

by George M. Cobren and Maurice Liebenberg ☆

Inventories in Postwar Business Cycles

BUSINESS inventories registered a sizable advance in the opening quarter of 1959. The rise in nonfarm stocks was the first in more than a year and followed a period of liquidation which had reached its maximum in the first half of 1958 before tapering sharply with the subsequent improvement of business. As in the two previous postwar recoveries, the swing in inventories accounted for a substantial fraction of the increase in national output—approximately one-third since the first quarter 1958—and has interacted with other demand elements to stimulate economic recovery.

The first quarter inventory advance centered in durable goods manufacturing, in which earlier reductions had been particularly heavy. In addition, it reflected special developments, such as unusual increases in the inventories of the metals, machinery, and other steel-using industries, in anticipation of possible interruptions in supplies.

Accumulation in nondurable goods manufacturing and in trade was moderate, as liquidation in these industries had been much more limited. A sizable advance in dealers' inventories of new cars to meet expected increases in market demand and to enlarge floor stocks, was the principal factor in the rise registered at retail.

Even though affected by special developments, the current inventory position is broadly similar to that associated with the early stages of recovery in the two earlier postwar business cycles. Following the usual pattern, inventory liquidation continued after the upturn of economic activity, and the inventory-GNP ratio fell well below average. Preliminary data for the opening quarter of 1959 indicate a further decline in this ratio.

Data on postwar inventory movements which appear in the recently released OBE publication, *U.S. Income and Output* (see announcement on the back cover of this issue) provide a basis for viewing developments in perspective. In preparing the volume statistics underlying the GNP measure of inventory change were carefully reviewed. In particular, a major effort went into the adjustment of the basic quarterly series to eliminate seasonal variations. The methods used, which are described on page 98 of the report, were the outcome of intensive testing of several alternative approaches to this difficult area of statistical adjustment.

While the estimates were constructed by separate processing of seven major subgroups, the difficulty of obtaining reliable detailed results precludes publication of the component series. It is believed, however, that some useful groupings of the underlying components can be made which are sufficient to indicate the broad patterns of inventory movements in the postwar period.

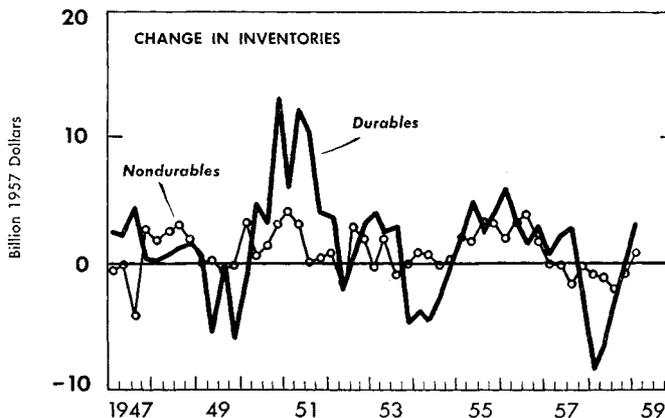
These inventory movements reflect changes in the total stock of nonfarm inventories in the pipelines of the economic

system. These currently amounted to about \$100 billion. Goods are continuously flowing into and out of this vast reservoir so that the total is always fluctuating. The net change—or investment—in inventories during a period reflects not only increases or decreases programed by the business community in response to current or anticipated needs, but also the unplanned accumulations or depletions that result from unforeseen factors, such as rapid shifts in demand.

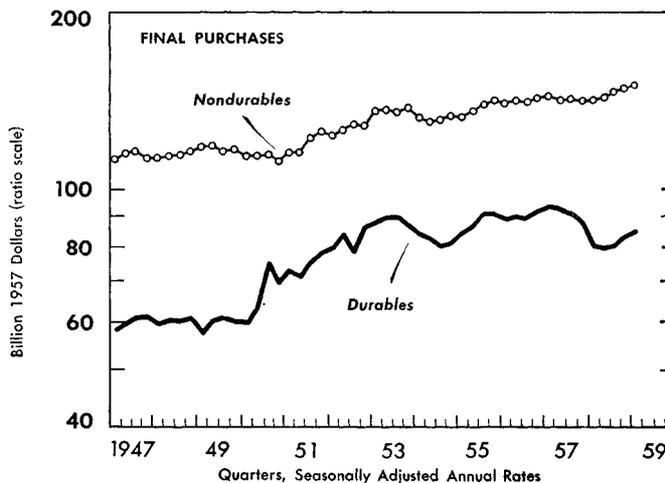
Changes in business inventories react in a highly sensitive and complex manner to movements in other economic vari-

Inventory Patterns

Wider swings in durable goods . . .



reflect the greater volatility in demand



NOTE.—MESSRS. COBREN AND LIEBENBERG ARE MEMBERS OF THE NATIONAL INCOME DIVISION OF THE OFFICE OF BUSINESS ECONOMICS. SHIRLEY LOFTUS ASSISTED IN THE PREPARATION OF THE ESTIMATES.

ables and—given the large volume of total inventory holdings—are an important element in the chain of events that account for the short-run behavior patterns of the economic system.

Some of the specific conclusions suggested by the examination of the postwar record are as follows:

1. Apart from cyclical fluctuations, the ratio of nonfarm business inventories to GNP was essentially stable throughout the postwar decade. As compared with the 1920–29 period, the ratio was about one-fourth lower.

2. Although cyclical fluctuations in the total stock of inventories were moderate in percentage terms, the absolute changes were large and volatile and accounted for a substantial fraction of the quarterly changes in national output.

3. The cyclical fluctuations in inventories occurred mainly in durable goods.

4. Inventory movements, in line with the pattern of general business activity, were characterized by extended periods of growth followed by sharp declines confined to relatively short spans of time. In each of the broad inventory waves, liquidation canceled only part of the previous accumulation.

5. The highest rates of accumulation generally occurred well in advance of the peaks of business activity, although inventories continue to grow until after the cyclical downturn took place. In contrast, stock liquidation reached its maximum at or near the trough of the business cycle and thereafter tapered fairly rapidly.

6. The total stock of inventories turned down approximately one quarter after the peak in GNP, and turned up approximately two quarters after the trough in activity.

7. Despite sharp liquidations after business downturns, the relatively larger declines in output resulted in stock-output ratios which remained high throughout the period of contraction and showed substantial improvement only after the recovery of business had begun.

Measurement of inventories in GNP

Since inventories are to be examined in the GNP framework, the way in which they enter into GNP will be reviewed briefly.

Most of the gross national product is measured in terms of sales of goods and services to major purchaser groups—consumers, business investors, government, and foreigners. To convert the aggregate of national sales of final products into a measure of national production, the change in business inventories is added to these sales—or deducted, if negative.

In the current-dollar gross national product all sales are measured at current market prices—i.e., physical units sold are expressed at the prices that final purchasers pay for them. In harmony with this treatment, inventory change also reflects the change in physical volume expressed in terms of the current prices of the period.

However, the change in inventories as it is obtained initially from the accounting records of business (change in “book” values) on which the national product estimates of inventory change are based, does not conform to this principle of valuation. Though additions to inventories are valued at current prices on the books of business, the inventories that are used up and enter the cost of goods sold are generally not so valued. Depending on the accounting methods used, their valuation may depart widely from current prices. For instance, under the prevalent first-in, first-out (FIFO) method it reflects in part the prices of prior accounting periods. Accordingly, in measuring the inventory component of GNP an “inventory valuation adjustment” is introduced which, in effect, serves to express inventories used up in production—and hence total net inventory

changes—in current-dollar terms, in conformity with the valuation of other GNP components. It may be noted that this method of inventory valuation is very similar to the last-in, first-out (LIFO) method.

The book value concept of inventory change will not be used further in this article.

In the constant-dollar measure of GNP, all components are expressed in terms of the prices of a common base period so as to eliminate the influence of changing prices and to focus on physical-volume change. The constant-dollar data on inventory change are a component of the constant-dollar or “real” gross national product. They measure the physical or real change in the volume of business inventories.

The detailed deflation of GNP was carried out in terms of 1954 prices. However, inasmuch as it is easier to grasp quickly comparisons that are made in terms of recent price levels, the charts and text-analysis that employ constant-dollar figures are in terms of 1957 prices. In addition, the following discussion deals exclusively with nonfarm inventories.

ANALYSIS OF POSTWAR PERIOD

Both the stock of nonfarm business inventories and the gross national product increased in real terms by approximately two-fifths from 1947 to 1958. The broad composition of inventory holdings changed little over this period.

In spite of variations in the relative annual rates of growth of business inventories and GNP, the average of the beginning and ending inventories when related to gross national product fell within the comparatively narrow range of 22 to 23½ percent in every year of the postwar period.

The quarterly ratios fluctuated more markedly over the course of successive business cycles. However, since deviations from the average were of relatively short duration, the influence of the quarterly movements was in large part offset in the annual figures. It will also be noted later that while total stocks showed a relatively stable relationship to GNP, changes in these stocks—both annual and quarterly—displayed a very high degree of variability.

Three waves

Inventory growth in the postwar period proceeded in three major waves which were closely related to the cyclical behavior of total business activity. The first of these may be dated roughly from the start of 1946 to 1950 and had its origin in the economic readjustment and the burst of restocking which followed World War II. The second wave—extending from 1950 to 1954—was sparked initially by the recuperative powers of the private economy, and later influenced greatly by the Korean conflict. The third, extending from 1954 to 1958, was affected by a more varied set of factors which are not readily classifiable under any single heading.

In each of these periods, inventory investment accelerated up to a crest and then receded before turning negative in the concluding phase. However, as shown below, liquidations canceled only part of the increases that had occurred in the buildup stage of the same cycle. Thus, the 1949 liquidation offset about one-fifth of the additions that had taken place since the end of World War II; the 1953–54 liquidations canceled about one-sixth of the increase from 1950 up to that time; and according to preliminary data, 1957–58 reductions offset almost half of the preceding cyclical growth.

Table 1.—Three Phases of Postwar Inventory Movement

[Billions of 1957 dollars]

Period	Changes in nonfarm stocks
First quarter, 1946—first quarter, 1949.....	14.9
First quarter, 1946—fourth quarter, 1946.....	(9.9)
First quarter, 1947—first quarter, 1949.....	(5.0)
Second quarter, 1949—fourth quarter, 1949.....	-3.1
First quarter, 1950—third quarter, 1953.....	22.1
Fourth quarter, 1953—third quarter, 1954.....	-3.7
Fourth quarter, 1954—third quarter, 1957.....	12.9
Fourth quarter, 1957—fourth quarter, 1958.....	-6.4

The net accumulations over the course of the entire interval totaled \$36½ billion (in 1957 prices), with about one-third occurring in the 1946-49 period, almost one-half in the 1950-54 period, and one-sixth since then.

Summary of durable goods

As can be seen from the first chart, durable goods stocks accounted for most of the fluctuations in total nonfarm inventories during the postwar period.

This greater sensitivity of hard goods inventories is closely related to the instability of the demand for durable goods. Private demand is inherently uneven and is, moreover, bunched or postponed in response to changes in the economic circumstances of the purchaser. Large shifts in the volume of Government demand for durables, stemming from rapid changes in defense requirements, have also been a source of instability in this area.

In the chart the durable goods inventory change is compared with final purchases of all durable goods. The latter encompass consumer durables, producers' durable equipment, durables bought by Government and those purchased by foreign customers. The chart shows the large fluctuations in this type of demand and the abrupt changes in inventories that have followed them closely.

One must not, however, ascribe too close a relationship to the two series. Durable goods inventories are influenced also by developments in other final markets—for instance in the market for construction. Moreover, inventory investment is affected by factors other than current purchases—such as expectations relating to future supply and cost and price developments. The following summary of durable goods inventory movements in the postwar period will bring out the influence of current demand and of other factors.

The initial phase of the inventory swing which followed the war reflected restocking for civilian purposes. During the war, private output of consumer and producer durables was restricted, and the associated inventories were correspondingly reduced. In addition, Government controls operated to hold stocks to a minimum.

After the war, inventory holdings were built up to support expanded production for civilians and to restore more usual inventory-sales ratios. With direct Government purchases greatly reduced, and a much larger proportion of total production flowing once more through regular trade channels, inventory accumulation by distributors was particularly heavy. The major phase of the restocking movement appears to have been completed by the end of 1946, and the inventory rise proceeded at a much more moderate rate thereafter.

Owing mainly to a decline in business fixed investment, durable goods purchases began to drop in the opening quarter of 1949, and a sharp liquidation in hard goods inventories

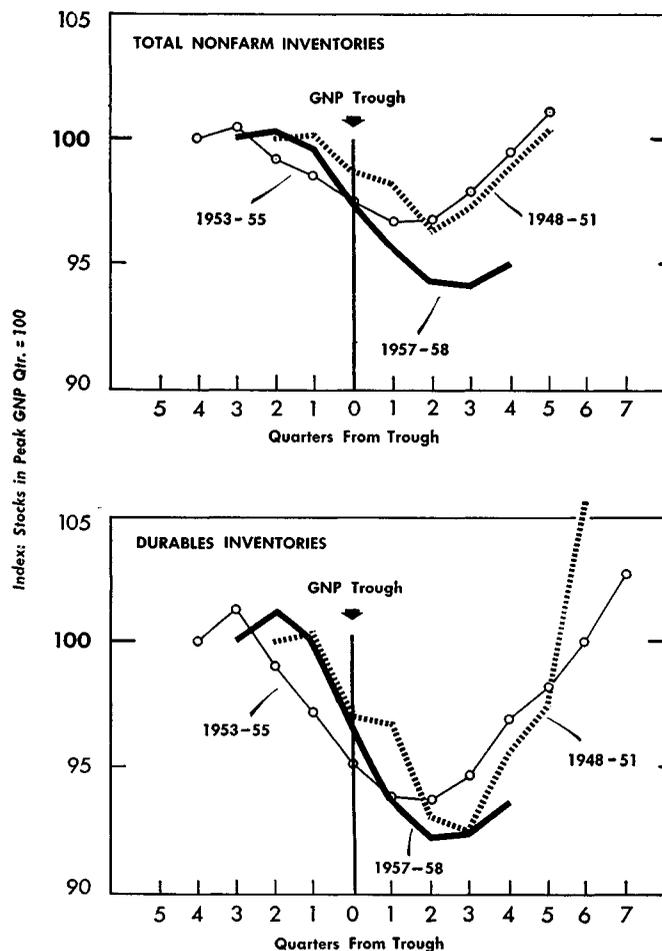
began in the second. Inventory movements in this year were greatly influenced also by strikes or the threat of strikes in the automobile and steel industries.

1950-54 Period

After the outbreak of the Korean conflict in mid-1950, final purchases of durable goods, which were already advancing in the first half of that year, surged forward and hard goods inventories with them. With the experience of wartime shortages still fresh in the public mind, waves of anticipatory buying occurred in the third quarter of 1950 and in the opening quarter of the following year. These surges in demand were so sudden that they outstripped the rising volume of production, and in each case they reduced temporarily the rate of inventory accumulation below what it would otherwise have been. This saw-toothed pattern is clearly seen in both of the durables curves depicted in the chart. Business concern over the future course of supplies and prices also were important factors lifting the rate of inventory accumulation to record amounts in this period.

With full utilization of the labor force and of the expanding industrial capacity, and a marked rise in productivity, the national output expanded rapidly during this period. This expansion helped to allay concern about excess demand and serious physical shortages. The fact that both consumers

Stock Movements in Three Postwar Cycles Show Similar Timing Patterns



and producers had been successful in adding to their durable goods holdings had similar effects. Tax increases and Government controls of prices, wages, credit, and the flow of strategic commodities gave some assurance that inflation would be kept in check.

Accordingly, a broad corrective movement started in the autumn of 1951 and in the ensuing three quarters the rate of inventory accumulation fell sharply. This reduction increased the volume of output available for final use and facilitated the orderly adjustment of the economy to the continued massive expansion of national defense purchases.

Durable goods inventories continued to mount at moderate rates until the business downturn of 1953. The pattern during 1952 was greatly affected by the steel strike, which led to some liquidation in the second quarter of the year. The subsequent rebound was mainly a reaction to this temporary dislocation. It also reflected some acceleration of aggregate demand, as Government limitations on private markets were gradually removed during this period.

The durable goods inventory liquidation which occurred during the business contraction of 1953-54 reflected mainly the reduction in the national defense program. It was reinforced by the decline in business expenditures for plant and equipment, and, to a much lesser extent, by a dip in the final demand for consumer durables.

The post-1954 period

Durable goods stocks began to increase again in the opening quarter of 1955 and continued to be augmented until the final quarter of 1957. With strong advances in automobiles and other consumer durables and in business outlays for capital equipment, final purchases of durables moved ahead briskly in 1955 and provided the main impetus to the accumulation of durable goods stocks in this period. From the closing quarter of 1955 to mid-1957, final purchases were maintained at a generally high level and inventories continued their advance, though the rate of increase slowed appreciably after mid-1956.

In the 1957-58 recession inventory liquidation was associated with a general downturn of durable goods demand. The largest reduction occurred in producers' durable equipment. Reductions in new-car purchases were also substantial. Government purchases of durable goods registered only a moderate and brief decline. However, new orders for major procurement items were cut back sharply in the second half of 1957 before being stepped up again in the first half of 1958. The reaction was particularly notable in aircraft and other defense-related industries.

Inventory liquidation reached a peak in the first quarter of 1958 and diminished thereafter with the recovery of general business activity. By the fourth quarter, liquidation had ceased and, as already noted, there was a sizable accumulation in the opening quarter of 1959.

Nondurables less sensitive

Inventory movements in nondurable goods were affected by many of the same forces which influenced durable goods. The restocking movement after World War II and the anticipatory buying in the Korean period, for example, had marked effects on nondurable goods inventories. On the whole, however, these inventories fluctuated within much narrower limits than did stocks of durable goods.

The greater stability of nondurable goods inventories reflects the comparative steadiness of the final demand for nondurables. The bulk of this demand comes from consumers, and short-term changes in consumer outlays for nondurables are generally moderate. Moreover, consumer purchasing

has been supported by the relative strength of disposable personal income in the postwar period. The factors that helped to stabilize disposable income—unemployment insurance benefits, compensating changes in taxes, and maintenance of corporate dividend payments in spite of fluctuations in after-tax earnings—have been discussed frequently in the SURVEY.

CHARACTERISTICS OF FLUCTUATIONS

In spite of the variety of forces acting upon them, inventories have displayed some recurrent patterns of behavior in the postwar period. These will now be summarized.

Two facts about the course of postwar stocks have already been suggested. The broad swings in inventory holdings were of about the same length as those in GNP and total final purchases, and like them were characterized by relatively short downturns which were followed by extended periods of recovery and growth.

The second chart is in index form, with stocks in each of the peak GNP quarters as the base. The troughs of the various business cycles are made coincident to permit timing comparisons. Peak and low quarters of GNP were selected on the ground that GNP constitutes the broadest measure of total output and of the business cycle. Final purchases (GNP exclusive of inventory change) and other variables related to inventory behavior will, however, be introduced subsequently.

The amplitude of the postwar inventory waves can be examined conveniently by reference to this chart. In the 1949 recession, stocks dipped 4 percentage points from their peak to their low. The swing in the 1954 recession was about the same. On the basis of preliminary data, the 1957-58 decline appears to have been somewhat more pronounced.

Stocks at business turning points

A feature of the three major movements is that a lag of approximately one quarter occurs after the peak of business activity before total inventories begin to decline. More specifically, a small rise in stocks is registered in the quarter following the peak in output. A lag of one quarter is found also when peaks of final purchases instead of total output are used as points from which to date the downturns—except in the last cycle when the downturn in stocks coincided with that of final sales. (It should be noted that timing comparison in terms of monthly data might differ somewhat from those summarized here.)

Another feature of the chart is that stocks continue to decline until the recovery phase of the business cycle is well underway. In the first downturn, stocks reached their low two quarters after the trough in total output. The second period of liquidation showed a stock minimum one quarter later than the low in business activity, with only a very slight rise in the next. Preliminary data for the most recent business cycle indicate a three-quarter lag.

When stocks are related to lows in final purchases rather than in total output, the lags are three, one, and two quarters respectively.

Maximum accumulation early

The lags mentioned above imply, of course, that inventory changes remain positive after peaks and negative after troughs in economic activity. An additional characteristic of inventory investment is that it reaches a maximum long

before the peak in business activity occurs. This maximum is associated with recovery from relatively low inventory positions. Thereafter, inventory growth tends to proceed at reduced rates until after the business downturn. The early peak in inventory accumulation has already been pointed out in connection with the summary of durable goods inventory movements during the postwar period.

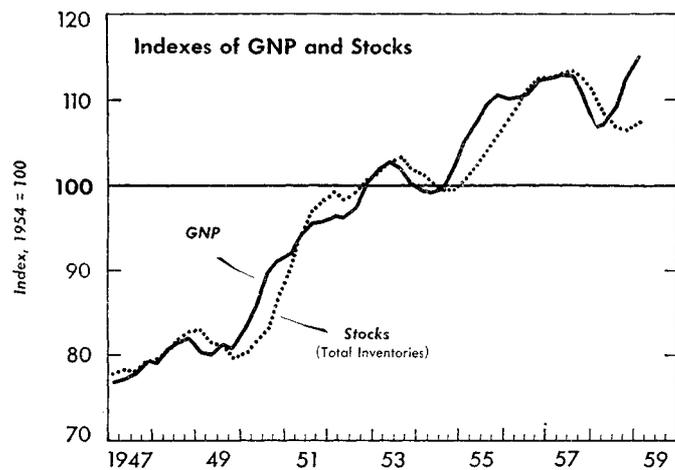
In contrast, the maximum rate of inventory reduction tends to coincide fairly closely with the troughs in business

increase after the peak in economic activity is reached. Both the absolute increase in stocks noted above and the decline in output contribute to this rise in the first quarter of the contraction. Although stocks are liquidated very rapidly in the later stages, the decrease is insufficient to offset the effects of the pronounced decline in output. As a result, the ratios show significant improvement only after the upturn in business occurs.

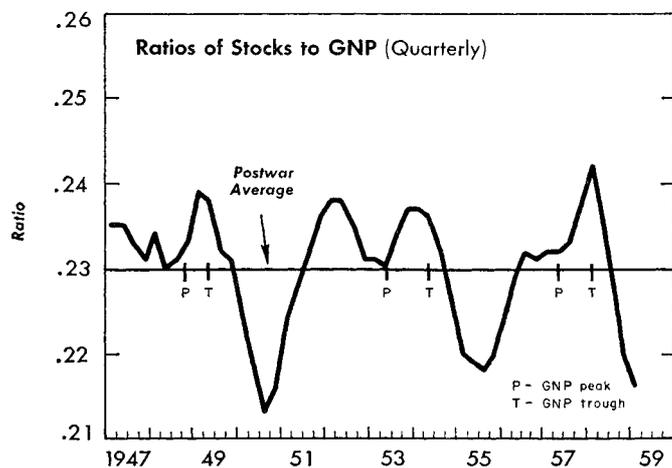
The downward course of stock-output ratios continues after stocks begin to accumulate. In the first and second upturns, for which data are complete, the low point in the ratio is reached approximately five quarters after the trough in business activity. After that stock-output ratios begin to rise again. However, no uniformity in the movements of the ratios is found for the periods immediately prior to the business downturn. The first cycle shows a slight increase, the second a decrease, and the third approximate stability.

When stocks are related to final purchases rather than output a similar pattern emerges.

Stocks Lag Output Changes



Ratio High in Contraction—Low in Early Recovery



U. S. Department of Commerce, Office of Business Economics

59-4-4

activity. This is really implied by two observations made earlier—namely, that the downturns in business activity and stocks are separated by only one quarter, and that both were of relatively short duration.

Stock-output ratios

The bottom panel of the third chart, which shows the ratio of stocks to GNP, makes explicit the relative movement of inventories and output over the postwar period. Since the ratios do not reveal evidence of trend, a line drawn at the average ratio is included for easy reference. The pattern is one of more or less regular oscillation around the average line.

In each of the cycles the ratio of stocks to GNP is seen to

Measures of volatility

As is apparent from the previous review of postwar inventory developments, the course of durable inventory movements was characterized by much more volatility than that of nondurables. If the mean departure of inventory investment from its average for the period is used as a rough measure of absolute cyclical variability, it is found to be \$3 billion at annual rates for durables, while nondurable goods varied by only about \$1½ billion. In addition, durable goods inventories display a marked tendency toward erratic behavior, with large changes in investment between adjacent quarters. The average quarter-to-quarter change was also \$3 billion for durables and \$1½ billion for nondurables.

Although these measures are suggestive of the marked volatility of durable goods inventories, they do not make explicit their major role in each of the postwar cycles. This role can be seen from the contribution of durable stocks to the total drop in inventories from prerecession peaks to subsequent lows. In the first postwar downturn, durable stocks accounted for approximately 95 percent of the total inventory decline. In the second downturn, they dropped more than total nonfarm stocks, with nondurable stocks offsetting part of the reduction. In the most recent cycle, durable goods contributed about 80 percent to the total liquidation.

Another indication of cyclical sensitivity of durable goods—in terms of total holdings—is provided by the lower panel of the second chart. As can be seen, durable goods inventories declined by about 8 percent in each of the postwar downturns—about twice as much as nonfarm inventories as a whole.

In contrast to the marked liquidations in durable goods stocks, nondurable inventories showed remarkable insensitivity in each of the recessions. In the first two downturns such stocks dipped only slightly. In the 1957–58 recession a more pronounced dip in soft goods inventories appears to have occurred.

Industry variations

Considerable differences in absolute variability are found also on an industry basis. Cyclical variability, as measured by the average departure from the typical postwar rate of increase, was highest for manufacturing, \$3 billion at annual rates. Retail trade followed with \$1½ billion. If the average change in investment between adjacent quarters is used to measure erratic movement, a value of \$2 billion is obtained for manufacturing and \$1½ billion for retail trade.

The larger absolute variability of manufacturing than of

retail stocks stems from two factors. First, durable goods inventories have a larger weight in total manufacturing than in total retail stocks. Second, the variability of durable stocks is higher in manufacturing than in retail trade.

Although the manufacturing industries hold only a little more than one-half of all nonfarm inventories, they account for most of the observed cyclical fluctuations. In the first and third cycles they contributed about three-quarters to the total nonfarm drop; in the second they accounted for virtually all of the decrease.

LONG-TERM CHANGES IN INVENTORY-OUTPUT RATIOS

The last chart presents annual inventory-GNP ratios since the end of World War I. The central point that emerges is that the economy has operated with approximately one-fourth less inventories per dollar of real GNP in the postwar period than in the 1920's.

In view of the cyclical influences to which inventory-output ratios were subject during the 1930's and the dislocations of World War II which they subsequently reflected, it is not possible to establish when the new, lower long-term relationship between inventory holdings and output was established. The data do tend to suggest, however, that the change had occurred by 1940-41, and that the economy returned to these new relationships after the abnormal conditions stemming from the war had been removed. In any event, it is quite clear that the postwar period is homogeneous in this respect; as has been pointed out earlier, annual inventory ratios have been quite stable.

Table 2.—Selected Ratios of Inventories to Output

Ratios	Index numbers, 1929=100		Percentage change 1920-29 to 1947-58
	1920-29	1947-58	
Manufacturing			
1. Inventories to output.....	114	86	75
2. Output to GNP.....	93	110	118
3. Inventories to GNP.....	106	96	91
Retail trade			
4. Inventories to retail trade.....	n.a.	77	n.a.
5. Retail trade to GNP.....	n.a.	99	n.a.
6. Inventories to GNP.....	n.a.	75	n.a.

n.a.—Not available.

A basic question is raised by the observed long-run decline in the overall inventory-output ratio. Is the reduction due to genuine changes in the inventory-output ratios of the component industries or does it reflect declines in the relative importance of industries that have high inventory-output ratios?

Analysis of this problem is hampered mainly by the absence of proper breakdowns of the volume of GNP by industry

of origin. However, some tentative conclusions can be established by using the movements of the FRB index of manufactures and of a rough series of constant-dollar retail trade sales as indicators of the changing relative importance of these two industries in the total volume of national production.

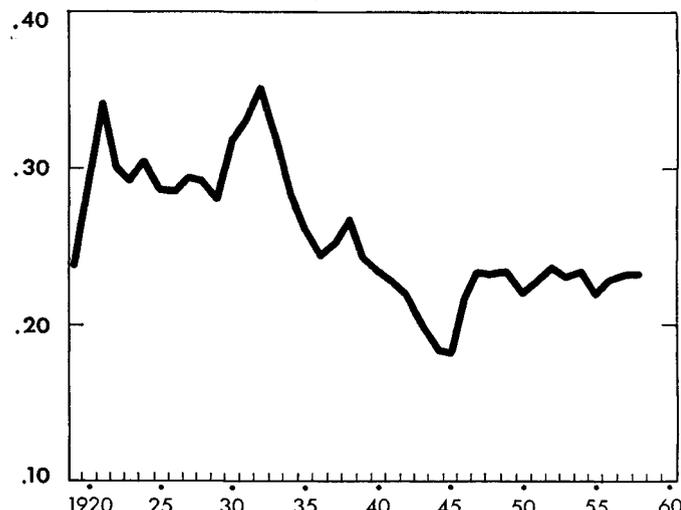
As can be seen from line 1 of table 2, the average manufacturing inventory-output ratio in 1947-58 was about one-fourth lower than the corresponding average for the 1920-29 period. Line 2, in turn, indicates that the manufacturing share of the total national output increased by about one-fifth over the same interval. This increase served to reduce the decline in the ratio of manufacturing stocks to total GNP to about one-tenth, as shown in line 3. (Line 3 is equal to the product of lines 1 and 2 within the limits of rounding.)

The comparable calculations for retail trade can be made only for the period since 1929. The estimates show that the ratio of retail inventories to deflated retail trade fell by

Ratio of Stocks to GNP—1919-58

Postwar ratios relatively stable and lower than in the 1920's

Ratio (based on constant dollars)



U. S. Department of Commerce, Office of Business Economics

59-4-5

almost one-fourth from 1929 to 1947-58 (line 4). The ratio of deflated retail trade to total GNP dropped only slightly (line 5) and consequently had little effect on the movement of the retail inventory-GNP ratio.

This analysis suggests, therefore, that the decline in total nonfarm inventory holdings in relation to GNP reflects genuine reductions in inventory-output ratios within industries. In fact, the relative increase in the importance of manufacturing, which is an industry that is characterized by high inventory-output ratios, has dampened the decline of total nonfarm inventories relative to GNP.