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INFLUENCE OF INVENTORY INVESTMENT ON BUSINESS CYCLES*

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This paper treats two major aspects of fluctuations in inventory invest-
ment: (1) their size, expressed as a percentage of the cyclical changes in
gross national product (which we may refer to as the 'share' of inventory
investment in fluctuations of gross national product); and (2) the timing
of the peaks and troughs of inventory investment cycles compared, first,
with those in business cycles and, secondly, with those in the rate of change
in output.

I

A study of comprehensive data on inventory investment for 1919-38 easily
establishes the obtrusive fact that the share of inventory investment in the
5 business cycles identified by the National Bureau is large. If we depend
on average measures, the indicated share was 23 per cent for expansions,
47 per cent for contractions, and 32 per cent for full business cycles.[1] This
last figure may be compared with analogous measures for other important
categories: the average share of consumer durable goods in full cycles was
15 per cent; of producer durable goods, 19 per cent; and of construction,
8 per cent.

The data strongly suggest also that the share of inventory investment
varies inversely with the duration of expansion or contraction. If we omit
two short recessions in the mid-'twenties, when annual gross national
product did not decline (though inventory investment did), and classify
the remaining phases of expansion and contraction by duration, the aver-

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[1] These calculations are based on data in constant prices. But the figures in current
values do not differ significantly. To the writer's knowledge, Simon Kuznets, in addi-
tion to providing the necessary basic data, was the first to make calculations of this
sort and to establish the large share of inventory investment in the cyclical changes
of gross national product. See his Commodity Flow and Capital Formation in the
Recent Recovery and Decline, 1932-1938, NBER, *Bulletin 74,* June 25, 1939.

age share of inventory investment in the cyclical changes of GNP was 60 per cent for phases of 9-12 months; 36 per cent for phases of 18-27 months; and 19 per cent for phases of 45-50 months. If we treat the period 1921-29 as a single long expansion, only 7 per cent of the increase in GNP between the beginning and end of the period took the form of an increase in the level of inventory accumulation.[2]

An explanation of the cyclical share of inventory investment depends in part on its timing. So far as can be judged from annual data, the only comprehensive measures available for a suitable period, inventory investment appears typically to reach its peaks and troughs at about the same time as gross national product or business at large, as indicated by National Bureau reference dates. The behavior of the data does not preclude the possibility that there is a real tendency for inventory investment to lead or lag behind the turning points of business cycles, but if such tendencies exist, the typical leads or lags are probably not longer than 3 or 4 months.[3] This finding is, of course, consistent with the conclusion of other parts of the writer's work that the peaks and troughs of inventories themselves, when measured in constant prices, tend to lag behind the turning points of business cycles by 6-12 months.

The timing of the turning points of inventory investment at the turning points of business cycles has implications for another important timing relation — that between inventory investment and the rate of change in output. On this point special caution is indicated because monthly or quarterly measures of aggregate output are less satisfactory than annual data; moreover, the month to month or quarter to quarter changes form a choppy series, and trends often reverse themselves in the course of a cyclical expansion or contraction. On the basis of several output indicators,[4] it appears, however, that the following statement is justified: the rate of

[2] These figures apply to total stocks excluding stocks held by farmers.

[3] Experience with time series indicates that if a monthly series typically leads (or lags behind) the reference turns of business by more than 3 months, the same series in annual form will reach its cyclical turning points in the year before (or after) the reference turns of business a larger fraction of the time than has been true of inventory investment.

[4] Month to month or quarter to quarter changes in the following series were studied for 1918-38: Barger's estimates of national income and national outlay, both in current prices; bank clearings outside New York City; the Federal Reserve Board index of industrial production. A more detailed study was made of rates of change in manufacturing output. This was based on the Federal Reserve Board index of manufacturing production, the New York Federal Reserve Bank and Leong's indexes of output of manufactured goods classified by durability, the industry group components of the Reserve Board index, and data for 57 individual industries and commodities.

growth in output during expansions typically reaches a peak early in the phase, then declines. It sometimes picks up again later in the phase and sometimes does not. Similar statements may be made about the rate of decline in output during contractions. If we treat the turning points of inventory investment as coincident with those in business cycles, we may safely say that they usually occur many months after the dates when the rate of change in output first exhibits a marked decline. In this special sense we may speak of a long lag of inventory investment behind the rate of change in output.

<div align="center">II</div>

To what are these behavior characteristics of inventory investment due and what is their significance? So far as concerns the proportion of the cyclical changes in GNP that takes the form of a change in the volume of inventory investment, a unified hypothesis may be advanced to explain both aspects of the observations already described: the large share that inventory investment has in business cycles and the tendency for that share to vary inversely with the duration of expansions or contractions. The essential points in an explanation may be suggested by a very simple, in many ways unrealistic, but nevertheless revealing model.

We may start from the solid ground that, allowing for a lag, the chief determinant of the level of inventories is the level of output. As a first approximation, we may give this precision by stating — less realistically — that business men try to keep their inventory-output or inventory-sales ratios constant. This, in turn, means that the absolute level of inventory investment during a peak year in business will bear the same relation to the absolute growth in output during a single year as inventories bear to gross national product. Roughly speaking, the ratio for nonfarm stocks during the interwar period was 35 per cent. The change in the volume of inventory investment between trough and peak is, of course, the difference between the volume of liquidation at the end of contraction and the volume of accumulation at the end of expansion. If there is no regular difference between the size of the changes in output during contraction and expansion, but only a difference in sign, the associated change in inventory investment during a phase would typically be twice the volume of accumulation at the peak. Thus the ratio of the change in investment between the beginning and end of a phase to a single year's change in gross national product would tend to be about twice the ratio of inventories to aggregate output; that is, about 70 per cent.

This figure, however, relates the change in inventory investment to the growth of gross national product in a single year. Other things being equal, the total change in output during an expansion or contraction will be

greater the longer the phase. Thus the share of inventory investment in the cyclical changes of gross national product will tend to vary in inverse proportion to the duration of the phase. This highly simplified model suggests that the share of inventory investment in the cyclical changes of gross national product may be expected to approximate the fraction $\frac{2t}{a}$, where t is the ratio of inventories to aggregate annual output and a is the duration of an expansion or contraction in years. Thus in relatively short phases we should expect the share of investment to be high; in long phases, low. The typical expansions and contractions of business have, in fact, been short. The average expansion between the two wars was 2.1 years and the average contraction, 1.75 years. This suggests that the average share of inventory investment change in expansions should have been 33 per cent; the actual average share was 20 per cent. The theoretical average share for contractions was 40 per cent; the actual average share, 43 per cent. Considering the simplicity of the theory, this seems to be suggestively close agreement, and comparisons of theoretical and actual values for phases of different length are also reassuringly close. The theory, however, is unrealistically simple and obviously needs qualification at many points.[5] Nevertheless it seems justifiable to say that the typical share of inventory investment in production cycles is large partly because the volume of inventories held in our economy is large compared with aggregate output, partly because the level of inventories is adjusted fairly promptly to changes in the level of output, and partly because the typical business cycle has been short.

These observations deserve comment also in connection with the hypothesis put forward by Professor Hansen and others that business is subject to a dual or multi-cyclical influence; in particular that major upswings developing under the stimulus of an upsurge of investment in durable capital and construction are regularly interrupted by minor recessions attributable to fluctuations in inventory investment.[6] The considerations advanced above support these views in certain important respects. They make it clear — if it was not already clear — that upswings of business lasting, say, 4 years or more cannot be based in any important degree on a rise in inventory investment. For unless output rises at an ever increasing rate, we may expect the rise of inventory investment to level off after 2 or 3 years even if we allow for the lag of inventories behind output. Further increases in output must be based largely on other categories of expenditure. Conversely, short expansions and recessions would be much milder than those we have experienced were it not that they are aggravated by inventory accumulation and liquidation.

[5] See *Inventories and Business Cycles,* Chapter 21.

[6] A. H. Hansen, *Fiscal Policy and Business Cycles* (Norton, 1941), Chapter 1.

This, however, is not to say that minor recessions and revivals are typi-
cally initiated by changes in inventory accumulation. The hypothesis
advanced above to explain the importance of inventory investment in short
cycles is consistent with the view that minor downturns and upturns are
typically precipitated by changes in other categories of expenditure. Opin-
ion on this question must rest indirectly on evidence concerning the devel-
opment of inventory surpluses or deficiencies and more directly on the
precise timing of the peaks and troughs in inventory accumulation. On
neither point is present evidence conclusive. Such data as we have about
inventory-output and inventory-sales ratios lend little support to the view
that stocks are unduly large just before the peak of business or in need
of replenishment just before revival. The data, however, leave much to be
desired; and their interpretation is difficult in the absence of information
about the stocks business actually wishes to maintain in prosperity and
depression. As to the actual timing of inventory investment, there is no
evidence of a tendency to lead the turns in output and income. But in view
of the importance of inventory investment for movements in output and
income payments, it is unlikely that an observed lead would be long, and
almost certain that it would be too short to be reliably detected by the
annual data on which we must now rely. Such data are, moreover, likely
to be biased against a lead by reason of the involuntary accumulation that
takes place immediately after a business downturn and of the involuntary
liquidation that occurs after a revival. When reliable monthly or quarterly
data become available for peacetime cycles, they may yet reveal the lead
that Hansen's theory seems to demand. The way still seems open, there-
fore, for the view that minor cycles are, in fact, precipitated by inven-
tory fluctuations. But until we have further evidence, we must suspend
judgment.

III

The following paragraphs present a summary explanation of the timing
of inventory cycles and a brief statement about its significance for the
character of business cycles. As already noted, the studies on which this
paper are based lead to the conclusion that inventory investment reaches
its cyclical turning points on about the same dates as the National Bureau
assigns to the peaks and troughs of business cycles. Measures of month to
month or quarter to quarter changes in output indicate that significant
declines in the rate of growth of output occur much earlier in expansions,
and the same is true of the rate of decline of output in contractions. Appar-
ently, therefore, inventory investment typically lags behind the rate of
change in output.

This lag seems due to a combination of three factors: imperfect fore-
casting with respect to the course of business; obstacles to a rapid altera-

tion in production or in the volume of goods being received from suppliers; deliberate management of stocks with a view to reducing fluctuations in output. This hypothesis is based mainly on an investigation of manufacturers' stocks, but there is reason to think that much of it is applicable to wholesaling and retailing.

First, as to imperfect forecasting. When a cyclical decline in demand begins, business men generally appear to be caught unawares, and the first result is an involuntary accumulation of goods. When firms are convinced that the decline is more than temporary, they attempt to liquidate stocks. The vigor with which this attempt is pressed varies with the character of the commodity, presumably being greatest for perishables and weakest for durable staples. The relative safety with which some kinds of goods can be carried may prevent some firms from making large reductions in orders for some time. But even if orders and production are promptly reduced, the effect on stocks of any given reduction is bound to be partly dissipated by the fact that incomes and consumption will themselves fall as a result of the planned drop in production.

The second general cause of the lag is the fact that when business men reduce orders and input, various obstacles prevent inventories from feeling the effects of the reduction at once. So far as purchased materials are concerned, smaller orders will not reduce receipts of goods until after an interval sufficient to cover the production period of suppliers and the time involved in transportation. In most cases, these intervals are short, but in some they are protracted. (The possibility of cancellation, of course, mitigates the severity of this condition, but may only impose the burden of the unwanted stocks on supplying firms.) So far as finished goods are concerned, reduced input cannot register as reduced output until after a production period, which again is typically short, but is sometimes considerable.

Not all producers, however, wish to reduce stocks as soon as demand falls off. This is the third cause of the lag. Manufacturers, for obvious reasons, seek to cushion their operations as much as they can from the effects of irregularities in sales. If the goods they make are durable and staple, they can and do accept steady accretions to their inventories in the face of falling demand, for periods as long as 2 or 3 years. Of course, such accumulations become more risky the larger they become relative to sales. The rate of accumulation tends to fall after a point and if a contraction lasts long enough, liquidation begins.

These factors in combination prevent stocks from falling as fast as output in the early stages of contraction; but conversely, when the rate of output decline begins to fall off, inventory liquidation becomes more rapid than ever — exhibiting the delayed effects of earlier attempts to reduce

stocks and the beginning of deliberate liquidation by those whose accumulations have become intolerably large. An analogous story may be told about expansions.

Were it not for the lag of inventories, an upturn or downturn in output would be aggravated by a larger concomitant change in inventory investment than in fact takes place. The speed of expansion and contraction is, therefore, reduced by the lag of stocks. When the rate of output growth begins to fall, this mere retardation in growth would tend to be transformed into an actual decline if inventory accumulation fell simultaneously. The continued rise of inventory investment, however, tends to sustain the expansion after its pace has begun to slacken. And the same with contractions. Thus, the delayed reaction of inventory investment tends to retard the pace and increase the duration of business cycles.

COMMENT

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Fluctuations in inventory investment play an important role in almost all theories of business cycles, particularly in theories of the so-called 'short' cycle. But in spite of the importance attributed to inventories by many economists, inventory statistics for the American economy as a whole have become available only in comparatively recent times; and, unfortunately, they remain among the least reliable of our over-all statistics. In view of the forbidding problems certain to arise in the interpretation of the data, it is not surprising that Abramovitz' admirable study of the cyclical behavior of manufacturers' inventories is one of the first empirical investigations, on a comprehensive scale, of the interrelations among the different phases of business cycles and the rate of investment or disinvestment in inventories.[1] Not only is Abramovitz' work one of the first of such investigations; it will probably become, in addition, the definitive study on manufacturers' inventories during the interwar period. For it is unlikely that any significant improvements will be made in our information concerning inventories during this period, and the skill with which Abramovitz has

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[1] Abramovitz points out in his *Inventories and Business Cycles,* Chapter 1, that some of his results were anticipated by Ralph H. Blodgett in *Cyclical Fluctuations in Commodity Stocks* (University of Pennsylvania Press, 1935). Blodgett, however, covered a shorter period and employed less comprehensive data.

interpreted the data makes one suspect that very little will be gained from further studies employing the same data.

The completion of Abramovitz' important book thus provides an opportune occasion to ask what light the empirical evidence throws upon prevailing theories of the business cycle. Do the results refute or confirm these theories? Is the so-called 'short' cycle primarily an inventory cycle, as some economists, including myself, have suspected, or is it the result of other forces? To put the matter another way, we may ask, first, what sort of relations we should expect to find between inventories and the rate of output in a typical inventory cycle, and second, whether these relations are actually apparent in the impressive evidence Abramovitz has assembled. I do not pretend that I can answer these questions completely in the few remarks I shall make. All I hope to do is to indicate a few of the points at which Abramovitz' results are pertinent to prevailing ideas concerning the role of inventories in the business cycle.

Investment or disinvestment in inventories is related to the business cycle in two fundamentally different ways. In the first place, business men sometimes deliberately plan to increase or decrease inventories in anticipation of rising or falling prices. Fluctuations of this sort are essentially speculative, and the rising and falling output that results from such deliberate attempts to alter inventories will accordingly be called a speculative cycle. Secondly, the leads and lags of the circular flow of income are such that the mere attempt of business men to maintain a normal relation between inventories and sales will usually lead to cyclical variation; i.e., the cycle is inherent in the structure of the system. If the inventory fluctuations are of this second type, the resulting cycle will be called a 'structural cycle' to distinguish it from the speculative cycles. In the structural cycle, variations of inventories represent a passive adaptation of the system to economic disturbances arising elsewhere, whereas in the speculative cycle the variations of inventories are the active cause of the cycle.

It is my view that most of the short cycles of the interwar period were structural cycles in which inventory fluctuations played a passive role. Although the inventory movements were probably not the initiating cause of these short cycles, it is nevertheless true that the upward and downward movements of output and employment were related in a unique way to the variations in inventories. I believe, in other words, that the inventory movements largely explain the cyclical appearance of the short upswings and downswings of economic activity that characterized the interwar economic history of the United States. I do not have time, in these remarks, to give the reasons in detail for my belief that the short cycles of the interwar period were structural rather than speculative cycles. The evidence on this score, for what it is worth, will be presented in a subsequent paper. In

what follows, I intend simply to summarize briefly the principal features of a structural inventory cycle, and to ask whether the movements of inventories to be expected in such a cycle are consistent with the statistical evidence Abramovitz has compiled.

Structural inventory cycles are basically a result of the fact that output tends to lag behind changes in demand. The lag may occur at any stage of the production and marketing processes. It may be attributable to the fact that retailers and wholesalers do not quickly adjust their new orders to fluctuations in their sales or to the fact that manufacturers cannot immediately increase or decrease output in response to rising and falling sales to wholesalers and retailers. Or the lag may occur even further back in the process of production and sale, in the production of raw materials. But regardless of where the lag occurs, it can be shown that its presence at some stage of output and sales is likely to bring about a cyclical movement of total output. In describing the resulting cycle, I shall not attempt to specify the exact location of the lag between output and final sales. For present purposes I shall simply assume that at some point in the process, or perhaps at several points, output tends to lag behind sales.

Consider, now, a hypothetical situation in which an initial balance has been achieved between total output and the demand for this output. Suppose that inventories at each stage of the process are at a level business men regard as normal in relation to the level of output so that none of the current demand consists of a demand for additional inventories. As long as demand is sustained at the existing rate, output will tend to remain constant from one month to another; and as long as output is constant, income earned in production will also be constant. But what happens if over-all demand is increased?

In the usual case output will not immediately be adjusted to meet the increased demand. This means that, for a time, total inventories will decline, and inventories will thus become abnormally low in relation to sales. Eventually, however, the level of output will be increased for two purposes: Part of the increase will be intended to meet the higher volume of sales and part will be intended to build up the depleted inventories. As output is increased, however, income earned in production will also be increased, and the demand for the goods produced will accordingly rise. Inventories will remain abnormally low in spite of attempts to increase them. A cumulative upward movement of output is thus set in motion as producers and traders attempt to bring their inventories up to a normal level in relation to sales. Each attempt is to some extent self-defeating, since the rise in output leads to a rise in demand. Unless the system is completely unstable, however, a point will eventually be reached at which inventories begin to catch up with sales; i.e., the increase in demand will

be smaller than the increase in output, and inventories will begin to accumulate.

When inventories finally reach a level that is regarded as normal, relative to sales, an important source of demand will be eliminated: business men will no longer attempt to increase their inventories by producing more than they expect to sell. This means that even if demand for goods for other purposes is sustained, total output will nevertheless decline. When output falls, however, income earned in production also falls, which causes a decline in sales. The decline in sales, in turn, causes inventories to continue to rise, and inventories thus become abnormally large in relation to sales. Producers now reduce the rate of output for the dual purpose of eliminating excess inventories and bringing output into line with declining sales. But just as the attempts to increase inventories in the upward phase of the cycle were to some extent self-defeating, so also are the attempts to reduce inventories in the declining phase. As output is reduced, income earned and demand also fall, and inventories thus remain abnormally high in spite of attempts to reduce them. Again, however, the change in demand will normally be smaller than the change in output, and a point will therefore be reached at which inventories begin slowly to approach a normal level.

As long as inventories remain high relative to sales, the attempt to reduce them will cause output to continue to decline. But as inventories approach a normal level the rate of decline of output will gradually be reduced; and when inventories finally reach the normal level, output will cease to decline. Indeed, when this point is reached, output must slowly begin to rise. For, in the periods immediately preceding the low point, business men were producing less than they expected to sell, whereas at the low point they produce exactly the amount they expect to sell. This means that even if total demand for non-inventory purposes remains constant, output will nevertheless rise. When output begins to rise, however, demand also rises, and inventories thus decline even below the amount considered normal for the low level of sales. In other words, the decline of inventories continues after the low point of the cycle has been reached, just as the rise of inventories continues after the high point of the cycle has been reached. From this point onward, the explanation of the cyclical process is the same as before. The abnormally low level of inventories leads to a rise of output, and the entire cycle is repeated, perhaps with a diminished amplitude.

Having outlined briefly the main characteristics of a structural inventory cycle, I wish now to inquire into the empirical implications of the cyclical process just described. If a given cycle is assumed to be a structural inventory cycle, what does this imply concerning the timing and amplitude of

changes in the physical volume of inventories? And, as a corollary, what does it imply concerning the rate of investment or disinvestment in inventories during different phases of the cycle? Considering first the volume of inventories, it should be apparent from the foregoing description that during a structural cycle inventories exhibit the same cyclical pattern as the rate of total output, except that they tend to lag, reaching peaks and troughs after output. In other words, inventories continue, for a time, to rise after output has begun to fall and to fall after output has begun to rise. It can be shown that the length of the lag is approximately one fourth of the duration of the entire cycle, or one half of either the upward or the downward phase.[2]

Investment in inventories is of course the same as the rate of change in total stocks, and it is easily shown, from the nature of the lag in stocks, that the rate of accumulation will normally reach its peak when output reaches its peak. Likewise, in depression, the rate of *dis*investment in inventories will be greatest when output is at its lowest point. Taking all phases of the cycle into account, it is thus evident that in a typical structural inventory cycle, investment in inventories will be positively correlated with the level of output, with neither series showing any tendency to lead, or lag behind, the other. Investment in inventories, in other words, will normally continue to rise as long as output rises, and to fall as long as output falls; and the turning points will coincide.

How does this expected behavior of inventories compare with the facts as they are summarized in Abramovitz' account of the interwar period? A complete empirical test of the theory outlined above cannot be obtained from Abramovitz' study alone, since he has limited his investigation to inventories held by manufacturers. Moreover, the inventory statistics he used were annual data, and, as he repeatedly emphasizes, many of the cycles studied were so short that it is difficult to get an accurate notion of the timing of the turning points from such data. Even after making due allowance for these difficulties, however, it seems to me that Abramovitz' results, as far as they go, provide a striking confirmation of the theory summarized above. At any rate this is true as far as *total* manufacturers' inventories are concerned. In the first parts of his investigation he finds that the turning points in the *volume* of inventories tend to lag behind the turning points of business cycles, the average lag being approximately 9 months. In other words, inventories tend to reach their peaks and troughs approximately 9 months after general business activity.[3] For the short cycles of the '20's this lag is not far from the lag of one fourth of a cycle predicted by the theory of structural cycles.

[2] See my paper The Nature and Stability of Inventory Cycles, *Review of Economic Statistics,* August 1941.   [3] *Op. cit.,* p. 27.

The theory is confirmed also, as nearly as this is possible from the limited data, by the observed behavior of inventory investment. Thus, in his summary of the timing of investment in inventories, Abramovitz says (p. 460):

In . . . constant prices, total investment reached its peaks and troughs in the same years as general business at seven of the ten turns between the two world wars. Investment by manufacturers did the same, and investment by retailers and wholesalers did so at eight out of ten turns. The few investment turns that did not coincide with those in business were evenly divided between leads and lags.

As they stand these figures suggest that inventory investment tends neither to lead nor to lag behind the turning points of business cycles.

Considering manufacturers' inventories as a whole, it is evident, I believe, that the observed interrelations between inventories and total output agree closely with the interrelations implicit in the theory of inventory cycles. This agreement suggests that the short cycles of the interwar period may well have been inventory cycles of the structural variety. Before accepting this conclusion, however, we ought to look more closely at the different categories of inventories that make up the total. We shall find that the various components of total manufacturers' inventories do not all have the same cyclical pattern as the total itself. Abramovitz divides the total figure into three categories — finished goods, goods in process, and raw materials. He further subdivides the finished goods category into two parts — goods made to order and goods sold from stock. He argues that the volume of goods made to order will necessarily vary in proportion to output, as will the volume of goods in process. Consequently, the level of investment in such goods must be a function of the *rate of change* of total output, as envisaged in the principle of acceleration. In other words, Abramovitz argues that during the expansion phase of a cycle, investment in goods in process and in finished goods made to order will normally reach a peak before output; and, similarly, during the contraction phase the low point of investment will normally precede the low point of output.

In my summary of the theory of structural cycles I did not take either goods in process or finished goods made to order explicitly into account. As far as I can determine, however, there is no inconsistency between Abramovitz' conclusions with respect to these categories of goods and my assertion that the short cycles of the interwar period were probably structural cycles. In more rigorous explanations of the typical structural cycle that I have presented elsewhere, I assumed that the interval under investigation was arbitrarily divided into periods and that all producers formed their production plans at the beginning of each period and completed their output by the end of the period. Under these admittedly artificial circumstances there was no need to make a special study of goods in

process. I see no reason, however, why one could not assume a continuous process of production without altering the basic conclusions derived from my highly simplified models. The point to be emphasized is that inventories are important in the theory of business cycles principally because they affect the *output decisions* of producers, and, unlike other inventories, stocks of goods made to order or of goods in process simply reflect the current rate of output and do not represent independent determinants of output in subsequent periods.

When we come to the other categories of inventories the evidence is more puzzling. Perhaps most important, the conclusion Abramovitz has reached concerning manufacturers' inventories of goods sold from stock raises some serious questions for the theory of structural cycles. Such inventories do indeed lag behind cyclical variations in total output. But the lag appears to be longer than would be expected from the theory of structural inventory cycles. During the shorter cycles, in fact, inventories of finished goods of this type usually continue to rise throughout the contraction and to fall throughout the expansion. Taking the cycle as a whole, the short cycles thus display an inverse relation between the rate of economic activity and the volume of inventories of goods sold from stock. More than this, the accumulation of inventories at the beginning of a downturn is so great that the *rate of investment* in these goods continues to rise throughout the first half of the downward phase of the cycle. Likewise, during the upswing the rate of investment *falls* throughout the first half of the expansion. It must be admitted that these results are contrary to what one would expect from the theory of inventory cycles. And if they were characteristic of all inventories of finished goods, including inventories held by retailers and wholesalers as well as those held by manufacturers, they would constitute a definite refutation of the theory I have presented. In other words, if inventories held at all stages of the marketing process tended to move inversely with the rate of economic activity, it would be impossible to explain the short cycle, as I have attempted to do, in terms of the partly frustrated efforts of producers and dealers to restore their inventories to some normal level in relation to sales. Under such circumstances the business men's inventory policies would not in themselves explain the cyclical behavior of total output, as they do in the theory of structural cycles. Instead, the inventory policies would merely alleviate the cycle, and the cycle itself would have to be explained by other forces.

From the over-all statistics, however, it is obvious that inventory policies do not thus alleviate the cyclical variations of output. Quite the contrary. Since the peaks and troughs of inventory investment coincide with the peaks and troughs of economic activity, it is evident that inventory

investment in all types of manufacturers' inventories together is one of the principal contributing influences in the generation of the cycle. In this respect the conclusions derived from the over-all statistics are decidedly different from those derived from statistics of inventories of goods sold from stock. The over-all statistics confirm the theory of inventory cycles while the statistics of finished goods sold from stock raise some serious doubts.

The fourth category of inventories, manufacturers' stocks of raw materials, seems to agree more closely with the hypothetical behavior predicted by theory. They tend to lag, as expected, behind the rate of output as a whole. But the lag is much shorter than the lag in finished goods inventories, and the volume of raw materials accordingly falls throughout a substantial part of the downward phase. Liquidation of stocks thus contributes to the downward movement of output, as envisaged in the theory of structural cycles. Similarly, in the upswing, accumulation of raw materials definitely contributes to the expansion of total output. Although the actual lag of raw materials inventories behind output is somewhat shorter than would be expected of all inventories in a typical structural cycle, the difference is hardly large enough, in my judgment, to raise any serious questions for the theory of such cycles.

The general conclusion that emerges from this comparison of theory with fact is that the over-all statistics of manufacturers' inventories seem to confirm the theory of structural cycles, while the statistics of inventories at various stages of production tend in some respects to refute it. Why do manufacturers adopt a more passive attitude toward their stocks of finished goods than toward their stocks of raw materials? If it is desirable to maintain some normal relation between raw materials stocks and output, why is it not also desirable to maintain a corresponding relation between finished goods and sales? I doubt that this question can be answered by examining the inventory data alone. In drawing inferences from the statistics of inventories, Abramovitz has advanced about as far as can be expected. Beyond this point we must rely, I believe, upon detailed studies of the inventory policies of particular industries and particular firms. So far few such studies have been made. But it seems to me that a careful examination of the inventory policies of individual firms or industries would yield much valuable information concerning the relation of inventories to business cycles. Not only would it help considerably in explaining the differences in cyclical behavior between one type of inventory and another; it would also provide at least partial explanations of the differences in inventory movements between one cycle and another.

At the beginning of these remarks I pointed out that fluctuations in inventories may be either speculative or structural. But my emphasis

throughout has been almost entirely upon the latter. Unfortunately it is rather difficult, with the available data, to distinguish between inventory cycles that are primarily structural and cycles that are primarily speculative. Such a distinction can be made accurately only after the inventory policies of a substantial number of firms and industries have been studied. Individual firm or individual industry studies would help greatly in answering questions such as: Do business men attempt to maintain some sort of normal relation between inventories and sales? If so, is the normal relation one of strict proportionality or does the normal ratio of inventories to sales decline as sales rise? What part do producers' expectations concerning future prices play in their decisions with respect to inventories? Which of the inventory fluctuations during the interwar years were attributable to speculative motives and which to the structure of the system? If inventories are permitted to deviate appreciably from the normal level for speculative reasons, what is the cost to the producer of attempting to produce with abnormal stocks? That is, if stocks are abnormally low, what is the cost in terms of interruptions to production or sales opportunities missed? And if inventories are abnormally high, what is the cost in the form of carrying charges, deterioration, etc.?

Answers to questions such as these for a considerable segment of American industry would be most helpful in explaining the movements of inventories Abramovitz has measured. For this reason it seems to me that the next step ought to be a series of investigations of the inventory problems of specific industries and firms. These investigations would be extremely useful as an indication of the motives of business men, even though they did not yield much additional data concerning the actual movements of inventories as a whole.

FURTHER COMMENT BY MR. ABRAMOVITZ

Professor Metzler's interesting confrontation of his theory of inventory cycles with experience leads me to add three comments. Two lend additional support to his theory, but one is negative.

Metzler notes that his theory requires inventories to lag behind sales and output, and inventory investment to reach peaks and troughs at about the same time as business activity. He observes that the behavior of manufacturers' stocks is consistent with the expectations of theory. One may add that the same appears to be true of inventories held in the distributive trades (cf. *Inventories and Business Cycles,* Ch. 4 and 14).

Metzler is disturbed by the fact that the inverted behavior of manufacturers' stocks of finished staples is clearly not in accord with the require-

ments of his theory and that the lag of stocks of raw (purchased) materials
is shorter than that required. He correctly points out, however, that the
behavior of stocks of finished staples may be treated as exceptional,
affecting as it does only some 20 per cent of manufacturers' total stocks
and less than 10 per cent of all business inventories.[1] He might have added
that the sample of raw materials stocks I studied is both small and unrepre-
sentative. On this account I distrust the length of the lag for this category
indicated by the sample commodities and, in my book, note several rea-
sons for thinking the true lag may be longer (Ch. 9 and p. 324).

One aspect of the empirical evidence raises serious doubts about Metz-
ler's hypothesis. This has to do with the behavior of inventory-sales and
inventory-output ratios.

If we suppose that business men seek to maintain some single inventory-
sales ratio that they regard as normal, Metzler's theory, as he states it,
would require that the downward movement of inventory-sales ratios,
with which expansion begins, be reversed before the end of the phase and
that the ratios once more attain normal levels before the peak in business.
When they did, inventory investment and, therefore, output would decline.

For total manufacturers' stocks, inventory-sales and inventory-output
ratios, however, do not behave in this way. Characteristically, they are at
or near their lowest points at the peaks in business, at or near their highest
points at the troughs in business, and give no evidence of a regular tendency
to lead output and sales.

My impression is, however, that this is too strict a test of Metzler's
theory. His hypothesis, I believe, does not require a return of inventory-
sales ratios to normal. It requires only that there be an approach to normal
such that the accompanying decline in inventory investment be sufficient
to offset increased output intended to meet rising sales. Since the estimates
of inventory-sales ratios are annual, their failure to give evidence of up-
turns before business peaks and downturns before business troughs is not

[1] Metzler asks, "Why do manufacturers adopt a more passive attitude toward their
stocks of finished goods than toward their stocks of raw materials? If it is desirable
to maintain some normal relation between raw materials stocks and output, why is
it not also desirable to maintain a corresponding relation between finished goods
and sales?"

Statistics now available do not provide a basis for a conclusive answer. But a
guess may be risked. Manufacturers are interested in keeping their plants and work
forces employed as steadily as they can. To permit inventories of finished goods to
pile up when demand falls off and to liquidate such stocks when sales improve con-
tributes to stability of operations. In handling stocks of raw materials, however,
manufacturers have no such interest in the stability of their suppliers' operations.
Hence they consult only the convenience that stocks provide in servicing a given
rate of production.

decisive. Such leads may be typical, and the recovery before the business peak and decline before the trough may possibly be large enough to produce a sufficient decline in inventory investment. The question is whether they are large enough. The annual data do not suggest that they are.

If quarterly or monthly data for aggregate stocks, when they appear, should confirm the testimony of the annual data, this would be even more disturbing but still not conclusive. Since portions of manufacturers' stocks (e.g., the finished goods referred to above) move inversely to business, the failure of the aggregate ratios to turn up (down) decisively before peaks (troughs) in business may be due to the behavior of these exceptional categories. Ratios for most manufacturers' stocks may behave as Metzler's theory demands.

Finally, even if the ratios for every important category of stocks failed to show the required lead, the theory would not be decisively refuted. For the inventory-sales and inventory-output ratios that business men desire to maintain may themselves vary inversely with the state of business. If so, the actual ratios may come to coincide with the desired ratios in the course of a business expansion even if the actual ratios continue to fall. The actual ratios may come to coincide with the desired ratios during contraction even if the former continue to rise. This, indeed, is the nub of the trouble with a verification of the theory. We do not know what ratios business men desire to maintain. And it is in this connection that we should most heartily second Metzler's plea for detailed studies of the inventory policies of particular industries and firms. For unless we can discover what ratios firms desire to maintain at various stages of business cycles, Metzler's theory may turn out to be not merely unverified — what general business cycle theory is not? — but also unverifiable.