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A REVIEW OF EXISTING ESTIMATES OF BUSINESS INVESTMENT IN INVENTORIES

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The measurement of inventory investment is one of the most difficult problems encountered in estimating capital formation. While reasonably accurate and complete data are available on the book valuation of business inventories, such figures provide only the basic raw material for the measurement of inventory investment, defined as the net change in the physical volume of inventories valued at current prices. Under prevailing methods of business accounting, with inventories on hand usually valued at cost or the lower of cost or market on a first-in, first-out or similar cost basis, changes in unit costs of inventory goods between accounting dates are reflected in the book value of stocks in the balance sheet. In periods of rapidly changing prices, substantial adjustment of the book value data is required to derive the measure of physical change in current prices needed for inclusion in estimates of gross national product and capital formation.

This paper is designed primarily as a review of available estimates of inventory investment for the period 1919 to date,[1] as developed by several workers in this field. Estimating procedures and underlying assumptions as well as sources of basic data are examined and compared. The emphasis throughout is on the practical solutions actually adopted and their effect on the results achieved rather than on a detailed discussion of the conceptual problems involved.

In addition several recent developments relevant to the measurement of inventory investment are described briefly in Part 2. Among

Note: At the time this paper was prepared, Mr. Daly was a member of the National Income Division, Office of Business Economics, Department of Commerce. Views expressed in this paper are those of the author and not necessarily those of the Office of Business Economics.

[1]For decade estimates of net inventory change prior to 1919, see Simon Kuznets, *National Product since 1869*, National Bureau of Economic Research, 1946, pp. 108–110.

the topics covered are the book value estimates published in the quarterly corporation financial reports of the Securities and Exchange Commission and the Federal Trade Commission, surveys of the extent to which various inventory accounting methods are used, and the recent improvement of the commodity price data on which the deflation of inventories is based.

1. Review of Existing Estimates

The original estimates of business investment in inventories for the calendar years 1919–1933 were presented by Simon Kuznets in Chapter VII of *Commodity Flow and Capital Formation.*[2] Separate estimates of net inventory change, both in current dollars and in constant (1929) dollars, were given for agriculture, manufacturing, mining, trade, and all other industries combined. A great deal of supplementary information on the development of book value series and the choice of deflating indexes was included. These estimates were extended by Kuznets through 1939 in *National Product since 1869*, but the post-1933 figures were based on more summary techniques than were used in developing the estimates for the earlier years. In *National Income and Its Composition*[3] Kuznets presented annual estimates of net inventory change from 1919 to 1938 for all industries except agriculture, with major revisions of the original estimates for construction and trade and minor changes in other sectors. The discussion of Kuznets' estimates in this paper generally relates to the 1919–1933 figures in *Commodity Flow and Capital Formation* since this is the only source in which a full description of sources and methods is provided.

The National Income Division of the Department of Commerce has published annual estimates of the "net change in business inventories," in current dollars for all years from 1929 to date. Separate figures are shown for farms and for four nonfarm components: manufacturing, wholesale trade, retail trade, and all other nonfarm. Quarterly inventory change estimates, broken down into farm and nonfarm shares, are available since 1939 on both unadjusted and seasonally adjusted bases. A complete set of these figures can be found in the *National Income Supplement, 1951, Survey of Current Business* and the July 1953 issue of the *Survey.*

[2]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, Vol. I, Chap. VII, 1938.

[3]Simon Kuznets, *National Income and Its Composition, 1919–1938*, National Bureau of Economic Research, 1941.

Moses Abramovitz, in his book on *Inventories and Business Cycles*,[4] has presented estimates of inventory investment, in constant (1929) dollars only, for manufacturing and four other major industrial divisions for the years 1919–1938. Although the Abramovitz estimates lean heavily on the earlier work of Kuznets, revisions are introduced which merit separate attention, particularly in manufacturing.

Finally, in *Outlay and Income in the United States, 1921–1938*,[5] Harold Barger has prepared estimates of quarterly inventory investment for manufacturing and trade industries.

Before a detailed comparison of the data is begun, the procedures and assumptions which have been more or less uniformly adopted by the various estimators will be outlined and the more important causes of differences in the results indicated. These comments will deal only with the annual estimates, but many of the points raised are relevant to the quarterly series as well.

The measurement of real inventory change falls naturally into two separate phases: (1) the determination of the level of inventory book value, based on business accounting records, for each industrial group, and (2) the adjustment of the book value data to eliminate the effect of changing prices on inventory valuation.

Sources of Book Value Data

In developing series for year-end inventories the estimators have employed, whenever possible, book value data compiled from corporation income tax returns for 1923 and 1924 and all years since 1926 and published by the Bureau of Internal Revenue in *Statistics of Income*.[6] The degree of industrial detail in which the published figures are classified has been gradually extended. The 1947 data are broken down by major industry in manufacturing, by kind of business in retail trade, and to a lesser degree in other groups.

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

[5]Harold Barger, "Outlay and Income in the United States, 1921–1938," *Studies in Income and Wealth, Volume 4*, National Bureau of Economic Research, 1942.

[6]The *Statistics of Income* (Bureau of Internal Revenue) totals cover only those firms which submit balance sheets in conjunction with their tax returns. To include the small percentage of corporate taxpayers not submitting balance sheets, the reported totals are raised by the ratio of cost of goods sold for all returns to cost of goods sold for balance sheet returns. An adjustment of this nature is applied by all the estimators when *Statistics of Income* is used as a source of book value data for any industry.

The basic unit is, of course, the individual corporation, and each return is classified according to the major business activity of the reporting firm.

The book value of corporate inventories for a given calendar year, as shown in *Statistics of Income*, is actually a summation of reports for fiscal years ending during the period from July 1 of the given year to June 30 of the following year. The great majority of the returns, however, are on a calendar year basis,[7] and in any event an attempt to construct corrected year-end totals would be highly speculative. Abramovitz discusses this problem at some length[8] and concludes that, for manufacturing at least, the departure of the reported totals from a true December 31 figure as a result of noncalendar year reporting is probably of minor significance. In the estimates described in this review, *Statistics of Income* inventory totals, when used as the basic book value source, have been uniformly treated as year-end inventories.

Periodic reports of the book value of inventories in manufacturing and trade are also available in the Census of Manufactures and the Census of Business.[9] Collected data are classified according to the nature of the activity engaged in by the reporting unit which, for census purposes, is the individual establishment or place of business.[10] Total inventories for each minor industry in manufacturing are reported in two categories, raw materials and goods in process combined, and finished goods. The trade data are classified by kind of business and, in wholesale trade, by type of opera-

[7] *Statistics of Income*, 1947, pp. 16–42.

[8] *Op. cit.*, p. 504.

[9] Inventory book value data for both beginning and end of the year appear in the census of manufactures for 1937, 1939, and 1947. In addition the Census Bureau has published manufacturing inventory estimates for beginning and end of the years 1950 and 1951 in the annual survey of manufactures for the corresponding years. These data, based on a representative sample of manufacturing establishments, are presented in the same industrial detail used in the complete 1947 census.

Wholesale and retail inventory data have been compiled in the census of business for 1929, 1933, 1935, 1939, and 1948. The Census Bureau recently instituted an annual report on total retail inventories derived from blown-up sample data. The initial report, showing year-end 1951 inventories by kind of business and percentage of change from year-end 1950 for establishments reporting both beginning and ending inventories, was released in November 1952.

[10] For a discussion of the classification differences between the Census Bureau and BIR, see Abramovitz, *op. cit.*, pp. 509–512. Specific exclusions from the census coverage and the basic difference in classification make the reconciliation of census and BIR book value data quite difficult. If allowance is made for these essential differences, the BIR figures for a given industrial sector generally show a higher level.

tion. Census coverage includes both corporate and noncorporate business, and in certain years the inventory data have been classified by legal form of organization.

Once a direct source of this nature is chosen, the reported book value is accepted as representative of the universe of commodity stocks held by business in the industry concerned. No attempt is made to adjust the data to cover other elements—such as overhead costs, goods-in-transit, or miscellaneous small assets—which may be omitted or understated,[11] or to allow for possible deliberate misstatement of inventory values according to the dictates of tax convenience.

In those areas where a common source of annual book value data is used by all the estimators, such as *Statistics of Income* for corporate manufacturing, important differences in the figures for book value change are not likely to arise. When basic sources are not identical, however, as in wholesale trade where Kuznets adopts a census book value base interpolated between censal years and the NID adds a corporate figure from *Statistics of Income* to a census-based noncorporate estimate, it is not surprising that relatively large discrepancies exist between the two sets of aggregate book value and book value change figures. Differences also crop up when, as in noncorporate manufacturing, there is no regular source of direct book value data, and approximations based on the combination of sales data and inventory-sales ratios are used.

The change in book value, rather than the aggregate amount, is of course the important factor in the estimation of net inventory change. Book value series estimated by the combination of sales data and inventory sales ratios or similar devices may be reasonable approximations of the actual levels, but the movement of such series from year to year is subject to a much greater degree of error than are data based on direct inventory reports.

Adjustment for Price Changes

The basic techniques, as well as the theoretical background, for the adjustment of book value data to eliminate the influence of changing unit prices were originally outlined by Kuznets,[12] and

[11]The "scope of cost" limitation of business inventory data is discussed in George M. Cobren, "The Nonfarm Business Inventory Component of National Wealth," *Studies in Income and Wealth, Volume Twelve*, National Bureau of Economic Research, 1950.

[12]Simon Kuznets, "Changing Inventory Valuations and Their Effect on Business Savings and on National Income Produced," *Studies in Income and Wealth, Volume One*, National Bureau of Economic Research, 1937.

his approach has been adopted in later estimates. In brief, estimated book value for each industrial sector at successive year ends is deflated by appropriate price indexes to a constant dollar basis. The deflated series, in effect, provides an index of the physical volume of stocks. The annual change in physical volume, measured in constant dollars, is then revalued in terms of average current prices for the year to arrive at the net inventory change in current prices.[13] The difference between the latter figure and the change in book value, commonly called the "inventory valuation adjustment," becomes an adjusting entry in the estimation of business profits and national income.[14]

The initial step in the implementation of this adjustment process, once the accounting valuation of year-end inventories in a particular industry has been established, is the selection of price indexes which represent as nearly as possible the cost elements that underlie the aggregate book value to be deflated. In practice, commodity price indexes drawn from the monthly wholesale price index of the BLS have been used almost exclusively for this purpose. The lack of adequate information has generally precluded the alternative procedure of deflating separately the cost elements—materials, labor, and overhead—which enter into the book valuation of manufacturing inventories. The most useful guide in the choice of appropriate commodity price indexes has been the tabulation of inventories by minor industry in the Census of Manufactures and by kind of business in the Census of Wholesale and Retail Trade. There is no strict uniformity in the selection of deflating indexes by the individual estimators, but common sense knowledge of the types of commodities handled limits the choice to more or less similar indexes for any one industry.

In order to develop a single deflator for a given industry, the component indexes are weighted at least roughly in accordance with the relative importance of the commodities they represent in

[13]Net inventory change in agriculture is measured on the basis of physical series of crops and livestock on farms. Several other instances in which the NID does not apply the deflation procedure are mentioned below.

[14]The valuation adjustment is negative when prices are rising, positive when prices are falling, and is added to the unadjusted profits figures. It eliminates from reported earnings both the "inventory profits" accumulated during times of rising prices and the "inventory losses" suffered during price declines. The effect of this adjustment on business profits has received far more attention during the recent inflationary period than the corresponding correction of book value inventory change. For an excellent treatment of this subject see J. Keith Butters, *Inventory Accounting and Policies*, Harvard University Press, 1949.

inventories. In manufacturing and trade the NID has attempted to apply inventory weights based on 1939 census data on the distribution of inventories by minor industry or kind of business. Abramovitz used 1937 census inventory information as a guide in assigning weights to component indexes in his deflators for manufacturing industries. In constructing composite deflators, Kuznets used the value-of-product weights assigned to the corresponding indexes in the BLS wholesale price index. (It should be noted that Census of Manufactures inventory data were not available at the time the estimates appearing in *Commodity Flow and Capital Formation* were made.) Differences between inventory weights and value-of-product weights are most significant in manufacturing and, as pointed out below, can affect the results appreciably in years of rapid price change.

Ideally the index weights should be changed each year to coincide with shifts in the relative importance of various inventory elements, but in the absence of reliable data all of the estimators have used a fixed weighting system in the preparation of composite deflators. Tests made in the NID, whereby weights based on the 1947 Census of Manufactures and the 1948 Census of Business were substituted for the 1939 weights, yielded practically no difference in the estimates of inventory change for the years 1947, 1948, and 1949. It is probable that revisions over time in the BLS value-of-product weights used by Kuznets would have a negligible effect on his final estimates.

Once the component indexes for the deflation of each industrial sector have been selected and weights assigned, two further problems remain. In the first place the standings of the individual indexes must be related in time to the actual costs which they are assumed to represent. The construction of a cost deflator thus requires that some assumption be made as to the number of months over which the costs reflected in the year-end book value have been incurred. The length of this period can be approximated by dividing year-end inventories by cost of goods sold and multiplying the resulting ratio by twelve, the number of calendar months. Thus if the ratio of year-end inventories to cost of goods sold is one to six, the indicated turnover period is two months, which would be the correct cost period if only FIFO accounting were used. Both the NID and Abramovitz make this calculation and then proceed to lengthen the rough measure in order to take account of other costing methods—such as average cost and specific identification, both of which tend to lengthen the cost period—and to allow

for the time difference between the purchase date of inventory goods, to which the cost usually relates, and the delivery date at which the goods enter the inventory. Abramovitz uses a cost period equal to 1.5 times the number of months indicated by the turnover period. The NID uses the same lengthening factor in all industrial areas except trade. In trade the use of sales rather than cost of goods sold in the initial calculation yields a lower turnover period, and therefore a higher lengthening factor, 1.75, is used. In the set of estimates Kuznets finally selected as the most accurate, the cost deflators are computed on the assumption that stock-turnover ratios indicate correctly the average age of stocks.[15] Differences in the length of the cost period assumed are not an important cause of variation among the estimates reviewed in this paper.

One final assumption must be made regarding the methods of inventory accounting which are applied by business in the valuation of year-end inventories. Available evidence suggests that in the period since 1919 the predominant share of business inventories has been valued at the lower of cost or market, and estimators of net inventory change have incorporated this procedure into the construction of their deflating indexes. There are no exceptions in the basic Kuznets and Abramovitz series, apart from agriculture, but both have pointed out the importance of straight cost inventory valuation and attempted to measure the effect on the results of the uniform lower-of-cost-or-market assumption.[16]

[15]Kuznets, *Commodity Flow and Capital Formation*, line 1 of Table VII-a, p. 408 and Table VII-10, pp. 454–455.

The possibility that stock-turnover ratios understate the average age of stocks is also considered, and accordingly a second set of cost deflators is set up in which substantially longer turnover periods, twelve months for durable and semidurable goods and six months for perishables, are incorporated. Net inventory change estimates resulting from the use of these modified deflators are labeled "Cost or market, whichever lower, second variation."

A comparison of net change estimates based on alternative assumptions as to the average age of inventories is shown in VII-a, lines 1 and 2. In years of price decline, such as 1921, 1926, and 1930–1932, with market prices prevailing in the valuation of both beginning and ending inventories, the level of cost indexes was immaterial. When prices are rising, however, and inventory values are assumed to reflect cost prices, deflators computed on the "second variation" basis, with a greater average age of inventories assumed, tend to yield a more gradual rate of price increase and hence a smaller required adjustment for changing prices.

[16]Kuznets also developed a complete set of inventory change estimates based on the assumption that write-downs to market did not occur (*ibid.*, Table VII-a, p. 408). The "cost only" figures were computed with the same turnover period assumption as the basic lower-of-cost-or-market

The NID computes only cost deflators for construction and transportation and public utilities on the assumption that in these industries lower of cost or market is not commonly used. In all cases the level of market prices at year-end is approximated by averaging the December and January standings (which refer to average prices for each month) of the indexes chosen for deflation.

To summarize, price indexes deemed to represent the major inventory commodities of the industry to be deflated are selected and given weights roughly conforming to the importance of the matching commodities in the inventory. Each index is then averaged, first over a number of months at the end of each year corresponding to the estimated length of the cost accumulation period and, second for each December and following January to approximate the level of year-end market prices. The cost and market averages of the component indexes are then combined, using the assigned weights, into a composite cost and a composite market average.[17] The lower of these is used as the inventory deflator which measures the level, relative to the base year, of the prices implicit in the reported book value of the industry.

The deflators, applied to book value data, provide a series of year-end inventories in constant prices. Since the Kuznets and Abramovitz deflators are on a 1929 = 100 base, their constant dollar series represent inventories in average 1929 prices. The NID uses 1939 average prices as the base in computing its deflators. The net change in current prices is obtained from the deflated figures by multiplying the annual change in constant prices by the weighted composite annual average of the indexes used for deflation.

The extent to which the reported change in book value needs to be adjusted to derive inventory investment in current dollars

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series (line 1) which he finally accepted, and thus differed only in the assumption about write-downs. There are very large differences between the two series in some years, but it is difficult to perceive any pattern. In both 1931 and 1932, for example, year-end market indexes were generally lower than cost, but since the movement of the indexes was roughly similar on both bases, the adjustments for price change and, consequently, the net change estimates were fairly close. The greatest differences appear in a year like 1920 when beginning inventory prices were about the same on either straight cost or lower of cost or market, but ending market prices were far below cost levels. For that year the total net change in inventories was +$7.4 billion on the lower-of-cost-or-market basis but only +$1.5 billion when the inventories were deflated on the straight cost assumption. This exceptionally large discrepancy is caused by the very severe decline in prices toward the end of 1920.

[17] If a single index is used for deflation the combining step is, of course, unnecessary, and the lower of the two averages, cost or market, becomes the deflator.

for a given industry is a function of the year-to-year movement of the deflator. The dollar amount of the inventory valuation adjustment is also directly related to the aggregate book value of inventories, but is not sensitive to small changes in the aggregate. The correction for changing prices can thus either augment or offset the amount and direction of inventory investment indicated by the book value change. Discrepancies between alternative estimates of net inventory change can arise either from divergent estimates of the movement of book value or from differences in the construction of the deflators which, in effect, measure the change in inventory prices.

Annual Estimates

The period of years over which estimates of inventory investment can be compared is unfortunately brief. While the original Kuznets estimates are carried through 1939 in *National Product Since 1869*, the figures for the latest six years are based on a highly condensed deflation method, and no separate estimate is shown for manufacturing. The Abramovitz series on manufacturing is identical with Kuznets through 1926 and also terminates in 1938. The NID estimates do not begin until 1929, and after 1938 are the only comprehensive inventory investment series available.

The period 1929–1933 is stressed particularly because in those years of extreme price movements the effect of differences in the structure of the deflators can be more readily assessed. For the most part, the comparisons both in the text and the supporting tables are limited to four major industrial sectors: manufacturing, wholesale and retail trade, all other nonfarm, and agriculture. The manufacturing and trade sectors combined account for roughly 90 per cent of the total nonfarm book value of inventories, with the manufacturing share ranging between 45 and 55 per cent of the total and the trade share between 35 and 45 per cent. Inventories are generally about twice as great in retail as in wholesale trade. The remaining 10 per cent is distributed among the several industries in the all-other-nonfarm sector. In terms of dollar book value the nonfarm total grew from $23 billion in 1918 to $30 billion in 1929, fell to $17 billion in 1933, and reached $84 billion in 1952.

Manufacturing. All of the estimators perform a separate deflation of each of several industrial groups within manufacturing. Kuznets and Abramovitz distinguish ten groups and the NID twenty. The net change in inventories for all manufacturing is a sum of individual industry estimates.

Differences between the Kuznets, Abramovitz, and NID estimates in regard to the aggregate book value of manufacturing inventories and annual changes in these totals are definitely of minor significance. The Kuznets and Abramovitz series are for all practical purposes identical through 1933, and the NID figures vary slightly from them because of a lower estimate of noncorporate inventories.

The major source of book value aggregates for the various manufacturing industries has been the annual compilation of inventory data from corporation income tax returns published by the BIR in *Statistics of Income, Part II.* Kuznets used the BIR industry totals beginning in 1926. For two earlier years, 1923 and 1924, he obtained figures for total manufacturing inventories from *Statistics of Income* but regrouped these totals into an industry detail matching that used for 1926. For other years in the 1918–1926 period total corporate inventories as well as figures for each industry group were estimated largely on the basis of a sample of annual reports of manufacturing firms published in *Moody's Industrials.*[18]

Both Abramovitz and the NID also rely on *Statistics of Income* for book value data in corporate manufacturing, and since well over 90 per cent of manufacturing inventories are held by corporations, this uniform treatment results in consistently similar estimates for book value change.

The Kuznets estimates of noncorporate inventories in manufacturing (which Abramovitz used with very slight revisions) are consistently more than twice as great as the NID figures. Kuznets estimated noncorporate inventories by applying to the corporate figures for each industry a ratio based on the relationship of noncorporate to corporate value of product as given in the 1919 and 1929 Census of Manufactures. The assumption was that the ratio of inventories to value of product was the same for corporate and unincorporated firms. The NID estimates of noncorporate manufacturing inventories were obtained by cross-multiplying noncorporate sales data by inventory-sales ratios developed from tabulations of the 1939 tax returns of sole proprietorships and partnerships. The noncorporate ratios suggested by these tabulations were found to be generally much lower than corporate inventory-sales ratios for the corresponding industries. Although the movement of the Kuznets and NID noncorporate book value series is quite similar for the period 1929–1933, the higher level of the Kuznets series gives rise to small differences in the year-to-year book value change.

[18] *Ibid.*, Notes A, B, and C to Table VII-1, p. 412.

An examination of the deflators constructed to correct the manufacturing book value data for price changes reveals very interesting contrasts both in composition and behavior. All three of the estimators whose work is compared have assumed in their computations that manufacturing inventories are valued at lower of cost or market, and the minor differences that may exist in the length of the cost accumulation periods adopted are of no importance. But in the nature of the price indexes selected and the weighting systems by which they are combined, there are characteristic differences in approach which can be traced through to their effects on the final results.

Kuznets describes his selection procedure as follows:[19] "Indexes that are assumed to reflect changes in valuation for the different inventory groups have been compiled from the Bureau of Labor Statistics wholesale price quotations." For the most part he limited the choice to three or four indexes per group and to subgroup indexes rather than detailed commodity indexes. Both raw material and finished product elements were included, and the weights used were those attached to the corresponding series in the BLS wholesale price index. Thus, for example, the deflator for the rubber products industry was a weighted average of the crude rubber and auto tire indexes; in textiles, price indexes for textiles, raw cotton, and raw wool were combined; and in the paper and printing industries, a single index, the BLS series for paper and pulp, was used. In all of these instances greater weight was given to finished goods than to raw materials, a result which is implicit in the use of BLS value-of-product weights.

Abramovitz adopted the Kuznets deflators in all manufacturing industry groups for the years 1918–1925 on the grounds that the book value data were not sufficiently reliable to warrant revisions of the price correction procedure. The Kuznets deflators were retained for the entire period (through 1938) in the stone, clay, and glass and miscellaneous manufactures groups because suitable raw material price indexes were not available, and in the metal and metal products group because of the belief that published market prices do not accurately reflect prevailing book costs in this highly integrated industry. For the seven remaining industry groups, however, Abramovitz constructed revised deflators, beginning in 1926.

[19] *Ibid.*, p. 405.

The rationale of these revisions as well as the details of preparing the new deflators are amply covered in the source.[20] Raw material indexes were selected and weights derived on the basis of census data on inventory holdings by minor industry and materials consumed by industry. In one instance (lumber and wood products) an index of wages was included, but otherwise non-raw-material elements were excluded for lack of data, and the use of finished product indexes was specifically rejected.[21] As a result the measure of changing inventory prices was determined solely by the movement of raw material indexes.

The construction of inventory deflators by the NID parallels the Abramovitz technique in that inventory data from the Census of Manufactures serve both as a guide in the selection of suitable component indexes and as the source of the weighting system. On the other hand it is similar to the Kuznets approach in the inclusion of finished product as well as raw material indexes. The census provides inventory book value figures for each minor industry in two categories: raw materials and goods in process combined and finished goods.[22] The NID procedure has been to weight selected raw material indexes by the first of these census categories and finished goods indexes by the second. The non-raw-material share of the cost of goods-in-process inventories is thus allocated to raw material indexes, and more importantly an index of the market price of finished goods is taken as a measure of the bundle of material, labor, and overhead costs that enter the valuation of finished inventories.

The difficulty caused by the lack of data on the movement of labor and overhead costs in manufacturing is dealt with in two contrasting ways. Although recognizing that his procedure caused some distortion in the results, Abramovitz in effect used price indexes of purchased raw materials to represent all the costs entering inventory valuation. Kuznets and the NID on the other hand have included in their deflators indexes of the selling price of finished goods which do reflect changes in labor and overhead

[20] Abramovitz, *op. cit.*, pp. 528–547.

[21] In discussing the defects in the Kuznets deflators, Abramovitz says: "The component price series do not accurately represent the cost of inventories because the part consisting of goods processed by their owners is valued not at any commercial selling price but at a figure compounded of the purchase cost of materials, direct labor and an allowance for some portion of overhead expenses" (*ibid*, p. 528).

[22] These data have been published for beginning and end of the three most recent census years, 1937, 1939, and 1947, and for 1950 and 1951 in the annual survey of manufactures for those years.

costs but are also affected by changes in profit margins and selling costs, which are inappropriate for purposes of inventory deflation.

The example below illustrates how the alternative index selection and weighting methods affect the composition of the deflator in a particular industry group, leather and leather products.

BLS Index	*Kuznets Weights*[a]	*Abramovitz Weights*	*NID Weights*
Hides and skins	0.21	0.43	0.28
Leather	0.22	0.57	0.51
Boots and shoes	0.48	...	0.16
Other leather products	0.09	...	0.05
	1.00	1.00	1.00

[a]Value-of-product weights implicit in the hides and leather products index which Kuznets used to deflate the leather and leather products group (see *Wholesale Prices—1931*, Bureau of Labor Statistics, Bull. 572, 1933).

The pattern indicated here is repeated in other industries. The revised Abramovitz deflators are composed almost entirely of raw material indexes; the original Kuznets deflators give heavy weight to finished goods indexes; the NID procedure strikes a balance with the bulk of the weight allocated to raw material indexes and a small but significant portion to finished goods indexes.

The greater volatility of raw material prices causes the level of the Abramovitz deflators to fluctuate more rapidly and widely than either the Kuznets or NID deflators, especially in periods of changing prices. A rough measure of this effect can be obtained by comparing over a number of years the annual percentage changes in the composite implicit deflators derived by dividing the aggregate book value of year-end inventories by the deflated or constant dollar value. Such a comparison is shown in Table 1 for the period 1928–1933.

During the long price decline from 1928 to 1932 the level of manufacturing inventory prices fell 42 per cent as measured by the Abramovitz deflators but only 33 per cent and 36 per cent by the Kuznets and NID figures respectively. Correspondingly the Abramovitz deflators show a much steeper rise (24 per cent) from 1932 to 1933 than do the Kuznets (14 per cent) and the NID (19 per cent) estimates. In four of the five years the degree of inventory price change as measured by the NID falls between the Kuznets and Abramovitz figures.

TABLE 1

Comparative Measures of Price Change in Manufacturing Inventories, 1928–1933

	Book Value	*Constant Dollars*[a]	*Implicit Deflator*	*Annual Change in* (3)
	(millions of dollars)		(1) ÷ (2)	*(per cent)*
	(1)	(2)	(3)	(4)
Kuznets:[b]				
1928	13,362	13,379	99.9	
1929	13,920	14,301	97.3	−2.6
1930	12,264	14,793	82.9	−14.8
1931	9,864	13,733	71.8	−13.4
1932	7,950	11,956	66.5	−7.4
1933	8,852	11,675	75.8	+14.0
Abramovitz:[c]				
1928	13,359	13,286	100.5	
1929	13,917	14,344	97.0	−3.5
1930	12,258	15,589	78.6	−19.0
1931	9,856	14,953	65.9	−16.2
1932	7,944	13,622	58.3	−11.6
1933	8,846	12,269	72.1	+23.6
NID:[d]				
1928	12,663	10,632	119.1	
1929	13,261	11,379	116.5	−2.2
1930	11,708	12,074	97.0	−16.8
1931	9,469	11,481	82.5	−14.9
1932	7,623	10,061	75.8	−8.1
1933	8,451	9,343	90.5	+19.4

[a]The Kuznets and Abramovitz constant dollar figures are in average 1929 prices; the NID figures are in 1939 prices.

[b]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, 1938. Column 1 is taken from Table VII-6, pp. 440–441, and column 2 from Table VII-8, pp. 450–451.

[c]Moses Abramovitz, *Inventories and Business Cycles*, National Bureau of Economic Research, 1950, Tables 110 and 111, pp. 566–567.

[d]Worksheet data previously unpublished.

The impact of variations in the behavior of the deflators upon estimates of inventory investment is also illustrated by Table 1. Kuznets estimates that inventory liquidation in constant (1929) dollars in the years 1929–1932 exceeded $1.4 billion, while for the same period Abramovitz reports a net gain in inventories in constant dollars of $336 million. In 1933, with the price trend reversed, the Abramovitz estimate of inventory change is approximately −$1.4 billion, and Kuznets measures inventory liquidation at less than $300 million. These substantial discrepancies in estimates of the timing and amount of real inventory investment

are entirely due to the differences we have outlined in the structure of the deflating indexes.[23] Because of the difference in the base year, direct comparisons between the NID figures and the two other series in terms of constant dollar inventory investment cannot be made. It may be noted, however, that while Abramovitz reports a rise in real (deflated) inventories of 2.5 per cent and Kuznets a decline of over 10 per cent between 1928 and 1932, the NID figures again show an intermediate result, a decline of 5.4 per cent.

The Kuznets and NID estimates of the net change in manufacturing inventories in current prices are compared in Table 2. Discrepancies between the two series are caused both by slight differences in the measure of book value change and by the generally larger price adjustment called for by the NID deflators. These two factors support each other in 1930, 1931, and 1932 when the Kuznets series show a greater decline in book value and a smaller positive inventory adjustment, and again in 1933 when Kuznets reports a greater book value increase and a smaller negative adjustment than the NID series.

The direct relationship of the assumed degree of price change to the size of the required price adjustment is borne out by matching the Kuznets and NID inventory valuation adjustment figures in column 3 of Table 2 with the "annual per cent change in prices" in column 4 of Table 1. In each year the larger inventory valuation adjustment (ignoring signs) is associated with the greater change in inventory prices. Since Abramovitz does not carry his computations through the "reflation" stage, he provides no estimates either of net inventory change in current prices or of the difference between the net change and the change in book value. However, the implicit inventory valuation adjustment is greater than in either of the other series.

A considerable amount of space has been devoted to the manufacturing sector in the early 1930's because it is one of the few areas in which fruitful comparison of existing estimates is possible.

[23] Abramovitz clearly recognizes that the overweighting of raw material components gives his deflators an "identifiable bias." He continues: "While different classes of prices tend to turn at about the same time, the prices of highly fabricated goods have a somewhat smaller cyclical amplitude than the prices of less highly fabricated goods which are given undue weight in our indexes. Similarly, commodity prices probably have a larger cyclical amplitude than labor costs per unit, which are inadequately represented. In general, therefore, because of the price deflators we use, the amplitude of inventories in constant prices is probably understated to some degree" (Abramovitz, *op. cit.*, p. 92).

TABLE 2

Comparison of Inventory Change Estimates, Manufacturing, 1929–1933

(*millions of dollars*)

	Change in Book Value (1)	*Change in Current Dollars* (2)	*Inventory Valuation Adjustment*[a] (2) − (1) (3)
Kuznets:[b]			
1929	558	920	362
1930	−1,656	442	2,098
1931	−2,400	−883	1,517
1932	−1,914	−1,281	633
1933	902	−209	−1,111
NID:[c]			
1929	598	911	313
1930	−1,553	747	2,300
1931	−2,239	−594	1,645
1932	−1,846	−1,155	691
1933	828	−578	−1,406

[a]In *National Income and Its Composition, 1919–1938* (National Bureau of Economic Research, 1946) Kuznets computes this adjustment with the opposite algebraic sign by subtracting the net change from the book value change. He labels the result "Business savings due to revaluation of inventory." The corrected savings (profits) measure is then found by *subtracting* the adjustment from the reported figures. The NID method yields the same absolute adjustment, but the opposite sign, and this amount is then *added* to reported profits to arrive at the adjusted profits estimate. To avoid confusion the NID method is used in computing the IVA for both series in all the tables in this review.

[b]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, 1938. Changes in book value, column 1, are first differences in the entry "Total manufacturers stocks," Table VII-6, pp. 440–441. Figures in column 2 are from Table VII-10, pp. 454–455.

[c]*National Income Supplement, 1951 Survey of Current Business*, Dept. of Commerce, Table 33, "Net Change in Business Inventories, 1929–50," p. 200.

Moreover the correction of manufacturing inventories for changing prices is complicated by a difficulty not faced in other sectors, namely the presence in inventory valuations of production costs (labor and overhead) whose movements cannot be directly measured by available commodity price indexes.

Beginning in 1939 an important revision was made in the estimating procedure of the NID to take account of inventories valued by the last-in, first-out (LIFO) method. In that year the BIR permitted the election of the LIFO method in the preparation of busi-

ness income tax returns, and a growing number of companies have adopted it.

The deflation of inventories until 1939 was carried through on the assumption that the valuation method underlying the book value data was either cost or lower of cost or market and that, whether FIFO, specific identification, or average cost was used, the accounting value of inventories reflected changes in unit prices. Since inventory values determined by the LIFO method are not affected in the same manner by changing prices, they are subtracted from the reported totals and treated separately.

Under the LIFO method, if the physical volume of stocks is unchanged at successive accounting dates, the book value will be constant regardless of fluctuations in the cost of new units. Although physical turnover continues, the flow-of-cost assumptions are such that the goods on hand are always valued at the earliest cost incurred, and inventories used up or sold are charged out at the most recent cost.

An increase in the physical volume of stocks is valued at current cost of the year in which it occurs. The increase in LIFO book value is therefore equal to the real change at current prices and is included, without adjustment, in computing the total net change in inventories. The important difference is that under LIFO equivalent physical inventories carry the same valuation at the beginning and end of the period whereas under traditional accounting methods inventories are continually being revalued as unit prices fluctuate.

If the physical volume of inventories decreases, however, the liquidation under LIFO is valued not at current cost but at cost in an earlier period when equivalent stocks were accumulated. The decline in book value must be revalued in current year prices. Liquidations of LIFO stocks have thus far been negligible.

The correction for LIFO inventories was first applied in the petroleum and nonferrous metals industries for 1939 and, as use of the method spread, it was introduced in other manufacturing industries. At the end of 1951 an estimated 15 per cent of the total book value of manufacturing inventories was on a LIFO basis.[24]

Trade. Three series of annual estimates of inventory investment in trade are reviewed in this section. Two are the work of Kuznets:

[24]For estimates of the growth and present importance of LIFO inventories in manufacturing, see James P. Daly, "Lifo Inventories and National Income Accounting," *Survey of Current Business*, Dept. of Commerce, May 1953.

the original series from 1919 to 1933 in *Commodity Flow and Capital Formation*, later extended to 1938 in the Abramovitz book, and a revised series, covering the same 1919–1938 period, which appears in *National Income and Its Composition*. The third is the NID series beginning in 1929. The chief differences between these alternative estimates are due to divergent measures of the year-end book value of inventories.

In *Commodity Flow and Capital Formation* Kuznets developed independent estimates of the book value of trade inventories by the application of inventory sales ratios to estimated sales totals.[25] He considered, but decided against, the use of *Statistics of Income* corporate book value data on the ground that these represented too small a share of the total to be of use in building up an aggregate inventory figure. In his procedure he used Census of Business wholesale sales and inventory sales ratios for the census years 1929 and 1933 and extrapolated these figures to other years by various means. His wholesale inventory estimates for 1929 and 1933 are naturally equivalent to the census levels, and the entire book value series can thus be considered as census-based.

In his original estimates for retail trade, Kuznets adopted from the census only inventory sales ratios. His retail sales data, developed for the measurement of the flow of finished commodities to ultimate consumers, are higher than the census figures and the resulting inventory totals are correspondingly above census levels. The differences are indicated below.

Book Value of Year-End Inventories
(*millions of dollars*)

	1929		*1933*	
	Kuznets	*Census*	*Kuznets*	*Census*
Wholesale	5,247	5,247	3,021	3,013
Retail	7,982	7,263	4,563	3,904
Total trade	13,229	12,510	7,584	6,917

Abramovitz did not provide any details on his extension of these Kuznets book value estimates through 1938, but we must assume that the same procedures were used in the calculation of total book values.

[25]Kuznets, *Commodity Flow and Capital Formation*, Table VII-5, pp. 728–733.

In *National Income and Its Composition*[26] Kuznets presented a series on total trade inventories which appears to incorporate the straight census basis, although its source is not given. Because of the reduced level of retail book value implicit in this series, it runs consistently below the original estimates described above. In movement, the two series are roughly parallel except in 1931 and 1933 (see Table 3). The movement of the NID book value totals agrees more closely with the original Kuznets figures in these two years.

Book Value of Year-End Trade Inventories
(*millions of dollars*)

Year	*Kuznets*	*Census*
1929	12,372	12,510
1933	6,889	6,917
1935	7,456	7,404

Estimates of corporate and noncorporate inventories in wholesale and retail trade are developed separately by the NID. The source of corporate data is *Statistics of Income.*[27] Noncorporate inventories are estimated by cross-multiplying noncorporate sales series prepared in the NID and inventory sales ratios based on census and BIR information.

This procedure results in trade inventory estimates which are substantially lower, in the aggregate, than either of the Kuznets series. The most marked difference is in wholesale trade where the census book value figures, collected on an establishment basis, include the stocks of corporate manufacturers' sales branches and petroleum bulk tank stations, which are reported for tax purposes by the parent manufacturing concern. The use of census data for wholesale inventories and *Statistics of Income* for manufacturing thus involves an element of double-counting.[28] In retail trade the NID book value series is above the census level reflected in the second Kuznets series but still below that used in the original.

These rather complex differences between the three series in terms of the level of aggregate book value do not necessarily affect the ultimate estimates of inventory investment. Far more im-

[26] *Ibid.*, Table VII-5, p. 907.
[27] The category "trade not allocable" is prorated between wholesale and retail.
[28] Cobren, *op. cit.*, p. 405.

portant are the movement of the aggregates, as measured by the change in book value, and the degree of price change assumed.

In *Commodity Flow and Capital Formation* Kuznets set up separate deflators for three types of distributive, i.e. wholesale and retail, stocks: perishable, semidurable, and durable.[29] The indexes chosen and the assigned weights were again taken from the BLS wholesale price index. Estimates of net change in inventories and inventory valuation adjustment appearing in the first section of Table 3 are based on these detailed deflators.

In deflating the aggregate book value of trade inventories in *National Income and Its Composition*, Kuznets carried over the composite implicit deflator for each year from his earlier work. As a result the valuation adjustment estimates are quite close in most years even when there are dissimilar book value movements.

The NID based the selection and weighting of deflating indexes for the two trade sectors on the tabulation of wholesale and retail inventories by kind of business in the 1939 Census of Business. Net inventory change estimates are computed separately for wholesale and retail, but only the combined result is shown in Table 3, for easier comparability with the Kuznets figures. An adjustment for LIFO inventories was introduced in retail trade in 1947 to allow for adoption of the method by a number of large department stores. As in manufacturing, estimated LIFO inventories, approximately 3 per cent of total book value in retail trade, are excluded from the deflation process.

One element of difference in the composition of trade deflators deserves mention. Kuznets deflated perishable stocks in wholesale and retail trade by a combination of the deflators for the three manufacturing industries classified in the perishable category—food, chemicals, and paper. Similarly the semidurable and durable deflators were composed of the indexes used to deflate manufacturing inventories in the corresponding durability categories. This procedure brought into the trade deflators the price indexes for a number of raw materials, such as leaf tobacco, woodpulp, hides and skins, and crude rubber, which are of almost no importance in trade inventories. It is probable that the generally greater absolute amount of price adjustment in the Kuznets series for the years shown can be traced to the presence in the deflators of these volatile raw material indexes.

[29] Table VII-7, pp. 444–447.

TABLE 3

Comparison of Inventory Change Estimates, Trade, 1929–1933

(*millions of dollars*)

	Change in Book Value (1)	*Change in Current Dollars* (2)	*Inventory Valuation Adjustment* (2) − (1) (3)
Kuznets:[a]			
1929	362	706	344
1930	−2,208	−360	1,848
1931	−1,978	−526	1,452
1932	−1,892	−1,134	758
1933	433	−656	−1,089
Kuznets:[b]			
1929	350	676	326
1930	−2,203	−507	1,696
1931	−1,438	−8	1,430
1932	−1,651	−909	742
1933	−191	−1,204	−1,013
NID:[c]			
1929	13	291	278
1930	−1,917	−479	1,438
1931	−1,980	−790	1,190
1932	−1,494	−928	566
1933	491	−574	−1,071

[a]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, 1938. Changes in book value, column 1, are first differences in the entry "Total distributive stocks," Table VII-6, pp. 440–441. Figures in column 2 are from Table VII-10, pp. 454–455.

[b]Simon Kuznets, *National Income and Its Composition, 1919–1938*, National Bureau of Economic Research, 1941, Table VII-5, p. 907.

[c]*National Income Supplement, 1951, Survey of Current Business, Dept.* of Commerce, Table 33, "Net Change in Business Inventories, 1929–50," p. 200.

All Other Nonfarm. Limitations of space forbid a thorough comparison of inventory change estimates for individual types of nonfarm business outside manufacturing and trade. In the following comments only significant dissimilarities in treatment are cited, and the numerical comparison in Table 4 is in terms of total net inventory change for the entire groups. The industrial content of this sector is as follows: mining; construction; transportation and public utilities; finance, insurance, and real estate; service; and miscellaneous.

The NID uses corporate book value data from *Statistics of Income* for every industry in this "all other nonfarm group." Kuznets

also used this source except in construction. Both series exclude any estimate of noncorporate inventories in the transportation and public utilities, finance, and miscellaneous industries, and Kuznets made no estimate for noncorporate service. Of the industries listed for this group, Kuznets estimated noncorporate inventories only for mining and construction and the NID for those two and service industries.

There are two industries in which the alternative estimates of aggregate book value differ markedly. In finance, Kuznets used the reported *Statistics of Income* total whereas the NID excluded the inventories reported by stock and bond brokers on the ground that they represent claims to assets rather than real assets. The level of the Kuznets book value series is thus considerably higher in this industry ($1 billion versus $700 million in 1929), and while the two series have a parallel movement, the changes in the Kuznets' series are naturally greater. This discrepancy disappears

TABLE 4

Comparison of Inventory Change Estimates, All Other Nonfarm Industries, 1929–1933

(*millions of dollars*)

	Change in Book Value (1)	*Change in Current Dollars* (2)	*Inventory Valuation Adjustment* (2) – (1) (3)
Kuznets:[a]			
1929	852	858	6
1930	−1,449	−1,064	385
1931	−585	−246	339
1932	−300	−171	129
1933	231	−9	−240
NID:[b]			
1929	589	612	23
1930	−579	−302	277
1931	−475	−285	190
1932	−601	−516	85
1933	1	−196	−197

[a]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, 1938. Changes in book value, column 1, are first differences in the sum of the entries "Total all other stocks" and "Total mining stocks," Table VII-6, pp. 440–441. Figures in column 2 represent the sum of the "all other" and "mining" entries in Table VII-10, pp. 454–455.

[b]*National Income Supplement, 1951, Survey of Current Business*, Dept. of Commerce, Table 33, "Net Change in Business Inventories, 1929–50," p. 200.

in later years when the BIR regulations were changed to exclude securities from inventories and reclassification and other factors reduced the level of finance inventories to a negligible amount.

The Kuznets estimate of inventory book value in construction which appears in *Commodity Flow and Capital Formation* runs at a level three times as high as the NID estimate ($1.4 billion versus $500 million in 1928). This is admittedly an overstatement[30] since the Kuznets method of estimating total construction inventories includes stocks of construction materials held by firms in other industries, particularly manufacturing. For the years 1929–1933 the two series also exhibit divergent movements which, of course, are reflected in the estimates of net inventory change.

In the four remaining industries both the level and movement of the Kuznets and NID book value series are closely similar. Corporate inventories make up the dominant share of the total in each industry.

Kuznets carried over to this "all other" sector the deflation procedure applied in manufacturing and trade. Inventories were assumed to be valued at lower of cost or market, and price indexes were chosen for the deflation of each industry.

The NID alters this procedure in several respects. Kuznets deflates the service, finance, and miscellaneous industries by the single BLS indexes for housefurnishings, office furniture, and all commodities, respectively. The NID, on the other hand, does not attempt deflation in these industries, because suitable price indexes are not available for the deflation of the most important single item, motion picture films, and the commodity composition of the remaining inventories is so uncertain. Changes in book value are thus included without adjustment in the estimates of net inventory change.

In the remaining industries, transportation, public utilities, and construction, the deflating indexes used in the two sets of estimates are very similar, but the NID works up the deflators on a straight cost basis on the assumption that write-downs to market are not common in these industries.

Kuznets divided the book value of mining inventories into four categories by type of product and deflated each separately. The NID deflates the total amount by a composite price index in which the various products (coal, crude petroleum, metals) are represented.

[30] *Ibid.*, p. 404. The level of construction inventories is cut in half in a revised series presented in Kuznets, *National Income and Its Composition, 1919–1938*, Table VII-3, p. 905.

TABLE 5

Comparison of Inventory Change Estimates, Total Nonfarm Business, 1929–1933

(*millions of dollars*)

	Change in Book Value (1)	*Change in Current Dollars* (2)	*Inventory Valuation Adjustment* (2) – (1) (3)
Kuznets:[a]			
1929	1,772	2,484	712
1930	–5,313	–982	4,331
1931	–4,963	–1,655	3,308
1932	–4,106	–2,586	1,520
1933	1,566	–874	–2,440
NID:[b]			
1929	1,200	1,814	614
1930	–4,049	–34	4,015
1931	–4,694	–1,669	3,025
1932	–3,941	–2,599	1,342
1933	1,320	–1,348	–2,668

[a]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, 1938. Changes in book value, column 1, are first differences in the entry "Grand total excluding farmers' stocks," Table VII-6, pp. 440–441. Figures in column 2 are from Table VII-10, pp. 454–455.

[b]*National Income Supplement, 1951, Survey of Current Business*, Dept. of Commerce, Table 33, "Net Change in Business Inventories, 1929–50," p. 200.

Total Nonfarm. A summary comparison of the original Kuznets estimates and the NID estimates of total nonfarm not inventory change is given in Table 5. Because the level of aggregate book value in the Kuznets series is generally higher in all the sectors, his estimates of book value change are correspondingly greater in all five of the years shown. The larger positive valuation adjustments in the Kuznets series for 1930, 1931, and 1932 act to offset the greater amount of book value liquidation and bring the two sets of net change estimates into closer agreement. In 1929 and 1933, the effect of the respective valuation adjustments is to widen the gap between the net change estimates.

Agriculture. The estimates of net change in farm inventories are based on Department of Agriculture physical volume data for stocks of crops and livestock in the hands of farmers at the end of each calendar year. The change in physical volume, valued at December 15 prices received by farmers, represents net change in current prices. The deflation procedure used to derive a real

change measure in nonfarm industries is therefore unnecessary. For the five years over which direct comparison is made (1929–1933), the volume of farm inventory change is not large. Differences between the Kuznets and NID series (Table 6) are undoubtedly due to revisions in the physical volume data which became available after Kuznets had completed his estimates.

TABLE 6

Net Change in Farm Inventories, 1929–1933

(*millions of dollars*)

Year	*Kuznets*[a]	*NID*[b]
1929	−70	−252
1930	−146	−249
1931	280	308
1932	125	36
1933	−255	−271

[a]Simon Kuznets, *Commodity Flow and Capital Formation*, National Bureau of Economic Research, 1938, Table VII-10, pp. 454–455.

[b]*National Income Supplement, 1951, Survey of Current Business*, Dept. of Commerce, Table 33, "Net Change in Business Inventories, 1929–50," p. 200.

Quarterly Estimates

The review of quarterly estimates of inventory investment is confined to a brief description of procedures used since the two available series do not exist for overlapping years.

Barger Estimates, 1921–1938. Harold Barger made estimates of seasonally adjusted net inventory change in manufacturing and trade. In the 1921–1928 period he developed a quarterly inventory series in 1929 dollars for six of the manufacturing industries distinguished by Kuznets, using Kuznets' annual deflated figures as year-end controls and interpolating by appropriate Department of Commerce indexes of commodity stocks. The changes in 1929 dollars were reflated to current price levels for each quarter. The results were then added to seasonally adjusted quarterly net change figures for the remaining manufacturing industries obtained by distributing the Kuznets annual net change estimates.

For the 1929–1938 period, Barger employed quarterly indexes of inventories in current value (book value) for durable and nondurable manufacturing industries prepared by the National Industrial Conference Board. The book value indexes were converted to 1929 dollar indexes by separate deflators for durable and nondura-

ble inventory goods, and the deflated dollar indexes were then used to interpolate between year-end aggregate deflated inventory totals which Barger credits to Moses Abramovitz. The quarterly net changes in 1929 dollars were revalued into current dollars, and the separate durable and nondurable figures combined into all manufacturing totals.

In retail trade Barger converted a book value index, the Federal Reserve Board series on department store stocks, into an aggregate all retail book value series by application of a constant conversion ratio. The book value series was deflated by selected BLS indexes and the change in constant dollars reflated to current prices by the quarterly average of the same indexes. Since no reliable indicator of quarterly inventory movement was available for wholesale trade, the Kuznets net change totals for each year were arbitrarily distributed among the quarters. The trade data were seasonally adjusted, where necessary. In the absence of information on the quarterly behavior of inventories, Barger did not develop net change estimates for industries other than manufacturing and trade.

Barger compares the 1921–1938 annual net change in inventories in manufacturing and trade derived by summing his quarterly estimates with the Kuznets annual figures for the same groups.[31] He contends that, in the years when differences are extreme, his results are more plausible because quarterly real changes valued at quarterly prices and summed for the year result in a more accurate valuation than annual real changes valued at annual average prices regardless of when they occurred during the year. Quite apart from the validity of this argument, another factor, the disparity in movement between the Kuznets annual book value and constant dollar levels and the data used by Barger, is more directly responsible for the differences that appear.

In the pre-1929 period, Barger controlled his deflated manufacturing inventory series to the Kuznets year-end controls, and the sum of his quarterly net change estimates agreed closely with the Kuznets annual totals in most years. The retail trade series, however, was not linked to the Kuznets controls since Barger used an independent retail book value series. In 1921, for example, when the Barger annual net change total for manufacturing and trade is +$1,468 million as compared to +$295 millions in the Kuznets series, the difference is minor in manufacturing (+$229 vs. +$34), but very great in retail trade (+$1,239 vs. +$261).

[31] Barger, *op. cit.*, Table 35, p. 328.

After 1929 Barger shifted to an annual control deflated series in manufacturing which differed markedly from the Kuznets series. For 1930 the annual change in constant dollars used by Barger is +$1,741 while in the Kuznets series it is only +$492. These discrepancies in the basic data, rather than the effect of reflating the constant dollar inventory changes at quarterly rather than annual intervals, as Barger suggests,[32] are the major source of the differences between the Barger and Kuznets estimates of net inventory change.

National Income Division Estimates. The NID estimates of quarterly inventory change, covering the period since 1939, are based on far more complete book value data than were available in the earlier period. Year-end aggregate book value figures for manufacturing, wholesale trade, and retail trade are interpolated quarterly by the monthly series on book value in the corresponding industries prepared by the Business Structure Division of the Department of Commerce and published in the *Survey of Current Business.*[33] Seasonal adjustment factors are taken from the same monthly series. The quarterly book value movement in the various sectors of the all other nonfarm group is based on unpublished inventory data underlying the "Working Capital of United States Corporations" estimates of the SEC.

Quarterly deflating indexes for each of the four nonfarm sectors are developed by interpolation between the composite implicit non-LIFO deflators derived at each year-end by dividing the book value of non-LIFO inventories by the value in constant (1939) dollars. For interpolation, a single broad BLS index is chosen for each sector. Quarterly book value figures, after exclusion of estimated LIFO inventories in manufacturing and retail, are deflated, and the net changes in deflated dollars converted to average prices for the quarter. The estimated net changes in LIFO inventories in manufacturing and retail trade are then added to the non-LIFO results for these sectors.

Quarterly figures are always adjusted to agree in total with the annual estimates. The latter are believed to be more accurate because of the more detailed deflation method used and the greater

[32] *Ibid.*, p. 313.

[33] The Business Structure Division series in manufacturing is identical in scope with the NID year-end figures described above, and the quarterly levels can thus be used directly. The book value series in trade, however, are on a modified census base, somewhat lower in level than the NID figures, and are used for interpolation only.

reliability attached to year-end book value levels. For current quarterly estimates, which must be made in advance of data for the year as a whole, the implicit deflators for the most recently available year-end are extrapolated forward and the estimating procedure is otherwise unchanged. Since there are no data on the quarterly movement of farm stocks, the quarterly net changes in farm inventories are derived by distributing the annual net change estimates.

2. *Notes on Sources of Data*

In the following sections a number of newly developed sources of data of considerable value in estimating inventory change are discussed.

Book Value Series

The two primary sources of book value data, *Statistics of Income* and the *Censuses of Manufactures and Business*, provide only year-end inventory totals and do not become available until at least two years after the year to which they refer. To fill the need for more current data and for knowledge about the monthly and quarterly behavior of inventories, government agencies have developed a number of aggregate book value series.

The Department of Commerce monthly series on business inventories is available since 1939. Unadjusted and seasonally adjusted book value estimates are given for each major industry in manufacturing and kind of business in wholesale and retail trade. The manufacturing series is revised annually to reflect the most recent *Statistics of Income* data. Interpolation between year-ends and extrapolation of the latest bench-mark data into the current period are based on regular reports from a large sample of manufacturing companies. The series covers both corporate and noncorporate business, with the noncorporate component (approximately 5 per cent of the total) derived by the usual combination of sales data and inventory-sales ratios.

The base of the Department of Commerce monthly wholesale inventory series is the most recent Census of Business. Interpolation between census years, extrapolation for later years, and the monthly movement are based on a variety of sources including *Statistics of Income* reports for corporate wholesale trade and a monthly wholesale trade sample of the Bureau of the Census.

The original Department of Commerce retail inventory series from 1939 through 1951 was also based on the Census of Business.

Beginning in December 1950, a new series has been developed[34] which is linked to Bureau of the Census total retail inventory estimates, based on blown-up sample data, for year-end 1951. The two chief sources of monthly information are a Census Bureau sample of retail chain stores and the FRB index of department store stocks. Periodic revisions of the Department of Commerce monthly business inventory series, as well as more detailed information on sources and methods, are published regularly in the *Survey of Current Business*.

Beginning with the first quarter of 1947, the SEC and the FTC have published a quarterly financial report on United States manufacturing corporations which has included the estimated book value of inventories for each major industry. The report is based on a two-part sample with data for corporations registered with the SEC compiled by that agency and data for nonregistered corporations collected by the FTC.[35] These estimates are not identical in scope with *Statistics of Income* corporate data since the sample reports reflect a greater degree of consolidation than occurs in corporate returns for tax purposes. This factor should tend to yield a higher inventory total on the SEC-FTC basis since reports from manufacturing firms on a completely consolidated basis probably would add a larger volume of inventories held by affiliated nonmanufacturing companies than would be lost through the exclusion of manufacturing subsidiaries consolidated with parent corporations in other industries. In fact, however, the *Statistics of Income* manufacturing inventory totals are above the SEC-FTC fourth quarter levels for 1947, 1948, and 1949. A general revision was introduced into the SEC-FTC report in 1952, which raised the level of most of the items reported. In the case of inventories, the increase was approximately 10 per cent. The new series, on the higher level, was carried back to the first quarter of 1951. The quarterly figures in the SEC-FTC are not adjusted for seasonal variation.

The same two agencies, the SEC and the FTC, have also prepared a financial report on retail and wholesale (merchant wholesalers only) corporations. These estimates have been published in kind-of-business detail for the end of 1950 and the four quarters of 1951. The quarterly reports beginning in the first quarter of 1952 were based on much more limited data and presented only

[34] *Survey of Current Business*, November 1952, p. 14.

[35] The estimating procedure is described in detail in the initial issue of the report for the first quarter of 1947.

Corporate Manufacturing Inventories
(*millions of dollars*)

Year	*SEC-FTC*[a]	*Statistics of Income*[b]
1947	26,473	27,967
1948	29,722	30,630
1949	26,425	28,052

[a]Fourth quarter inventory estimates from SEC-FTC reports.
[b]Adjusted to cover inventories of firms not submitting balance sheets.

total retail and total wholesale figures. The series was discontinued after publication of the fourth quarter 1952 report.

Methods of Inventory Accounting

The BIR recently completed a special tabulation of 1950 corporation income tax returns to determine the total amount of inventories reported under each of several inventory accounting methods. This information was compiled from the responses to routine questions which have been included in the returns for many years. Each corporate taxpayer for whom inventories are an income-determining factor is required to state whether reported inventories are valued at cost or lower of cost or market. If neither of these is used, a full explanation of the inventory method is required. Firms using the elective (LIFO) method must submit a special form in the first year of its adoption and additional information on the quantity and acquisition cost of LIFO inventories with each return for as long as the method is retained.

On the basis of the responses to these questions, the BIR has classified each return into one of seven inventory categories: cost or market; cost; LIFO; LIFO and other; retail method; other basis; and not stated. The final tabulation will thus provide for each industry a classification of number of returns and total ending inventories by type of inventory method. The results were released in 1954.

The estimates of inventory investment which we have reviewed are based on a more or less uniform assumption that year-end business inventories, with the exceptions noted, are valued for accounting purposes at the lower of cost or market rather than on a straight cost basis. The evidence underlying this procedure is not conclusive and the arbitrary nature of the lower-of-cost-or-market assumption is fully recognized.[36] In the absence of more

[36]Abramovitz, *op. cit.*, p. 525–527.

complete information, however, it seemed preferable to adopt a uniform basis rather than attempt to apportion the reported book value between the two methods. The results of the special inventory tabulation from tax data should provide comprehensive evidence for each industry on the extent to which inventories are subject to write-downs when market prices fall below cost.

A question immediately arises, however, in regard to the treatment of returns in which inventory values are based on more than one accounting method. One fact which has been definitely established in previous surveys is that there are relatively few cases in which the LIFO method is used exclusively. Far more common are firms which value only their raw materials or some specific item on LIFO and use cost or lower of cost or market for their remaining inventories. If all of these firms are lumped into the "LIFO and other" category, the results will be of very little value in measuring the quantitative importance of LIFO inventories. The distortion caused by classifying reported inventories which reflect two or more separate procedures into a single category could be avoided only by a very complex procedure of allocating reported inventories on "mixed basis" returns among two or more categories. Even in its present form, however, the tabulation will indicate the industrial penetration of the LIFO method.

In recent years the rise of LIFO accounting has encouraged a number of sample surveys to determine the relative importance of this novel inventory method. In his broad study of the LIFO method, J. Keith Butters estimated that LIFO inventories at year-end 1947 made up about 9 per cent of total manufacturing book value and about 2 per cent of retail trade inventories.[37] A Department of Commerce survey among the sample manufacturing firms participating in the Monthly Industry Survey resulted in an estimate of 15 per cent as the share of LIFO inventories in total manufacturing book value at year-end 1951. Both the Butters and Department of Commerce surveys include data on the distribution of LIFO inventories by major industry. The American Institute of Accountants has published a series of studies on accounting practices in recent years, based on published corporate reports, which give further evidence of the growth of the LIFO method.[38]

The BIR tabulation will furnish no information on the relative importance of the various "flow of cost" assumptions (apart from

[37] Butters, *op. cit.*, p. 54.

[38] *Sixth Annual Survey of Accounting Trends and Techniques in Published Corporate Annual Reports*, American Institute of Accountants, 1952.

LIFO) used in business accounting. In the American Institute of Accountants survey for 1951, approximately one-fourth of the 534 firms covered reported inventories on a FIFO basis, another one-fourth used average cost, 30 per cent were on LIFO, and the remaining firms reported a variety of other methods, such as standard cost, actual cost, and estimated cost. These proportions are based on published corporation reports and thus probably differ somewhat from a tabulation of the methods used by the same firms for tax purposes. Standard cost, for example, is not a permissible tax reporting method, and average cost is not specifically authorized although it is believed to be generally accepted by the Department of the Treasury as long as it is consistently applied.[39] In view of the scarcity of reliable data on this point, the determination of the "cost period," which is a necessary step in the deflation of non-LIFO inventories, will continue to be based on a rough approximation.

Availability of Deflating Indexes

The BLS wholesale price index, which has been the major source of the commodity price indexes used to deflate inventory book values, has recently undergone a major revision.[40] The number of commodities included has been expanded from 900 to 2,000, and several groupings, such as machinery and apparel, are much more adequately represented than previously. Other important changes are the increase in the number of groups and subgroups and the addition of several hundred "product class" indexes, each of which combines a number of related commodities with generally similar price movements. The latter are especially useful since they permit the representation in the deflators of a particular type of commodity without the mechanical complications of including several individual price series. In the new index, for example, there is a single product class for "cotton yarns," whereas in the earlier index such a grouping could only be derived by combining five separate indexes for different varieties of yarn.

The base period of the revised wholesale price index is 1947-1949, and monthly levels of all indexes are available since January 1947. The old index, on a 1926 = 100 base, was discontinued at the end of 1951. A table has been prepared by BLS showing the continuity of individual items from the old series to the new.

[39] Cobren, *op. cit.*, p. 394.
[40] *Monthly Labor Review*, February 1952.