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CHARACTERISTICS OF INVENTORY INVESTMENT: THE AGGREGATE AND ITS PARTS

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1. *Introduction*

Changes in aggregate inventories for the country as a whole augment and reinforce cyclical fluctuation. The physical volume of inventories typically rises during recovery in general business and and declines during recessions, though in both cases with a lag. The *change* in physical volume—inventory investment—conforms to, and on the average synchronizes with, business fluctuations. It contributes a large part of the notorious cycle-sensitivity of capital formation, sometimes more than 100 per cent, especially in short cycles.[1]

But it is the contention of this paper that it is necessary to know certain facts in addition to the size of aggregate change in order to gauge even very approximately the impact of inventory investment on the economy as a whole. Capital investment in inventories is characterized by great diversity within the aggregate; at any particular time, some stocks are rising sharply, some are falling sharply, and some are hardly changing at all. What sorts of stocks are doing which, and the extent to which extreme changes occur and counteract one another in the net total, condition the results that follow from a given amount of aggregate net inventory investment.

In part, diversity itself has implications of importance. A given net change in stocks composed of a large amount of positive and negative change has, regardless of any further knowledge about the character and distribution of change, a different impact on employment, production, prices, and probably additions to plant, than if all change bore the same sign.

But diversity of certain sorts has in addition specific implications and a few of these matters are examined insofar as they bear on business fluctuation. As a preliminary, I review a few figures on the extent of plus and minus change in stocks. Then two broad

[1]Moses Abramovitz, *Inventories and Business Cycles, with Special Reference to Manufacturers' Inventories*, National Bureau of Economic Research, 1950. I have made extensive use of this excellent study and am greatly indebted to its author.

sorts of implications of diversity within the aggregate are discussed. The first rests in the framework of purchasing power analysis and concerns the impact of current changes in stocks on the economy; it involves, in other words, ex post analysis as far as inventory change itself is concerned. The second concentrates on differences in the impact on business fluctuation of a given amount of inventory investment depending on whether it is intended, unintended, or simply not intended—passive. Here, in other words, stocks are analyzed with respect to ex ante considerations. Needless to say there are other distinctions of a similar sort that might be made. For example if the future impact of a given current change in stock is to be understood, it is important to know whether it is likely to be associated with strong changes in prices or with considerable change in stocks *on order*; these matters, however, will not be taken up in this paper.

2. *Extent of Diversity in Inventory Behavior*

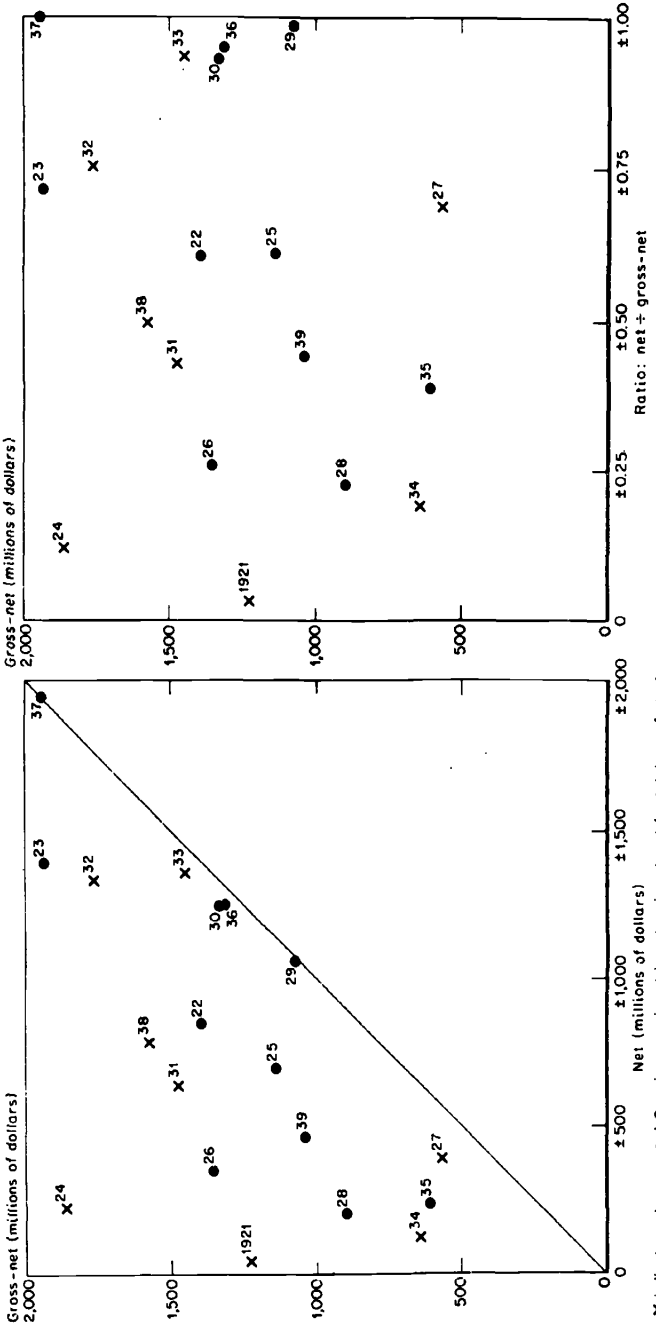
It would be useful to be able to measure the extent to which the pattern of net change in stocks for all business inventories was repeated in smaller and smaller parts. But changes in prices and changes in the value that businesses place upon their stocks by write-ups or write-downs obscure the character of physical change in stocks; information on the value of the change in stocks is required, not change in the value of stocks. Yet there appears to be no readily available statistical information concerning changes in the inventories of individual firms that eliminates change in evaluation. Consequently, without an elaborate investigation, diversity cannot be studied for individual firms or for small groups of industries such as would be available from biennial census volumes on a value basis.

The first point at which a measurement can be made readily is for firms grouped into ten branches of manufacturing in Moses Abramovitz's minor modifications of Simon Kuznets' estimates. The year-to-year changes in aggregate manufacturers' inventories in constant prices, ignoring signs, amounted to $14.6 billion for the nineteen annual intervals between 1921 and 1939. If similar figures are obtained for each of the ten subdivisions of total manufacturers' inventories and these ten totals are summed, the figure is $24.6 billion.[2] The ratio of net investment (ignoring its sign) to the "gross-net" figure—the sum of net change ignoring signs for the

[2]The figure is based on *ibid.*, Table 108, pp. 564–565.

CHART 1

Net Inventory Investment for Total Manufacturing (Net) and Summed, Ignoring Signs, for Ten Subdivisions (Gross-Net), 1921-1939



X indicates a decrease and ● an increase in net inventory investment for total manufacturing.
Source: See text note 2.

ten subdivisions—for the nineteen years was 0.59. (The average of these ratios for each of the nineteen years was 0.57.) In other words, even among the ten major branches of manufacturing, the value of net change in stocks from year to year often had opposite signs, so that net change for all manufacturing for the interwar period was less than three-fifths of the total net change for the ten branches.

For individual years the ratios of net (ignoring the sign) to gross-net, as defined, varied between 1.00 in 1937 and 0.03 in 1921. In some years most of the ten subdivisions experienced net change in their inventories in the same direction (all divisions in 1937) whereas in other years many subdivisions had net positive and many net negative changes (a five-to-five division in 1921). The question then arises whether the years of small net capital formation in inventories for manufacturing as a whole were years when most branches of manufacturing were also experiencing little net accumulation or reduction in stocks.

The relationship between the net and the gross-net figures (years when net investment is negative are shown as crosses) can be seen in the left-hand side of Chart 1. By definition the points must locate above the diagonal as drawn. Within this technical restriction, they seem to be quite widely scattered so that small net positive or negative investment will almost as often be associated with large gross-net investment as with small. By and large, however, there is a positive relationship between the two sets of figures (partly imposed by the arithmetic)—the correlation coefficient is +0.62.[3] The right-hand side of Chart 1 shows the ratios of net (ignoring the sign) to gross net, plotted against gross-net investment. These figures, which though limited to between 0 and 1 are unrestrained within the rectangle, also show a wide scatter with a vague positive association (the rank correlation coefficient is +0.40).[4] Ex-

[3]The correlation between gross-net and net for the nine years in which net investment was the lowest positive or negative figure was +0.18. For the nine years of highest net investment, the figure was +0.57.

[4]If the ratios are plotted against the net figures, the correlation seems a bit closer and the reason may be seen by study of the first scatter diagram. A line fitted by inspection to the points would lie above the diagonal and move in the same direction though with less slope. Reading from the chart, the ratio read at three points of net investment would be about 100/800 or 0.13, 800/1,300 or 0.62, 1,500/1,800 or 0.83. In other words the scatter seems to follow some sort of modified arithmetic principle (though not entirely so since there is some nonhomoscedasticity present). Consequently the ratios must have a pattern with respect to either their numerators or denominators and it is greater with respect to the numerators, which have a wider scatter than the denominators.

amination of both diagrams fails to suggest any principle that explains the location of individual years; years of prosperity or depression, of recovery or recession, of positive or negative net investment are undifferentiated as far as one can see.

Apparently the knowledge that net investment for manufacturing as a whole is a given amount does not convey much information about what even net investment for the sum of ten major subdivisions of manufacturing will be. Total manufacturing inventory investment would convey still less information about smaller subdivisions and still less about the behavior of stocks in various stages of processing within a firm ("finished," "in process," or "raw"), which, we know from Abramovitz's work, often move in opposition to one another.[5]

Diversity may also be viewed statistically for five major groups —manufacturing, trade, transportation and other public utilities, mining and quarrying, and agriculture—for which data on changes in stocks in 1929 prices are available.[6] Net change for total commercial stocks for the eighteen years 1921–1938 was $23.1 billion or 67.1 per cent of the sum of net change for each of the five branches ($34.5 billion).[7]

This diversity in itself, and quite independent of its particular constitution, is important to the course of change. A given amount of net inventory investment for the economy as a whole that is composed of a large amount of plus and minus changes for various segments of the economy, for various industries, for various firms, and within the various departments of individual firms will have very different implications in terms of employment, durable capital formation, and industrial output than if the aggregate net change duplicates the direction of change in each unit. This area of ignorance needs to be dispelled by new information.

But the meaning of similarities or differences in the change in inventories experienced by individuals or groups depends further on

[5]Quotation marks are used throughout to indicate that the reference for the designation "raw" or "finished" is the production process of the individual firm rather than that of the whole sequence through which the goods pass on the way to final consumption.

[6]Abramovitz, *op. cit.*, Table 112, p. 368. These figures are given only through 1938.

[7]Net investment for manufacturing has invariably the same sign as the total for all branches, and for trade this was the case in all but four of the eighteen years or 22 per cent; for the other divisions the corresponding figures were 39 per cent for transportation, etc., 67 per cent for mining, etc., and 56 per cent for agriculture.

whether, in the context of the particular problem under consideration, it is randomly distributed or systematic. There are quite a number of situations in which it is reasonable to assume that whether inventories increase or decrease and how fast they do so is not a matter of chance but is intimately associated with matters having economic significance. A few examples will be considered.

3. *Diversities Important in Ex Post Purchasing Power Context*

Changes in inventories can involve shifts during business cycles in the relationship between income received by consumers and the aggregate value at current prices of goods available for purchase. If, in the course of business cycles, there were a systematic tendency for a change in inventories to be composed in varying proportions of relatively finished and unfinished goods, this fact would bear on the adequacy of purchasing power in an ex post sense. If, for example, finished goods tended to constitute a larger proportion of stocks in the neighborhood of the troughs in cycles than in the neighborhood of the peaks (and as we shall see in a moment this is probably the case), how would the pattern affect the ability of consumers to absorb the products of industry at the prices at which they were made to sell?

Near the peak of a cycle, finished goods have amassed processing costs which, all along the line, are relatively high. The current value of these goods at cost is higher than the value at which they could be reproduced after recession had gotten underway. However, the current stream of income (current wages, rents, interest, etc.) is a function of current costs. Thus during recessions income tends to be inadequate to purchase the goods at their original cost values. Mark downs are required to put finished goods held in stock on an equal footing with goods that have, from first to last, just been produced, or produced from stocks of raw or nearly raw materials. But these markdowns and price reductions are often slow to occur. What is more, once occurring, they have further implications. They affect profits and expectations, and consequently the availability of credit, and decisions about future production.

In our institutional setting, then, it is not a matter of indifference whether the ratio of inventories of finished goods to those of raw materials shifts in the course of the business cycle.

Behavior of Inventories at Various Vertical Stages

An examination of the figures previously cited indicates that different cyclical patterns seem to characterize inventories at the

various vertical stages of production. Abramovitz finds that agriculture and mining stocks conform inversely to business cycles; between 1922 and 1938, agricultural stocks and mining stocks averaged 17 per cent of the total for five major branches which together accounted for 95 per cent of all stocks. At the opposite end of the economic process, inventories of merchants show a clear conforming pattern; these stocks are large, constituting around 37 per cent of the five-group total. Manufacturers' inventories, which were 43 per cent of the whole, have a positive pattern.[8] Agricultural and mining stocks tended therefore to damp the conforming swings of total inventory investment as a whole. The countercyclical behavior of these raw-material stocks means that the net change in aggregate stocks comprehends, in effect, some shift in stocks in recession from the later to the earliest stage, and in revivals from the earliest to later stages.

Whether this general effect is increased or reduced by shifts within the vertical stages of manufacturing itself is very hard to say. Stocks that are held awaiting sale tend to have an inverse conformity to output, while in-process and raw-material stocks have a direct conformity. Were the relative importance of finished as compared with total stocks typically to shift between the earliest and latest manufacturing processes, at least a supposition might arise of some systematic differences in cyclical patterns of stock holdings.

For six manufacturing sequences it is possible to examine two, three, or four vertical steps.[9] Reports of the *Census of Manufactures* in 1939 on closing inventories of "finished" and other

[8]Transportation and public utilities stocks, averaging 3 per cent, completed the total. Figures are based on Abramovitz, *op. cit.*, Table III, p. 567. The five branches are: manufacturing, trade, transportation and other public utilities, mining and quarrying, and agriculture. Computations are made in 1929 prices.

[9]Material for the following areas was examined in the biennial *Census of Manufactures:*

Product Group	*Number of Vertical Sequences*	*Number of Census Industries*
Leather and products	3	5
Cotton products	3	9
Woolen products	2	6
Paper and products	3	6
Lumber and products	4	12
Iron and steel and products	3	12

stocks have been used. The data are entered at book value, but since 1939 was not a year of many falling prices, there may be little difference between cost and book value for that year. There seems to be a tendency in all but one of the sequences (the one based on hides) for the proportion of finished goods to total stocks to increase with successive processing stages. This is true whether comparisons are made of finished inventories at cost (subtracting an estimate of value added) or at book value.[10]

This suggests, but only in a most tentative fashion, that if we assume as a first approximation that there are no systematic interstage differences in the patterns and amplitudes of "finished" as contrasted with other stocks, or in rates of change relative to stocks proper—all quite questionable assumptions—there may be a very mild tendency for cyclical shifts in stocks within the manufacturing aggregate to dampen rather than to reinforce the tendency for such shifts to take place between true raw material and finished consumers' goods.

For the whole vertical sequence, the cyclical shifts that seem to take place in the location of stocks would add to the alternating excess and deficiency of purchasing power that characterizes business cycles. The aggravation would be due to the fact that prices tend to adjust slowly rather than swiftly with cycle-aggravating effects. This would be true were price behavior equally sluggish at each vertical stage.

Prices at Various Vertical Stages

Actually, resistances and secondary reactions to price change are far greater in some industries than in others. Thus they provide a further way in which nonhomogeneity in the inventory aggregate can carry implications in a purchasing power context. Ignoring the matter of secondary reactions, some prices have very strong cyclical amplitudes and others reach peaks and troughs long after the turns in output. If cyclical alterations in the composition of the inventory aggregate were systematic with respect to the price flexibility of inventory goods, implications in a purchasing power context would ensue. Unfortunately, however, little can be said about the full picture of the association, commodity by commodity, between

[10]We also find that finished stocks are, of course, typically smaller than stocks of raw and in-process materials; were this not the case, the directly conforming pattern of total manufacturing stocks would require rather special explanation.

cyclical patterns of inventory and price behavior, though it seems likely that the two have an element of causal interdependence.[11]

However, one systematic aspect is certainly present. One of the better established empirical facts appears to be that prices of raw materials have greater cyclical sensitivity than those of finished goods. The prices of finished goods tend, by and large, not only to have shallow but also late reactions to cyclical forces. Combining this fact with the tendency for cyclical patterns of stocks to differ somewhat from one vertical stage to another, differential price behavior is superimposed on differential inventory behavior in such a fashion as to aggravate the significance of the latter. For in the neighborhood of peaks the added weight of retailers' stocks (relative to those of raw materials) in the inventory aggregate falls on goods whose prices are slow to turn down and are resistant to cuts. Therefore reduction of these stocks absorbs more of current income than would be the case if rapid and considerable price reduction, of the sort usual at earlier stages, were to take place.

Price regidities also imply lessened physical volume of consumer buying. Other things being equal, this has secondary implications in the reduction of intermediate buying all along the line as new orders and production schedules are cut, pending the using up of stocks now on hand. The lethargy transmits itself immediately through the ordering system from the latest to the earliest stage of production.

4. *Intended and Unintended Change in Stock*

Although it has been impossible to avoid the subject entirely, the foregoing discussion has eschewed the question of later or secondary effects on business activity of given changes in stocks. It has concentrated on the immediate effect in terms of the relation between aggregate ability to buy and goods available for purchase. Yet obviously the impact on business tomorrow of a given decrease in stocks today will differ depending on whether the decrease was clearly intended or the undesired result of misjudged demand. In the first case inventories will be reduced until they have shrunk to the desired size; the reduction will be made by cutting production relative to customers' estimated requirements. In the second case

[11]It seems likely for example that the inverse association that has been observed between cyclical sensitivity of output and prices would bave a counterpart in inventories—inflexible production schedules are often made possible by large stocks of finished goods.

production will be raised relative to customers' estimated requirements in order to prevent further reduction of stocks and to reverse the unwanted reduction. These statements may be transposed to apply to an intended or unintended increase in stocks. So conceived, the distinction between unintended and intended inventory investment depends on what, in the second instance, is done about it—whether, in other words, it is nonpermissive or permissive—and this is the sense in which the distinction seems typically to be made in aggregative analysis.[12]

But although it is clear that a given change in stock is, at a given time, either permitted to remain or reversed, and thus treated as permissive or nonpermissive, it is not true that all permissive stock changes are properly called intended, or even that all nonpermissive stock changes are truly unintended. The term intention simply does not apply to many changes in stocks that actually take place. Failure to understand this fact and the circumstances that give rise to it can cause serious misinterpretation of the consequences likely to follow from a given amount of inventory investment or disinvestment at a given time. It can also be responsible for poor forecasts of how stocks are likely to behave.

To comprehend all sorts of inventory change, a third category is required—"passive" inventory investment. Passive inventory investment or disinvestment takes place in part because plans about the proper size of stocks are hardly ever precise figures; instead, they are ranges, and variation within the range or band is a matter of indifference. Passive stock change also occurs when business objectives that focus on other matters than the appropriate size of stocks nevertheless affect their size.

Stock objectives are actually ranges rather than precise figures even under circumstances where stocks are an important focus of management decisions. In a retail store, for example, where model stocks are carefully planned and elaborate methods for holding stocks to planned figures are incorporated in buying procedures, a certain amount of divergence is expected and consequently ignored. Day to day customer demand could hardly be foretold, and even seasonal patterns will vary from year to year. Thus basically un-

[12]The line of thought to which I refer is found in two articles by Lloyd Metzler: "The Nature and Stability of Inventory Cycles" and "Factors Governing the Length of Inventory Cycles," *Review of Economics and Statistics*, August 1941 and February 1947, respectively; and in Ragnar Nurkse's "The Cyclical Pattern of Inventory Investment," *Quarterly Journal of Economics*, August 1952.

knowable elements in business imply, perforce, that short-term intentions with respect to stocks must be phrased in terms of bands and only transgression of the band brought to the attention of management.

For any given period of time, the band widens as the appropriate size of stocks is affected by factors that do not focus directly on stocks but involve matters such as convenience in procurement, efficient flow of work or service to customers, and the expected prices of purchased materials. Indeed the more important such factors are relative to those linking stocks to some defined requirement, the less do terms such as intended or unintended stock change apply to the variations in the size of stock that take place.

The need to fill orders promptly, for example, when other circumstances are permissive, can result in large inventories of finished goods which are drawn down when business is brisk and which pile up when sales are slow. Importance attached to the even flow of goods through productive processes tends to cause stocks to vary inversely with sales. Attention to opportune procurement, on the other hand, may cause stocks to vary in a fashion which is neither directly nor inversely associated with sales, and this may also be true when procurement of "raw" materials is influenced by expectations about prices or the availability of goods. However, if the course of expectations about these market conditions tend to parallel sales, the pattern imposed on stocks will be at least partly systematic with respect to sales. Changes in inventories resulting from actions of these sorts are neither intended nor unintended but simply passive.

But passive attitudes do not persist indefinitely. Even changes in stocks associated with reservoir stocks that are intended to provide prompt service to customers, or from the necessities of efficient production or procurement, can transgress acceptable limits and thus move into the focus of management purview. Consider for example a time when the number of weeks' supply on hand has been extended in anticipation of a rise in prices to a point which it is not thought safe to exceed. Or consider the circumstances when a period of slack sales has caused stocks of finished goods to exceed limits that are judged safe in terms of either the financial or physical investment that they involve. At such times passive change has become nonpermissive. We may call it unintended though this involves a slight distortion of the word. In any event, buying and production schedules will be revised to effect a correction in the size of stocks. Without doubt, limits of this sort are

at least partially responsible for the fact that the inverse cyclical conformity of manufacturers' inventories of finished goods turns to positive conformity as long cyclical phases run their course.[13]

Apparently then we must add a third category, "not intended" or simply, "passive" change, to the dichotomy of intended and unintended change. Passive behavior of stocks is found even where their proper control is a central objective of management, as in retail stores. For objectives are seldom so precise as to exclude some stock change to which management is indifferent and which is therefore passive. But the longer the time interval over which change is calculated, the narrower the area of passive behavior grows. Thus stocks of a size that would be disregarded for a short period of time become subject to correction if they persist at the same relative level too long. At the other extreme—stocks characterized by strong inverse conformity—inventory change is mostly of the passive variety; but even here when the interval is long enough the bounds of permissive behavior may be transgressed and action instituted to correct the violation. Thus all change associated with any one sort of stock is virtually never entirely intended nor unintended but also passive. The width of the passive band in space and time is one of the more important distinguishing features of the behavior of stocks held by various sorts of business enterprises.

For one thing its width is subject to trend change as industrial composition shifts, as the proportion of goods held in the finished state changes, or as speed of transportation increases. Its width is subject also to cyclical shifts dictated in part by the factors to which these passive stocks respond: expected prices and market conditions, convenience in production and procurement, or proper service to customers. It is subject also to cyclical shifts dictated by the conditions under which passive change transgresses limits and becomes unintended and therefore subject to correction.

Traces of this third type of influence are found even in annual aggregate figures on inventory investment. They serve to indicate that passive stocks change, and its conversion to nonpermissive or unintended change, is quantitatively important in the cyclical behavior of stocks. The same data previously summarized may be used for each year of the long recession and recovery that spanned the period 1929–1937. This is the only cycle long enough so that annual data have at least some power. however feeble, to illustrate the point at issue (see Table 1).

[13]Abramovitz, *op. cit.*, pp. 352–354.

TABLE 1

Inventory Investment, 1929–1937

(*millions of 1929 dollars*)

Year	*Summed for 10 Divisions of Manufacture*[a]		*Total Manufacture*[a]	*Total Trade*[b]
	Net Increase (+)	*Net Decrease* (−)	*Net Change*	*Net Change*
1929	1,065	7	+1,058	+706
1930	1,290	45	+1,245	−365
1931	419	1,055	−636	−601
1932	218	1,549	−1,331	−1,643
1933	47	1,400	−1,353	−963
1934	260	385	−123	+6
1935	422	185	+237[c]	−34
1936	1,280	32	+1,248	+741
1937	1,939	0	+1,939[c]	+402

[a]Based on Moses Abramovitz, *Inventories and Business Cycles, with Special Reference to Manufacturers' Inventories*, National Bureau of Economic Research, 1950, Table 108, p 565.

[b]*Ibid.*, Table 112, p. 368.

[c]There are very minor unexplained discrepancies for 1935 and 1937 between net change for the ten divisions as shown here and the figures given in Table 112.

In the peak year of 1929 the stocks of all but one of the ten major branches of manufacturing increased. Much of the increase was doubtless intended, although since the turn in business occurred toward the middle of the year, some unintended increase must also have occurred. This increase would have been found both in stocks accumulated in some close relationship to sales and in stocks purchased in anticipation of a rise in prices. In the first case the drop in sales would have flouted intentions; in the second case the drop in prices would have changed expectations and thus turned passive inventory investment to unintended change. In both cases, by the end of the year stocks would certainly have been larger than desired.

By the next year a far larger portion of the increase in stocks that occurred in all but two of the branches was certainly no longer of the passive variety. Efforts to stem the increase bore fruit in the predominance of decreases occurring in 1931. It is interesting to note that in retailing, where passive inventory change is doubtless quite small, a net reduction had been effected by 1930, a year earlier than for manufacturing as a whole. Toward the close of 1930

and throughout 1931 increases in stocks, originally of the passive variety, must have reached a point where strong efforts to reverse the trend were made and reflected in the growing tide of decreases in 1932 and early 1933.

But by the middle of 1933 many businesses had picked up sharply so that some of the decreases in that year were certainly passive and often actually unintended and thus subject to reversal. Here again, retailing stocks suggest a swifter reaction—witness the sharply decreased rate of fall which they, but not manufacturers' stocks, show in 1933. During the following years there must have been more cases where stocks were subject to unintended decreases than increases, but the relatively deliberate pace of the expansion until the last half of 1936, and its interruption by several minor setbacks, obscured their presence in the annual figures. By 1937, however, substantial amounts of the increase were once again unintended, for the turn occurred in May and the very abrupt drop in output and prices must, by the end of the year, have left many manufacturers with more "raw" materials than they wanted and with "finished" goods that transgressed the barriers of passive change. Here again, retailers got their stocks under control a bit faster than did manufacturers; for retailers, the sharpest annual rate of increase came in 1936 rather than, as for manufacturers, in 1937.

The presence of unintended increases of stocks in the neighborhood of peaks and of unintended decreases in the neighborhood of troughs means, of necessity, that in the one case the stimulating effect and in the other the depressing effect of actual inventory investment is reduced in proportion to the unintended portion of the change. For that portion, the future will have to reverse current change. It seems likely that this effort toward reversal comes *early* in connection with passive change in stocks which is converted to unintended change. The desire to reverse the increases may even occur before the rate of inventory investment starts to decline in the neighborhood of peaks, just as the desire to reverse the decreases may occur before the rate of inventory disinvestment starts to retard in the neighborhood of troughs. In part this occurs simply because market-based factors counseling extension or contraction of market positions refer typically to stock on hand and on order, rather than to stock on hand only, to which available statistics apply. Time is required for increases or decreases in stock on order to eventuate in increases or decreases in stock on hand. In part it may be that expectations about market conditions may actually reach greatest rates of increase or decrease before the turn in

business. In part too the limits to variation in stocks that are regarded passively by business often are reached, at least for many firms or sorts of stock pools, before business itself turns.[14]

5. *Summary*

The impact on cyclical fluctuation of a given net aggregate of inventory investment depends on the constitution of the total. The figures, inapt as they are, suggest, as does far more clearly the logic of the inventory process, that net change in aggregate stocks is composed of a great deal of plus and minus change for various sectors of the economy. Small net change is as often due to the fact that substantial quantities of plus and minus change cancel out as to the fact that stocks are relatively static. The implications of this fact are numerous; some of them that bear on cyclical fluctuations have been briefly explored.

One of the ways in which inventory change is deemed to have an important bearing on cyclical fluctuation is through its impact on the relation between the amount of income currently distributed to individuals and the amount of goods offered to consumers at current prices. In this sense inventory change operates like other sorts of capital investment. In order to measure its influence, however, data on net change in stocks for industry as a whole need to be modified to take account of at least two ways in which gross positive and negative change are distributed in the course of business cycles. The first has to do with the degree of processing to which the inventory goods have been submitted. The second concerns its distribution among commodities for which prices are or are not readily and rapidly reduced to eliminate unwanted stocks. More likely than not, if figures on net change could be adjusted to take into account these two ex post influences on purchasing power relations, the role of inventory change in accentuating business cycles would be a bit stronger than the net figure alone suggests.

Considerably more important to the functioning of the system than these ex post considerations is the impact of the nonhomogeneity on the dynamics of change in the ex ante sense. This impact is

[14]Factors making for early reversals, some of which are relevant to the point made in the text, have been discussed in Ruth P. Mack, "The Process of Capital Formation in Inventories and the Vertical Propagation of Business Cycles," *Review of Economics and Statistics*, August 1953. The present paper relies heavily throughout on information and analysis presented in this article, which in turn drew upon work discussed in *Consumption and Business Fluctuations: A Case Study of the Shoe, Leather, Hide Sequence*, National Bureau of Economic Research, 1956.

bound to be different if a given amount of net change in stocks is composed of a large amount of positive and negative change than if it is not, regardless of any further knowledge as to the character and distribution of the change—disturbance in employment, in production, and in prices result from change of any sort. In addition there is reason to believe that the way in which positive and negative change is distributed with respect to several variables has further consequences; one of these has been studied here—whether inventory change is intended rather than unintended.

In aggregative analysis, "intended" or "unintended" stock change ordinarily refers to change which on the one hand is permissive and on the other hand is nonpermissive and therefore corrected in the second instance. Following this line of thought, it is necessary to add a third category—"passive" inventory change, which though not sought is also not corrected. Passive inventory change takes place partly because stock objectives must be formulated with some leeway within which variation is tolerated; it takes place partly because business decisions that do not focus on stocks at all often result in inventory change. In both cases passive stock change is a function not only of the way it is generated but also of its duration. Increases in stocks that are typically passively associated with expectations of rising prices or recent declines in customers' orders may eventually reach proportions that are no longer regarded with equanimity. When this occurs, this change in stocks shifts to the unintended category, and action is set in motion to reverse it.

Unintended stock change that results from the conversion of passive change, operates in the same way as unintended stock change that results from unexpected change in sales or other considerations that bear on those stocks which lie at the center of management attention. Its course is reversed as fast as it is feasible to do so with all the consequences that this implies for the economy during subsequent months. It seems likely that a large amount of the increases in stocks in the neighborhood of cyclical peaks and of the decreases around the troughs are of this variety. Conforming movements of "finished" stocks after recession or prosperity have continued for some time are also likely to be, in considerable measure, of this type.

The division of total net change in business inventories into parts significant to judging their impact on the cyclical process seems to indicate that the net aggregate of capital formation in inventories understates the impact of stocks on cyclical fluctuation.

Also it seems likely that much of the impact occurs earlier than statistics on stock change indicate. I might add that changes in prices and in expectations, both inextricably bound up with changes in stocks—and these have not been discussed in this paper—doubtless have a similar tendency to augment and set ahead the impact of a given amount of inventory investment on cyclical fluctuation.

But perhaps more informative than this particular conclusion, based as it is on all too slight information, is the vivid presence of basic variety in the total net figures which intimate study and analysis conveys. The variety is not one of detail. I think it likely that inventories—composed as they are of plus and minus change—have a more compelling variety, and one relevant to more sorts of problems, than do many of the aggregates that we measure. But consideration of the parts which make up the whole is essential to proper use of most aggregates in most contexts. Consideration of these diversities are likely to cause some lightening of the burden of argument that aggregates have in recent years been required to bear.

COMMENT

HARRIE F. LEWIS, Kaufmann Department Stores

Not only are Ruth P. Mack's findings of particular interest to students of retailing but her descriptions of motives for inventory change have a certain valid ring that is sometimes lacking in other academic sources. In her earlier work on the shoe industry, she has shown considerable skill in identifying a retailer's reasons for handling inventory as he does. Her generalizations there also seem applicable to large department stores, the type of retail organization with which I am most familiar. This is an achievement for at least two reasons. First, these motives are varied, interrelated, and complex: many retailers have no particularly clear understanding of them in all their facets. Second, retailers' behavior is to some extent governed by stereotyped notions of what is desirable. These notions are expressed in terms of various operating ratios that over the years achieve an almost mystical authority even though there is little appreciation of the basic situations underlying the ratios (and of the circumstances in which they would lose validity). I would be inclined to put somewhat more emphasis on management's use of these ratios, particularly the stock-sales

ratio, for control purposes, and on the extent to which management itself, rather than the buyer, makes those decisions which are speculative in character and go beyond the established stock limits. This, however, is a detail concerning emphasis, and, no doubt, debatable.

I have two comments on the present paper, of which the first concerns Mack's triple classification of motives for changes in inventory. She suggests the terms "unintended," "passive," and "intended." Particularly the term "passive" does not seem well chosen. Passive stock change, she writes, "...occurs when business objectives that focus on other matters than the appropriate size of stocks nevertheless affect their size." And, "It seems likely that a large amount of the increases in stocks in the neighborhood of cyclical peaks and of the decreases around the troughs are of this variety."

For the most part, at the retail level these are changes that reflect a desire to improve or curtail customer service or to buy speculatively. In actual practice in large stores at least, such decisions result from a great deal of conscious effort and do not seem passive at all. Most stores maintain elaborate staple stock lists of so-called "never out" items for customer service. These are not at all the same as model stocks. The model stock notion is at the base of the "intended" inventory concept. The staple stock list, on the other hand, records situations in which, in the name of customer service, stock limits will be ignored. This decision is not one that would strike a retailer as "passive" in character.

Similarly decisions that cotton prices are at a bottom and that this is the time to "cover" on domestics for such an abnormally long period, in terms of retail sales, as the next nine months—a speculative decision—will usually be made by the general manager in consultation with the general merchandise manager, the divisional merchandise manager, the buyer, and possibly the controller on the basis of many hastily assembled fragments of evidence. Again "passive" seems an unfortunate word to use in describing such a situation.

Perhaps somewhat more important is a reservation I have about the emphasis placed on stickiness of retail prices as compared to raw material prices. For example Mack writes, "One of the better established empirical facts appears to be that prices of raw materials have greater cyclical sensitivity than those of finished goods. The prices of finished goods tend, by and large, not only to have shallow but also late reactions to cyclical forces."

One hesitates to take exception to this widely accepted generalization. Even if there were no price indexes to support such an opinion, we would know that one of retailing's contributions to distribution is its averaging of the cost of goods acquired at different times so as to minimize price changes for the consumer. I would like to point out, however, some respects in which statistical indexes tend to overstate the differences between retail and other price fluctuations. I do not know how great the quantitative overstatement is, but I am confident that there is such overstatement up to a point. I state it here in the hope that this may lead to further study.

Professional sellers at all levels, whether manufacturers, brokers, or retailers, show great concern about "protecting the market." This means, simply, minimizing price fluctuations. It cannot be done, of course, if the upward or downward swing is very violent or if it lasts very long; but even then an attempt at protection will be made until the extent of the fluctuation becomes apparent.

There is reason to believe that the techniques used to protect markets at the retail level are more likely to be effective and to escape full measurement in price indexes than elsewhere. To the extent that this is true, the popular generalization quoted above would be modified.

There are a number of ways in which this protection is accomplished. One that is particularly interesting, because it applies to branded goods where price changes are most readily apparent, is the practice of moving goods by marking them as "seconds," "imperfect," or "irregulars" even though they are in fact not imperfect. When there is early softness this will be done more or less extensively, and the price reductions may be as great as one-half. Labels may or may not be removed. In this way price cuts are passed on to the consumer—it may be on an advertised or on an unadvertised basis—and it would be extremely difficult for example, for a consumer price index shopper to know that this $15 suit which is marked as a "second" is perfect and is the same as a $25 suit sold previously.

There are other related but somewhat more complex situations that contribute to price changes which may be more or less concealed from the various price indexes. These include such techniques as allowing excess anticipation on invoices; advertising allowances by the manufacturer in periods of softness, by the retailer in periods of scarcity; agreements by manufacturers to carry inventory for the retailer; consignment purchases; freight absorp-

tion; packaging charges; the growth of private store brands in soft markets; and fluctuations in the use of trading stamps and premiums. I am also uncertain about the extent to which existing price indexes measure the full effect of increased offerings of merchandise at special sale prices, which is characteristic of downward turning points in the market.

It is possible that, for the long run, these special situations would have a very small effect, although this is far from being immediately apparent. Note, however, that they will occur most frequently at the first signs of market softness, and will apply particularly to goods manufactured at high production costs but offered for sale somewhat later in a period when consumer purchasing power is reflecting the income from a lower level of production costs. Therefore at this particular time they could have a fairly substantial modifying effect on the generally accepted notions about the stickiness of retail prices.

Finally I have checked turnover rates in two department store series: the Harvard Business School's, *Operating Results of Department and Specialty Stores*, published annually since 1923, and the National Retail Dry Goods Association Controllers' Congress, *Merchandising and Operating Results*, published since 1930. There is a great deal of duplication in the coverage of these series, and there is at least one troublesome change in definition. Nevertheless they show that department store stocks were heavier in relation to sales during the 1920's than in the 1930's and that these stocks were adjusted downward quite rapidly when depression started. This is compatible with Mack's thesis. In the late 1940's and so far in the 1950's, even after merchandise shortages were eliminated, stock-sales ratios do not appear to have been much different from those of the 1930's, except in 1951 when stocks were high for speculative reasons related to the Korean War.

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I suspect that many readers of Ruth P. Mack's paper will be left with the impression that inventory investment is an enormously complex subject and that there is little hope of simplification and generalization about the causes and consequences of inventory change. My own belief is that she has introduced unnecessary complications into the analysis of the role of inventory investment in business cycles.

Mack introduces the term "passive" to denote those changes in stocks that result from business policies which are not focused di-

rectly on the proper size of stocks and which do not result in efforts to reverse the direction of change of stocks. It is no doubt true that the behavior of stocks reflects business decisions other than those usually discussed under the heading "optimum control of stocks," but I can see no reason why changes in stocks that reflect such factors should not be considered intended. They are intended because they are associated with definite management policies in a world where uncertainty exists and fluctuations occur. In such a world the "proper size of stocks" simply depends on more variables than it would in a less complex world. As Mack makes clear, from the standpoint of cyclical analysis the critical distinction is whether a change in stocks leads to action to reverse that change. The dichotomy between intended and unintended inventory investment, as used in the literature, is sufficient to make that distinction.

Mack uses her intended-passive-unintended terminology to make two major points: the proportion of passive inventory change to total inventory change varies as between classes of stocks and over the course of the cycle. In the case of retailers' stocks the range of passive (and therefore permissive) inventory change is relatively narrow; one of the results is that as sales decline from a cyclical peak an increase in stocks is tolerated only briefly. Thus the peak in inventory investment is likely to display a shorter lag with respect to sales in retailing than in manufacturing, for example. For all classes of stocks, the ratio of passive to total inventory change varies over the cycle, both because the longer the passive change persists the more likely it is to exceed the bounds of tolerance, and because the bounds of tolerance shift with the duration of the cyclical phase and with changes in prices and expectations.

These observations could be interpreted as follows. For most classes of stocks—distributors', raw materials, goods in process —there is an optimum inventory-output or inventory-sales ratio which businessmen would like to maintain if circumstances permitted. However, for various reasons it is either impossible or undesirable to maintain a constant ratio so that variation is permitted within certain limits before corrective action is taken. The range of permitted variation depends in part on the character of the business (and on the type of stock in the case of manufacturing) and in part on the management's appraisal of the market conditions facing the firm. Since manufacturer's finished-goods stocks are often used as a countercyclical buffer to moderate fluctuations in output, a

constant stock-sales ratio is not desired; nevertheless there are limits beyond which the ratio will not be permitted to fluctuate.

It is convenient to interpret Mack's propositions this way because it calls to mind the assumptions of the acceleration principle. In its simplest application in this area, a constant ratio of inventory to sales is assumed. Mack's analysis reminds us that this assumption is unrealistic, even if stated as a goal. However, this reminder should not lead us to the inference that the acceleration principle is invalid even in this simple form. The major conclusion of the hypothesis is that inventory investment is a function of the rate of change of sales or output, and the usefulness of the hypothesis depends on the correctness of that prediction rather than on the realism of its initial assumptions. As Abramovitz has shown,[1] the empirical evidence is consistent with the proposition that inventory investment in manufacturing is a lagged function of the rate of change of output or sales, despite the fact that inventory-output or inventory-sales ratios vary inversely with cycles in output or sales. These facts can be interpreted in either of two ways: manufacturers attempt to maintain a constant inventory-output ratio but are prevented from so doing by lags in the adjustment process, so that simultaneous ex post data do not display a constant ratio; or they attempt to maintain the ratio only between certain limits. There is little choice between these interpretations if both lead to the same testable prediction of the relation between inventory investment and sales or output; in any event the important thing is the prediction.

Economists are currently supplied with two leading hypotheses about the causes of inventory investment: that it depends on the rate of change of output or sales and that it depends on price expectations. It is to be doubted that either hypothesis is correct to the exclusion of the other; the difficulty lies in disentangling the two influences and estimating the importance of each in the cyclical process. How best to proceed with this task? As Mack and others have stressed, some disaggregation is necessary. For example there are presumptions that decisions to alter stocks of purchased materials are more likely to be affected by price expectations than are decisions about finished goods stocks, that durable finished goods stocks will often be used as a countercyclical buffer, that the relative influence of price expectations will vary among in-

[1]Moses Abramovitz, *Inventories and Business Cycles, with Special Reference to Manufacturers' Inventories*, National Bureau of Economic Research, 1950.

dustries, that lags in the adjustment process will differ from industry to industry, etc. A promising approach would be a series of industry studies in which the role of inventory investment in transmitting cyclical impulses through the vertical market structure would be investigated. This is especially desirable where the role of inventory investment in cycles rather than cycles in inventory investment is the problem. The difficulties of wresting ex ante meaning from ex post inventory data are reduced when inventory investment is studied in relation to sales, orders, output, prices, etc. in a vertical market sequence. A small number of such studies representative of classes of market structures where important differences in the determinants of inventory investment exist would probably shed considerable light on the part played by inventory investment in economy-wide business fluctuations.

The studies should stress the statistical verification of the acceleration and price speculation hypotheses. Qualitative information about market conditions, management inventory objectives and controls, and the like should be introduced as aids in the interpretation of the statistical evidence, e.g. the explanation of leads and lags, rather than as integral parts of the problems studied. Part of my concern about Mack's concept of passive inventory change is the possibility that it might direct attention to intensive studies of inventory policies and controls within individual firms as investigators tried to segregate the passive and intended elements of inventory change. It seems to me that once the importance of the breakdown by type of inventory in manufacturing and the likelihood that different industrial sectors will react somewhat differently to the same general stimuli have been recognized, most of the factors which Mack has emphasized as affecting the movements of aggregate inventory investment will be considered. The existing hypotheses about the major determinants of inventory investment are simple and promising. The existing concepts of intended and unintended investment are adequate for the task of interpretation. It is quite conceivable that the behavior suggested by simple models with somewhat artificial assumptions will be validated when applied to components of the aggregate, and that the behavior of the aggregate can then be understood through some simple combination of the movements of the components.