for the marked secular growth in the former. Conformity indexes for tallow production during 3 slaughter cycles, 1921-39, that run +100, −50, +67 constitute further evidence of this relation.

Chart 47
Inedible Tallow Production and Cattle Slaughter
Average Patterns during 3 Slaughter Cycles, 1921-1939



Note: Reference framework for tallow production derived from turns in quarterly series of cattle slaughtered under federal inspection. Specific cycle pattern for cattle slaughter based on monthly data.

Chart 48
Wholesale Prices of Inedible Tallow and Tallow-Meat Production Ratio*



* Beef, veal, lamb, and mutton.
Contractions (shaded) and expansions (unshaded) are marked off by the yearly reference chronology.
Logarithmic scales

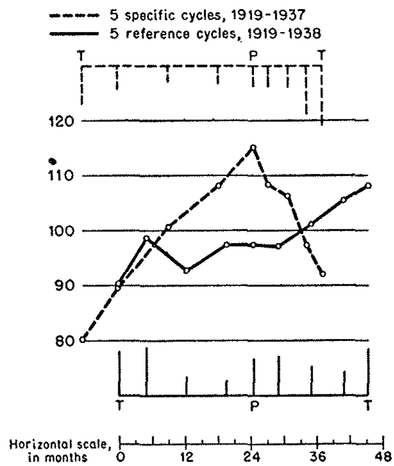
What is surprising is that the recovery of tallow does not seem to have been sensitive to changes in its price, certainly not to interannual movements (Chart 48). The sharp decline in prices between 1928 and 1932, for example, did not prevent a concomitant increase in the rate of tallow recovery. Indeed, the dominant impression of Chart 48 is that the rate of tallow recovery per pound of meat has moved inversely to tallow prices. Though prices vary positively with business cycles the tallow-meat production ratio does not respond in any regular fashion to prosperity and depression. In the cycles of 1918-20, 1921-24, and 1923-26 it moves positively with business, but in the cycles of 1919-20, 1920-23, 1929-37, and 1932-38 it moves inversely. The effect of the violent cycle of 1927-32 is hardly noticeable.

I cannot explain this perverse behavior, but it is consistent with other characteristics of tallow output and stocks. For example, in the interwar period the rate of cattle slaughter tended to vary with business cycles.[9] The influence of the irregular movements of the rate of tallow recovery per pound of meat, however, was sufficient to make the output of tallow during business cycles irregular as

[9] See above, Sec. 3. The conformity indexes of cattle slaughter to the 5 interwar business cycles were +60, +100, +78.

well. The full cycle index of the conformity of tallow output was +11, and the average reference cycle pattern of tallow output, despite marked specific cycles, exhibits little except secular growth of output (Chart 49).

Chart 49
Inedible Tallow Production, Average Patterns

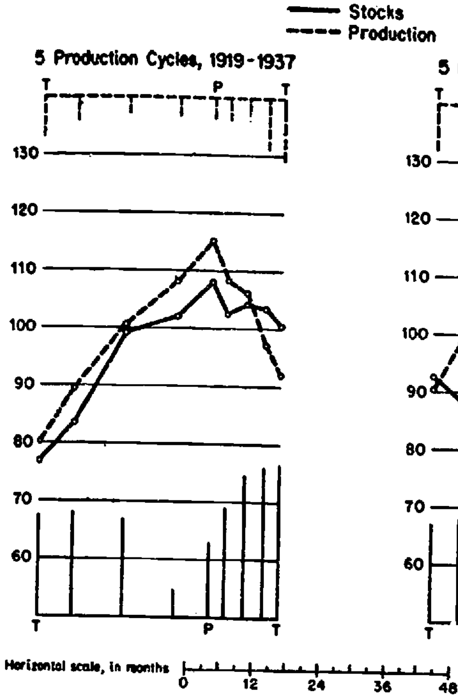


It appears, therefore, that despite a local rendering industry presumably able to increase output in response to demand, production of tallow was not, in the interwar period, sensitive to short-run changes in demand as indicated by prices. Instead, it fluctuated in cycles of its own, influenced partly by the rate of animal slaughter and partly by other factors. As a result, the relation of tallow stocks to production and business cycles is similar to that of cottonseed oil and other commodities with the same characteristics. Stocks conform positively to production cycles and inversely to business cycles, with some tendency to lead the latter (Chart 50). The conformity indexes of stocks during 5 production cycles 1919-37 were +60, +20, +78; during 5 business cycles 1919-38, —20, —20, —56 when stages I-IV were matched with expansions.

5 *Linseed Oil*

The behavior of linseed oil stocks permits a somewhat fuller development of the idea first encountered in the review of tallow inventories. Variations in the supply of domestic raw materials, in this

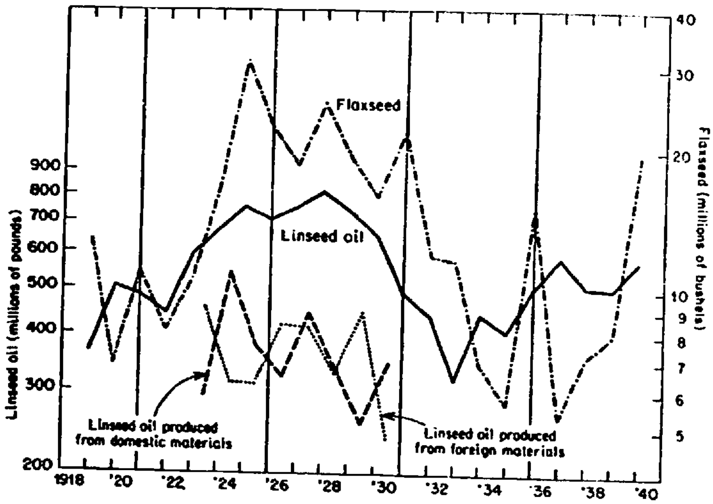
Chart 50
Inedible Tallow Stocks and Production, Average Patterns



case flaxseed, influence the output of linseed oil, but again another factor intervenes to enable production to proceed with some degree of independence of raw material supply and thus to be adjusted more closely to demand than in the cases of cottonseed oil and hog products.

The fact that both are vegetable oils invites comparison between cottonseed oil and linseed oil. With respect to the former, we found that output cycles were dominated by cycles in the cotton crop, since the cottonseed itself could not be stored economically; hence the production of oil was not correlated significantly with business cycles. The domestic crop of flaxseed does not impose its own pattern upon the production of linseed oil nearly as strictly. The difference reflects the different degree to which operations in the two industries depend upon the size of the domestic seed crop. While cottonseed oil is made almost exclusively from American cottonseed, approximately half of our linseed oil in recent years has been pressed from imported flaxseed. The production of flaxseed in the United States controls the quantity of linseed oil produced from domestic materials, but year to year changes in the total output of linseed oil often disagree with those of domestic flaxseed output in direction and size (Chart 51). The balancing factor is the quantity of linseed oil produced from imported seed.[10]

Chart 51
Flaxseed and Linseed Oil Production



Linseed oil from foreign and domestic materials from U.S. Tariff Commission, Report to the Congress on Certain Vegetable Oils, Whale Oil and Copra (41), 1932, pp. 73-4.

The possibility of offsetting fluctuations in the domestic crop of flaxseed by varying the rate of imports makes the production of linseed oil responsive to changes in demand. To establish this relation, we estimated linseed oil shipments from output and changes in stocks.[11] Cycles in the output of linseed oil vary positively with shipments as evidenced by conformity indexes of +100, +100, +100 during 2 cycles of shipments 1921-38 (actually five phases—

[10] There is some suggestion in the chart that longer-run developments in domestic flaxseed production follow the trend of linseed oil production. If so, this would aid in adjusting linseed oil production to demand by gradually removing the pressure of excess supplies of raw materials when demand is falling and by gradually reducing dependence on imports during expansions.

[11] Stocks of linseed oil are largely held by manufacturers, but they include some stocks in public storage owned by others. The computed shipments series, therefore, is strictly an index of the 'disappearance' of linseed oil from the inventories in manufacturing plants and in public warehouses.

three contractions and two expansions). The same relation is revealed by the cycle patterns in Chart 52. Output as well as shipments also conformed positively to business cycles. The average patterns are confirmed by conformity indexes of +100, +20, +78 for shipments and +60, +60, +78 for production during the 5 business cycles 1919-38.

The low conformity of shipments to business contractions reflects the fact that shipments continued to rise during the two mild recessions of the mid-'twenties. This is, of course, characteristic of commodities used in building construction during the tremendous upswing of construction that marked the period. Production, in contrast, did not rise during one of the five expansions and declined during one of the two mild contractions skipped by the shipments series. Both the rise and decline indicate that while production can be adjusted to changes in demand, other important factors help to guide its course.

Confirmation comes from a fact hidden in the average patterns and other information of Chart 52. While there were 5 business cycles during the period, and only two and one-half cycles in linseed oil shipments, the National Bureau has identified 8 cycles in linseed oil production. The situation may be clarified by inspecting the complete series of seasonally corrected production and shipments data in Chart 53. The circles and asterisks indicate the specific cycle turns identified by the National Bureau. Beginning with a peak tentatively placed in the third quarter of 1919, shipments decline until the end of 1921. They then begin a long cycle which reaches a peak at the end of 1928 and a trough in 1933. Another long cycle corresponding to the long business cycle of 1933-37-38 follows. Production has an initial expansion in 1918-19 before our shipments series begins. It has a contraction corresponding to that of shipments in 1919-22, then moves through the two long cycles found also in shipments. In addition, production moved through several shorter cycles: two during the major expansion from 1922 to 1929, one during the major contraction from 1929 to 1932, and two during the major expansion of the 'thirties.

Most of the 'extra' cycles in production may reasonably be attributed to the fact that variations in imports cannot offset immediately and completely the effects of fluctuations in the domestic

Chart 52
Linseed Oil Production and Shipments, Average Patterns

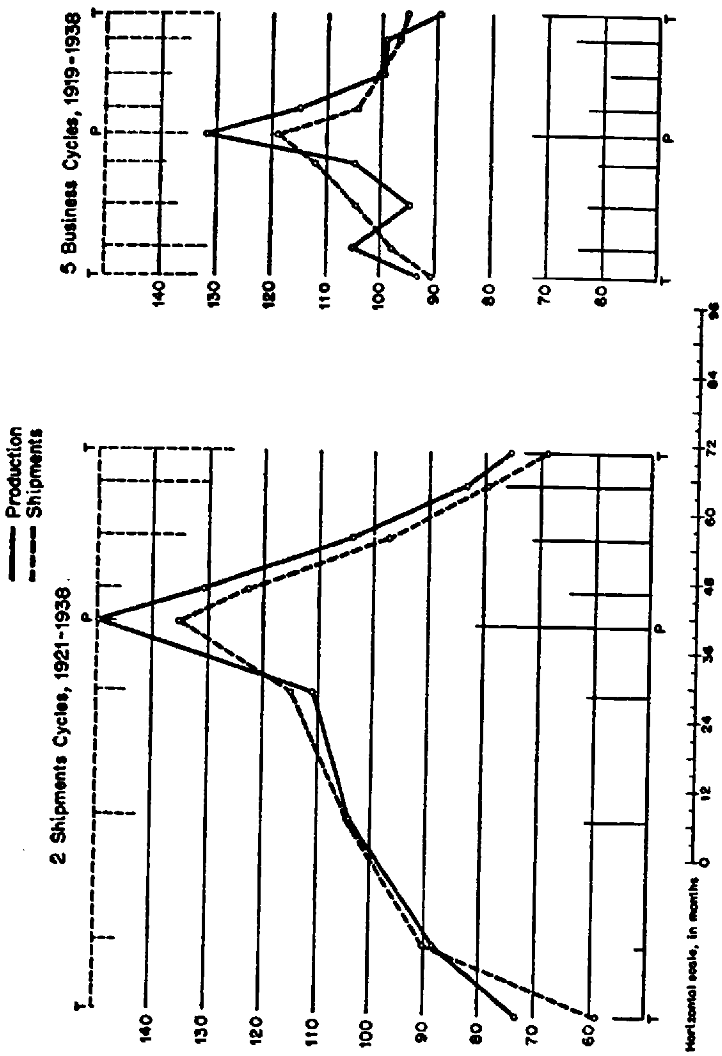
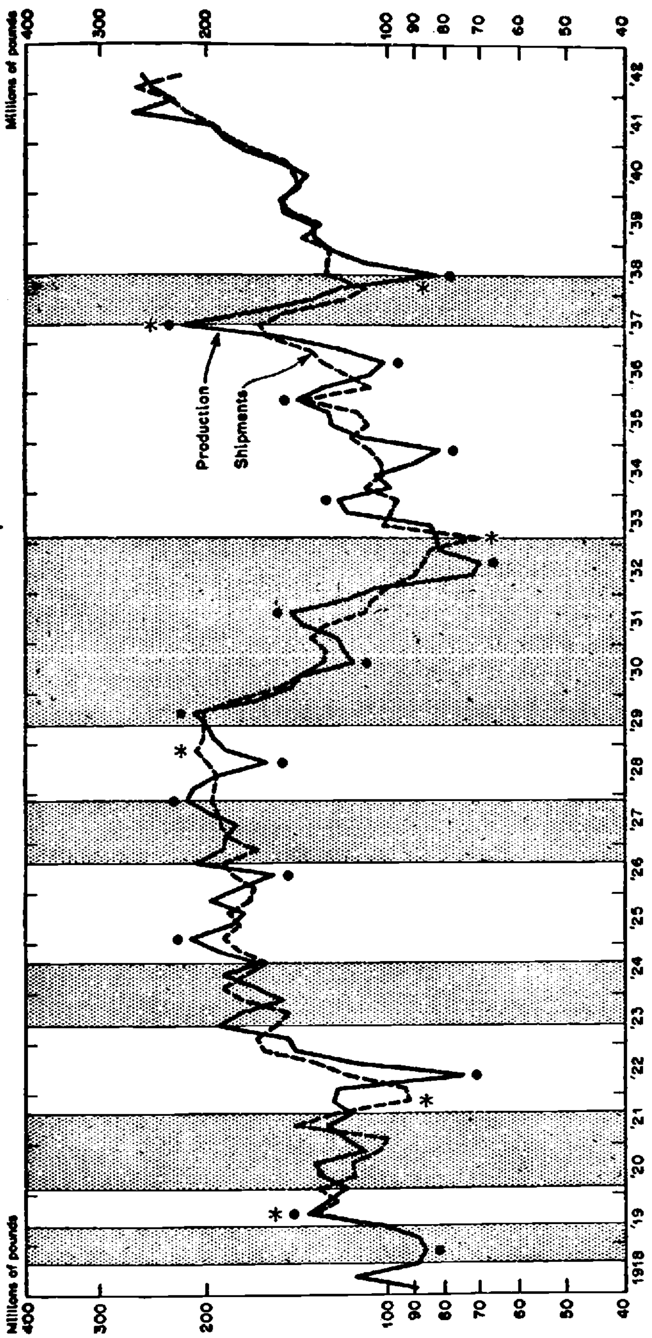


Chart 53
Linseed Oil Production and Shipments



● Peaks and troughs of cycles in production.
* Peaks and troughs of cycles in shipments.
Contractions (shaded) and expansions (unshaded) are marked off by the quarterly reference chronology.

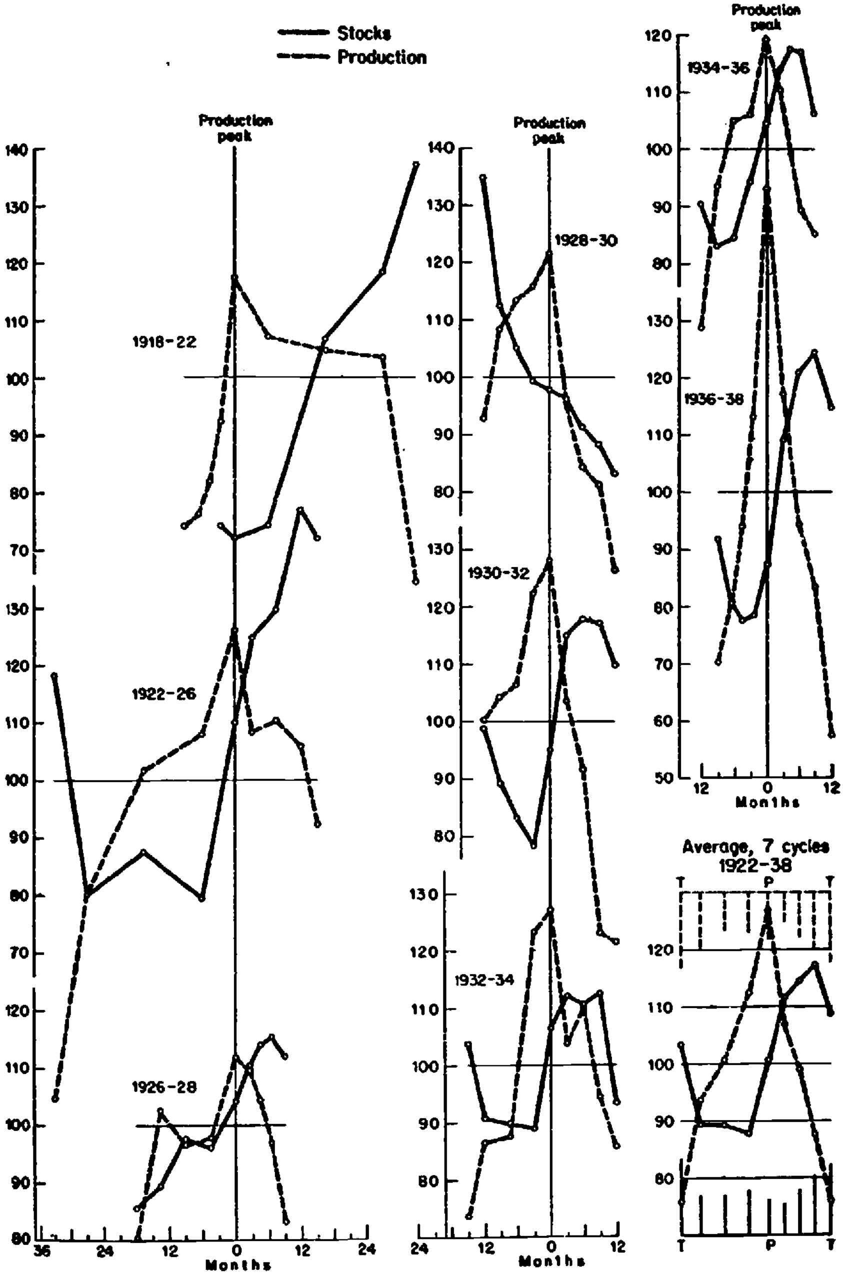
crop of flaxseed. A bumper crop, therefore, is likely to cause a temporary increase in linseed oil production; a short crop, a temporary decline. After some months, indeed, larger imports can make good deficiencies, and smaller imports remove the pressure of surplus seed. Hence the larger movements of linseed oil shipments are faithfully followed by production. Fluctuations in the domestic crop, however, seem still able to activate smaller production cycles that are independent of demand.

A glance back at Chart 51 lends support to this view. If we neglect the initial expansion of production before the shipments data begin, we can match four of the other five extra movements of linseed oil production with a pronounced fluctuation in the crop. The output peak in early 1925 then corresponds to the large flaxseed crop harvested in autumn 1924. The output peak at the end of 1927 followed the large harvest of that year. The large output of 1931 can be matched with the big crop of 1930, and in the same way a large harvest was followed by a peak in linseed oil output at the end of 1935.

The fifth extra movement in output, in 1933-34, presumably has a different explanation. It represents, I think, the additional output stimulated by the expectation of increases in prices and wages that accompanied the dollar devaluation and NRA episodes of 1933. Once these influences had spent themselves, production was cut and stocks liquidated.

These two sets of influences upon output, the longer cycles of demand and the shorter fluctuations of raw material supply, help to explain the behavior of linseed oil stocks. As already shown in connection with cottonseed oil stocks, during the shorter, supply-stimulated production cycles, stocks of linseed oil tend to follow production with a lag (Chart 54). The fluctuations in the supply of flaxseed carry linseed oil output now above, now below, the rate of shipments. When output turns up, however, it does not immediately rise above shipments, and until it does, stocks continue to fall. And similarly when it turns down. Note particularly the pattern of stocks in the first full cycle of output, 1922-26, the contraction of the next cycle, and the patterns of the last four cycles. Despite the fact that production does not proceed independently of demand but, as we have seen, is correlated also with the rate of

Chart 54
Linseed Oil Stocks and Production, Patterns during Production Cycles



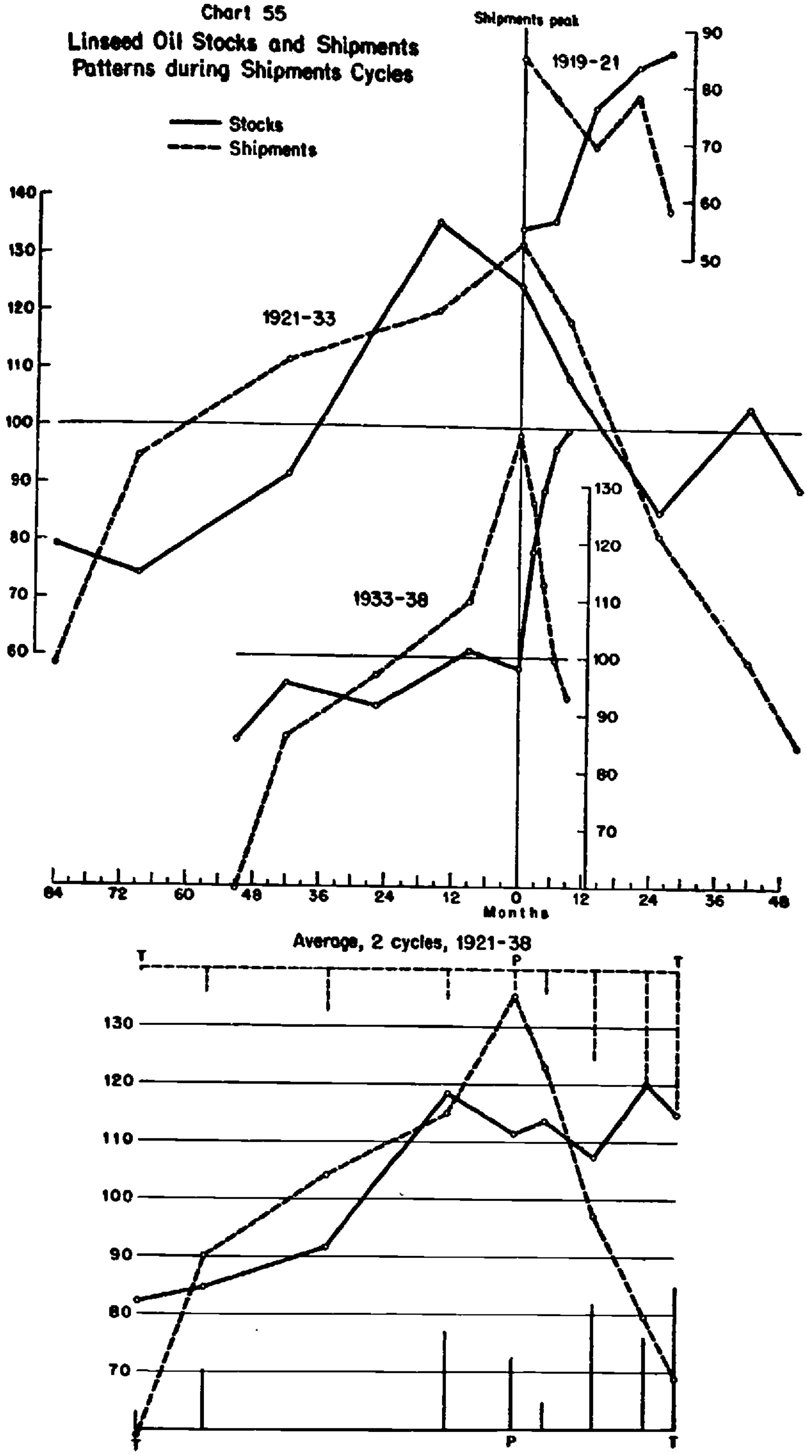
shipments, the influence of production cycles has made itself felt in fairly regular fashion. Stages IV-VIII seemed to be the most typical period of expansion for stocks during output cycles, which accounts for the negative sign of the conformity indexes. Matching the typical expansion stages of stocks with contractions of production yielded indexes of −71, −75, −100 for the seven and one-half cycles.

The movement of stocks during cycles in shipments (Chart 55) is roughly consistent with the findings of Chapter 11 for finished staples whose output can be adjusted to movements of demand. Stocks move inversely during the short contraction of shipments from 1919 to 1921 but during the exceptionally long phases 1921-28, 1928-33, and 1933-37, they move with shipments. During the short contraction of 1937-38, they again respond inversely. This even mixture of very long and short phases and of the differing behavior of stocks during them yields low indexes of conformity: +100, −33, 0.

The resemblance between the behavior of linseed oil stocks during cycles in shipments and the typical behavior of nonagricultural commodities is not, indeed, perfect, but the differences seem traceable largely to the influences of the shorter, independent output cycles. For example, stocks turn up unexpectedly early in the long expansion of shipments beginning in 1921. The explanation seems to lie in the very large increases of the flaxseed crop between 1922 and 1923 and again between 1923 and 1924. We would expect stocks to rise for a time after the peak of shipments in the last quarter of 1928 but instead they reached a peak earlier, in the second quarter of 1928, then declined. The explanation again is the movement of crops. The large flaxseed crop harvested in autumn 1927 was followed by an upsurge of production in the fourth quarter of the year and the first quarter of 1928 (see Chart 53) which lifted stocks to a peak some months later. The early decline of stocks therefore seems to reflect liquidation of excess stocks of linseed oil accumulated as a result of the bumper crop of flaxseed in 1927. Similarly, the choppiness of the pattern of stocks in the 1928-33 contraction and in the 1933-38 expansion (Chart 55) can be traced to the extra production cycles already noted.

The relation of linseed oil stocks to business cycles is fixed by

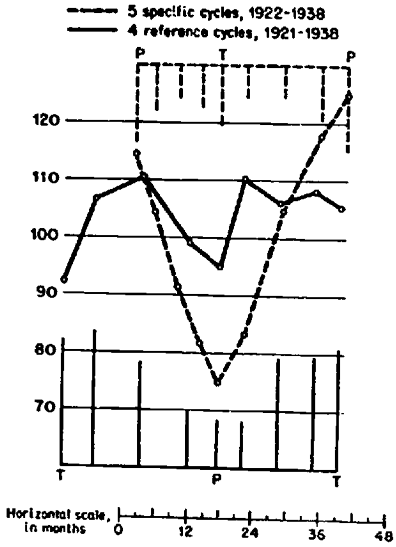
Chart 55
Linseed Oil Stocks and Shipments Patterns during Shipments Cycles



the relation between stocks and shipments and output. As indicated above, both output and shipments tend to conform positively to business cycles, although in the period covered there were significant irregularities connected with the long cycles in shipments and the supply-stimulated fluctuations in production. The relation between stocks and shipments was sometimes inverse, sometimes positive, depending on the length of the phase; the relation between stocks and production was more or less regularly positive with a very long lag—equivalent to an inverse correlation with a lead.[12] It is not surprising, therefore, that stocks should behave irregularly during busines cycles, as Chart 56 suggests, with some slight tendency toward inverted behavior: the conformity measures are —20, —60, —33 for 5 business cycles 1919-38.

Chart 56

Linseed Oil Stocks, Average Patterns



6 *Finished Cattle Hide Leather*[13]

Even better than linseed oil, the output of leather illustrates how manufacturers of farm products can proceed independently of short-term changes in the supply of raw materials. The independ-

[12] The conformity measures for stocks during output cycles are, indeed, negative allowing for a one-stage lead.

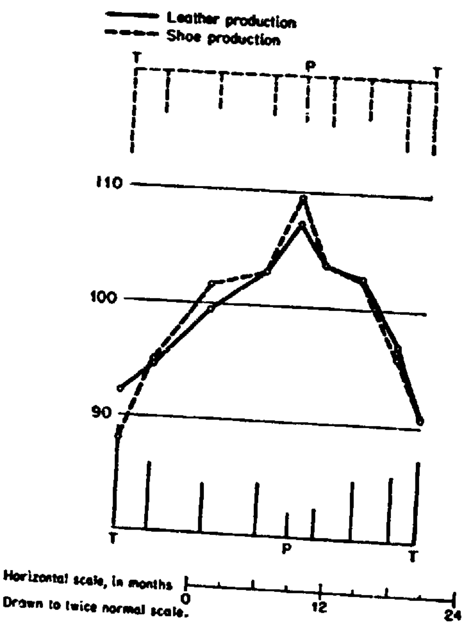
[13] See also Ruth P. Mack's forthcoming study referred to in Ch. 10, note 8.

ence, of course, is not absolute, but it is marked, and the behavior of tanners' stocks of finished leather reflects the kinship between leather and other commodities whose output in the short-run is controlled largely by demand.

The principal source of cattle hide leather in the United States is domestic slaughter. The supply of domestic hides in a given period is, therefore, influenced both by the current demand for meat and the breeding decisions made several years earlier. The current demand for leather is of little consequence since hides do not account for more than 10 percent of the value of slaughtered cattle. Despite these conditions, as we saw in Chapter 10, tanners can, in most cases, obtain enough hides to meet their current needs. First, cattle slaughter and leather output are at least indirectly related. Cattle slaughter tends to increase when consumer incomes rise. And since the demand for shoes and industrial leather too is stimulated by better business and rising incomes, the output of leather and the domestic supply of hides both conform positively to business cycles. The increase in cattle slaughter is not nearly as large as in leather output, however (Chart 20). The discrepancy between the consumption and output of hides is covered largely by imports. When demand for hides outruns supply, the price tends to rise, and with rising prices, imports increase (Chart 21). Hence, the total movement into sight of cattle hides is more nearly adjusted to the demands of leather production than is domestic cattle slaughter (Chart 22). Finally, since hides can be stored economically for long periods, a buffer stock is kept by dealers, importers, and packers on which manufacturers can draw when the current supply, whether from domestic slaughter or imports, is inadequate.

This argument, of course, is not exhaustive. When demand for hides tends to outrun supply, the rising price can and, to some degree presumably does, check leather output. To this degree the cycles in leather output are influenced by the supply of raw materials. To some degree the same is presumably true of all manufactured goods, whether from agricultural or nonagricultural materials. But here, as in the case of most nonfarm products, the influence of raw materials is not decisive. By increasing imports and drawing on stocks of hides, leather output can outrun the supply of hides from domestic slaughter, and by reducing imports and allowing excess stocks to accumulate in the hands of dealers and importers, it can be curtailed when demand falls off. One indication that tanners can adjust receipts to current needs is that their inventories of raw hides increase and decline with leather output, leaving to dealers' and importers' stocks the function of ironing out disparities between supply and demand (Chart 23). Additional confirmation is afforded by the relation between leather and shoe production. Cycles in leather output conform positively to those in shoe output, and their patterns are generally similar (Chart 57). Conformity indexes for leather output during 7 cycles in shoe output 1924-40 were +100, +75, +100.

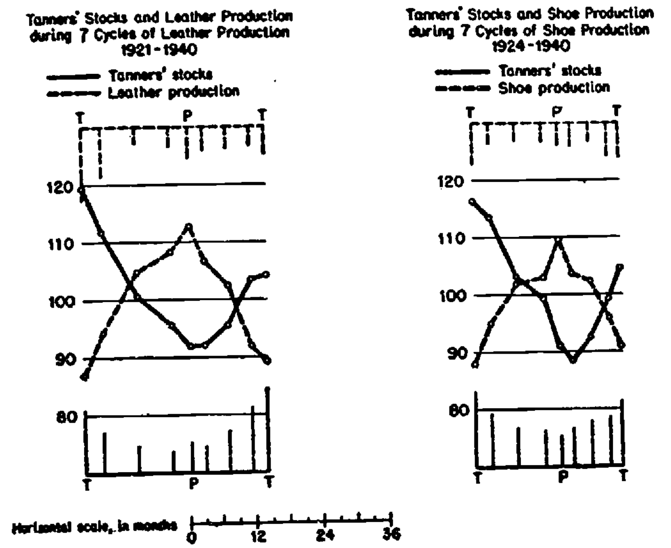
Chart 57
Leather and Shoe Production
Average Patterns during 7 Shoe Production Cycles
1924-1940



In this situation, stocks of finished leather at tanners act like the commodities derived from nonagricultural materials reviewed in Chapter 11: they move inversely to both leather and shoe output. The conformity indexes of leather stocks during 7 cycles in leather output 1921-40 were −100, −14, −100. Similarly, the conformity indexes of leather stocks during 7 cycles in shoe output 1924-40 were —100, —50, —100 (Chart 58).

Chart 58

Finished Leather Stocks at Tanners and Leather and Shoe Production
Average Patterns during Production Cycles



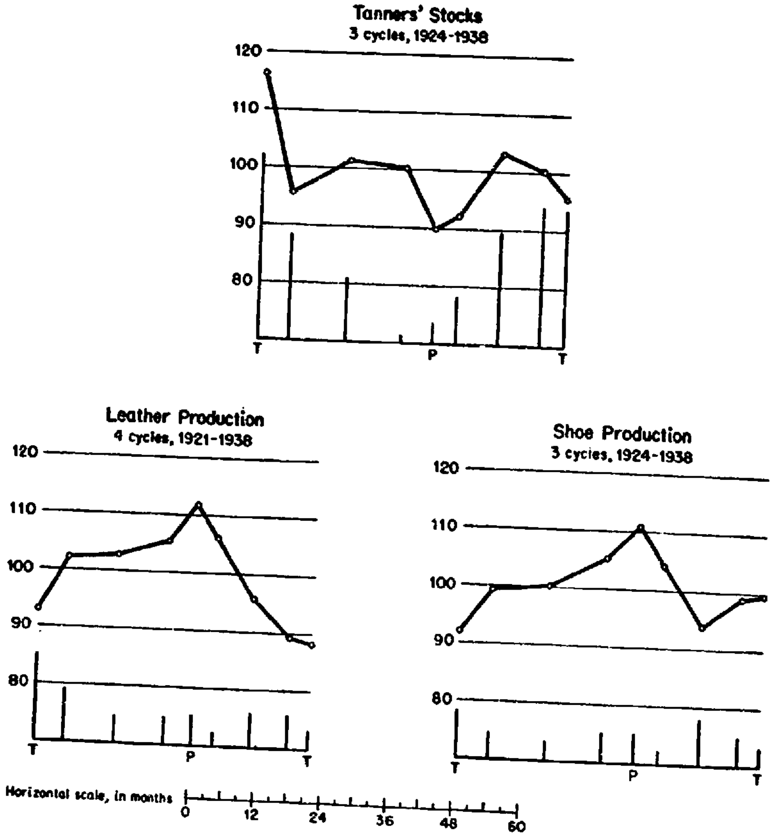
Leather stocks also tended to move inversely during business cycles, although less regularly because of the imperfect conformity of leather and shoe output to business cycles. The conformity indexes were —33, —33, —20 for 3 business cycles 1924-38 (Chart 59).

This behavior contrasts markedly with that of commodities whose production is governed by the supply of raw materials. Cottonseed oil and hog products, for example, tend to move irregularly, or inversely with a lag, during cycles in demand but to conform positively to cycles in output. Leather stocks, like stocks of other commodities whose production is dominated by demand, tend to move inversely to output, to demand (as represented by shoe output), and to business at large.

7 *Other Fabricated Agricultural Products*

Unfortunately, I cannot yet explain even tentatively the behavior of stocks of evaporated milk and shortenings. I can merely record some of the relevant measures of their movements.

Chart 59
Finished Leather Stocks at Tanners and Leather and Shoe Production
Average Patterns during Business Cycles



EVAPORATED MILK (CASE GOODS) AT MANUFACTURERS

During the business cycles for which we have data inventories moved irregularly. Conformity indexes for 4 cycles 1921-38 were +50, 0, −14. There does seem to be some evidence, however, of a tendency for stocks to conform positively to cycles in evaporated milk output with a lag of approximately two stages (Chart 60). Conformity indexes are +60, +33, +40 for 5 output cycles 1920-37 when the expansion of stocks was measured between stages III and VII; measured synchronously, the indexes are 0, −20, +20.

Unlike several other fabricated farm products reviewed above, cycles in the output of evaporated milk are not controlled by cycles in the supply of its raw material. The output of fluid milk is very steady compared with that of evaporated milk (Chart 61). Fluctuations in the latter must, therefore, be regarded as responses to changes on the side of demand. But these changes themselves are likely to be very complex; for evaporated milk is merely one of a fairly large number of products derived from whole milk. Hence its production would tend to be stimulated when the demand for evaporated milk is high relative to the demands for other milk products rather than when the demand for evaporated milk by itself is high. Moreover, since canning milk is one means of storing an otherwise perishable product, the demand for evaporated milk, including the demand for storage purposes, might be expected to be high when the demand for milk products in general is low. This in turn leads one at first to expect evaporated milk output to be high during depression, low during prosperity. The evidence, however, shows that it has not fluctuated in any regular fashion during business cycles. Conformity indexes for 5 cycles 1919-38 were +60, —50, 0.

I suspect that stocks tend to respond positively with some lag to cycles in evaporated milk output because the latter is influenced by the relative profitability of storing milk in this form. This hypothesis, however, should be tested by studying the cost of producing evaporated milk and its price relative to costs and prices of numerous other milk products. Apparently, too, the complex factors that control the relative profitability of producing evaporated milk as against other milk products do not make evaporated milk output respond in any regular fashion to business cycles. Hence the irregular behavior of its stocks during business cycles.

SHORTENINGS

The meager evidence we have on stocks of shortenings does not suggest behavior consistent with any of the standard patterns so far defined. Since shortenings are made from various vegetable oils and animal fats, both domestic and imported, output cycles are not likely to be strongly influenced by cycles in the output of raw materials. This, indeed, is suggested too by the conformity measures for shortenings output which run +100, +50, +67 for 3 cycles 1923-38 when expansion is calculated from stages I to V.

Stocks of shortenings do not, however, act like stocks of other fabricated goods whose output cycles are dominated by demand

Chart 60

Evaporated Milk Stocks and Production Patterns during Production Cycles

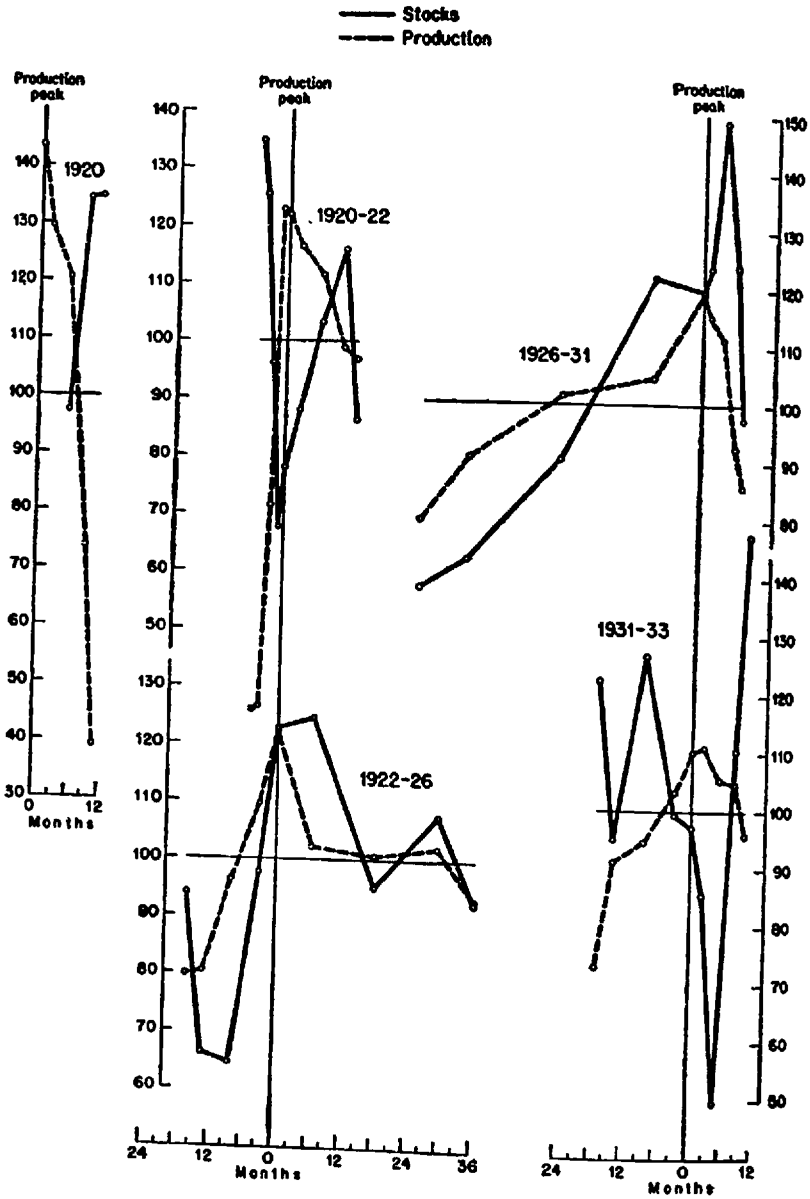


Chart 60 (concl.)

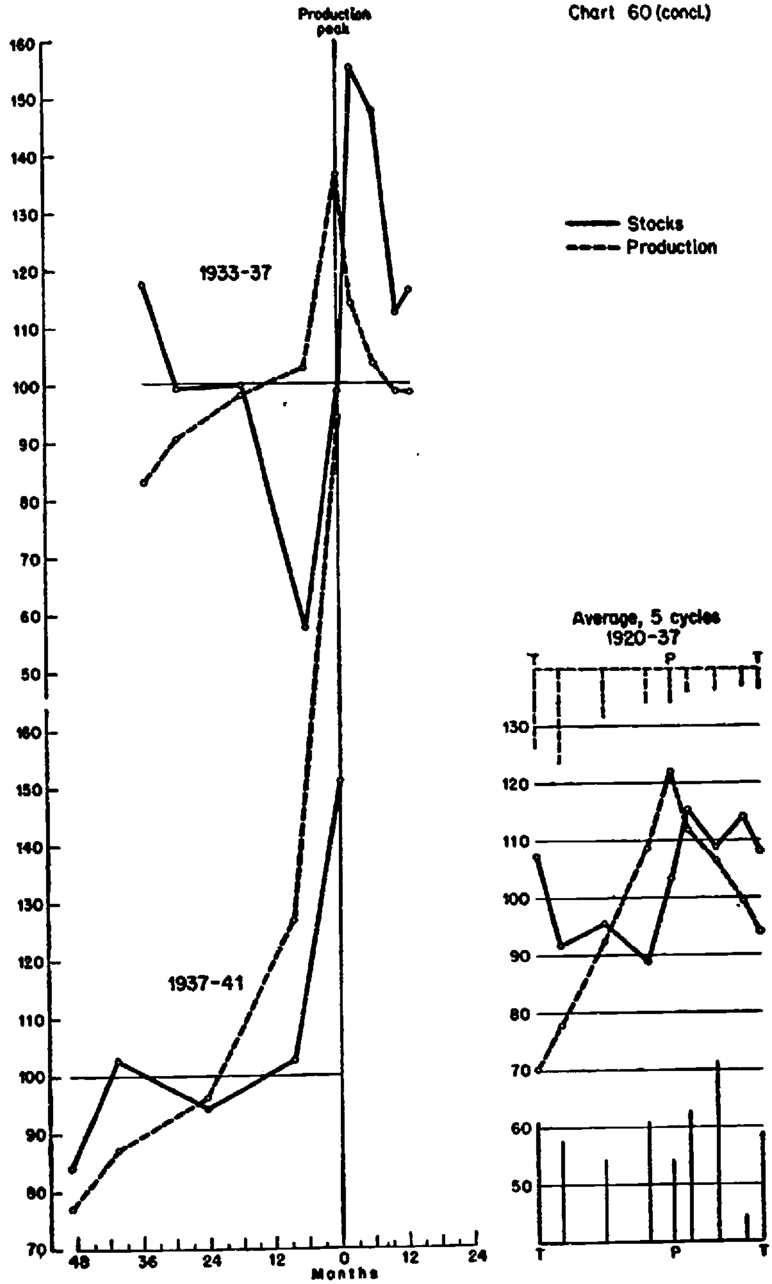
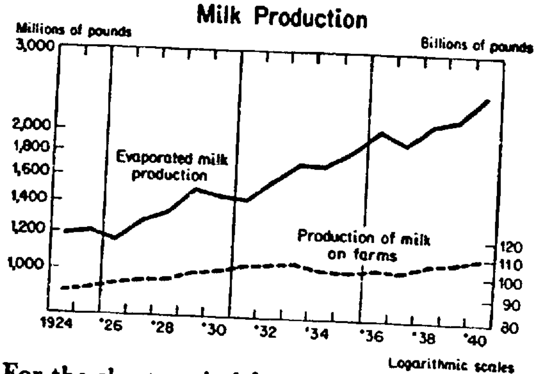


Chart 61
Milk Production



(Ch. 11). For the short period for which we have data, they appear to move irregularly during both business and output cycles (Chart 62). Conformity indexes are +100, 0, 0 for 3 business cycles 1923-38. Conformity indexes to 3 output cycles 1923-40 are +50, −100, 0. The low conformity may, of course, reflect conditions peculiar to the industry during the years for which we have data, and in the future its behavior may resemble that of other staple manufactured items whose production responds to demand. Of that, however, there is as yet no evidence.

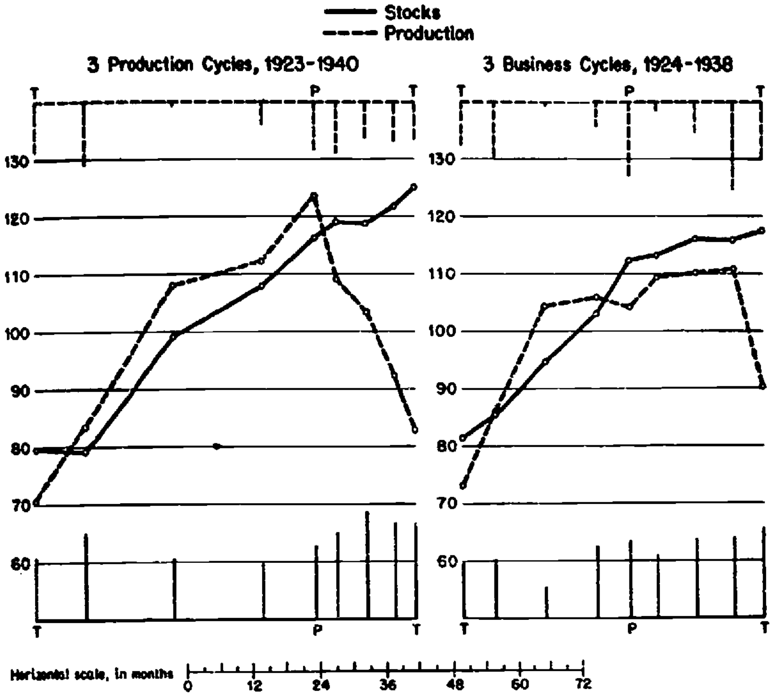
8 *A General Account*

The key to the behavior of stocks of finished goods made from nonfarm materials is, as Chapter 11 showed, the ready response of the supply of these raw materials to changes in demand. The rate of fabrication of commodities derived from them, therefore, fluctuates chiefly in response to changes in the demand for fabricated goods. The response of production is typically tardy (since production decisions are guided by demand) and, in the case of durable staples, perhaps deliberately inadequate. The result is that stocks of finished goods made for the market tend to vary inversely to shipments. Since production lags behind shipments by only a short interval, such stocks also vary inversely to production. And since demand and shipments conform to business cycles, the typical response of these inventories to business cycles is also inverse.[14]

Stocks of finished goods made from agricultural materials were studied separately because the supply of these raw materials generally does not respond in elastic fashion to short-run changes in

[14] Stocks of perishable goods are probably an exception; see Ch. 11.

Chart 62
Shortenings Stocks and Production, Average Patterns



demand. The current supply, as determined by weather and other natural causes, may, therefore, largely determine the rate of fabrication independently of the influence of the demand for the fabricated products. The effect of supply conditions on cycles in the stocks of finished goods, however, is not uniform. The conclusions to which the analysis of this chapter leads may be summarized in a series of statements.

1) If a fabricated commodity's principal raw material is agricultural, and if a current deficiency in supply cannot be supplemented by imports or drafts from stocks or a current surplus removed by accumulating stocks, then the level of fabrication is determined by the output of raw materials. Examples are cottonseed oil, lard, frozen and cured pork.[15]

2) If the finished product is perishable, it must be marketed fairly quickly at whatever price it will bring. Stocks, representing only

[15] Frozen and cured beef is not a good example since the stock of cattle is sufficiently large to allow slaughter to respond to current changes in demand.

the quantities in the course of distribution or the seasonal carry-over, will rise and fall with output. They will not be correlated with demand since supplies cannot be carried over when supply tends to outrun demand, nor will stocks be available to supplement current output when demand tends to outrun supply. Examples are lard and frozen and cured pork.

3) If the finished product is durable, (a) finished stocks again will tend to rise and fall with the production of the fabricated commodity because the latter is not correlated with demand. Stocks, however, will tend to lag behind production since an interval will usually elapse between the time production begins to increase (decline) and the time it surpasses (drops below) consumption. An example is cottonseed oil.

Stocks of finished durables (b) will tend to vary inversely to demand. For when demand is weak, a tendency for output to exceed utilization will lead to the accumulation of stocks; and when demand is strong, a tendency for utilization to exceed output can be met partly by drawing on stocks. Peaks in stocks, however, will tend to come later than troughs in the utilization of the commodity since an upturn in utilization will not immediately carry it above output. And the same can be said for the relation between troughs in stocks and peaks in utilization. The correlation between stocks and utilization will be disturbed by the irregular fluctuations in stocks caused by irregular movements in output during cycles in utilization. The strength of the correlation will, therefore, depend upon the relative amplitudes of output and utilization. If demand and utilization are positively correlated with business cycles, stocks will tend to conform inversely to business cycles with a lag. And again this pattern will be disturbed by the irregular fluctuations of output and concomitant movements in stocks. Again an example is cottonseed oil.

4) For the above relations to hold, it is neither a necessary nor a sufficient condition that the goods be fabricated from agricultural materials. (a) It is not a necessary condition because the output of a raw material may fluctuate independently of demand for reasons other than the hazards of farming. It will do so, for example, if it is a byproduct of another commodity. (b) It is not a sufficient

condition because short-run movements in the production of the fabricated commodity can be rendered independent of current raw material supply if: (i) the material can be stored economically, (ii) supplies can be supplemented from abroad, (iii) in the case of byproducts, more can be obtained at special expense.

5) If fabrication is not controlled by current domestic supply because one or more of these conditions is present, its movements tend to follow demand. The behavior of stocks of finished goods will then resemble that of goods produced from nonagricultural materials. Examples are leather, linseed oil and, less clearly, tallow.

It would, of course, be of great interest to measure accurately the stocks held by various industries that fit each case described above. This is not possible, but rough figures indicate that manufactured commodities whose rate of output is dominated by variations in the supply of raw materials are probably of minor importance (App. E, Table 106). Apart from byproducts, a very small group, the class is confined at the outset to products that are made from agricultural raw materials. These accounted for some $1,368 million worth of stocks of finished goods on December 31, 1939, or approximately 35 percent of total finished goods stocks. Of this quantity, however, some $560 million represents goods made from cotton, wool, silk, hides, and rubber which can be economically stored in crude form. The possibility of holding large quantities of such goods for long periods undoubtedly accounts for the fact that cycles in the output of commodities made from these materials are influenced principally by changes in demand, as common knowledge assures us they are. Eliminating these goods reduces the class virtually to manufactured food and tobacco products which amounted to $808 million, or 20 percent of all finished goods.

But not all of this remainder clearly meets the specifications of the class. Products made from grains can be better stored raw than in the form of flour, and better as flour than in the form of bakery products. It is uncertain how much to allow for these exceptions. Roughly, we may say that stocks of finished foods whose output cycles are governed by raw materials supply constitute perhaps 15 to 20 percent of all finished goods inventories, or 6 to 8 percent of manufacturers' total inventories.