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## Chapter 21

# Size of Cyclical Fluctuations in Inventory Investment

### 1 *Share of Inventory Investment in Movements of Gross National Product*

The timing of inventory investment indicates the direction in which it acts on business activity at different stages in the cycle. The importance of the role of inventory investment depends upon the size of its fluctuations. Some summary indication was given in Chapter 1 on the basis of average experience in the interwar period (Table 1). This preliminary discussion ended with the following paragraph:

"These estimates are, of course, crude, but they are sufficiently accurate to establish several important propositions. One is that, on the average, a very considerable portion of the cyclical change in total output has taken the form of an alteration in the volume of goods added to stocks. A second is that, during ordinary business cycles, fluctuations in the rate of inventory investment as a whole have been larger, in terms of the value of goods involved, than those in construction or in the flow of durable goods to either producers or consumers. And a third proposition is that inventory investment, in terms of the violence of fluctuation, is the most volatile of the main components of output."

Table 84 subjects these conclusions to more detailed examination to see whether the observations based on averages are equally valid for individual cycles and are not peculiar to only one or two. If they are generally valid, fluctuations in inventory investment will obviously have a very great effect on the movements of gross national product. For each expansion of general business Table 84 shows the difference between gross national product in the year of depression with which the expansion starts and that in the year

## TABLE 84

## Gross National Product and Its Main Components
## Changes during 5 Business Cycles, 1919-1938

| | AV. AN. VALUE, $ BILLION, 1929 PRICES (1) | CHANGE, $ BILLION, 1929 PRICES Exp. (2) | Contr. (3) | Cycle (4) | CHANGE AS % OF CHANGE IN GNP Exp. (5) | Contr. (6) | Cycle (7) |
|---|---|---|---|---|---|---|---|
| | | FIRST CYCLE: 1919-20-21 | | | | | |
| 1 Gross national product | 66.6 | 1.4 | −3.6 | 5.0 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 52.1 | 2.0 | 1.6 | 0.4 | 142.9 | −44.4 | 8.0 |
| a Durables | 4.7 | −0.1 | −0.9 | 0.8 | −7.1 | 25.0 | 16.0 |
| b Nondurables | 28.0 | 0.1 | 2.1 | −2.0 | 7.1 | −58.3 | −40.0 |
| c Services | 19.4 | 2.0 | 0.3 | 1.7 | 142.9 | −8.3 | 34.0 |
| 3 Capital formation | 14.5 | −0.6 | −5.1 | 4.5 | −42.9 | 141.7 | 90.0 |
| a Construction | 5.2 | −1.2 | 0.9 | −2.1 | −85.7 | −25.0 | −42.0 |
| 1) Public | 1.4 | −1.1 | 0.5 | −1.6 | −78.6 | −13.9 | −32.0 |
| 2) Business | 2.2 | 0.3 | −0.1 | 0.4 | 21.4 | 2.8 | 8.0 |
| 3) Residential | 1.6 | −0.4 | 0.5 | −0.9 | −28.6 | −13.9 | −18.0 |
| b Prod. durable equip. | 4.9 | −0.1 | −1.7 | 1.6 | −7.1 | 47.2 | 32.0 |
| c Net change in claims against foreign countries | 1.55 | −0.7 | −0.1 | −0.6 | −50.0 | 2.8 | −12.0 |
| d Net change in inventories (inventory investment) | | | | | | | |
| 1) Total | 2.79 | 1.4 | −4.2 | 5.6 | 100.0 | 116.7 | 112.0 |
| 2) Total, excl. farmers | 2.53 | 0.6 | −2.8 | 3.4 | 42.9 | 77.8 | 68.0 |
| 3) Mfr. inventories | 1.09 | 0.4 | −1.6 | 2.0 | 28.6 | 44.4 | 40.0 |
| | | SECOND CYCLE: 1921-23-24 | | | | | |
| 1 Gross national product | 73.3 | 14.6 | 1.5 | 13.1 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 59.4 | 8.1 | 4.1 | 4.0 | 55.5 | 273.3 | 30.5 |
| a Durables | 5.7 | 1.6 | 0.3 | 2.3 | 17.8 | 20.0 | 17.6 |
| b Nondurables | 32.2 | 3.7 | 1.0 | 2.7 | 25.3 | 66.7 | 20.6 |
| c Services | 21.5 | 1.9 | 2.8 | −0.9 | 13.0 | 186.7 | −6.9 |
| 3 Capital formation | 13.9 | 6.4 | −2.7 | 9.1 | 43.8 | −180.0 | 69.5 |
| a Construction | 7.6 | 2.5 | 1.0 | 1.5 | 17.1 | 66.7 | 11.5 |
| 1) Public | 1.6 | −0.1 | 0.3 | −0.4 | −0.7 | 20.0 | −3.1 |
| 2) Business | 2.7 | 0.7 | 0.1 | 0.6 | 4.8 | 6.7 | 4.6 |
| 3) Residential | 3.4 | 1.9 | 0.6 | 1.3 | 13.0 | 40.0 | 9.9 |
| b Prod. durable equip. | 4.8 | 2.2 | −0.4 | 2.6 | 15.1 | −26.7 | 19.8 |
| c Net change in claims against foreign countries | 0.54 | −1.1 | 0.4 | −1.5 | −7.5 | 26.7 | −11.5 |
| d Net change in inventories (inventory investment) | | | | | | | |
| 1) Total | 0.88 | 2.8 | −3.7 | 6.5 | 19.2 | −246.7 | 49.6 |
| 2) Total, excl. farmers | 1.17 | 2.3 | −2.9 | 5.2 | 15.8 | −193.3 | 39.7 |
| 3) Mfr. inventories | 0.69 | 1.4 | −1.6 | 3.0 | 9.6 | −106.7 | 22.9 |
| | | THIRD CYCLE: 1924-26-27 | | | | | |
| 1 Gross national product | 85.4 | 8.2 | 1.0 | 7.2 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 67.9 | 4.0 | 1.7 | 2.3 | 48.8 | 170.0 | 31.9 |
| a Durables | 8.0 | 1.7 | −0.4 | 2.1 | 20.7 | −40.0 | 29.2 |
| b Nondurables | 35.8 | 2.0 | 1.7 | 0.3 | 24.4 | 170.0 | 4.2 |
| c Services | 24.1 | 0.3 | 0.4 | −0.1 | 3.7 | 40.0 | −1.4 |
| 3 Capital formation | 17.5 | 4.3 | −0.7 | 5.0 | 52.4 | −70.0 | 69.4 |
| a Construction | 10.3 | 1.6 | 0.1 | 1.5 | 19.5 | 10.0 | 20.8 |
| 1) Public | 2.0 | 0.3 | 0.3 | 0 | 3.7 | 30.0 | 0 |
| 2) Business | 3.6 | 1.0 | 0.1 | 0.9 | 12.2 | 10.0 | 12.5 |
| 3) Residential | 4.7 | 0.4 | −0.3 | 0.7 | 4.9 | −30.0 | 9.7 |
| b Prod. durable equip. | 6.1 | 1.1 | −0.4 | 1.5 | 13.4 | −40.0 | 20.8 |
| c Net change in claims against foreign countries | 0.31 | −0.5 | 0.3 | −0.8 | −6.1 | 30.0 | −11.1 |
| d Net change in inventories (inventory investment) | | | | | | | |
| 1) Total | 0.85 | 2.1 | −0.8 | 2.9 | 25.6 | −80.0 | 40.3 |
| 2) Total, excl. farmers | 0.99 | 2.1 | −1.3 | 3.1 | 22.0 | −130.0 | 43.1 |
| 3) Mfr. inventories | 0.27 | 0.6 | −0.8 | 1.4 | 7.3 | −80.0 | 19.4 |

## TABLE 84 (Concl.)

| | AV. AN. VALUE, $ BILLION, 1929 PRICES (1) | CHANGE, $ BILLION, 1929 PRICES: Exp. (2) | Contr. (3) | Cycle (4) | CHANGE AS % OF CHANGE IN GNP: Exp. (5) | Contr. (6) | Cycle (7) |
|---|---|---|---|---|---|---|---|
| | | FOURTH CYCLE: 1927-29-32 | | | | | |
| 1 Gross national product | 86.7 | 7.6 | —32.0 | 39.6 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 72.1 | 4.7 | —15.2 | 19.9 | 61.8 | 47.5 | 50.3 |
| a Durables | 7.2 | 0.6 | —4.5 | 5.1 | 7.9 | 14.1 | 12.9 |
| b Nondurables | 37.8 | 1.8 | —4.4 | 6.2 | 23.7 | 13.8 | 15.7 |
| c Services | 27.0 | 2.3 | —6.2 | 8.5 | 30.3 | 19.4 | 21.5 |
| 3 Capital formation | 14.6 | 2.8 | —16.7 | 19.5 | 36.8 | 52.2 | 49.2 |
| a Construction | 8.9 | —0.5 | —5.8 | 5.3 | —6.6 | 18.1 | 13.4 |
| 1) Public | 2.6 | 0.1 | —0.2 | 0.3 | 1.3 | 0.6 | 0.8 |
| 2) Business | 3.4 | 0.1 | —2.9 | 3.0 | 1.3 | 9.1 | 7.6 |
| 3) Residential | 2.9 | —0.8 | —2.7 | 1.9 | —10.5 | 8.4 | 4.8 |
| b Prod. durable equip. | 5.7 | 1.4 | —5.0 | 6.4 | 18.4 | 15.6 | 16.2 |
| c Net change in claims against foreign countries | 0.47 | 0 | —0.4 | 0.4 | 0 | 1.2 | 1.0 |
| d Net change in inventories (inventory investment) | | | | | | | |
| 1) Total | —0.37 | 2.0 | —5.6 | 7.6 | 26.3 | 17.5 | 19.2 |
| 2) Total, excl. farmers | —0.48 | 2.0 | —6.1 | 8.1 | 26.3 | 19.1 | 20.5 |
| 3) Mfr. inventories | 0.21 | 1.5 | —2.4 | 3.9 | 19.7 | 7.5 | 9.8 |
| | | FIFTH CYCLE: 1932-37-38 | | | | | |
| 1 Gross national product | 79.0 | 28.7 | —3.1 | 31.8 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 69.8 | 17.8 | 0.7 | 17.1 | 62.0 | —22.6 | 53.8 |
| a Durables | 5.7 | 3.0 | —1.4 | 4.4 | 10.5 | 45.2 | 13.8 |
| b Nondurables | 39.8 | 8.7 | 0.1 | 8.6 | 30.3 | —3.2 | 27.0 |
| c Services | 24.3 | 6.0 | 2.0 | 4.0 | 20.9 | —64.5 | 12.6 |
| 3 Capital formation | 9.2 | 11.0 | —3.9 | 14.9 | 38.3 | 125.8 | 46.9 |
| a Construction | 4.5 | 1.3 | —0.2 | 1.5 | 4.5 | 6.5 | 4.7 |
| 1) Public | 1.9 | —0.1 | 0.2 | —0.3 | —0.5 | —6.5 | —0.9 |
| 2) Business | 1.2 | 0.4 | —0.4 | 0.8 | 1.4 | 12.9 | 2.5 |
| 3) Residential | 1.4 | 0.9 | 0.2 | 0.7 | 3.1 | —6.5 | 2.2 |
| b Prod. durable equip. | 4.4 | 4.1 | —1.9 | 6.0 | 14.3 | 61.3 | 18.9 |
| c Net change in claims against foreign countries | 0.08 | —0.2 | 1.1 | —1.3 | —0.7 | —55.5 | —4.1 |
| d Net change in inventories (inventory investment) | | | | | | | |
| 1) Total | 0.18 | 5.8 | —2.9 | 8.7 | 20.2 | 93.5 | 27.4 |
| 2) Total, excl. farmers | 0.26 | 5.4 | —2.4 | 7.8 | 18.8 | 77.4 | 24.5 |
| 3) Mfr. inventories | 0.18 | 3.2 | —2.6 | 5.8 | 11.1 | 85.9 | 18.2 |
| | | AVERAGE OF FIVE CYCLES | | | | | |
| 1 Gross national product | 79.8 | 12.1 | —7.2 | 19.3 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 66.5 | 7.3 | —1.4 | 8.7 | 60.5 | 19.6 | 45.2 |
| a Durables | 6.3 | 1.6 | —1.4 | 2.9 | 12.9 | 19.1 | 15.2 |
| b Nondurables | 36.2 | 3.3 | 0.1 | 3.2 | 26.9 | —1.4 | 16.3 |
| c Services | 24.0 | 2.5 | —0.1 | 2.6 | 20.7 | 1.9 | 13.7 |
| 3 Capital formation | 13.3 | 4.8 | —5.8 | 10.6 | 39.5 | 80.4 | 54.8 |
| a Construction | 7.1 | 0.7 | —0.8 | 1.5 | 6.1 | 11.0 | 8.0 |
| 1) Public | 2.0 | —0.2 | 0.2 | —0.4 | —1.5 | —3.0 | —2.1 |
| 2) Business | 2.5 | 0.5 | —0.6 | 1.1 | 4.1 | 8.8 | 5.9 |
| 3) Residential | 2.6 | 0.4 | —0.5 | 0.7 | 3.3 | 4.7 | 3.8 |
| b Prod. durable equip. | 5.1 | 1.7 | —1.9 | 3.6 | 14.4 | 26.0 | 18.7 |
| c Net change in claims against foreign countries | 0.50 | —0.5 | 0.3 | —0.8 | —4.1 | —5.6 | —5.9 |
| d Net change in inventories (inventory investment) | | | | | | | |
| 1) Total | 0.56 | 2.8 | —3.4 | 6.3 | 23.3 | 47.5 | 32.4 |
| 2) Total, excl. farmers | 0.58 | 2.4 | —3.1 | 5.5 | 20.0 | 42.8 | 28.5 |
| 3) Mfr. inventories | 0.36 | 1.4 | —1.8 | 3.2 | 11.7 | 24.9 | 16.6 |

Sources and method of computation are described in notes to Table 1 except for the average cycle values shown in col. 1. To avoid downward bias the average value for each cycle is computed by weighting the years of initial and terminal trough one-half, and the other years included in a cycle one.

of prosperity with which the expansion ends. For each contraction it shows the difference between gross national product in the year of prosperity with which the contraction begins and that in the year of depression with which the contraction ends. The total change in gross national product during the expansion and contraction that make up a full cycle (measured from trough to trough) is computed by adding the change in gross national product during expansion to its change during contraction (signs disregarded).[1] Table 84 shows also the same sort of calculation for each of the principal components of total output. And each absolute change in a component is expressed also as a percentage of the change in total product during the same period. For easy reference the averages of Table 1 are repeated.[2]

The preliminary conclusions of Chapter 1 are well supported by the data for individual cycles. No less than 17.5 percent of the change in gross national product took the form of a change in inventory investment in any single phase (expansion or contraction). For full cycles the minimum figure, which occurred in 1927-32, was 19 percent. At the other extreme the change in inventory investment in one contraction, 1923-24, was nearly two and one-half times as big as the change in gross national product. Inventory investment moved down during this business recession but gross national product measured by annual data increased slightly. The maximum figure for a full cycle, that of 1919-21, was 112 percent. Excluding investment by farmers, the figures are only slightly smaller. Investment in manufacturing industries alone accounted for a large share, ranging from 28 to 100 percent of the change in all inventories and averaging almost exactly one-half.

Cycle by cycle fluctuations in the rate of inventory investment as a whole have also involved larger changes in the value of goods

[1] The mild business contractions of 1923-24 and 1926-27 appear in the annual gross product estimates only as virtual cessations of growth, not as actual declines. In these cases we *subtracted* the change during contraction from that during expansion to get the change over the full cycle. In effect, we treated the growth during contraction as a negative response to the business cycle.

[2] Similar computations were presented in NBER *Bulletin 74*. The importance of fluctuations in inventory investment in changes in gross national product has been emphasized also by Alvin H. Hansen, *Fiscal Policy and Business Cycles*, Ch. 1; see below, Sec. 3.

produced than in producer durables, consumer durables, or total construction. Indeed, the difference in total inventory investment between prosperity and depression was usually about twice as large as that in the first two categories, and more than twice as large as that in the third. The change in manufacturers' inventory investment alone was usually about as large as that in the output of producer and consumer durables and larger than that in construction.

Volatility is a vexed question on two counts. It suggests some measure of relative amplitude, that is, a comparison between the absolute size of the swing in a series and its normal level. However, some of the present series have negative values, notably the inventory investment series themselves. In consequence, their average level for the entire period approaches zero and in some cycles is negative.[3] Percentage computations in such cases give absurd results. True computations of volatility, in the sense stated above, are therefore impossible. But speaking loosely, there can be little question that inventory investment is extremely unstable. Imagine, for example, that manufacturers' inventory investment were $2 billion higher each year and that total inventory investment was $4 billion higher, thus eliminating all negative values. The average level of total inventory investment (either including or excluding farming) would still not exceed the average level of the output of consumer or producer durables or of total construction. And the average level of manufacturers' inventory investment would be about half as high. The relative amplitude of inventory investment in toto or by manufacturers alone would still be larger than the relative amplitudes of these other volatile series.

This, however, raises a second problem. While inventory investment is, of course, measured net, the output of producer durables and of construction is measured gross, that is, before depreciation is deducted. Since depreciation varies little during business cycles, the total cyclical swing of these activities would be little, if at all, reduced on a net basis; but their average levels would be markedly lower. Net output of producer durables is, of course, far more volatile than gross output. But for the analysis of business

[3] The same is true of 'net changes in claims against foreign countries'.

cycles the comparison between net additions to inventories and gross additions to other capital is the correct one. Decisions to purchase or produce plant and durable equipment over and above the quantity required to replace plant and equipment retired depend upon the same set of considerations as influence purchases to offset retirements. Both depend upon estimates of the profitability of the capital in the future, not simply on the operations of the current period. And since replacements rarely have the same technical capacity as the equipment retired, it is doubtful that a clear line can be drawn between production or purchase for replacement and that for additions to durable equipment. There can be little question, however, that businessmen do distinguish between purchase or production of goods for sale or consumption in the current period and that for addition to inventory, and base their decisions about each on different considerations. Subject to what has already been said about unplanned inventory investment it is this fact that makes it useful to study inventory investment in analyzing business cycles.

These questions aside, there are still qualifications to be borne in mind when studying Table 84. They do not, I think, affect the major showing of the data, but they are important. Annual estimates typically understate the size of cyclical fluctuations and do so in different degree in different cycles and in different series.[4] Monthly data would undoubtedly change the size of the cyclical swings in inventory investment compared with those in other elements of capital formation, but I would not expect my general observations about relative magnitudes to be modified.

Another consideration is that Table 84 shows the size of cyclical changes during fixed periods, namely, those bounded by the business cycle peaks and troughs identified by the National Bureau. It does not show the magnitude of the cycles in individual series. In annual data this has little effect upon the cyclical amplitude of the two inventory investment series or upon that of the output of producer durables. It does, however, reduce significantly the am-

[4] While quarterly estimates of gross national product are available (notably in Barger's *Outlay and Income in the United States, 1921-1938*) I do not regard quarterly estimates of aggregate or manufacturers' inventories to be sufficiently reliable for these purposes.

plitude of the fluctuations in consumer durables and construction. The reason is that the first three series responded regularly, and almost synchronously, to the ups and downs of business in the interwar period.[5] The last two, however, not only declined during the business expansion of 1919-20 but skipped the mild contraction of 1923-24; construction also skipped that of 1926-27. Nevertheless, the relations previously discerned among the cyclical magnitudes of the series still hold good if we confine our observations to the last cycle when all five series conformed closely to the movements of business at large. And the same is true if we extend our observations to 1926-38 when all except construction conformed closely to the calendar year reference dates.

We must repeat the cautionary note sounded above. The figures show how much of the change in total output between the trough and peak of business took the form of a change in the rate of inventory investment. They do not tell how much of the change in output was caused by a change in the rate of inventory investment, because the inventory investment figures include some unplanned investment or disinvestment and hence either overstate or understate the actual quantity of output that can be traced to some businessman's desire to increase his stock. Such unplanned changes in stock are, no doubt, less important in annual than in monthly data, but they are always present in some degree.

Finally, although a large portion of the cyclical changes in gross national product typically takes the form of a change in inventory investment, the share of inventory investment has varied a great deal from cycle to cycle. These variations are not entirely haphazard. If we classify our data by the length of expansion and contraction, an inverse relation is apparent between the length of the phase and the share of changes in inventory investment in changes in gross national product (Table 85). Despite some variation, the trend of the figures in each column is clearly downward the longer the phase, and the inverse relation stands out still more boldly if we average the figures for phases that lasted about a year, those that lasted about 2 years, and those that lasted about 4 years.

[5] Producer durables declined slightly from 1919 to 1920 when business was rising.

TABLE 85

Cyclical Changes in Inventory Investment as Percentage of Changes in Gross National Product, by Length of Phase, 1919-1938

| LENGTH OF PHASE, YEARS* | CHANGE AS % OF CHANGE IN GNP | | |
|---|---|---|---|
| | Total | Total, excl. farmers | Mfg. |
| .67 | 100 | 43 | 29 |
| 1.00 | 93 | 77 | 84 |
| 1.17 | −247 | −193 | −107 |
| 1.17 | −80 | −130 | −80 |
| 1.50 | 26 | 26 | 20 |
| 1.67 | 117 | 78 | 44 |
| 1.67 | 19 | 16 | 10 |
| 2.25 | 26 | 22 | 7 |
| 3.75 | 17 | 19 | 7 |
| 4.17 | 20 | 19 | 11 |
| | AVERAGES FOR PHASES OF STATED LENGTH[a] | | |
| .67 & 1.00 | 96 | 60 | 56 |
| 1.50-2.25 | 47 | 36 | 20 |
| 3.75 & 4.17 | 19 | 19 | 9 |

* Derived from the National Bureau monthly reference cycle chronology.
[a] Phases with negative figures omitted.

### 2 *Factors Determining the Relative Size of Fluctuations in Inventory Investment and in Gross National Product*

This section attempts to identify the causes of the two chief characteristics of the size of fluctuations in inventory investment: the relatively large fraction they typically constitute of the cyclical fluctuations in gross national product and the tendency of the fraction to diminish the longer the expansion or contraction. We consider first an oversimplified and, in many ways, unrealistic system, whose operation can be expressed in easy formulas. Later we allow for the main differences between the imaginary economy described by our formulas and the more intricate economy of the real world.

Our imaginary economy has two features important for present purposes. First, the inventory-output ratio remains constant. This has its elements of reality, for most businessmen try to maintain an approximately constant ratio for most of their inventories, and wide departures from the desired ratio will not be tolerated indefinitely. But we know also that there are often large divergences

which may persist for months. We shall have to allow for them later. The second feature concerns the pattern of cyclical fluctuations. We assume that the absolute increase in output per unit of time is constant during expansions, that the absolute decline in output is constant during contractions, and that the rates of increase and decline are equal. These assumptions taken together imply that the increase in inventories per unit of time will be constant and proportionate to the rate of increase in output.

We may now write the following equation for inventory investment in a peak year of business ($I_1$):

1) $I_1 = Ptr$, where

$P$ = the average value of gross national product during the preceding cycle, measured from peak to peak

$t$ = the inventory-gross national product ratio

$r$ = the annual rate of increase in gross national product during expansion

The decline in inventories during the preceding trough year of business ($I_2$) would be:

2) $I_2 = Pt\ (-r)$

For the whole expansion the increase in output that takes the form of an increase in inventory investment is the difference between the amount added to stock in the peak year and the amount liquidated in the preceding trough year. Writing $\Delta I$ *for* $I_1 - I_2$, we have:

3) $\Delta I = Ptr - Pt\ (-r) = 2\,Ptr$

The total increase in output during expansion ($\Delta O$) may be written:

4) $\Delta O = Pra$, where

$a$ = the length of expansion in years, and $P$ and $r$ are defined as in (1).

Finally, the ratio of the change in inventory investment to the total change in output $\left(\frac{\Delta I}{\Delta O}\right)$ is:

5) $$\frac{\Delta I}{\Delta O} = \frac{2\,Ptr}{Pra} = \frac{2t}{a}$$

We may say, then, that the share of the change in inventory investment in the total change in gross national product during an expansion depends directly upon the size of $t$, the inventory-output ratio, and that it varies inversely with $a$, the length of the phase. Of course, exactly the same thing would be true of contractions.

Given the assumptions, the bases and implications of the formula can be grasped intuitively by considering the following facts:

a) The proportion that a given annual increase in output bears to the accompanying increase in inventories depends upon the inventory-output ratio. If the ratio is 1:4, when output increases $100 inventories will increase $25.

b) The change in inventory investment between a trough and a peak equals the difference in the amount of stocks accumulated in the last year of expansion and the amount liquidated in the last year of contraction. Hence the proportionate relation between a given annual increase in output and the change in inventory investment between a cyclical trough and peak must be some multiple of the inventory-output ratio. If the annual increase in output and inventories in expansion equals the decline in contraction, the multiple is, of course, 2.

c) The change in inventory investment between a trough and a peak is, however, not to be compared with a single year's increase in output, but rather with the cumulative increase during all the years of an expansion. Given a constant absolute annual increase in output, the total change between trough and peak equals the annual increase multiplied by the number of years the expansion lasts. Hence the length of the expansion in years is the denominator of the fraction.

This summary formulation draws attention to two important and valid aspects of a true explanation of the contribution of inventory investment to general business fluctuations. One is the size of the inventory-sales ratio in the United States. The technique and organization of our economy are such that the inventories carried to facilitate production and sales are large relative to the output or sales of a year. Excluding farm stocks, which behave erratically and to which the theory does not apply, the ratio during the interwar period was about .34. Thus a given increase in output should be accompanied by inventory accumulation about

34 percent as large. And the change in inventory investment between the beginning and end of expansions or contractions should, on our preliminary assumptions, be 68 percent of the change in output during one-year phases and proportionately less during longer phases. The second point is that business cycles in the United States have typically been short. Four of the five contractions in the interwar period lasted 20 months or less, and four of the five expansions lasted 27 months or less. The simple theory outlined above suggests that the combination of a large inventory-output ratio and short cycle phases will usually produce high ratios of changes in inventory investment to changes in gross national product, and this is what we find (Table 85).

We must now make a closer comparison between the theoretical values that may be derived from our formula with the observed shares of inventory investment. Since the argument on which the formula is based clearly does not apply to farm stocks, the calculations are confined to total investment excluding farming and to investment by manufacturers. As stated, the inventory-output ratio, $t$, was about .34 during 1919-38; the corresponding ratio for manufacturers was about .16.[6] Theoretical values for the share of changes in inventory investment were calculated from these ratios and from the actual length of expansions and contractions as shown in the National Bureau monthly chronology of business cycles (Table 86).

Despite the wide differences in individual phases between the actual and theoretical values of inventory investment the values tend to be roughly similar, since averaging the figures for phases of about the same length greatly reduces the differences. The largest divergences are in the shortest phases, for which, as will be seen, there is a good reason. Moreover, the extreme differences appear in the two phases lasting 1.17 years—the mild contractions of 1923-24 and 1926-27, when inventory investment dropped markedly but the annual estimates of gross national product rose slightly. This made the changes in inventory investment very large compared with the (inverse) change in gross national product.

[6] The average value of nonfarm stocks in current prices was about $26 billion, that of manufacturers' stocks about $12 billion. Gross national product was about $76 billion on the average. These figures are based on Kuznets' estimates from which the inventory investment figures were derived.

TABLE 86

Cyclical Changes in Inventory Investment: Theoretical and Actual Shares in Changes in Gross National Product, 1919-1938

| LENGTH OF PHASE, YEARS ($a$) | CHANGE AS % OF CHANGE IN GNP: TOTAL, EXCL. FARMERS — Theoretical values $\left(\frac{2t}{a}\right)$ | TOTAL, EXCL. FARMERS — Actual values | MANUFACTURING — Theoretical values $\left(\frac{2t}{a}\right)$ | MANUFACTURING — Actual values |
|---|---|---|---|---|
| .67 | 91 | 43 | 43 | 29 |
| 1.00 | 68 | 77 | 32 | 84 |
| 1.17 | 58 | −193 | 27 | −107 |
| 1.17 | 58 | −130 | 27 | −80 |
| 1.50 | 45 | 26 | 21 | 20 |
| 1.67 | 41 | 78 | 19 | 44 |
| 1.67 | 41 | 16 | 19 | 10 |
| 2.25 | 30 | 22 | 14 | 7 |
| 3.75 | 18 | 19 | 9 | 7 |
| 4.17 | 16 | 19 | 8 | 11 |
| AVERAGES FOR PHASES OF STATED LENGTH* | | | | |
| .67 & 1.00 | 69 | 60 | 32 | 56 |
| 1.50-2.25 | 39 | 36 | 18 | 20 |
| 3.75 & 4.17 | 17 | 19 | 8 | 9 |

* Phases with negative figures omitted.

The observed discrepancies are no less than might be expected in view of the unreal elements in the theory on which the formula is based. The essential requirement of the theory is that inventory investment in the last time-unit of an expansion or contraction—in this case the last year—be proportionate to the average absolute increase in output per time unit during the phase. This in turn would occur if (a) the absolute rate of change in output were constant during a phase, (b) the rate of growth in output during (say) expansion were equal to the rate of decline during the preceding contraction, and (c) the inventory-output ratio remained constant so that changes in inventory were always proportionate to changes in output.

None of these requirements is wholly satisfied by the output and inventory cycles we observe. The rate of change in output is not constant over an entire phase. As we have seen, it usually increases to a maximum, often early in a phase, then tends to grow or decline at a lower rate. Irregular movements are common, and especially in expansions output often tends to spurt toward the end of the phase. Rarely, therefore, will the rate of change in output at the

end of the phase just equal the average rate during the phase. On the other hand, the irregularities characterizing the rate of change in output make it unlikely that the differences between the average and end of phase movements will be systematic.

Next, the rate of change in output during a given phase will rarely equal that during the preceding phase. While there is no evidence that expansions and contractions usually have different paces, the rate of change does vary from one phase of the business cycle to the next. Therefore, even if we could assume that the inventory-output ratio is always constant, the change in inventory investment per annum would seldom be exactly proportionate during any given phase to twice the rate of change in output per annum.

Finally, the inventory-output ratio is not constant because changes in inventory are not proportionate to changes in output during the same period. During the first 6-12 months of expansion of output, stocks continue the decline begun during the preceding contraction, although at a slower pace. Thereafter they grow, first slowly, then more rapidly, attaining a maximum at or near the peak of the business cycle. During contractions of output, similarly, stocks usually continue to grow, though at a slower pace, during most of the first year; thereafter they decline at an increasing pace, being most rapidly liquidated near the trough in business.

In these circumstances, it is easy to see why there are so many large discrepancies in individual cycles between the actual change in inventory investment relative to the change in gross national product and the relation indicated by the formula. But why does the formula yield results that are satisfactory in a general way? Why do the average shares for inventory investment approach the theoretical shares, attaining large values in short phases and varying inversely to the length of the phase? An answer can be formulated in general terms.

The relation between output and most categories of inventories is such that one cannot long increase or decline substantially faster than the other. If they did, stocks would become either intolerably large or inconveniently small compared with output, and businessmen would take corrective measures. For the function of most classes of stocks is precisely to facilitate output or sales. This is ob-

vious for the bulk of stocks held by retailers and wholesalers. Most manufacturers' stocks are in one of four classes: goods in process, materials or finished goods in transit, reserves held against delays in delivery, or finished goods ordered and awaiting delivery. For all these purposes, the amount of stocks required is controlled by the rate of output or sales. The inventory-output ratio may vary, but it cannot increase or decline indefinitely without setting off a corrective reaction.

As far as can now be judged from our studies of manufacturers' stocks, when the rate of change in output leaps upward at the beginning of expansion—or downward at the beginning of contraction—businessmen are unable, and, with respect to some classes of stocks, unwilling to effectuate a simultaneous and comparable movement of inventories. Not until the better part of a year has passed are the inertial forces derived from the preceding phase so far overcome that stocks begin to move in the same direction as output. As the first year of a phase proceeds, more and more businessmen accept the fact that the cycle has definitely turned, and more are able to free themselves from old commitments. At the same time, a growing disproportion between output and stocks emphasizes the necessity for energetic measures to bring the latter into line.

In the first year of a phase, then, the net change in inventories will be small—either the preceding movement will continue at a slower pace or a small movement in the opposite direction will start. The difference between the change in output and in inventories is large in this stage. Not until the second year of a phase does accumulation or liquidation of stocks pick up speed. From that time forth, inventories may change more slowly or faster than output,[7] but their pace, though it may lag, cannot continue to differ widely from that of output without producing an intolerable departure of inventory-output ratios from the levels businessmen consider efficient. The rate of change in output in the later stages of a phase may, and in most individual instances will, differ from the average rate during the phase, but there is no general rule

[7] The indications are that the movement of inventories continues, on the whole, somewhat more slowly than that of output since inventory-output ratios vary inversely to output until near the end of phases.

about the difference between them. The average rate will sometimes be higher, sometimes lower. We may, therefore, conclude that the rates of change in stocks in the latter part of a phase will, on the average, be similar to the average rate of change in output during a phase. In the same way, if there is no large systematic difference between the pace of expansions and of contractions, the difference between inventory investment at the end of any given phase and at the end of the preceding phase will, on the average, be about twice the size of either.

This argument applies to phases long enough for inventories to overcome their initial lag behind output, that is, phases of two years or more—the usual duration. But what about shorter phases? Does our argument imply that the change in inventory investment is unlikely to absorb a large part of the change in national product? On the contrary, it suggests merely that inventory investment or disinvestment in the given phase is unlikely to be large. The change from the rate of investment at the end of the preceding phase may well be large, as it was in each of the four short contractions of the interwar period. Three followed expansions of two years or longer, which ended with high rates of inventory accumulation. The fourth, 1920-21, followed the great speculative accumulation of 1919-20. Therefore, while liquidation was large in only one of these short contractions, the reduction in the rate of accumulation from that ruling at the end of the preceding expansion accounted for large reductions in output and income. In general, it would take a short contraction following a short expansion to create a presumption that a cyclical change in inventory investment would not be large relative to a change in gross national product.

The large share of the cyclical changes in gross national product that typically takes the form of a change in inventory investment is founded on a particular combination of time factors: the length of the usual cycle phase and the lag of changes in inventories behind those in output. Given the lag, changes in inventories would be a less aggravating agent in business cycles were it not that cyclical phases exceed a year. For in a phase that lasted only a year, the rate of change in stocks at the end of the phase would probably be small. It might even operate in a counter-cyclical direction as often as not. And given the duration of phases, the course and charac-

teristics of the cycle would be different did inventory investment not lag behind the rate of change in output. For if output and stocks moved together, the swings of output would be strongly reinforced early in each phase by parallel movements in inventory investment. And inventory investment in turn would tend to fall off later in the phase as the rate of change in output often does in expansion and usually does in contraction. It would not sweep up smoothly until the end, or near the end, of expansion and down until near the end of contraction.

This formulation, however, is in an important sense unreal. The combination of phase length and inventory lag is not fortuitous. As we have seen, in contractions the rate of decline in output has usually reached a maximum well before the end of the phase, oftener than not in the first half. Thereafter it slackened. If we now suppose that inventory investment and the rate of change in output move synchronously, the rapid decline in output in the first half of contraction would be aggravated by an equally rapid decline in stocks. When the rate of decline in output falls, however, inventory liquidation also would decline. This would constitute a powerful force for revival. These considerations suggest, therefore, that if inventories changed synchronously and proportionately with sales, business cycles would be shorter and more violent than they are. The lag of inventory investment tempers the effect of the early decline in sales on output. But when the rate of decline (or growth) of sales begins to fall off, more rapid inventory liquidation operates to extend, rather than to halt and reverse, the swing of business. And similar considerations apply to expansions. The lag of inventory investment thus helps to account for a notable feature of expansions and contractions: business usually continues to move in the same direction for many months after its pace has begun to slacken. By the same token, it helps account for the fact that cyclical phases usually last two years and often longer during which inventory investment (or liquidation), despite its tendency to lag, reaches high levels. On the other hand, since phases rarely exceed three years, their length does not usually act as a drag, bringing the share of inventory investment in changes in gross national product to a low level.

There are indeed good reasons for believing that the relation

between the length of expansions or contractions and the share of inventory investment in changes in gross national product must be inverse. For, as we have seen, if changes in output per unit of time are constant during a phase and changes in inventory are proportionate, an inverse relation is inevitable. This would not be true if we assumed that the rate of change in output increased sufficiently rapidly during a phase. But the assumption would be unrealistic (Ch. 16).

Must the relation be inverse if we make the realistic assumption that inventory movements lag behind those in output at the trough (peak) of business and increase (decline) steadily until the peak (trough)? It must, provided certain restrictions on the variation of inventory-output ratios are accepted. Consider an hypothetical expansion from a trough in an imaginary Year O.

CASE 1

| | | YEAR | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| 1 | Gross national product | 100 | 110 | 120 | 130 | 140 |
| 2 | Change in GNP between Year O & given year | .. | 10 | 20 | 30 | 40 |
| 3 | Inventories (end of year) | 40 | 40 | 43.2 | 46.8 | 50.4 |
| 4 | Inventory investment | −4.0 | 0 | +3.2 | +3.6 | +3.8 |
| 5 | Change in inventory investment between Year O & given year | .. | +4.0 | +7.2 | +7.6 | +7.8 |
| 6 | Ratio: line 5 ÷ line 2 | .. | .40 | .36 | .25 | .195 |
| 7 | Inventory - output ratio: line 3 ÷ line 1 | .40 | .36 | .36 | .36 | .36 |

The special assumptions of Case 1 are:

a) Inventory investment in the trough year equals 40 percent of the annual change in output assumed. This is reasonable in the last year of a phase in view of the over-all inventory-output ratio in this country.

b) The annual increases in output are constant. The trend of the figures in line 6 would be still more strongly downward if we assumed that output increased at a declining rate. It would not necessarily be downward if the rate of growth in output increased rapidly enough. But, as stated, to assume increasing rates of growth throughout a phase is unrealistic.

c) Inventories do not show any net change during the first year

of expansion. This corresponds approximately with the facts and reflects the long lag of stocks behind output.

d) The inventory-output ratio falls in the first year, reflecting the lag of stocks behind output, then remains constant. The trend in line 6 would be still more strongly downward if we assumed, in accordance with the evidence (Ch. 6), that the inventory-output ratio continues to decline at least slowly until near the peak of business. But the ratio of the change in inventory investment to that in gross national product need not decline as the expansion lengthens if the inventory-output ratio is allowed to increase.

Case 2 illustrates a situation in which the share of inventory investment in the cyclical rise of gross national product remains constant. But the implications are such as to make this situation unlikely in the real world. The inventory-output ratio rises 28 percent from the first year of expansion to the fourth, the rate of rise accelerating each year. This, moreover, is the ratio of aggregate stocks to aggregate output. Since many categories of stocks lag behind output by more than a year or vary inversely, inventory-output ratios for other categories must rise even more swiftly. A tendency for inventories to increase so much more rapidly than sales would probably be checked by a reduction in inventory accumulation. A stable ratio of change in inventory investment to that in gross national product could be consistent with a stable inventory-output ratio only if output increased at an ever faster pace. And the acceleration in output growth would need to be still more rapid if the inventory-output ratio were to decline during expansions and rise during contractions, as it appears to have done. In

Case 2

| | | YEAR | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 |
| 1 | Gross national product | 100 | 110 | 120 | 130 | 140 |
| 2 | Change in GNP between Year O & given year | .. | 10 | 20 | 30 | 40 |
| 3 | Inventories (end of year) | 40 | 40 | 44 | 52 | 64 |
| 4 | Inventory investment | −4 | 0 | +4 | +8 | +12 |
| 5 | Change in inventory investment between Year O & given year | .. | +4 | +8 | +12 | +16 |
| 6 | Ratio: line 5 ÷ line 2 | .. | .40 | .40 | .40 | .40 |
| 7 | Inventory-output ratio: line 3 ÷ line 1 | .40 | .36 | .37 | .40 | .46 |

the light of experience, however, continued acceleration in output growth or decline is an inadmissible assumption.

The tendency for the share of change in gross national product that takes the form of a change in inventory investment to be smaller the longer the phase rests, it appears, on two circumstances: (a) the tendency for the inventory-output ratio to vary inversely to output; (b) the fact that the rate of change in output does not continue to accelerate during expansions and contractions. The inverse movement of the inventory-output ratio may be traced to the conglomeration of factors that together control the volume of stocks—the desire of businessmen to keep stocks of most kinds in line with output or sales; the obstacles to prompt adjustment of stocks to changes in sales, especially the time required for purchasing, production, and transportation, and the difficulties of forecasting; finally, the fact that some kinds of stocks are used as buffers to cyclical changes in demand. The cyclical pattern of changes in output, however, raises problems far beyond the scope of this book. For present purposes, we must accept it as a fact, established empirically and to be explained only by a more comprehensive investigation of business cycles.

### 3 *Short Cycles, Minor Cycles, and Inventory Cycles*

The analysis in preceding sections shows that changes in inventory investment are significant in short expansions and contractions. But the longer the phase, the smaller the contribution of inventory investment to the further advance or decline of business. Conversely, the longer the phase, the more it must depend upon consumers' expenditures or business investment in plant and durable equipment for its motive force. In this significant but limited sense, it seems appropriate to think of short cycles as inventory cycles while longer movements are identified with other categories of demand. Short expansions or contractions would be far milder than those we have experienced were it not for the action of inventory investment. Longer phases, say of 3 years or more, could not have occurred without the increasing intervention of changes in consumer or business expenditure that are independent of inventory movements. For after that interval further change in inventory investment, if there is any, is likely to be quite small.

While this aspect of the role of inventories in fluctuations of different length should be recognized, it leaves open another vital question: why do some movements end after 12 or 15 months while others last 4 or 5 years? The outcome may turn on the entire assemblage of forces controlling expenditures on producer durable and consumer goods. These may at times make for a strong sustained increase in demand while at other times their strength is quickly exhausted and a decline ensues. If this is the case, there is nothing to add to what was said in the preceding paragraph.

Several writers, however, have developed a more systematic conception of the relation between short and long cycles in business. Professor Hansen, for example, following the lead of Professor Schumpeter, distinguishes 50 year "long waves", 8 year "major" cycles, and 3 or 4 year "minor" cycles.[8] The long waves and major cycles he attributes to innovations, that is, to investment in construction work and durable equipment associated with the business exploitation of significant developments in technology, business organization, the geography of markets, and the like. The minor cycles he believes are caused "not infrequently" by fluctuations in inventory investment.

The general thesis that business cycles may be arranged in sets of 2 or 3 that together constitute a cycle of a higher order—minor cycles, in Hansen's terminology, combining to make major cycles —is too broad to be examined here. Some preliminary tests by Burns and Mitchell repay study.[9] Here we are especially interested in the possibility that the minor cycles in Hansen's multi-cycle theory are, in some significant sense, inventory cycles.

With respect to this question, Hansen's ideas appear to rest upon his analysis of 1921-32. He observed that the business contractions of 1923-24 and 1926-27 were especially mild. Annual estimates of gross national product in constant prices did not decline, and several important categories of output skipped one or both contractions. He therefore regards 1921-29 as a single major expansion interrupted by two minor recessions. Together with the long and severe contraction of 1929-32, it makes up a major cycle. Hansen points out (Ch. 2) that if we treat this period as a major

[8] Op. cit., Ch. 1.

[9] *Measuring Business Cycles*, Ch. 11.

cycle: "Unlike investment in plant and equipment . . . inventory investment does not progressively sustain the recovery during an entire major upswing. On the contrary, the upswing is checked, at intervals of three to four years, by disinvestment in inventories, or a decline in the rate of accumulation. It is this ebb and flow of inventories which apparently dominates the minor cycle." In the terminology of preceding sections, Hansen finds that the portion of the change in gross national product taking the form of a change in inventory investment was much smaller in the major upswing 1921-29 than in the minor fluctuations within that period.[10] The validity of this observation may be seen in Table 87 which analyzes the major cycle 1921-32 in the same form as the business cycles identified by the National Bureau are analyzed in Table 84. The share of inventory investment was drastically lower in the long cycle 1921-32 than in the five shorter cycles of the interwar period. The difference is especially marked in comparisons between the long expansion 1921-29 and the short expansions. The share of inventory investment in the expansion of gross national product between 1921 and 1929 was only 7.3 percent; excluding farmers, it was 5.8 percent; for manufacturers alone it was 3.3 percent. In the short expansion 1921-23, when inventories were less important than in any other short expansion of the period, the comparable figures were 19.2, 15.8, and 9.6 percent. The difference between the share of inventory investment in the long expansion 1921-29 and its average share in the five shorter expansions was still more marked. A similarly drastic shift appears in the relative size of inventory investment and other elements of private investment. In the shorter expansions the portion of the change in total output that took the form of a change in the rate of accumulation of stocks was regularly larger than that which took the form of an increase in the output of producer durables, consumer durables, or construction. The share of inventory investment by manufacturers alone sometimes exceeded that of the various elements of durable goods output or construction and it was always larger than half the share of each of the other categories. In the 1921-29 expansion, however, total inventory investment increased less than any of

[10] To the writer's knowledge, the first investigator to make this observation was Simon Kuznets (NBER *Bulletin 74*).

TABLE 87

Gross National Product and Its Main Components
Changes during the Major Fluctuation, 1921-29-32

| | AV. AN. VALUE, $ BILLION, 1929 PRICES | CHANGE, $ BILLION, 1929 PRICES | | | CHANGE AS % OF CHANGE IN GNP | | |
|---|---|---|---|---|---|---|---|
| | | Exp. | Contr. | Cycle | Exp. | Contr. | Cycle |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1 Gross national product | 82.7 | 32.9 | −32.0 | 64.9 | 100.0 | 100.0 | 100.0 |
| 2 Flow of goods to consumers | 67.7 | 22.6 | −15.2 | 37.8 | 68.7 | 47.5 | 58.2 |
| a Durables | 7.0 | 4.8 | −4.5 | 9.3 | 14.6 | 14.1 | 14.3 |
| b Nondurables | 35.8 | 10.2 | −4.4 | 14.6 | 31.0 | 13.8 | 22.5 |
| c Services | 24.7 | 7.7 | −6.2 | 13.9 | 23.4 | 19.4 | 21.4 |
| 3 Capital formation | 15.2 | 10.1 | −16.7 | 26.8 | 30.7 | 52.2 | 41.3 |
| a Construction | 8.9 | 4.7 | −5.8 | 10.5 | 14.3 | 18.1 | 16.2 |
| 1) Public | 2.1 | 0.9 | −0.2 | 1.1 | 2.7 | 0.6 | 1.7 |
| 2) Business | 3.5 | 2.0 | −2.9 | 4.9 | 6.1 | 9.1 | 7.6 |
| 3) Residential | 3.5 | 1.8 | −2.7 | 4.5 | 5.5 | 8.4 | 6.9 |
| b Prod. durable equip. | 5.6 | 3.9 | −5.0 | 8.9 | 11.9 | 15.6 | 13.7 |
| c Net changes in claims against foreign countries | 0.44 | −0.9 | −0.4 | −0.5 | −2.7 | 1.2 | −0.8 |
| d Net changes in inventories (inventory investment) | | | | | | | |
| 1) Total | 0.30 | 2.4 | −5.6 | 8.0 | 7.3 | 17.5 | 12.3 |
| 2) Total, excl. farmers | 0.37 | 1.9 | −6.1 | 8.0 | 5.8 | 19.1 | 12.3 |
| 3) Mfr. inventories | 0.36 | 1.1 | −2.4 | 3.5 | 3.3 | 7.5 | 5.4 |

these other categories of capital formation, and the gain in investment by manufacturers alone was less than half the increase in any of them.

The long contraction 1929-32 was marked by a similar shift in the proportion of the total change in output accounted for by inventory investment. The share of total inventory investment in the decline of output was only 17.5 percent while the average for the 5 contractions was 47.5 percent; the share of total investment excluding that by farmers was 19.1 percent and the five-cycle average, 42.8 percent; for manufacturing alone, the comparable figures were 7.5 and 24.9 percent. The share of all three was much smaller than in any of the shorter contractions.

Hansen offers the following explanation of the role of inventory investment in minor cycles (p. 17):

"When an upsurge in real investment occurs, it is not unusual for the spurt in inventory accumulation to run ahead of the normal requirements indicated by the rising trend. When this is the case, sooner or later a temporary saturation in inventory accumulation develops, leading to an inventory recession. Not infrequently the minor setbacks experienced in the major upswings may be characterized as inventory recessions. But sometimes other situations may initiate or aggravate

these minor recessions. Thus, for example, in the beginning of the major upswing it may be that large investment in improved machinery occurs and that after a time a temporary saturation is reached in this type of investment leading to a recession. The general buoyancy of the upswing, however, soon starts the economy upward again with a further burst of real investment after the temporary setback thus sustained. Sometimes special situations are partly responsible for minor recessions, such as critical international developments, labor disturbances, or even special factors having to do with major industries, such as the Ford shutdown in 1927. Regularly, however, inventory movements play an important role."

The prominence of inventory investment as an aggravating agent in short cycles, asserted in Hansen's last sentence, may be considered as established (see Sec. 2 above). The issue, however, is precisely whether the shorter declines of business are initiated by the appearance of saturation in the demand for additional inventories or by a failure of demand for other kinds of goods. Unfortunately, with the evidence now available this issue cannot be brought to a decisive test.

Hansen's statements—"it is not unusual for the spurt in inventory accumulation to run ahead of the normal requirements indicated by the rising trend" and "When this is the case, sooner or later a temporary saturation in inventory accumulation develops, leading to an inventory recession"—leave open the question of the forces that cause inventory investment at first to rise too rapidly, then to fall off. The cause suggested by the analysis in preceding chapters of this study is that output at first rises rapidly but later more slowly and that inventory investment follows the pattern of the rate of change in output. Sooner or later inventory investment would diminish. However, investment in major categories of stocks —raw materials held by manufacturers and stocks of wholesalers and retailers—tends to lag behind the rate of change in output. There is also some evidence that toward the end of expansions, investment in finished goods held by manufacturers tends to rise. It may be questioned, therefore, whether the downturn in inventory investment that the retarded growth in output would eventually bring about actually occurs before the demand for producer durables and other categories of commodities begins to fall. Were

adequate monthly data available, this issue could be settled; but, as pointed out above, in their absence the facts remain in doubt (Ch. 14).

Mere retardation in the growth of output is not the sole agency able to cause a decline in inventory investment that may precipitate a business recession. Lloyd Metzler has described another process the outlines of which are plausible (cf. Ch. 1). He calls attention to the fact that when business revives, manufacturers and dealers have difficulty in effecting an appropriate increase in their stocks. Indeed, the first effect of an increase in business is to cause stocks to fall temporarily, leading to a sharp drop in inventory-output and inventory-sales ratios. In subsequent periods businessmen attempt not merely to increase inventories in proportion to increases in output and sales but also to accumulate enough goods in addition to restore inventory-output ratios to desired levels. The process of bringing inventories once more into line with the level of output and sales takes some time, but when it has been accomplished, an important source of demand for additional goods disappears and inventory investment tends to fall.

Forces of this type undoubtedly influence the behavior of some leading categories of stocks. But whether, in the face of the obstacles to the prompt adjustment of stocks to sales and output, they operate sufficiently rapidly is again not clear. Indexes of inventory-sales and inventory-output ratios for all manufacturers suggest that there is no pronounced rise before the peak in business. If this were true for all important inventory categories it would count heavily against Metzler's thesis. But whether or not it is true will be known only when long series of inventory data are available for the components of manufacturers' stocks and of stocks held by other industrial divisions.

A decline in inventory investment may be precipitated by still other causes. Price speculation may occur from time to time leading to periods of rapid accumulation followed by attempted liquidation when price expectations change. Widespread alternations in the degree of optimism with respect to the demand for goods may have the same results. But again there is no evidence that these forces regularly exert a powerful influence on the behavior of stocks.

Finally, there is no presumption in favor of the idea that the role of inventory investment is the same in every short cycle. It may, as Hansen suggests, act as the precipitating agent of some recessions and merely as an aggravating agent in others. The outcome may turn on how soon after the onset of business revival the rate of growth of output begins to decline and on the degree of retardation. If the rate of growth starts to fall relatively early, inventory investment is more likely to reach a peak earlier than other types of expenditure. And if retardation is very marked, the concomitant decline in inventory investment is more likely to be sufficient to precipitate a business recession despite the continued rise in other categories of output. If the retardation occurs relatively late and is relatively mild, the recession in business may be set off by a failure in other types of demand. That the precise order of events does not repeat itself from cycle to cycle is, of course, highly plausible. But future studies must still try to determine the relative frequency with which inventory investment initiates the upturns and downturns of business.

This is an important problem in the mechanism of business cycles quite apart from the Schumpeter-Hansen multi-cycle theory which has given it prominence. If it proves impossible to identify an 8 or 10 year cycle in expenditures for construction and equipment, we shall still want to know how often and under what circumstances upturns and downturns are precipitated by inventory investment. If the existence of a major cycle can be established, the multi-cycle theory will stand whether or not inventory investment turns out to be a regular precipitant of the minor fluctuations it envisages. It would be extremely interesting if one could resolve these questions now, but they must await additional work and better evidence.