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Chapter 5

Manufacturers' Stocks during Manufacturing Activity Cycles

In Chapter 4 we found that manufacturers' stocks, in the aggregate, tended to lag behind business by a considerable number of months—a rule that appeared to operate with impressive regularity in view of our dependence upon annual data. In this chapter we shall see whether the same behavior is characteristic of stocks during cycles of activity in the various manufacturing industries.

1 *Inventories in Current Prices during Manufacturers' Sales Cycles*

For comparison with inventories in current prices, the most appropriate indicator of manufacturing activity seems to be manufacturers' sales in the changing prices of the period. Sales of manufacturing corporations are published by calendar years in *Statistics of Income*.[1] Adjusted for sales by unincorporated firms,[2] they can be compared with Kuznets' estimates of year end inventories (Chart 9), also based on *Statistics of Income*. To supplement these annual estimates we have the NICB monthly indexes of the value of manufacturers' shipments and inventories since 1929 (Chart 10).[3]

In both charts the suggestion that conformity is positive and that inventories lag behind sales is very strong. Kuznets' series reaches a peak at the end of every year when sales reach a peak, and the same is true for troughs. In these annual series inventories move

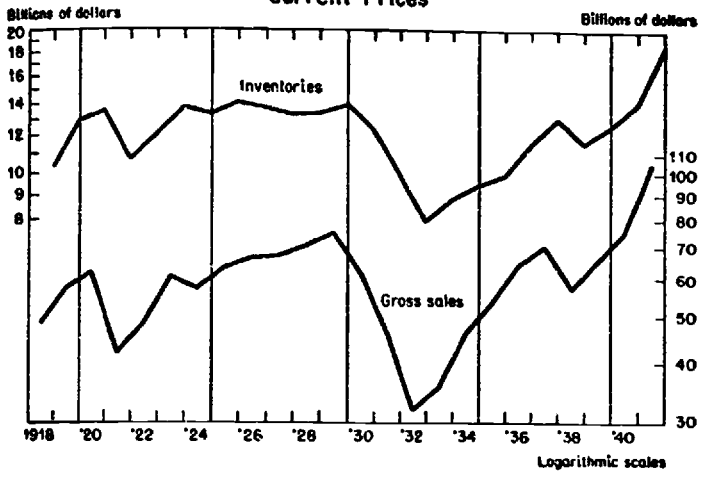
[1] Before 1922 the figures are for gross income alone. Since gross income and gross sales are very nearly the same, gross sales before 1922 could be estimated from gross income.

[2] The adjustment is made in the same way as for inventories; see App. A.

[3] The NICB indexes do not include manufacturers of food products, tobacco, liquors, petroleum, or certain lumber products; see Ch. 4, Sec. 1.

through one more cycle than sales, but this extra inventory cycle corresponds to a cycle in the rate of growth of sales and bears the same lagging relation to it as other inventory cycles do to actual cycles in the level of sales.

Chart 9
Manufacturers' Inventories and Gross Sales
Current Prices

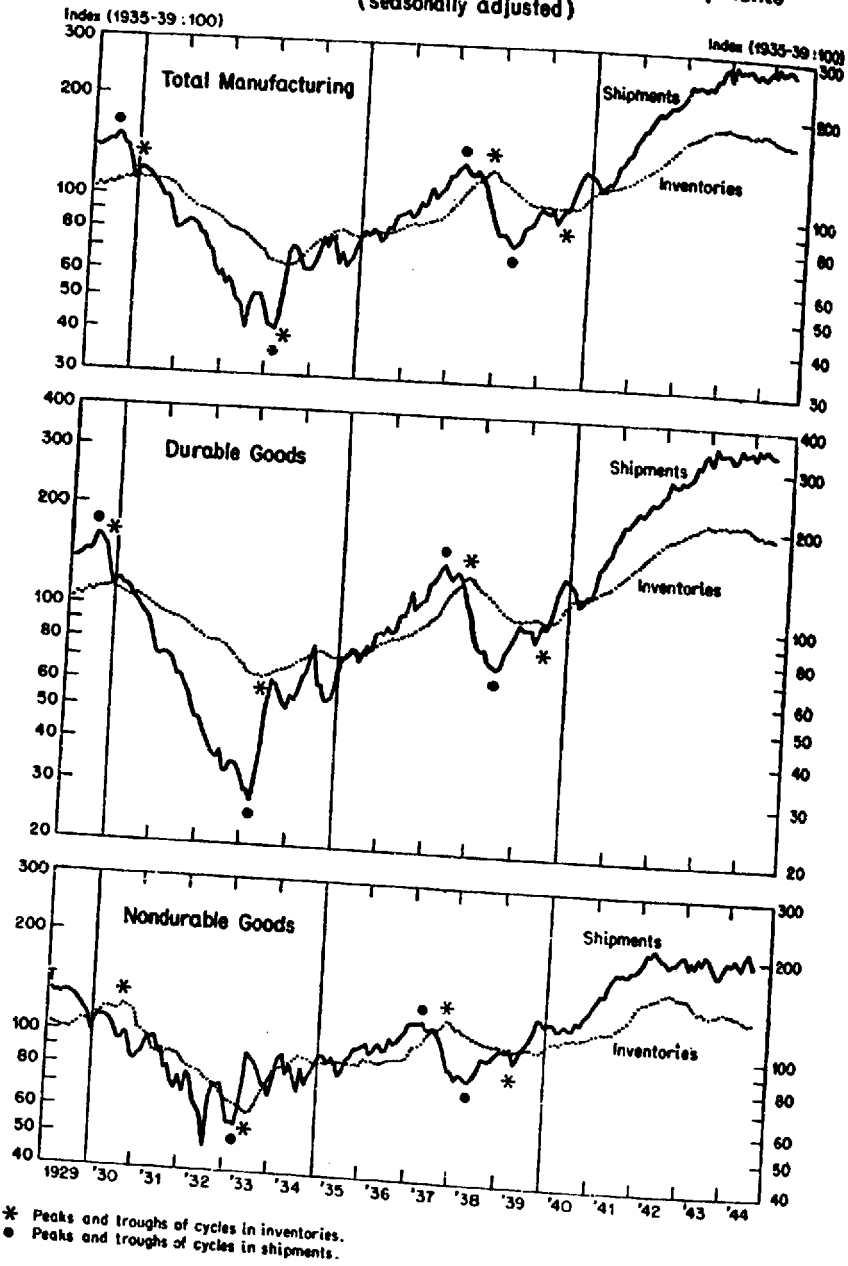


These tendencies characterize the NICB monthly indexes also. Stocks lag at the two cyclical peaks and troughs that can be identified between 1929 and the beginning of the war boom. One possible exception is the behavior of stocks in nondurable goods industries at the 1929 peak of shipments. Stocks appear to lag but they may possibly have had an earlier peak, and the value of shipments of nondurable goods may have reached a peak before 1929.[4] A more definite exception occurred at the peak of the war expansion. The peak in the value of shipments is hard to date in view of the long period of high but fluctuating shipments. Inventories, how-

[4] We place the peak of the value of shipments of nondurables tentatively in January 1929 because our estimate of the value of their output (based on the Federal Reserve index of production of nondurable manufactures and F. C. Mills' index of wholesale prices of nondurable processed goods) reaches its peak in July 1929. The product of price and output indexes constructed with different weights is, no doubt, a somewhat irrational compound. But to identify the 1929 peak in this series it was necessary to discover how the value of shipments of nondurables behaved before 1929 when the NICB index begins. This procedure affords a usable approximation.

Chart 10

National Industrial Conference Board Indexes of Value of Manufacturers' Inventories and of Shipments (seasonally adjusted)



* Peaks and troughs of cycles in inventories.
● Peaks and troughs of cycles in shipments.

Logarithmic scales

ever, apparently began to decline before shipments—which is hardly unexpected in view of the strained conditions of supply during the war.

The absence of monthly indicators of activity in current prices before 1929 makes it necessary to measure the relative timing of turns in inventories and in business activity by comparing the year end estimates of activity with calendar year estimates of sales. We assume that calendar year sales approximate the relative levels of sales on June 30. Thus if inventories reach peaks at the end of the same year as calendar year sales, we say that inventories lag 6 months behind sales. If inventories reach a peak at the end of the preceding year, we say that inventories lead sales by 6 months, and so on. In 64 comparisons Kuznets' inventory estimates lagged behind comparable estimates of manufacturers' sales at 60 turns (Table 26). This proportion is substantially larger than that found when inventory cycles were compared with monthly reference turns. Moreover, the average lag seems to have been longer. Manufacturers' total holdings lagged 6 months behind sales on the average. Indeed, according to our crude measures, they appeared to lag 6 months at every turn in sales. The comparable figure for inven-

TABLE 26

Manufacturers' Inventories, Current Prices
Timing at Turns in Sales Cycles, 1919-1938

	NO. OF TIMES INVENTORIES		AV. LEAD (−) OR LAG (+) MONTHS
	Lead	Lag	
(1)	(2)	(3)	(4)
Total manufacturing	0	8	+6.0
Food, beverages & tobacco	0	6	+6.0
Textiles & textile products	3	4	+0.9
Leather & leather products	0	5	+8.0
Rubber & related products	0	6	+8.0
Lumber & wood products	0	4	+6.0
Paper, printing & publishing	0	6	+6.0
Chemicals & allied products	1	7	+4.5
Stone, clay & glass products	0	8	+13.5
Metals & metals products	0	6	+8.0
Miscellaneous	0	8	+7.5
Sum of 10 groups	4	60	

tories at business cycle turns was only 3.8 months. The average timing of the ten industry groups also indicates longer lags than was true for comparisons with reference turns.

We cannot conclude with any confidence, however, that inventories in current prices actually do tend to lag behind sales by a longer interval than they do behind business at large, because in the comparisons of turns in sales and inventories there is a source of error that was not present when inventory turns were compared with reference dates. Then inventories alone were represented by annual data. Now sales as well as inventories are in annual form. The apparent difference in timing, on the order of two months, is not longer than might be accounted for by the inaccuracy with which annual data may measure the average timing of turns in sales.[5] No substantial difference, moreover, appears in the timing of the turns of the NICB monthly indexes of inventories when compared with reference dates and with the peaks and troughs of shipments. The average lag of the NICB index of manufacturers' total inventories behind the reference dates at four business cycle turns between 1929 and 1938 was 6.5 months. The average lag behind the turns in shipments was 7 months.[6] I conclude that while inventories in current prices tend to lag behind sales, the material now available is not sufficiently reliable to determine whether the length of the lag is about the same as that of inventories behind business at large—that is, 3-6 months—or somewhat longer.

The regularity of the behavior of inventories in current prices during cycles in sales is indicated by the conformity measures of Table 27. The measures are constructed on a plan identical with the National Bureau standard measure of conformity to business

[5] Assume that manufacturers' total sales turned in the same months as reference cycles, as they may well do, on the average. Assume further that the peaks and troughs of calendar year sales run synchronously with the calendar year reference dates, as they actually did from 1919 to 1938. If we now measure the timing of sales at reference turns from annual sales data by comparing the midpoint of the years of specific cycle turns with the monthly reference dates, sales appeared to lead at reference turns by 1.5 months on the average during 1919-38. This interval is about the same as the timing difference with which we are here concerned.

[6] Since 'sales' in this context represent the value of goods billed to purchasers it is scarcely conceivable that there is a significant difference between turns in sales and in the value of shipments.

TABLE 27

Manufacturers' Inventories, Current Prices
Conformity to Sales Cycles, 1919-1938*

	NO. OF PHASES[a]	INDEX OF CONFORMITY TO SALES[b]		
		Exp.	Contr.	Cycle
(1)	(2)	(3)	(4)	(5)
Total manufacturing	7	+100	+100	+100
Food, beverages & tobacco	7	+100	+50	+67
Textiles & textile products	7	+33	+50	+67
Leather & leather products	7	+33	+100	+100
Rubber & related products	7	+33	+100	+100
Lumber & wood products	9	+50	+20	+75
Paper, printing & publishing	5	+100	+100	+100
Chemicals & allied products	7	+100	+100	+100
Stone, clay & glass products	7	+100	+50	+67
Metals & metal products	7	+33	+50	+67
Miscellaneous	7	+100	+100	+100

* Except miscellaneous. Since an estimate of sales for 1938 comparable with earlier years was not available, the last specific cycle phase that could be identified for this group ends in 1932.

[a] That is, expansions plus contractions; see Table 21, note b.

[b] A 6-month lag of inventories behind sales is allowed for; that is, end of year inventories are predated 6 months and their changes measured during expansions and contractions in calendar year sales.

cycles except that the reference expansions and contractions with which the movements of inventories are matched are marked off by the turns in the sales of the various manufacturing groups. The lag of inventories behind sales is allowed for by treating end of year inventory figures as if they represented calendar year figures for the same year. This amounts to predating inventories 6 months, an interval suggested by the timing measures of Table 26.[7]

The behavior of inventories in current prices during cycles in sales seems highly regular. If we allow for a 6-month lag, the total and three of the groups conformed perfectly to both expansions and contractions. Inventories in two other groups conformed perfectly to full cycles in sales; that is, they consistently rose more rap-

[7] Since sales run by calendar years, inventories could be matched with sales only by predating them either 6 or 18 months, etc. Other combinations could be arranged only by the awkward device of averaging year end inventories to get calendar year estimates. Neglecting this device, it appeared that predating by 6 months agreed well with the timing shown in Table 26 in all groups except stone, clay and glass for which it might have been appropriate to assume a longer lag.

idly when sales were expanding than during neighboring contractions in sales. The lowest full cycle measure is +67, indicating positive conformity in five out of six cycles.[8] The relation between inventories and sales was evidently more regular than between inventories and business cycles.

This striking degree of association between cycles in inventories and in sales raises the question whether the connection already observed between business cycles and the value of inventories is not to be traced largely to the relation between inventories and manufacturing activity on the one hand, and to that between manufacturing activity and the congeries of economic fluctuations that make up business cycles on the other. Plausible arguments may be advanced to the effect that inventories are held primarily to support the activities of production and distribution rather than as objects of price speculation. Combined with the close and regular connection in time between the turns of business cycles and those of manufacturing output, these arguments suggest that the connection between inventories and manufacturing activity may be the key to the connection between inventories and business cycles. But even a tentative statement is better postponed until we have reviewed the relation between inventories and manufacturing activity free from the common influence of prices.

2 *Inventories in Constant Prices during Output Cycles*

The regularity with which inventories in current prices follow the movements of dollar sales is doubtless to be attributed in considerable degree to the influence of price movements on both. To discover the extent to which these relations hold when prices are stable, we examine the behavior of inventories in constant prices during cycles in manufacturers' output.[9] The inventory data are

[8] As indicated in Table 27, most industry groups could be observed during 7 cyclical phases of sales. Seven phases, that is, expansions and contractions, make up 6 full cycles measured both from trough to trough and from peak to peak.

[9] We might have compared inventories with sales, both in constant prices. To do so, however, dollar sales would have had to be corrected for changes in prices, a procedure subject to error. In addition, we would have had to rely on annual sales data before 1929. It seemed better to substitute output data for price-corrected sales data. Physical output and sales will, of course, diverge whenever stocks of finished goods change, but output and sales un-

Kuznets' year end estimates in 1929 prices. The output data are the FRB indexes of manufacturers' output combined into comparable major industry groups.[10] Miscellaneous manufacturing was omitted because a comparable index of output was unavailable.

Inventories in constant prices lag behind turns in the output of manufactured goods just as they do behind reference cycle turns (Chart 11). Except after 1929 and 1932, when the apparent lag is longer, inventories reached a peak or trough at the end of each year in which a monthly peak or trough in output occurs. Again the impression of positive conformity allowing for a lag of inventories behind output is strong. Our measures for the individual groups tend to confirm this impression, though the results are not as nearly unequivocal as in preceding comparisons.

Table 28 summarizes our timing measures. In each industry group the measures are based on comparisons between the peaks and troughs of cycles in year end inventories and those of corresponding cycles in monthly output. Again inventories held by all manufacturers and by the individual industry groups appear to

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questionably follow very similar paths. And as indicators of output, the standard Federal Reserve Board indexes of manufacturing production are available in monthly form for the entire period.

[10] The following groups were constructed:

Food, Beverages and Tobacco: FRB indexes of manufactured food products, alcoholic beverages, and tobacco products

Paper, Printing and Publishing: FRB indexes of paper and paper products and of printing and publishing

Chemicals and Allied Products: FRB indexes of chemical products and of petroleum and coal products

Metals and Metal Products: FRB indexes of iron and steel, machinery, transportation equipment, and of nonferrous metals and products

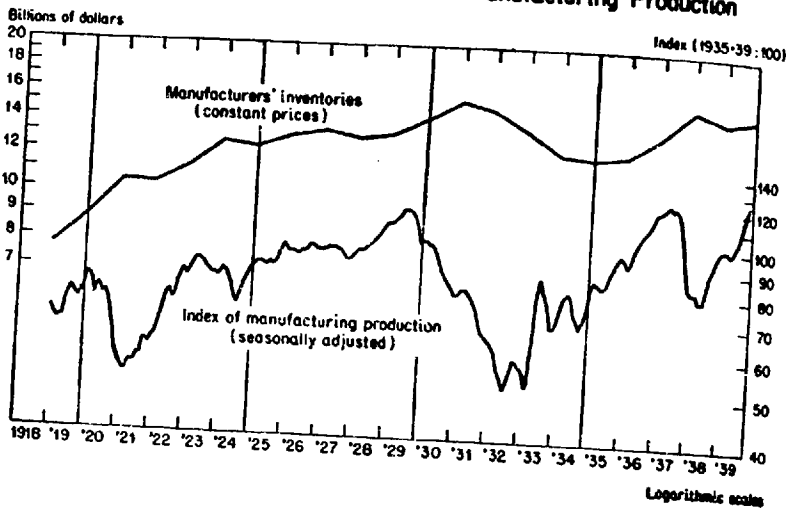
The remaining five indexes—textiles and textile products, lumber and wood products, leather and leather products, rubber and related products, and stone, clay and glass products—correspond to the inventory groups of similar title.

The indexes were combined according to the system of relative weights used in the FRB Bulletin for August 1940 and the *Federal Reserve Index of Industrial Production*, Oct. 1943. The data used here take into account the 1943 revision of the index.

For 1919-22 additional adjustments were necessary owing to the omission of several series. In these cases the level of the series representing a major group before 1923 was raised to the level of succeeding series by means of an overlap in 1923.

Chart 11

Manufacturers' Inventories, Constant Prices, and Federal Reserve Board Index of Manufacturing Production



lag behind output as they did behind reference turns. When we allow for the omission of the miscellaneous manufacturing group, the number of comparisons and the proportion that were lags are about the same as in our studies of business cycle behavior. The

TABLE 28

Manufacturers' Inventories, Constant Prices
Timing at Turns in Output Cycles, 1919-1938

(1)	NO. OF TIMES INVENTORIES Lead (2)	Lag (3)	AV. LEAD (−) OR LAG (+) MONTHS (4)
Total manufacturing	0	10	+7.8
Food, beverages & tobacco[a]	1	1	+6.0
Textiles & textile products	2	6	−4.0
Leather & leather products[a]	2	9	+8.6
Rubber & related products[a]	2	2	+2.8
Lumber & wood products	0	7	+15.1
Paper, printing & publishing[a]	0	2	+5.0
Chemicals & allied products[a]	0	3	+11.2
Stone, clay & glass products	0	8	+15.4
Metals & metal products	1	7	+7.8
Sum of 9 groups	8	45	

[a] Leads or lags longer than 24.5 months were excluded. All comparisons excluded were lags: foods, leather, paper, and chemicals, each 1; rubber, 2.

length of the lag also is about the same. Manufacturers' total inventories appeared to lag 7.8 months on the average behind manufacturing output and 8.6 months behind business cycle turns. The closeness of the figures is, of course, testimony only to the virtual coincidence of peaks and troughs in total manufacturing production and in business at large. Of somewhat greater interest is the fact that the average lags of stocks behind output in the various industry groups are also of about the same length as when stocks in constant prices were compared with business cycles. This again may not argue more than that a certain degree of common association exists among business cycles, manufacturing production, and inventories. It is consistent with the hypothesis that cycles in inventories are determined by those in output and that the connection between business cycles and inventories merely reflects the underlying link between inventories and output. As far as we have yet gone, however, our findings by themselves lend little positive support to the idea.

The indexes of the conformity of inventories in constant prices to cycles in production go little further. Table 29 is prepared on exactly the same plan as Tables 21 and 23 except that the expansions and contractions with which inventories are matched are determined by cycles in the output of the various industries rather than by the National Bureau standard reference dates. In the upper portion of the table, the measures allow for the difference in the relative timing of inventory and output cycles as revealed in Table 28. Again measurements on something other than a synchronous basis were made only if average timing was based on 7 or more comparisons. Only total manufacturing and 5 of the 9 groups met this standard. Of these, all except one, textiles, appeared to lag by a long interval—almost 9 or 12 months—and all except one, again textiles, yielded indexes that imply a fairly high degree of regularity of association between inventories and full cycles in production, allowing for the indicated lag. For 4 of the 9 groups conformity was measured on a synchronous basis since average timing was based on too few comparisons to do otherwise. Two groups, paper and chemicals, yielded zero conformity indexes to full cycles in production; two others, food and rubber, appeared to vary inversely to output.

TABLE 29

Manufacturers' Inventories, Constant Prices
Conformity to Output Cycles, 1919-1938

(1)	MEASURES FOLLOWING TIMING SUGGESTED BY TABLE 28: Lead (−) or lag (+) assumed[a] (mo.) (2)	No. of phases[b] (3)	INDEX OF CONFORMITY TO OUTPUT CYCLE: Exp. (4)	Contr. (5)	Cycle (6)
Total manufacturing	+9	9	+100	+60	+100
Food, beverages & tob.	0[c]	7	−33	−50	−67
Textiles & textile prod.	−3	14	+14	−14	+8
Leather & leather prod.	+9	10	−20	+60	+78
Rubber & related prod.	0[c]	8	0	−100	−71
Lumber & wood prod.	+12	9	0	+20	+50
Paper, printing & pub.	0[c]	5	+100	−33	0
Chemicals & allied prod.	0[c]	7	+33	−50	0
Stone, clay & glass prod.	+12	7	+100	+50	+100
Metals & metal prod.	+9	10	+100	+20	+78

	MEASURES ASSUMING A LONG LAG OF INVENTORIES BEHIND OUTPUT: Lead (−) or lag (+) assumed (mo.) (7)	No. of phases[b] (8)	INDEX OF CONFORMITY TO OUTPUT CYCLE: Exp. (9)	Contr. (10)	Cycle (11)
Total manufacturing					
Food, beverages & tob.	+12	7	+100	−50	+67
Textiles & textile prod.	+12	13	0	−14	−17
Leather & leather prod.					
Rubber & related prod.	+12	8	+100	0	+100
Lumber & wood prod.					
Paper, printing & pub.	+12	5	+100	−33	0
Chemicals & allied prod.	+12	7	+100	0	+33
Stone, clay & glass prod.					
Metals & metal prod.					

[a] From Table 28, col. 4. Results are rounded to the nearest 3-month interval.
[b] That is, the number of expansions plus contractions in the output of the industrial group with which the direction of movement of inventories is matched. The number differs from group to group because the groups do not have the same number of output cycles.
[c] Inventories are matched synchronously with output because the timing comparisons were too few to do otherwise.

The irregular or negative conformity of these last four groups is less seriously at odds with the hypothesis that inventories conform positively to business activity with a long lag than may appear at first sight. As already pointed out, positive conformity with a long lag may mean inverted behavior during a major part of many cyclical phases. And though a paucity of cyclical turns makes timing measurement difficult, these series may tend to conform positively to output with a long lag. If so, low or negative indexes

would be expected if conformity is measured on a synchronous basis.

In the lower portion of Table 29 this possibility is tested. Conformity indexes allowing for a 12-month lag were prepared for these four groups and for textiles, whose conformity was previously measured allowing for a 3-month lead of inventories over output. The results lend support to the general rule that manufacturers' inventories tend to follow production with a long lag. Of the five groups, three yield positive full cycle indexes, two of which are fairly high. The index for paper remains zero. Textiles yielded a very low negative index. Taking all nine groups together, and allowing for a long lag—either 9 or 12 months—the evidence of regular association with output is fairly impressive. The full cycle conformity indexes of seven groups are positive, and six indexes are +50 or higher (see Ch. 3, note 8). The indexes for the two remaining groups are of negligible size. As in the case of their relation with business cycles, therefore, I conclude that stocks tend to conform positively with a long lag—roughly 6-12 months—to cycles of manufacturers' output.

3 *Some Competing Hypotheses*

THE OUTPUT RATE AND MANUFACTURERS' STOCKS

Why do manufacturers' stocks conform positively to business cycles with a long lag? Primarily because of a connection between stocks and the rate of business activity? Are other factors either more significant or, at any rate, very important? If the level of manufacturing activity is a controlling factor, what is the nature of its relation to stocks?

The fact that stocks move together with output as well as with business cycles, with a long lag in both cases, does not, of course, mean that the connection between business cycles and stocks is to be traced to a connection between output and stocks. To begin with, the conformity indexes of stocks to production cycles are only moderately high. This, however, is not conclusive either way. The suggested connection would, no doubt, be more appealing if the conformity indexes were higher. But they do not differ much from those that measure the association between stocks and business cycles. Moreover, they are from annual data and, as we know,

such indexes are usually lower than those computed from monthly series.

More important is the long interval by which stocks lag behind production. An hypothesis that the level of production controls the level of stocks must explain this lag and, as we shall see, the common theory that links inventories with production does not assume a lag in inventories. If this investigation concentrates on the dependence of stocks upon manufacturing activity, as it does, it is because a plausible explanation for the lag can be found.

The obvious close correlation between production, in the aggregate, and business cycles also has an important bearing on the question. This cuts two ways. Were the correlation not close, the behavior of stocks during business cycles could scarcely be attributed to fluctuations in production. On the other hand, it might be attributable wholly or substantially to other factors associated with business cycles, and the association between production and stocks may be entirely or partly incidental.

Despite the latter possibility, we concentrate upon the connection between output and stocks. Justification for this emphasis, of course, must be sought in the study as a whole, not in the findings presented so far. Some preliminary argument in support of our position may, however, prove useful. It takes two tacks. One is to state, in broad outline, a theory that rationalizes the association between output and inventories. The second is to consider the plausibility of some alternative hypotheses to account for the cyclical behavior of stocks.

A COMMON THEORY ABOUT THE RELATION BETWEEN OUTPUT AND STOCKS

Businessmen and business observers generally think that manufacturers hold inventories primarily in order to support their current and immediately prospective rate of production and sales. A corollary is that stocks will vary more or less in proportion to output. As we have seen, this is the view Keynes adopted for his theory of working capital, which in turn he took to account for the bulk of stocks. It is implicit also in the 'acceleration principle' as applied to inventories (Ch. 1, Sec. 2).

The theory has a plausible rationale, and later chapters tend to substantiate it, at least for considerable portions of manufacturers'

total holdings. The argument rests in part on the fact that a portion of manufacturers' stocks consists of goods actually in process of fabrication. The volume of such stocks obviously depends more or less rigidly upon the rate of production. The quantity of goods in process must bear a relation to the rate of production per week or month, which is determined by the interval between the time goods are fed into production and the time they are finished and ready to be shipped. This interval, in turn, presumably depends upon the technique of production. It varies from industry to industry, but is probably fairly constant for any given industry during a business cycle. The average interval for manufacturing industries as a whole may, therefore, be assumed to be fairly constant during a business cycle allowing for changes in the commodity composition of output (see Ch. 8).

Other portions of manufacturers' stocks not generally considered to be 'in process' are nevertheless closely tied in volume to the level of activity; for example, raw materials and finished goods in transit to their purchasers; purchased materials and supplies that are being unpacked, sorted, cleaned, stored, and later issued to fabricating departments; and finished goods made to order and awaiting shipment. The propositions that are obviously true of goods undergoing fabrication can apparently be extended to various classes of stocks in stages preceding or following actual manipulation.

It is, of course, not clear *a priori* that goods in these classes make up the bulk of manufacturers' stocks. But it can be, and often is, argued that manufacturers attempt to maintain a fairly constant ratio between output or shipments and stocks even though a large part of their stocks do not consist of commodities whose volume is tied to output for technical reasons. Manufacturers are said to keep a stock of purchased materials equal to a certain number of weeks' supply at their current rate of consumption, partly to assure a smooth flow of materials into production by guarding against interruptions in deliveries, and partly to allow purchasing to proceed in an orderly fashion without immediate pressure to satisfy production requirements. Manufacturers are said to follow the same policy with respect to finished goods in order to provide a source from which delivery can be made rapidly to urgent custom-

ers. Good inventory practice is said to consist in maintaining such a relation between output or shipments and stocks as is required to support the normal functions of production and selling. Speculation is held to be a function of a specialized trader, not of a manufacturer, and descriptions of good manufacturing practice commonly call for manufacturers to hedge their inventory risks by future purchases or sales when possible and generally to manage their inventories according to the requirements of their production and selling activities.

Later chapters will suggest that this view of inventory policy contains a large element of truth for some portion of manufacturers' stocks and some element of truth for most of their holdings. But it cannot be true for all their stocks; or at least it cannot be the whole truth. If it were, inventories would fluctuate more or less synchronously with output. But they lag behind output by a considerable number of months. If, therefore, the common notion that manufacturers' stocks are held primarily to serve the convenience of the fabrication and distribution functions is to be retained, the pronounced lag of stocks must be explained. The solution is twofold. Many commodities are supplied under conditions that make it difficult for purchasers to alter promptly the rate at which they receive goods. Goods that must be brought from foreign countries over long distances or are bought on long term contract are extreme examples. But most materials destined for fabrication are purchased some time before delivery and it is difficult for manufacturers to forecast exactly, even 30 days in advance, the rate at which they will consume raw materials. Such difficulties account for part of the lag. One considerable category of manufacturers' stocks—finished staples—appears to vary inversely to the rate of output, at least in cyclical phases of short and medium length.[11] The reasons are somewhat obscure: poor forecasting perhaps or, more plausibly, a reluctance on the part of manufacturers to curtail operations until they are certain that business is falling off and a continuing reluctance even then to curtail operations as fully as would be required to prevent the accumulation of stocks and, still more, to liquidate them. When the commodities are

[11] They tend to reverse their direction of movement and to move together with output toward the end of long phases.

staples, such policies may be persisted in for many months. The lag of inventories behind output can be explained by a combination of the two factors: inability to control promptly the rate at which purchased goods are received and, in the case of staple goods, reluctance to curtail operations promptly and sufficiently.

All this, however, anticipates the argument and the evidence of later chapters. Even if strong evidence for this view is finally adduced, it will hardly be conclusive until it has been tested to reveal the influence of other factors and simultaneous measurement of their relative importance is attempted. Such simultaneous measurement is not possible, as indicated below, because of the inadequacy of the data now available. But it is useful to glance at some alternative theories to see whether any are plausible rivals for the post of working hypothesis. We consider two factors as alternatives to the rate of manufacturing activity: variations in interest rates for their bearing on the cost of carrying stocks and price speculation for its bearing on the expected return from holding inventories.

INTEREST CHARGES AND STOCKS

Though Hawtrey stressed interest charges as a factor influencing businessmen's desire to hold commodity stocks, he argued that they would be less likely to affect the calculations of manufacturers than of wholesalers. Interest charges can account for only a tiny fraction of the spread between the prices charged by manufacturers for their products and the cost of their raw materials. To wholesale merchants whose markup is small and who operate more largely on borrowed funds, the cost of credit is perhaps a bigger item. In any case, the tendency to minimize its importance to manufacturers seems justified. It may be worth while to consider the matter more closely.

Without passing judgment on their relative importance, a manufacturer's chief positive incentives to hold stocks may be said to be his desire to sustain or increase output and sales and to profit by successful price speculation. To maintain an output and rate of sales of $1,000 per month at sales prices, for example, a manufacturer may have to hold stocks of the same value for, say, three months. (The average turnover period for manufacturers between the wars was from two and one-half to three months.)

At an interest rate of 6 percent per annum—a fairly high rate for customers' loans during the 'twenties and 'thirties—the interest charge for a 3-month loan of $1,000 would be $15 or 1.5 percent. This assumes that extra business is typically financed by borrowed money—a common but not predominant practice. Since the earnings of his own funds, if not invested in his business, would probably net a manufacturer less than 6 per cent per annum, we may take 1.5 percent for three months to be the maximum interest cost required to carry stocks. The range of variation in the interest cost of customers' loans between the peaks and troughs of business cycles is perhaps 20 percent of the peak rate. The interest charge for 3-month loans, therefore, might vary between 1.2 percent at the trough and 1.5 percent at the peak, a difference altogether too small to affect a manufacturer's calculations about the profitability of carrying the additional stock necessary to do extra business.

The conclusion is similar when we consider the relation between interest charges and speculative incentives to hold stocks. In this instance we must compare the interest charge for, say, a month with the expected rate of price increase that stimulates speculative purchasing. An interest rate of 6 percent per annum is only 0.5 percent per month. The difference between a low and a high interest rate is the difference between, say, 0.4 and 0.5 percent per month. It is quite inconceivable that the monthly rate of change in prices that might stimulate speculation could be of the same order of magnitude. It seems highly unlikely, therefore, that the influence of interest rate charges could be detected in inventory records.[12]

The negligible influence of interest rates upon inventory policy was substantiated by the well known inquiry by J. E. Meade and P. W. S. Andrews (Summary of Replies to Questions on Effects of Interest Rates, *Oxford Economic Papers*, Oct. 1938). None of the managers interviewed said that the cost of borrowed funds affected his calculations about the volume of stocks he should hold.

[12] These arguments do not, of course, touch the more substantial point that banks may follow a more liberal loan policy in prosperity than in depression. But there is still no way to measure the influence of such changes in loan policy.

PRICE SPECULATION AND STOCKS

The influence of price speculation upon stocks stands on a quite different footing. Obviously prices often fluctuate so violently as to stimulate speculative investment in commodities. And whatever the common opinion about good practice, there can be little doubt that some manufacturers do on occasion attempt to anticipate price rises or declines by modifying their inventory policy. The ultimate problem, therefore, is to measure the specific influences of both price speculation and the rate of manufacturing activity. Unfortunately, the statistical materials at hand are not rich enough for this purpose. Preliminary consideration, however, may help to explain our neglect of price speculation in favor of the connection between output and stocks.

First, the incentives to price speculation do not have any single, clear, objective index. The most obvious indicator of the strength of the speculative motive is the rate of change in prices. The rationale of this index is that a rapid rise causes businessmen to assume a continuation of the rise, and that the rapidity of the expected rise will be proportional to the rapidity of the rise just experienced. The stocks businessmen will consider it profitable to hold would, on this argument, be expected to vary with the rate of rise in prices, with a short lag.[13]

In this simple form, the theory is not in accord with experience. Prices rise most rapidly at the beginning of expansions and reach a second maximum near the peak of business.[14] They usually fall most rapidly in the second quarter of a contraction. Manufacturers' aggregate stocks, on the contrary, approach their lowest point at the beginning of expansion and do not reach their maximum until the second quarter of contraction, just when prices are falling most rapidly.

There is, evidently, no obvious regular connection between

[13] If a businessman was absolutely sure that prices were going to rise at a rate rapid enough to cover the cost of carrying stock plus a profit, there would, of course, be no limit to the inventory he would desire to hold. The uncertainty that attaches to any forecast, however, limits the speculative investment an individual will make in any given circumstance.

[14] These observations are based on a study of the BLS index of wholesale prices, 1890-1938. The rate of change in prices during the various stages of business cycles were calculated according to the National Bureau procedure explained in Chapter 3.

stocks and the rate of change in prices. Nor is the case improved if we allow for the rate of manufacturing activity. As we shall see in Chapter 6, the ratio of inventories to sales or to output reaches its maximum at or near the end of contractions when prices are low and falling. At the beginning of expansion, just when prices are rising most rapidly, the inventory-sales ratio begins to decline, and continues to fall throughout the expansion, although prices rise slowly in the middle of expansion and more rapidly toward its close. Throughout contractions, prices fall first with increasing rapidity, then with declining rapidity; the inventory-sales ratio, however, rises throughout.

These observations suggest that price speculation is not a regular influence of great importance. But they do not settle the issue. A number of other possibilities deserve consideration.

1) Strong as the speculative motive may be when prices are rising rapidly, the attempt to accumulate stocks may not leave its mark on the statistical series now available—for two reasons. The effect of speculation may be concealed in the estimates of manufacturers' total stocks such as have been reviewed in this and preceding chapters because speculative accumulation presumably centers in stocks of purchased materials and supplies. Finished goods, that is, goods ready for sale, will be affected less, if at all, since there will be an incentive to accumulate them for speculative purposes only when the costs of fabrication, principally wage rates, are charging rapidly or when the finished product is more easily stored than the raw material. More important is the fact that a period of speculation is likely to be a period of rapidly rising production, sales, and employment consequent upon the increased orders placed with the object of anticipating a price rise.[15] As we shall see in Chapter 11, stocks of staple finished goods tend to move inversely to sales and output, perhaps offsetting any speculative accumulation of purchased materials. Unfortunately, the few examples of series representing manufacturers' holdings of purchased goods are not of a kind that might reveal the effect of speculative movements in such goods taken separately (see Ch. 9 and 10).[16]

[15] This is the course of events when expectations are bullish. When expectations are bearish, production and sales naturally tend to fall.

[16] Some of the commodities, such as crude rubber, raw sugar, and lead come from distant parts and another, newsprint at publishers, is bought on long

Even if we had adequate records on stocks of purchased materials, the effects of speculation might not be evident because manufacturers may not take sufficient account of the effect of their speculative orders upon output and employment and thus upon the demand for their products. Unless, therefore, selling prices are raised sufficiently to discourage purchasers, larger production may consume stocks of raw materials about as rapidly as they are replenished.

2) Some other stimulant to price speculation may be regularly connected with business cycles. In particular, the strength of the speculative incentive may depend less upon the rate of change in prices than upon the interval during which a rise persists. A sustained rise may give manufacturers more confidence in its continuation than a shorter period of rapidly vaulting prices. Since prices tend to rise more or less steadily from about the beginning to about the end of a business cycle, the incentive to speculation might be expected to be at a maximum at cyclical peaks. Unfortunately, from the standpoint of causal analysis, production too is ordinarily at a maximum at cyclical peaks. Thus the influence exercised by output and sales would merge with that exercised by speculative considerations.

The most obvious way to try to disentangle the influence of the two factors is to study the behavior of inventory-sales or inventory-output ratios during business cycles. The division of inventories by a comparable measure of manufacturing activity may be presumed to neutralize the influence of output and sales, and the behavior of the ratio should then reveal the influence of factors other than out-

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term contract. These conditions preclude a prompt response of manufacturers' holdings to expected price rises. Iron ore at furnaces moves freely in response to the demand of the fabricators only during summer months. But more important, the integration of the pig iron and ore producing industries reduces the incentive of firms making pig iron to profit by speculation in iron ore.

Raw cotton, silk, and hides are situated differently. Mills can replenish their supplies easily from domestic dealers, but there is no assurance that mill stocks, which are only a portion of aggregate stocks, represent manufacturers' total holdings. They certainly do not represent the long position since mills commonly hedge their position by future sales. Almost all cottonseed stocks are held by oil mills, but the size of the cotton crop is the chief determinant of the amount.

put, of which speculation may be the strongest. As already mentioned, the ratio, computed for total inventories and sales, moves counter to the direction required by the hypothesis that the speculative incentive to inventory accumulation varies directly with the duration of a price rise.[17]

This simple test, we have noted, is rendered partly inconclusive by the fact that total inventories reflect the movements of both purchased materials and staple finished goods which are likely to offset one another to some extent during periods of rising or falling output such as characterize speculative episodes. And again the sample of stocks of purchased materials for which we have data is not such as to reveal effects of price speculation.

3) Manufacturers may not customarily speculate on commodity prices but inventory policy is undoubtedly influenced upon occasion by speculation for reasons not regularly connected with prosperity or depression. A speculative episode of this type was engendered by the devaluation of the dollar and the promulgation of NRA codes in the spring and summer of 1933. Another example is the wave stimulated by the scarcity of goods after both world wars. Although such episodes are not a regular part of business cycles, they deserve study in their own right.[18]

The foregoing considerations are inconclusive. They establish a strong presumption that variations in interest rates do not influence inventory movements greatly and they indicate that price speculation is not such an important feature of manufacturers' actions during business cycles as to leave its stamp clearly on aggregate inventories. But the matter is far from settled. Indeed, as we

[17] This assumes that price cycles conform closely to business cycles without appreciable lead or lag—an assumption consistent with experience.

[18] For what it is worth, it is interesting to notice that in the two violent speculative episodes covered by our data, 1919-21 and mid-1933, ratios of manufacturers' aggregate inventories to aggregate sales do not indicate that inventories were especially high relative to manufacturing activity (see Ch. 6, Sec. 2). The evidence, however, may misrepresent the facts, because accumulation of purchased materials is offset by liquidation of finished goods. Inventory-sales ratios for department stores clearly reflect the effects of speculation at least in the 1919-20 episode. Department stores, however, may be better able than manufacturers generally to adjust the rate at which they purchase and receive goods to the demands of a speculative inventory policy.

saw, there are reasons for thinking that the kind of evidence this study can bring to bear cannot be sufficient to settle it.

With this in mind, we proceed on the tentative assumptions that price speculation is not a major factor regularly affecting variations in manufacturers' inventories during business cycles, that it may be neglected in seeking a first approximation to an explanation of inventory movements, and that it will be illuminating to concentrate attention on the relations between stocks and production or sales. The validity of this procedure is not, of course, founded solely on the facts and arguments so far considered. It is based upon a review of all the materials available. Its soundness, therefore, can be better judged at the end of this book. But though support for this view will then be stronger, it will not be conclusive. Nor can a definite conclusion be reached until the data are sufficiently improved in detail and frequency so that something like a separate measure of the specific effects of manufacturing activity and price speculation becomes feasible.