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Appendix A

Sources and Methods Used to Estimate Manufacturers' Inventories Based on Company Accounts

1 *Estimates in Book Values*

A KUZNETS' ESTIMATES

These data for total manufacturing inventories are based on estimates of the value of holdings in ten major manufacturing groups on December 31 of each year 1918-41.[1] First, inventories held by corporations were estimated, then holdings of unincorporated business were allowed for.

1) Inventories held by corporations

The sources and methods are best described in four periods.

1926-1939

From 1926 to 1939 the data are based on the inventories reported by corporations submitting balance sheets for income tax purposes and published in *Statistics of Income*, classified in ten manufacturing groups. To render the reported figures representative of all corporations in these branches, they were raised to allow for corporations not submitting balance sheets. The adjustment, based on the ratio of the cost of goods sold by all corporations to that by corporations submitting balance sheets (both from *Statistics of In-*

[1] The series are presented in Appendix F.

The figures I attribute to Kuznets are the ones published in his *Commodity Flow and Capital Formation*, Part VII, for ends of years 1918-33, and later extended by him through 1938. I have revised these estimates in two major respects: (1) I computed separate adjustment factors for noncorporate holdings in 4 manufacturing groups (foods, textiles, leather, and stone, clay and glass products). (2) Using later issues of *Statistics of Income* not available to him, I revised his 1936-38 figures and computed additional ones through December 31, 1941.

come), is minor, less than 3 percent for all groups except miscellaneous manufacturing (3.15 percent) in 1931. For the years before 1931, the 1931 ratios were used. After 1931, ratios for each year were available.

1924-1925

For 1923 and 1924 all corporations reported inventories to the Bureau of Internal Revenue for purposes of the capital gains tax; the figures are published in *Statistics of Income*. As the groupings did not seem comparable with those beginning with 1926, figures for total corporate manufacturing alone were used.

To distribute the totals among the component groups, a sample of 2,046 identical manufacturing corporations was regrouped to be comparable with the manufacturing subgroups in *Statistics of Income* (Table 88).[2] For each group sales and inventories were added and inventory-sales ratios computed for 1924, 1925, and 1926. The ratios were adjusted in accordance with the relation in 1926 between Epstein's figures and inventory-gross income ratios

TABLE 88

Gross Sales, All Corporations and Epstein's Sample of Manufacturing Firms, 1926

	EPSTEIN SAMPLE[a]	ALL CORPORATIONS[b]	% EPSTEIN SAMPLE IS OF ALL CORPORATIONS
	(millions of dollars)		
Total manufacturing	27309	59863	45.6
Food, beverages & tobacco	6400	13199	48.5
Textiles & textile products	1457	7593	19.2
Leather & leather products	369	1630	22.6
Rubber & related products	1035	1534	67.5
Lumber & wood products	537	2938	18.3
Paper, printing & publishing	885	3620	24.4
Chemicals & allied products	4478	7333	61.1
Stone, clay & glass products	570	1619	35.2
Metals & metal products	11065	17970	61.6
Miscellaneous	513	2428	21.1

[a] *Source Book for the Study of Industrial Profits*, Table 1, p. 8.
[b] *Statistics of Income, 1926*.

[2] Ralph C. Epstein, *Source Book for the Study of Industrial Profits* (Department of Commerce, 1932), Table 7, p. 14. Epstein's minor groups combined to form groups comparable with the *Statistics of Income* groups are given in *Commodity Flow and Capital Formation*, Table VII-1, Note B, p. 413.

derived from *Statistics of Income*. The 1924 and 1925 adjusted ratios were then applied to gross income as given in *Statistics of Income*.[3]

1918-1923

For the years before 1924 the manufacturing series depends (as do those for mining and corporate trade) upon a sample of corporate reports compiled by the National Bureau of Economic Research from Moody's Industrials. To avoid the difficulties engendered by mergers, Kuznets constructed an index of inventory-sales ratios. In order to include as many firms as possible, he used an index of linked relatives. All corporations were included that reported for at least two years both inventories and sales (or gross income or gross revenue). Inventory-sales ratios were computed for each industrial branch, and an index was constructed to extrapolate the final inventory-sales ratio for 1924. The resultant ratios were then applied to the gross income of the various branches as shown annually in *Statistics of Income*.[4]

The proportion of total business in each branch done by corporations in the sample varies widely among the groups (Table 89).

2) Noncorporate inventories

The estimates of inventories held by corporations were raised to allow for those held by unincorporated firms on the basis of the relation between their respective values of product in the 1919 and 1929 Censuses of Manufactures (Table 90). Ratios for the years between 1919 and 1929 were obtained by straight-line interpolation and the 1929 ratio was used for subsequent years.

[3] A final minor adjustment was necessary. When the 1924 estimates for the various groups and those for corporate trade derived in the same fashion were totaled, the sum was found to exceed the comparable figure from the capital stock returns in the ratio 1: .98906. The estimates for the various manufacturing groups were, therefore, reduced to accord with this ratio. The geometric mean between the latter and a ratio of 1.000 (assumed for 1926, since the data for that year were taken directly from *Statistics of Income*) was used to adjust the estimates for 1925.

[4] A final adjustment of less than 1 percent was again made to equate the resulting estimates with the total shown in the capital stock tax returns for 1923. The years before 1923 were adjusted by the geometric mean of the 1923 and 1924 adjustment ratios: .99161 and .98906.

TABLE 89

Coverage of NBER Inventory Sample

	NO. OF FIRMS	AV. TOTAL SALES ($ MIL.)	SALES AS % OF GROSS INCOME, ALL CORPORATIONS
Food, beverages & tobacco, 1923-24	43	1510.5	13.8
Textiles & textile products, 1923-24	39	351.0	4.7
Leather & leather products, 1920-21	10	234.7	14.2
Rubber & related products, 1923-24	14	633.0	57.5
Lumber & wood products, 1918-19	5	23.9	1.1
Paper, printing & publishing, 1918-19	10	56.1	2.5
Chemicals & allied products, 1918-19	19	830.8	19.2
Stone, clay & glass products, 1921-22	11	80.1	7.5
Metals & metal products, 1923-24	101	3904.2	24.0
Miscellaneous manufacturing, 1918-19	3	19.8	0.6

Commodity Flow and Capital Formation, Table VII-1, Note C, p. 415.

In only one industry, lumber, is the change between 1919 and 1929 more than 10 percentage points. Since these amounts are spread over a decade, the annual adjustments on this account are very small. If straight-line interpolation gives even a first approximation to the desired allowance, the errors due to this method cannot be serious. Census figures for 1939, which became available after our estimates had been made, indicate that in four industry groups the trend toward incorporation continued during the 'thirties. In two others, the trend was reversed. The changes between 1929 and 1939, however, were smaller than in the preceding decade, and our failure to take them into account cannot affect our cyclical measures significantly.

TABLE 90

Ratio of Value of Product of Unincorporated to Incorporated Firms

	1919	*1929* (percentages)	*1939*[a]
Food, beverages & tobacco	19.4	12.1	13.6
Textiles & textile products	31.3	23.7	16.8
Leather & leather products	18.3	9.0	6.8
Lumber & wood products	28.2	14.5	21.5
Paper, printing & publishing	16.6	10.2	8.3
Chemicals & allied products	2.5	2.6	2.4
Stone, clay & glass products	15.9	11.4	6.3
Metals & metal products	4.9	2.3	2.4
Miscellaneous manufacturing	16.9	13.4	..

Inventories held by unincorporated rubber and related products concerns were not estimated because of the extremely small proportion of business done by them.

[a] Ratios suggested by the 1939 Census of Manufactures, not available when Kuznets made his estimates, are included here for purposes of comparison.

B SIGNIFICANCE AND RELIABILITY OF KUZNETS' ESTIMATES IN BOOK VALUES

1) The reporting date

The data in *Statistics of Income* are conventionally referred to as 'inventories as of December 31'. Corporations are permitted, however, to keep their accounts and to report their income on the basis of a fiscal year other than the calendar year. In 1928 only about 14 percent of the gross income earned by all corporations was reported on a noncalendar year basis.[5] For several groups the figure was much higher (Table 91).

TABLE 91

Manufacturing Industries: Percentage of Gross Income Reported on a Noncalendar Year Basis, 1928

Total manufacturing	14.3
Food, beverages & tobacco	16.2
Textiles & textile products	26.4
Leather & leather products	42.0
Rubber & related products	16.4
Lumber & wood products	13.9
Paper & pulp	19.3
Printing & publishing	9.7
Chemicals & allied products	10.4
Stone, clay & glass products	10.9
Metals & metal products	10.8

See note 5.

These differences in practice with respect to the reporting basis raise a problem of some importance. First, the inventory data from *Statistics of Income* are weighted fiscal year averages in which dominant weight is given to standings on December 31 and minor weights to standings as much as 5 months earlier and 6 months later. Thus the change in inventories from one year end to the next is not simply due to forces acting during the calendar year in question. It is due also in some degree to the events of a period beginning 6 months earlier and ending 6 months later.

[5] Adapted from *Statistics of Income, 1928*. The published figures show the percentage of net income and net deficit reported on a noncalendar year basis in each industry. In calculating the estimate in the text, these percentages were averaged, weighted in each case by the gross income of all firms reporting net incomes and net deficits, respectively. This procedure implicitly assumes that the relation of gross income to net income or net deficit is the same for firms reporting on a noncalendar and on a calendar year basis.

A difficulty stemming from this situation arises when comparisons are attempted among the inventory groups or between any of them and other bodies of data. In comparisons among the inventory groups some small part of any differences in the behavior of inventories will be due to the fact that the various series are for somewhat different periods rather than to real differences. In comparisons between the inventory and price or production series, the correct figure would be a weighted fiscal year average of exactly the same type as that involved in the inventories series. Unfortunately, the distribution of reports by months is known only for the grand total of all corporations including nonmanufacturing; it is, therefore, necessary to make direct comparisons with December figures.[6]

How serious are the errors thus engendered likely to be? In nine of the ten groups the weight given the December figure is so heavy that there will be no substantial error in treating the reports as if they were unqualifiedly returns as of December 31. In eight, December accounts for over four-fifths of the returns; in a ninth, for nearly three-quarters. In other words, in the least favorable case, the reported figure for the companies operating on a noncalendar year basis must differ from their true December 31 figure by 4 percent in order to cause an error of as much as 1 percent in the group total. And since the reports not on a calendar year basis are scattered on both sides of December 31, considerable opportunity exists for differences between the actual fiscal year returns and those which would have been made had these firms reported on a calendar year basis to offset one another.

Related to this difficulty is one that arises in the process of deflation. Here again we must use an index that would be strictly correct only if the inventory series were really a series of December 31 figures. This source of error is as serious as that involved in the inventory data themselves. But whether errors from the second source offset or aggravate errors from the first cannot be said.

[6] For all corporations in manufacturing and other groups taken together we can, however, estimate the distribution of reports by months by methods similar to those described in note 5:

Percentage of total gross income reported for	
1928 on a noncalendar year basis,	12.20
Years ending July to November 1928,	4.92
Years ending January to June 1929,	7.28

2) Difficulties due to incompleteness of tabulation

J. Franklin Ebersole, Susan S. Burr, and George M. Peterson contend that serious shortages of a mechanical sort are present in certain years in the *Statistics of Income* data before 1926.[7] Of the years of interest to us, 1918-25, the authors contend that a significant shortage appeared only in 1919, when by the test on which they rely most, it was about 16 percent for all industrial divisions. In all later years except 1923 the difference between the apparent figure and the authors' estimate of a true figure was less than 1 percent.

The authors believe that the apparent shortage may be due to any of several imperfections in the tabulation procedure: failure to send returns through the statistical section (presumably due to delinquency in reporting), imperfect tabulation of returns sent through the statistical section, incompletely made-up returns requiring audit to obtain the necessary information.

The evidence on which shortage is estimated, however, is inconclusive in many particulars. The authors' test entails the addition of four expense items believed to be largely constant with respect to short-term variations in output: compensation paid officers, interest payments, domestic taxes paid other than federal income and profit taxes, and depreciation and depletion charges. The sum of these items, it is assumed, would move in a smooth linear trend unless mechanical errors were made in the tabulation.[8] It is such a trend, calculated from the data and based on 1927, that indicates a shortage in 1919.

One objection to the procedure is that the sum of the four fixed

[7] Income Forecasting by the Use of Statistics of Income Data, *Review of Economic Statistics*, XI (1929), 171 ff. The authors were at the time of writing employed in the Treasury Department. Their discussion of the overlapping of the various industrial divisions and groups and of the shifting of constituent firms among them is considered in the next section.

[8] Reliance is placed also on a comparison of total returns tabulated in any given year with the trend value calculated for that year. But on this basis, the shortage in 1919 is only some 3 percent, a discrepancy easily accounted for, even if one accepted the assumption that the true value and the calculated trend value were identical, by the fact that the clause with respect to consolidated returns went into effect in 1918. Further consolidations and, therefore, consolidated returns to the number in question would not be surprising.

expense items probably does not move along a smooth linear trend. Indeed, inspection of the figures suggests a tendency towards positive cyclical conformity, which is consistent with the low figures for 1919. Aside from this, however, one would hardly be surprised to find an abnormal movement in an economic series of this sort in the year following the Armistice.

Moreover, a shortage in tabulation is not the only possible explanation of an apparent divergence of the figures from the calculated normal. Ebersole, Burr, and Peterson point out that part of these expenses may have been included in 1919 among 'miscellaneous expenses', a category that grew in 1919 by a larger absolute amount than the four 'fixed costs' fell and by 43 percent of its own 1918 value.[9]

Finally, it is impossible to identify the shortage in manufacturing, the division of special interest to us. A linear trend for manufacturing alone drawn free hand and based on 1927 would show that the 1919 figure is close to its trend value.[10]

One may conclude that, while the opinion of these Treasury experts is not to be lightly discarded, the evidence of shortage in tabulation they are able to adduce does not cast serious doubt on the 1919 estimates of manufacturers' inventories.

3) The classification procedure

a) Industrial overlapping

The basic unit of reporting for tax purposes is a corporation or, before 1934, a group of corporations owned in common and filing a consolidated return. Such firms often engage in a variety of manufacturing activities which, if separable, would be appropriately classified in different industries. Because the activities of a corporation (or group of corporations filing a consolidated return) are not separable, the industrial classification used by the Income Tax Bureau is based on the "main income-producing ac-

[9] Op. cit., p. 174.

[10] There may, of course, have been a shift of corporations into manufacturing in 1919 which would hide a real discrepancy. But such evidence as Ebersole, Burr, and Peterson could gather was insufficient to lead them to suppose that this was so.

tivity" of a firm in a given year.[11] This means that, as far as activities properly falling in different classifications are carried on in combination, inventories and sales properly belonging in a certain group will often be placed in other groups and that any given group will include the records of activity that should properly be classed elsewhere. The amount of such overlapping is undoubtedly large in data from *Statistics of Income* relative to the amount to be found in census data which are based on an establishment, rather than a company, as the reporting unit.

Overlapping of this sort renders the definition of industry groups within manufacturing somewhat hazy; more important, it reduces the sharpness of the distinction between manufacturing and other industrial divisions. The chief difficulties arise from firms that carry on both manufacturing and mining operations and both manufacturing and trade.

T. C. Atkeson of the BIR wrote the National Bureau of Economic Research, May 25, 1939:

"If a return, whether or not consolidated, is engaged in a combination of mining a raw material and of converting this raw material into a manufactured product, it is placed in the correct industry group under manufacturing. Even with the discontinuance of the privilege of filing consolidated returns, except by railroads, the inventories of certain mines and quarries are included in the data for manufacturing. This is especially true of certain large oil companies which are engaged in both the extracting of crude oil and the refining of petroleum."

Similar difficulties are involved at the margin between manufacturing and trade. For example, manufacturers' sales branches, which might be thought to resemble wholesaling rather than manufacturing establishments (the census, for example, treats them as distributors), are treated as manufacturers in *Statistics of Income* provided they are operated by a manufacturing company under a single corporate charter. They would presumably be

[11] W. L. Crum writes: "A specific inquiry on the blank for corporate income tax returns calls for this information. The wording clearly suggests that production of income should be the criterion for classification, but there is good reason to doubt if this effectively is the case." *Corporate Size and Earning Power* (Harvard University Press, 1939), p. 22, note 2.

grouped with other trading firms if, as sometimes happens, they operate under separate charter.

b) Reconciliation of the census and Kuznets' estimates of manufacturers' inventories

To get some notion of the quantitative importance of these difficulties of classification as far as they affect the relations between manufacturing and other industrial divisions, we attempted to account for the difference between Kuznets' estimates of manufacturers' inventories, based on *Statistics of Income* (company) data, and the census estimates, based on establishment data. For December 31, 1936 the census reported manufacturers' holdings of $8,951 million after adjustments for underreporting of inventories within the industries covered.[12] Kuznets' estimate, corrected for underreporting and raised to allow for unincorporated firms, was $11,171 million.

Part of the difference, $2,220 million, can be accounted for by identifiable shortages in the census coverage of manufacturing establishments or of borderline manufacturing establishments. The census inventory survey did not cover most printing, publishing, and allied industries. If we substitute Kuznets' estimate of inventories in the paper, printing and publishing industry for the census estimate of inventories in the paper industry, the census total is raised about $233 million.

A second adjustment of a more doubtful character is required in tobacco. The census treats warehousing, assembling, and processing of leaf tobacco, even though carried on in connection with manufacturing, as part of distribution rather than of manufacturing. For December 31, 1938 the inventories of such establishments controlled by tobacco manufacturers was estimated to be worth $367 million.

The census treats manufacturers' sales branches as establishments engaged in trade. *Statistics of Income,* and consequently Kuznets' estimate, excludes them from manufacturing only if they are conducted under a separate corporate charter. We estimate that they held some $829 million worth of inventories at the end of

[12] In the Census of Manufactures, 1939, establishments accounting for 94.6 percent of the value of product in manufacturing replied satisfactorily to the question about inventories.

1936. But we do not know what proportion operated under separate charter and were, therefore, excluded from manufacturing by *Statistics of Income* and by the census.

Similar to manufacturers' sales branches generally are various establishments engaged in the distribution of petroleum products —largely bulk tank stations. The Department of Commerce estimated that inventories of such establishments owned and operated by refining companies but not reported in the Census of Manufactures were $233 million on December 31, 1938. Again we do not know how many were included in manufacturing by *Statistics of Income*.

The maximum overstatement in Kuznets' estimate, of $1.4 billion or nearly 14 percent above the adjusted census figure, is clearly excessive. The difficulties are both statistical and conceptual. In the reconciliation attempted in Table 92, many shortages in census coverage were not allowed for explicitly. They may amount to $250 million, or just over 2.5 percent of the adjusted census figure in line 5.

The conceptual difficulty concerns the definition of manufacturing. All manufacturing establishments carry on distribution functions of greater or less complexity. To exclude the distributive activities of fabricating companies simply because they are carried on in separate establishments is quite arbitrary. Similarly, almost all mining establishments manipulate their crude products to some degree—by cleaning, crushing, concentrating, and so on. The line between mining and manufacturing is itself vague. A logical criterion would be to include in manufacturing any extractive or distributive function carried on by a manufacturing company and exclusively devoted to providing the raw materials or distributing its products. Extractive and distributive activities not carried on in support of the fabricating activities of a given company ought logically to be excluded. From this standpoint, the census estimate, based as it is on the individual establishment (plant or unified set of works), tends to be low: it excludes nonmanufacturing activities not devoted to the support of the fabrication work of a given company but does not include many nonmanufacturing activities that are so devoted. Kuznets' estimate, based on *Statistics of Income* tends to err in the opposite direction because the reporting

TABLE 92

Manufacturers' Inventories, December 31, 1936: Reconciliation of Census and Kuznets' Estimates

(millions of dollars)

1)	Census figures adj. for underreporting in lines canvassed	8951	
2)	Adjustment for printing, publishing, & allied industries	233	
3)	Adjustment for undercoverage in tobacco industry[b]	367	
4)	Adjustment for distributing establishments owned by petroleum refining companies[c]	233	
5)	Census total adjusted		9784
6)	Kuznets' estimate		11171
7)	Maximum overstatement of manufacturers' inventories by Kuznets		1387
8)	Area of doubt		
	a) Manufacturers' sales branches,[d] roughly	829	
	b) Mining establishments owned by mfg. companies,[e] roughly	200	
	c) Census shortages & other unexplained differences[f]	358	
	d) Total		1387

[a] Kuznets' estimate for pulp, paper, printing and publishing minus census estimate for paper and allied industries adjusted for underreporting.

[b] Department of Commerce estimate of required adjustment for December 31, 1938 is applied here to December 31, 1936.

[c] Department of Commerce estimate for December 31, 1938. Overstates the value of such inventories included in Kuznets' estimates to the extent that distributing establishments owned by petroleum refining companies operated under separate corporate charter.

[d] The sum of estimates for lines canvassed and not canvassed in *Census Survey of Business: 1937-38, Wholesale Distribution*. U. S. Summary (1938).

1) Lines canvassed, $757,399,000

Estimate equals the figure reported for December 31, 1936 for manufacturers' sales branches in lines canvassed divided by the percentage that inventories held in 1935 by firms reporting in 1936 were of all inventories held by manufacturers' sales branches in 1935.

2) Lines not canvassed, $71,374,000

This estimate was derived as follows:

a) Total inventories of wholesalers in 1936 were calculated by dividing the reported inventories in 1935 by the relation between inventories held in 1935 by firms reporting in 1936 to inventories held by these firms in 1936.

b) Inventories in lines not canvassed in 1936 were calculated by dividing total 1936 inventories from (a) by the relation between total inventories held in 1935 and inventories held in 1935 by lines not canvassed in 1936.

c) Inventories held by manufacturers' sales branches in 1936 were estimated by multiplying total inventories in lines not canvassed in 1936 from (b) by the relation between inventories held in 1935 by manufacturers' sales branches in these lines to total inventories held in 1935 by the same lines.

Notes to Table 92 concluded:

This procedure yielded $828,773,000 for inventories held by manufacturers' sales branches in 1936.

Since manufacturers' sales branches operated under separate corporate charter would not have been assigned to manufacturing in *Statistics of Income*, the total overstates the value of such inventories included in Kuznets' estimates.

* Unpublished estimate by George Terborgh.

† A balancing item. To the extent that items 8a and b overstate the value of inventories included in Kuznets' estimates under those heads, 8d would be larger.

unit, the company operating under separate charter, lumps together all establishments owned by the company and, if the dominant activity is manufacturing, places all in that division.

A valid figure for manufacturers' stocks would seem to lie between the census and Kuznets' figures. In Chapter 2 we put the exaggeration in Kuznets' estimate at half the 'maximum overstatement', $1.4 billion, or roughly $700 million.

c) Consolidated returns

Related to these difficulties and enhancing their importance is the practice with respect to consolidated returns. This form of return, at first compulsory for an affiliated group of companies, was made optional in 1921 and remained so until the Revenue Act of 1934. In 1932 and 1933, however, corporations filing consolidated returns were subject to income tax at a rate 1.5 percent higher (in absolute terms) than that applying to individual returns. The Revenue Act of 1934 abolished the privilege of filing consolidated returns for all corporations except railroads, for taxable years beginning December 31, 1933.[13]

[13] Under the Revenue Acts of 1924-32 two or more domestic corporations were deemed to be affiliated if one owned at least 95 percent of the voting stock of the other or others or if at least 95 percent of the voting stock of two or more corporations was owned by the same interests.

During the entire period when consolidated returns were optional, statute and Treasury regulations stipulated that when a consolidated return was made for one year, the same form had to be used in subsequent years except in certain cases provided by regulation or when the Commissioner granted permission to change for good cause.

I am indebted to E. G. Keith for a memorandum on these points and those covered in note 14.

The influence of these considerations on the data from *Statistics of Income* is twofold. First, the privilege of making consolidated reports gave rise to many more reports of businesses engaged in a mixture of activities than would otherwise have been included. This fact aggravates the difficulties arising from the unavoidable practice of classifying firms according to their predominant business. Secondly, it means that a break in the series occurs between 1933 and 1934 when the privilege of filing consolidated returns was withdrawn.[14]

Fortunately, from *Statistics of Income, 1934*, we can gauge the effect of consolidated returns on the composition of the various groups before 1934 and of the change that took place when the privilege was withdrawn (Table 93). However, even before 1934, the number of consolidated returns was falling because of the unfavorable differential in tax rates applied in 1932.

TABLE 93

Number of Income Tax Returns Filed, All Corporations
Total and Consolidated

		1931	*1932*	*1933*
1	Total	516404	408636	504080
2	Consolidated*	8495	7426	7101
3	Line 2 as % of 1	1.65	1.46	1.41

* Figures obtained through the courtesy of T. C. Atkeson of the Bureau of Internal Revenue.

Unfortunately, Tables 93 and 94 show only the net changes consequent upon the withdrawal of the consolidation privilege. The loss of inventories to manufacturing as a whole was some 3.4 percent, and among the component groups chemicals alone suffered considerably larger percentage changes. However, we are still left wondering how much shuffling about among the manufacturing groups accompanied the reclassification of corporations. Fundamental changes in the composition of the various divisions are consistent with small net changes in the size of inventories.

[14] Since the privilege was abolished for taxable years beginning after December 31, 1933, most of the returns reported in *Statistics of Income, 1934* were subject to the new provision with respect to consolidated returns. The exceptions consist only of affiliated groups whose taxable years began after June 30, 1933 and before January 1, 1934, which are, therefore, included with the 1934 returns although not subject to the new provisions.

TABLE 94

Corporate Inventories for 1934 Classified on 1933 and 1934 Bases

	ALL CORPORATIONS		% CHANGE
	1933 basis	1934 basis	1934 FROM 1933 BASIS
	(millions of dollars)		
Total manufacturing	8611.9	8319.2	−3.4
Food, bev. & tobacco	1628.4	1568.2	−3.7
Textiles	1065.7	1071.5	+0.5
Leather	246.5	234.2	−5.0
Rubber	206.7	197.1	−4.6
Forest products	342.5	338.8	−1.1
Paper & printing	383.0	376.4	−1.7
Chemicals	1430.4	1289.0	−9.9
Stone, clay & glass	214.9	218.9	+1.9
Metals	2793.2	2722.1	−2.5
Manufactures n.e.c.	300.5	302.9	+0.8

4) Biased reporting for tax purposes

It is impossible to say anything in detail about this question which affects Kuznets' estimates for the years since 1926. The fact that inventories are an element in the determination of net income for tax purposes undoubtedly influences the value put on them. *A priori*, it would seem likely that this leads to a low valuation of stocks in good years and a high valuation in bad years (the latter in order to keep the reported value from getting too far out of line with reality). Beyond this, one can say merely that there would probably be little room for such biases in the case of raw materials whose purchase price can readily be determined; and probably incorrect valuations are relatively insignificant in the case of other staple goods whose production costs are computed in some regular fashion. But whenever cost is difficult to figure and market value can be influenced by physical deterioration or by changes in style, there will be opportunity for company treasurers to value their inventories according to the dictates of tax convenience.

5) Influence of the large corporation sample

From 1918 to 1922 and again in 1925 Kuznets' estimates for manufacturers' total stocks depend upon inventory-gross income ratios estimated from samples of large corporations. In 1923 and 1924 the distribution of the total by major industry groups, though not the total itself, rests upon the same method. How nearly accurate can we assume this method was? Errors arise from two sources:

sampling and bias due to overweighting large corporations. The experiment described below suggests the importance of the second but not the first.

Since 1931 *Statistics of Income* has published information on sales and inventories of manufacturing corporations by size of assets. Table 95 applies for the most part to 1931-35, although information with respect to the asset class required was not available for four of the industry groups for all years.

TABLE 95

Comparison of Kuznets' Samples and All Corporations in Selected Asset Classes

	RANGE OF AV. SALES KUZNETS' SAMPLE 1918-24	CORP. REPORT. BALANCE SHEETS *Statistics of Income* Size group used in test	Range of av. sales 1931-35	TOTAL SALES OF CORP. IN Kuznets' samples as % of gross income of all report. corp.	Selected asset classes as % of gross sales of all report. corp.
	(millions of dollars)				
Foods, bev. & tob.	35-80	3 & over	27-37	16.0	66.2
Textiles & textile prod.	8-16	5 & over	8-10	5.5	23.5
Leather & leather prod.	23-44	5 & over	12-13	19.2	30.6
Rubber & related prod.	42-62	5 & over	22-28	64.3	74.8
Lumber & wood prod.	6-9	5 & over	2-3	3.0	18.5
Paper, print. & pub.	6-8	5 & over	5-9	2.9	35.7
Chemicals & allied prod.	42-59	10 & over	38-44	29.4	72.7
Stone, clay & glass prod.	7-12	5 & over	5-8	8.7	48.9
Metals & metal prod.	20-41	5 & over	16-23	25.0	67.1
Misc. mfg.	7-8	1 & over	2-3	1.6	53.0

Our procedure involved the following steps:

1) Average sales per firm were computed for the various asset classes in *Statistics of Income*, 1931-35.

2) These figures were then compared with the average sales per firm enjoyed by the firms in Kuznets' samples (*Commodity Flow and Capital Formation*, Table VII-1, Note C, p. 415) and such asset classes from *Statistics of Income* selected for the test whose sales per firm were as nearly similar to the sales per firm in Kuznets' samples as possible. Changes in prices between the two periods were roughly allowed for.

3) The inventory-sales ratios for all incorporated firms in industries submitting balance sheets were extrapolated by indexes of inventory-sales ratios computed for firms in the selected asset classes in each industry.

4) Applying these inventory-sales ratios as calculated in (3) to the gross sales of all corporations yielded estimates of inventories that rest upon the methods Kuznets used earlier, and these may be compared with actual inventories of all corporations. To this statement, however, there is the important exception already noted: Kuznets' information was drawn from samples of large corporations. Our test estimates are based upon the experience of all corporations of about the same average size as those in Kuznets' samples. The significance of this can be judged by comparing the last two columns of Table 95.

Table 96 shows the actual inventories of all corporations reporting balance sheets and inventories as estimated. The movements of both the inventories themselves and of the first differences were compared. In 6 of the 10 manufacturing groups both series moved in the same direction in all four years. In paper and printing there was disagreement in two years. Taking all groups together, there were 27 agreements in 33 comparisons. First differences showed complete agreement in all years in 6 series. In every series there were more agreements than disagreements. For all 10 series, there were 19 agreements in 23 movements.

TABLE 96

Actual Inventories of All Corporations Reporting Balance Sheets and Estimates Based on Inventory-Sales Ratios of Large Corporations

(MILLIONS OF DOLLARS)

		1931	1932	1933	1934	1935
Foods, beverages & tobacco	A	1371	1185	1405		
	E	1371	1208	1479		
Textiles & textile products	A	982	781	1086	1072	1122
	E	982	793	1106	1146	1187
Leather & leather products	A	280	208	255	234	
	E	280	188	240	244	
Rubber & related products	A	163		160	197	186
	E	163		166	219	199
Paper, printing & publishing	A	436	347	370	376	401
	E	436	377	375	363	386
Lumber & wood products	A	448		357	339	352
	E	448		349	348	381
Stone, clay & glass products	A	269	222	215	219	235
	E	269	212	194	214	226
Metals & metal products	A	3045	2447	2583	2722	2967
	E	3045	2570	2607	2790	3037
Chemicals & allied products	A	1643	1347	1352	1289	1282
	E	1643	1299	1312	1286	1240
Misc. mfg.	A	367	302	301	303	314
	E	367	375	307	321	336

A: actual; E: estimated.

C OTHER ESTIMATES FROM BALANCE SHEET SOURCES

In Chapter 4 we noted five sets of estimates based on the annual balance sheets of samples of large corporations chiefly in order to check Kuznets' results for 1918-22, when his figures also depend upon large company samples, and during 1923-25 when his figures, though derived from large corporation samples, were adjusted to comprehensive data from capital stock tax returns. From 1926 forward, as indicated above, Kuznets' estimates are based upon the comprehensive corporation income tax data in *Statistics of Income*. This section describes the methods and sources used to get the alternative estimates for the early period.

1) Dun and Bradstreet's estimates

These figures are based "on an examination of the balance sheet records of 111 large corporations, as reported in Moody's Manuals, for the ends of the years 1913 through 1922. Only those companies were included where a consistent record of inventories could be obtained for the entire period. Where an important merger was involved, the company was included only if data were available for the earlier component firms. The 106 corporations, which are manufacturing and mining enterprises, are estimated to represent between 20 and 25 percent of the total manufacturing picture, so the sample is extremely significant."[15]

The authors doubt that such a group of large corporations can be regarded as typical of all enterprise, but they justly claim that the sample is significant in its own right, that is, is representative of larger companies.[16]

To obtain a general index for manufacturing, the companies were divided into 15 groups. Group indexes, combined on both a

[15] Five companies engaged in distribution are included in the group of 111 corporations but omitted from the index of manufacturers' inventories. The latter, however, includes a few concerns engaged in mining. *Dun's Review*, Feb. 1940, pp. 17, 19.

[16] The representativeness of these series is further restricted because of the apparent omission of leather tanning and lumbering companies except as far as they may be represented in the Dun & Bradstreet building materials group. In addition, it seems doubtful that the 10 companies in 'Consumer Goods, Miscellaneous' adequately represent all textile, clothing, and shoe manufacture.

weighted and an unweighted basis, were remarkably alike, the difference in no year exceeding 2 percent. The weights were based on 1937 Census inventory figures with allowance for differences in the rates of growth of the industries.

The authors' discussion of their results contains an interesting note on both their indexes and Kuznets' estimates (p. 19, note 1):

"His [Kuznets'] estimates [for 1918-23] are based on samples taken from Moody's Manuals, for which he could get both sales and inventory figures for pairs of years. Ratios of inventories to sales were developed for ten manufacturing groups and applied to estimates of total sales to obtain estimates for total inventories.

The principal differences in results are that the main increase from 1918 to 1920 is placed by Kuznets in the first of the two years, and by the Dun and Bradstreet index in the latter year; and that the Kuznets' estimates show a large increase in 1922, while the new index shows little change.

A considerable part of the difference is in the greater weight given to textiles in the Kuznets' sample, coupled with the fact that his estimates for textiles declined in 1920 and then went on to new highs in 1921 and 1922. However, even within the groups which should be fairly comparable, rubber and chemicals, for example, it is clear that quite different results are obtained by applying turnover figures of a sample to known sales figures."

2) NBER Financial Research Program estimates (Schmidt-Young sample)

In connection with its studies in business financing, the Financial Research Program of the National Bureau of Economic Research gathered a sample of balance sheets of large corporations for 1914-22.[17] The estimates are based on reports of 81 large manufacturing companies in Moody's Manuals, supplemented by annual reports to stockholders. The estimates for total manufacturing are simple aggregates of the values in the individual balance sheets. Minor adjustments were made in 1914-17 to allow for a few corporations whose reports were later available but that were either not in existence or not reported in one or more of these years. The sample is confined to companies in agricultural machinery, automobiles and trucks, building materials, chemicals, food (other than meat

[17] See NBER *Occasional Paper 10*, pp. 31 ff. and App. A.

packing), iron and steel, meat packing, petroleum, textiles, tobacco, and transportation equipment. During 1918-22, when the sample overlaps with Kuznets' estimates of all manufacturers' stocks, it covers about 18 percent of the total.

3) George Terborgh's estimates

By somewhat different methods and based upon a larger sample, George Terborgh prepared an index of all manufacturers' stocks for year ends 1915-23. The sample "covers, for each year of the period 1916-23, nearly all of the manufacturing concerns for which both the opening and the closing inventories are reported in Moody's Manuals. The percentage of the total manufacturing inventory held by these companies ranges from roughly 25 in 1916 to 40 in 1923."[18]

To derive his index for total manufacturing, Terborgh first classified his sample corporations into 19 industry groups, then divided the companies in each group into 'large' and 'small' on the basis of their inventories, and derived separate indexes for the large and small corporations in each industry. Since the sample changes from year to year, but contains opening and closing inventories for the same companies in each year, the indexes are constructed by means of link relatives. Terborgh points out that this form of index may produce a slight downward bias in the estimates since the number of companies increased between 1916 and 1923. Indexes for total holdings by corporations in each industry were constructed by weighting the size group indexes according to their importance as inventory holders in 1923. Terborgh assumed that his sample for 1923 included all 'large' corporations, and that the difference between the inventory tabulated for these concerns and the estimated totals for their industries consisted of small company inventory. The indexes for the various industries were then combined by means of 1923 weights to yield indexes for durable goods industries, nondurable goods industries, and total manufacturing. At this point, however, allowance was made for unincorporated firms.[19]

[18] *Federal Reserve Bulletin*, July 1941, p. 613.

[19] Terborgh and Kuznets treated unincorporated business differently. As Terborgh points out, unincorporated firms are generally small, and "since there appears a clear tendency for small concerns to have lower inventories *relative*

4) Lauchlin Currie's sample

This estimate, which gives annual (Dec. 31) figures 1922-28, is based on "the results of a study of the annual statements [from Poor's and Moody's Manuals] of 729 companies divided into 30 groups.[20] The basis of selection was availability, all companies being included for which continuous reports, in sufficiently detailed form, were given for approximately the same dates. The great majority of the reports are as of December 31. Although care was taken to include the available reports of all the smaller companies and also of companies in depressed industries, the series as a whole is mainly representative of the larger and more successful companies, owing to the greater availability of their financial statements."

Currie's companies held inventories valued at $5,053 million in 1928 when manufacturers' total inventories are estimated to be worth $13,359 million. A few of Currie's companies were not engaged in manufacturing.

5) NBER Financial Research Program estimates (Koch sample)

Data for a sample of large corporations 1920-39 were gathered by Albert R. Koch in connection with the Financial Research Program of the National Bureau of Economic Research.[21] For most of the period balance sheets were available for 84 corporations. For 1920, however, reports for 15 companies were missing; for 1921, reports for 6 companies were missing. We therefore use

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to sales than large corporations in the same line of business, we may infer that the ratio of noncorporate to total value of product overstates the relative importance of noncorporate inventory." He assumes that the relative share of unincorporated concerns in the total inventory of their industry is two-thirds their proportion of the value of product.

[20] This estimate originally appeared in Mr. Currie's Note in the *Quarterly Journal of Economics*, Aug. 1931, p. 699.

The 729 companies include 23 chain stores, 23 wholesalers, 11 department stores, and 16 amusement firms. Although they cannot be eliminated, the group as a whole may still be regarded as a sample of manufacturing firms.

Data from the financial manuals on cotton textile companies were supplemented by data from the credit files of the Federal Reserve Bank of Boston.

[21] See *Financing of Large Corporations* (1943); also Corporate Financial Data for Studies in Business Finance (preliminary unpublished draft, 1945), pp. 2-5 and Table A-2.

Koch's estimates only since 1922, although three company reports were missing for that year, and one for 1923-25. As Kuznets' estimates yield annual data based on full *Statistics of Income* figures since 1926, we did not use Koch's estimates after 1929.

Koch's estimates are simple aggregates of the year end inventory values shown by the balance sheets of his sample companies producing automobiles and trucks, building materials and equipment, chemicals, food (other than meat packing), iron and steel, machinery, meat packing, petroleum, rubber, textiles, tobacco. During 1922-29 the companies held about 22 percent of all manufacturers' stocks, according to Kuznets.

D VALUE OF MANUFACTURERS' INVENTORIES, MONTHLY ESTIMATES

All the estimates described above are for the end of calendar years. Two recently compiled samples furnish monthly information.

1) National Industrial Conference Board indexes

These estimates are designed to represent total manufacturing and two components, durable and nondurable goods industries. Available monthly since January 1929, they are based on the reports of a large number of companies, large and small. The sample does not include companies manufacturing food products, tobacco, liquors, petroleum, and certain lumber products "because these industries are so closely tied up with agriculture or with the extractive industries" and "do not represent the more active sector of industry, in which the individual decisions of industrial management have greatest effect on business activity".[22] In 1940 roughly one-sixth of total manufacturing was covered; in earlier years the coverage was less adequate.

The companies were grouped into 19 industries plus a miscellaneous group.[23] Chain indexes on a 1936 base were computed for

[22] *Economic Record*, II, Supplement, Dec. 26, 1940: Inventories, Shipments, Orders, 1929-40, p. 2.

[23] Durable goods: automobile equipment, building equipment, cement, electrical equipment, glass, iron and steel, machinery, nonferrous metals, office equipment, railroad equipment, house furnishings (since Jan. 1935), metal products.

each industry and corrected for seasonal variations. At this point, the base was shifted to make the 1935-39 average equal 100. The corrected indexes were finally combined into an index for the total and for the two durability groups by means of census weights adjusted for the change in the indexes between 1936 and 1937.[24]

2) Department of Commerce series[25]

These data, covering total inventories held in manufacturing since December 1938, are based upon reports from a sample of manufacturing firms that held nearly 40 percent of all manufacturers' stocks in June 1940 and 36 percent in June 1942. All establishments of the cooperating companies are included in the reports.

The sample is less than completely adequate. First, it is somewhat biased in favor of larger manufacturing firms. The Department of Commerce accepted this deficiency in order to avoid the cost of getting a fair representation for firms with assets under $500,000. It estimates, however, that although 89 percent of all United States manufacturing corporations have assets of less $500,000, they hold only 12.5 percent of all inventories.

The second difficulty lies in the inadequate sample obtained in certain industries where most of the business is handled by very small firms. For example, only 16 apparel manufacturers reported in June 1940. They must have accounted for only a small fraction of inventories in this industry. The Department of Commerce has attempted to remedy this difficulty and reports some progress in improving its samples.[26]

Companies report the value of their inventories for the current and preceding month, and for the corresponding month of the preceding year. Data are compiled for 11 major industry groups

Note 23 concluded:

Nondurable goods: boots and shoes, chemicals and drugs, clothing (since Jan. 1932), leather, paper manufactures, rubber goods, and textiles. The miscellaneous industries group is included in the total but not in the two components.

[24] The miscellaneous group was given the relative weight indicated by the ratio of their inventories to all inventories in the sample in 1936.

[25] *Survey of Current Business*, Sept. 1940, pp. 7 ff.; Jan. 1942, p. 22, and June 1942, pp. 6 ff.

[26] Ibid., Jan. 1940, p. 22.

and for two groups of miscellaneous industries, one producing durable goods, the other nondurable. These aggregates are used to construct chain indexes for the 13 industry groups.

Series representing the dollar value of inventories held by all manufacturing firms, durable and nondurable goods industries, are constructed by using the indexes just described to extrapolate the value of inventories for each group as reported to the Census of Manufactures, 1939, for December 31, 1938 and 1939. The census data were first adjusted to allow for establishments that did not report inventories and to get broader coverage in petroleum refining, tobacco, and printing and publishing.

The value of inventories thus established is further divided into holdings of finished goods, goods in process, and raw materials. Firms holding 28 percent of all manufacturers' stocks reported their finished goods and all other inventories in June 1942. Firms holding 24 percent of manufacturers' stocks divided their reports into finished goods, goods in process, and raw materials.

Indexes of finished goods inventories, computed by industries, were used to extrapolate the values reported to the Census of Manufactures for December 31, 1938 and 1939. The aggregate value of finished goods inventories for all manufacturers was then subtracted from the value of total inventories and the remainder split between goods in process and raw materials on the basis of the proportions suggested by the entire sample of reporting firms.

2 *Adjustment for Changes in Prices*

The series described above yield estimates of inventories in terms of changing book values. They can, no doubt, serve also as first approximations to indexes of physical volume. But an adjustment to take account of changing valuation factors is desirable, the more so as we are interested in studying the value of the physical changes in stocks, which would be seriously distorted if represented by the simple changes in book values. Kuznets' estimates of manufacturers' inventories in current prices were therefore divided by indexes of prices that represent unit values of commodities held in stock.

As the procedures are unavoidably complicated, we begin by setting forth the chief problems encountered in constructing defla-

ing indexes. We then describe the methods adopted and indicate the degree to which the problems were overcome.

A MAJOR PROBLEMS IN ADJUSTING INVENTORY VALUES FOR PRICE CHANGES

To construct a satisfactory index for a group of manufacturers holding several commodities, account must be taken of many matters that make the problem of inventory deflation somewhat different from the more usual problem of correcting dollar sales or value of output figures for changes in prices.

1) The weights by which price relatives are combined ought to be based on representative values of inventory held—constants more difficult to determine than values of product.

2) All inventories are not valued in the same way. Inventories of purchased materials (in this connection we shall call them raw materials) are usually valued at their purchase cost. If processed by their owners they are valued at the purchase cost plus an allowance for the cost of labor directly employed in processing plus an allowance for overhead expenditures. The allowance for overhead is seldom clearly defined, varies in detail from industry to industry and often from firm to firm. When, therefore, the inventories to be deflated consist in part of goods processed by firms that own them, our series of price relatives should be of three types: prices of raw materials, costs per unit of goods in process, and costs per unit of finished goods. The second and third types should be built by adding allowances for processing costs to the purchase costs of the raw materials in a fashion that takes into account the relative importance of raw materials, direct labor, and overhead costs in the total costs per unit of each type.[27]

3) The cost at which inventories are valued is usually cost at some earlier time, determined by the system of inventory accounting. The most common methods and, until recently, the only ones approved by the Treasury, are the so-called first-in, first-out and the actual cost of specific lots methods.

The first-in, first-out method is perhaps most popular in manu-

[27] These categories should, of course, be combined by means of weights proportionate to the value of inventory of each class of goods held. Ideally several classes of goods in process would be recognized.

facturing where inventory items are often so intermingled that it is impossible to determine the invoice or work tag covering the cost of individual lots. The method approximates the desired end by assuming that the goods in stock are those most recently purchased or processed. The costs of the various lots are, therefore, ascertained from the invoices or work tags of most recent date, enough of each being taken into account to cover the number of units in the stock. The problem in such cases, therefore, is to determine the periods to which the invoices or work tags refer.

Accounting by the actual cost of specific lots method is self-explanatory. The average age of the invoices which, under this scheme, determine the value of the goods held at the end of the year depends upon the actual order in which goods are utilized or sold.

4) While inventories are usually valued at cost at some preceding time, the values more often than not are marked down to year end replacement values when the latter are below ordinary accounting cost. The ideal method would be to combine two indexes for each industry, one constituted on the assumption that inventories are always valued at original accounting cost, the other on the assumption that inventories are always valued at the lower of original or replacement cost, weighting each by its relative prevalence. There is, however, little satisfactory evidence on the prevalence of markdowns to replacement values in manufacturing industries.

According to an NICB study of 800 firms about one-half of all inventories are subject to markdowns (Table 97).[28] Markdowns

TABLE 97

Practices in Inventory Valuation

	Method of Valuation	Raw Materials	Goods in Process	Finished Goods
		PERCENTAGE OF COMPANIES REPLYING		
A	Lower of cost or market	63	37	40
B	Actual cost of specific lots	14	19	15
C	Average cost	15	18	17
D	Standard cost	6	19	20
E	Basic or normal cost	1	4	4
F	Some other basis	1	3	4
Total		100	100	100

[28] Prevailing Practices in Inventory Valuation, *Studies in Administrative Control*, No. 1, Feb. 1938.

have a clear majority in the case of raw materials and a substantial plurality in goods in process and finished goods.

The meaning of Table 97 for our purposes, however, is difficult to assess. With respect to raw materials, 23 percent of the companies reported valuation methods for general balance sheet purposes that are not approved by the Treasury (methods C to F). Similar figures for goods in process and finished goods were 44 and 45 percent, respectively. It is not clear what methods firms employed for tax purposes. The meaning of method A also is ambiguous. If it is the lower of first-in, first-out cost or market, it is an approved method. But if so, how would a firm that used the lower of actual cost of specific lots or market have answered? In short, did all firms that applied markdowns to market prices answer in category A no matter what measure of cost they employed? How would a company have answered if it used first-in, first-out cost but did not mark its goods down at the end of the year?

Additional information regarding finished goods inventory practices is provided by a report by the National Association of Cost Accountants.[29] Of 156 classifiable replies from firms using actual, as distinguished from standard, costs, 84 reported values at the lower of cost or market and 4 valued the raw material component alone by this method; 75 valued at cost alone. Replies were received also from 131 companies valuing finished goods at standard costs, but how these companies kept their accounts for tax purposes is not known.

Direct quantitative evidence on the practices of manufacturers reporting to the Treasury for tax purposes—for most years the relevant question—does not exist. George Terborgh records the impressions of Treasury officials whom he consulted in preparing a memorandum for the Board of Governors of the Federal Reserve System. In their opinion, markdowns to market value when replacement prices are below cost are "overwhelmingly the more important" in the case of raw materials. For finished goods, markdowns are less prevalent but are used by a majority of firms. For goods in process, the predominance of markdowns was considered

[29] Finished Goods Inventory Practice, NACA Bulletin XXI, No. 14, Sec. III, March 15, 1940.

intermediate between that prevailing for raw materials and for finished goods.

This summary impression of practices should perhaps be qualified for goods in process and finished goods. Terborgh asserts that the practice of the Treasury is to allow writedowns of goods in process only in consequence of price declines in raw materials which accounts for at least 70 percent of their cost. And with respect to finished goods he writes: "The regulations appear to contemplate write-downs whenever the *current replacement market* for the elements of cost embodied in a manufacturers' finished inventory (material, labor and burden) is below the cost valuations at which they are carried on the books. (See *Regulations 101,* Article 22(c)-4, p. 46.) I am informed that in practice write-downs are not permitted on such inventory unless the *selling* price of the goods falls below their inventory valuation at cost."

The validity of Terborgh's last point seems questionable. If his impression is correct, it would indicate a practice in direct contravention of clear statements continually published in the Treasury regulations. Moreover, accountants of wide experience whom I have consulted do not confirm Terborgh's interpretation.

The surveys of practice cited above make it seem likely that markdowns to market values when the latter are below cost are probably made by at least a small majority of firms. In consequence, we consider that our estimates corrected on the assumption that this is always done are preferable.[30] The material in the text proceeds on this assumption. To test the possible range of errors, price corrections were made on both bases (Sec. D).

B CONSTRUCTION OF THE INDEXES

Kuznets and his staff, in connection with their estimates of capital formation, adjusted the estimates for changes in prices (*Commodity Flow and Capital Formation,* Part VII, Sec. 4, and Tables VII-7 to 10). Subsequently it was possible to improve Kuznets' procedure for at least some industry groups.

[30] It would have been better to combine indexes made on each assumption weighted by some approximation to the relative prevalence of each practice. But our information about practice in particular industries was too scanty.

1) Kuznets' method

Kuznets' procedures remain applicable to all manufacturing groups 1918-25 and to the metals and machinery, stone, clay and glass, and miscellaneous groups for all years covered. Since he describes his indexes in detail in Table VII-7, Note A, I content myself with describing the general character of his method briefly.

Kuznets' index for each industry group is simply an average of price relatives representative of the wholesale selling prices of the goods held. The component series are combined by means of BLS, that is, value of product, weights. To construct indexes of cost, price relatives for several months, usually in the latter half of a calendar year, are averaged. To construct indexes of replacement market values on December 31, relatives for December and the succeeding January are averaged.

The indexes have many defects. Foremost is the use of value of product instead of value of inventory weights. For the groups and periods in question, this unsatisfactory choice was, of course, dictated by the absence of a reliable method of determining value of inventory weights.

Secondly, 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.

A third, but minor, defect inheres in the number of months chosen to represent the period during which goods in stock at the end of the year were accumulated. I shall argue below that a number of months equal to one and one-half times the usual turnover period is probably the best approximation to the correct period that can be made. Kuznets consistently chose a somewhat larger number of months. This, however, is unlikely to have been of substantial importance. Experiment with varying numbers of months yielded substantially the same results (see Sec. C below).

In view of these defects, the accuracy attaching to the deflated figures is due largely to the general family resemblance of price series of many sorts. Even though inaccurate weighting systems are applied to price series that do not themselves strictly represent the

movement of the valuation factors for which they stand, the substantial resemblance of the behavior of prices of similar goods at fabrication stages not too far apart is some assurance that the results are not wholly untrustworthy.

2) The revised inventory value deflators

From the 1937 Census of Manufactures with its detailed classification of inventories by minor industry groups we derived inventory weights for constructing indexes to be applied to the manufacturing groups. Seven of the ten manufacturing groups were, therefore, treated more elaborately but only for the period since 1926 because our data in current prices before this date, based upon samples of large corporations, were deemed too crude to justify the labor of refining the deflating indexes.[31]

The solution of our problems in the groups for which a revised index was used calls for some detailed explanation.

The *Statistics of Income* data, which we must deflate, are classified by industry and do not distinguish raw materials, goods in process, and finished goods. Ideally an index is needed for each; and to deflate data that lump together the three categories, the three indexes must be weighted by the relative importance of each in each industry. Given sufficient data, our index for each category of inventory would be based upon three series:

1 Raw materials: raw materials prices
2 Goods in process: raw materials prices, direct labor, and overhead costs per unit, each element weighted by its relative importance in manufacturing costs per unit of goods in process
3 Finished goods: same three classes of cost series, each weighted by the relative importance of its class in manufacturing costs per unit of finished goods

[31] More refined indexes were not constructed for the metal products and processes group because its high degree of integration made it unlikely that published commercial prices would reflect accurately the inter-company transfer prices which determined inventory cost even after 1933 when the privilege of presenting consolidated tax returns was withdrawn. The simpler form of index was continued also for stone, clay and glass and miscellaneous industries since it was impossible to get price series sufficiently representative of the raw materials used, in contradistinction to the finished goods produced, by these industries.

The three indexes would be combined, weighted by the relative importance in each industry of inventories of raw materials, goods in process, and finished goods.

The data available make possible a good but by no means perfect approximation to this procedure. To weight the various classes of inventories correctly, we must depend upon the 1937 Census of Manufactures. Establishments in each industry were requested to state the value of inventories held at the beginning and end of 1937 in (a) raw materials and goods in process, and (b) finished goods. As we cannot separate raw materials from goods in process we throw the entire weight of goods in process upon the price of raw materials. This is less serious than may at first seem since, as we shall see, a very large proportion of the total cost of goods in process is composed of the price of raw materials.

In constructing indexes of costs of finished goods in the various industries, difficulties were encountered because of lack of data. No practicable method of measuring the movement of overhead costs per unit of product could be devised and this element does not appear explicitly in any of our indexes; and in five groups labor costs per unit of product do not appear. In two others, however, an index of labor costs per unit of product was constructed by dividing an index based on the sum of wages and salaries of the industries comprising the *Statistics of Income* group by a comparable index of physical output derived from figures presented by Solomon Fabricant in the *Output of Manufacturing Industries, 1899-1937* (NBER, 1940). Monthly movements were based upon either BLS or NICB data on hourly earnings and adjusted to the biennial index just described.

The departures of our methods from those described above as ideal are briefly: non-raw materials elements are not included in any of our indexes of costs of goods in process and in few of our indexes of costs of finished goods; nor are overhead costs in any of the indexes of cost of finished goods; we constructed indexes of labor costs per unit for only two of the seven groups. Finally, the indexes of labor costs per unit cannot be considered better than a crude approximation.

Because of the absence of non-raw materials cost elements from five groups and the heavy weight given raw materials prices in two,

our revised indexes may be described as averages of relatives of prices of raw materials or of materials into which they entered. Some idea of the seriousness of the distortions likely to arise may be gained by inspecting Table 98 and the calculation based upon it.

TABLE 98

All Manufactured Goods: Cost of Raw Materials and Total Costs (Plus Profits)

	1927	*1929*	*1935*
Value of raw materials & containers ($ mil.)[a]	32173	35608	24889
Value of product ($ mil.)[b]	60335	67994	44994
Raw materials as % of value of product	53.3	52.4	55.3
Raw materials as % of cost of goods in process[c]	69.6	68.7	71.2

[a] As revised data for 1927 and 1929 in the Census of Manufactures, 1939, do not exclude fuel and purchased electrical energy, the data were adjusted by the ratio of the value of raw materials and containers to total value including fuel and purchased electrical energy (unrevised figures in Census of Manufactures, 1929). For 1927 this ratio is 94.6; for 1929, 95.2.

The 1935 figure, excluding fuel and purchased electrical energy, is from the Census of Manufactures, 1937.

[b] Census of Manufactures, 1939.

[c] Computed upon the assumption that goods in process are, on the average, half-finished and have, therefore, accumulated costs comprising cost of raw materials plus one-half of all additional costs.

These figures are not quite suitable for our purpose in two countervailing ways. The significance of raw materials is exaggerated by an amount equal to the value of the containers used. On the other hand, non-raw materials costs are overstated and raw materials understated by the presence of profits, interest, and selling and general administrative expenses in the value of product.[32] Taking the figures as they stand, however, raw materials account, on the average, for about 54 percent of the costs of finished goods and for about 70 percent of the costs of goods in process. (We assume that goods in process are on the average half-finished and, therefore, that they have accumulated costs equal to the cost of raw materials plus one-half all additional costs.)

Our assumptions about the percentage distribution of inventories by stages of fabrication (Ch. 7) place us in a position to estimate the weights that ought ideally to be attached to raw materials

[32] Non-raw materials costs are further exaggerated to the extent that other elements of overhead cost are not counted as costs of inventory; see below.

prices on the one hand and non-raw materials elements on the other for manufacturing industries taken together.

Index of Raw Materials Prices, .750					Index of Non-raw Materials Elements, .250				
				Weight					Weight
Raw materials	.400	×	1.00	= .400	Goods in proc.	.200	×	.31	= .062
Goods in proc.	.200	×	.69	= .138	Finished goods	.400	×	.47	= .188
Finished goods	.400	×	.53	= .212					

On the average, a maximum of about one-fourth of the total cost of inventory elements are incorrectly represented in our indexes either because their weight was shifted to raw materials prices or because poor indexes were used to represent them. The distortion may actually be much less, however, for the calculation assumed that all value added entered into the cost of inventory. But profits, general office and selling expenses certainly never enter and other portions of overhead often do not. According to Terborgh's unpublished memorandum for the Board of Governors of the Federal Reserve System, a large portion of overhead is, in fact, neglected in inventory accounting. Tabulating the reports of 446 large manufacturing corporations as shown in the SEC's *Survey of Listed Corporations,* Terborgh found that substantial amounts of three important overhead items were not accounted as 'cost of goods sold'.

	Overhead items in cost of goods sold	
	Included	Not included
	(millions of dollars)	
Depreciation, depletion, & amortization	319	685
Taxes (other than income & excess profit)	358	381
Rents & royalties	84	73
Total	761	1139

In the absence of special adjustments of the inventory account, costs not included under costs of goods sold would not affect the value of inventories. Such adjustments, if made, would appear in the reports filed with the Treasury in the form of a discrepancy between the inventory value reported on the balance sheet schedule of the corporate income tax return and the value entered on the face of the return for computing the cost of goods sold. Concerning this point, Terborgh writes:

"The Treasury has never tabulated inventory values from the face of the returns for comparison with the tabulations from schedule N (balance sheet schedule); hence no conclusive measure of the disparity, if any, is available. I have consulted several officials of the Bureau of Internal Revenue on the matter, and they are unanimous in the opinion that in the overwhelming majority of the cases there is no disparity. One official was good enough to run over a stack of returns to check the point, and found not a single case in which the two valuations did not agree."

In the light of this evidence it seems likely that many companies omit a substantial fraction of overhead in valuing finished and process inventories. If we assumed that only raw materials, labor, and other direct costs figure as costs of inventory, we would have a counterpoise to our calculation which assumes that all overhead plus interest, profits, and selling expenses (the last three never enter into the inventory value) are counted in the cost of inventory. The two classes of index from which our deflations would then be derived would be indexes of raw materials prices and of labor costs per unit, which would on the average be weighted .818 and .182, respectively. The weight that would fall on non-raw materials cost elements would be substantially less than that indicated above. It is perhaps fair to say that elements not accurately represented in our indexes have a weight, on the average, of 18-25 percent, a range whose lower limit is bound to underestimate and whose upper limit is bound to exaggerate the true figure.

Index of Raw Materials Prices, .818	Weight
Raw materials	.400
Goods in process	.158
Finished goods	.260

Index of Labor Costs per Unit, .182	Weight
Goods in process	.042
Finished goods	.140

Price indexes representative of raw materials costs were selected in the following manner. For each census minor industry in each *Statistics of Income* group, the chief raw materials used were determined from census and other representative sources. Price indexes representing these materials were then selected from the BLS collection and combined by means of weights based on the relative importance of the various materials in the total value of raw

materials consumed in each minor industry. When raw materials prices were the only series used, the indexes for each minor industry were combined by means of weights based upon the relative importance of the value of inventories held by each minor industry in the total value held by all minor industries in each *Statistics of Income* manufacturing group. When indexes of labor cost per unit were used, the weight attached to the inventories held by each minor industry was distributed between raw materials prices and labor costs per unit in proportion to the relative importance of each in total costs excluding overhead.

After selecting indexes of prices or unit costs to represent various elements of the cost of different categories of stocks and after choosing a weighting scheme, we had to select the precise months whose standings should be averaged for an index of the cost of goods held in stock.[33] As explained above, the ideal procedure requires a knowledge of the inventory accounting methods in each industry and the rate of purchase of goods toward the end of the year. The methods approved by the Treasury during the period covered by our estimates were the so-called actual cost of specific lots method and the first-in, first-out method.[34]

Properly to deflate year end inventories valued at the actual cost of specific lots, an estimate of the age distribution of the specific lots of goods in stock is essential. In the deflator one could then include prices ruling at each date at which goods represented in the stock were purchased by the industry. Prices ruling at each date would be weighted by the importance of inventories bought on that date.

For inventories valued by the first-in, first-out method, however, what is necessary are the prices prevailing during a period long enough before December 31 for a quantity of goods to have been bought equal in volume to the stock at the end of the year whether or not the latter was bought during the specific period. Prices ruling within the period would be weighted by the rate of purchases at each date.

[33] The index of market, i.e., replacement cost, prices as of December 31 for use whenever they were below cost was uniformly computed by averaging standings for December and the following January.

[34] In 1938 the Treasury sanctioned last-in, first-out accounting for the leather tanning and nonferrous metals industries and has since approved it for other industries.

As neither procedure could be followed very closely, we included a number of months equal to one and one-half times a turnover period, as determined by the quotient of inventories divided by the cost of goods sold in each industry. This decision rests upon the following considerations. For companies charging inventory to process or sales by the first-in, first-out method, the average 'age' of inventory (that is, of the invoices that determine the value of the inventory) would be one-half a turnover period, provided goods were acquired at an even rate during a period equal to the turnover period. Thus for an industry whose turnover period was four months, the cost of inventory would be best represented by an average of the last four months of the year. Although it would be incorrect for any particular year, this figure would probably be the best if all inventories were accounted for on a first-in, first-out basis and if purchase and delivery dates were identical. Accounting by the other Treasury-approved method, actual cost of specific lots, and an interval between purchase and delivery tend to raise the relevant average age.

Accounting by the actual cost of specific lots produces an average 'age' which, of course, depends upon the order of utilization. Perishable goods (in this context 'perishability' is to be understood as a tendency to lose value with time, not through use) are probably used in the order of seniority (any departure from this order would raise the average age somewhat). Many goods that are durable and semidurable as far as their material is concerned are nevertheless to be included in this perishable class because of style characteristics.

If a good is highly durable the order of utilization may reasonably be expected to be random. That is, on the average, the goods used each month would have an average age equal to the average age of the supply of goods available during the month (opening inventory plus purchases). Experiment with arithmetical examples based upon the assumption that the goods used each month have an average age equal to the average of the supply available at the beginning of the month indicates that, on the average, actual cost of specific lots accounting will produce an age distribution of inventory such that the percentage bought in any given month decreases rapidly as one goes backward from the reporting date.

Hence the bulk of the stock is likely to date from the last few months of the year although an infinitesimal fraction is indefinitely old.

In view of these considerations and of another discussed below, we took an average of prices in a number of months equal to one and one-half times a turnover period to represent cost. The average outcome of the assumption of actual cost of specific lots accounting will always be that the bulk of inventory was purchased within such a period. For example, if we assume a turnover period of 4 months, so that we take an average of the last 6 months to represent cost, some 74 percent of total inventory accounted for in this fashion will have been purchased in this period, provided goods are used in the manner described above. If the turnover rate assumed is 12, so that we take an average of the last 2 months (1½ months rounded to the next higher figure), just 75 percent will have been purchased in the period.

A simple average, which weights each month equally, evidently underweights the most recent months and overweights the more distant months as far as the goods purchased are concerned. But since about a quarter of the goods will have been purchased in still more distant months, the method seems justified.

Finally, if purchase and delivery are not simultaneous, the average 'age' of goods will be increased, for in general the prices applying to a contract are those ruling at the time of sale, not at the time of delivery. It is probably also true that the time required for delivery reduces the variations in the age of inventory about its general average age because of an offsetting tendency in variations of turnover and of delivery periods, respectively. In poor years when deliveries are relatively prompt, turnover periods tend to be relatively long; and in good years, they tend to be relatively short and deliveries slow.

The age of inventory, however, is not a vital question. Experiment indicates that rather large variations in the number of months included in our average cost of inventories produce very small differences in the deflating index.

The methods described above were applied to the following *Statistics of Income* groups: food, beverages and tobacco; chemicals and allied products; textiles and textile products; rubber and

related products; leather and leather products; lumber and wood products; paper and products.

Our inability to find price series representative of raw materials used prevented the application of the technique to stone, clay and glass, and miscellaneous industries. And doubts about the values at which raw materials were priced in the integrated blast furnace and rolling mills industry as well as the importance of labor and overhead cost made it unlikely that we could improve the deflation of the metals and machinery group. The way our procedures were applied to the groups for which revised indexes could be calculated is described in the following sections.

Leather and leather products

The minor industries in this group were readily divided into two categories: those whose chief raw materials are (a) hides and skins, (b) leather. The BLS raw materials indexes selected to represent these two materials were combined, weighting by total inventories held at the end of 1936 and 1937 by leather manufacturers and leather products manufacturers, respectively. Hides and skins were weighted by .43 and leather by .57. The months included were September-December.

Non-raw materials cost elements were thus neglected, but extensive tests indicated that the inclusion of an index of direct labor costs or of total non-raw materials elements (when represented by the prices of leather and leather products) would not alter the index materially (see note on experiments in deflating inventories in the leather group). The weight attributable to non-raw materials elements because of inventories of finished goods was 15.5 percent, estimated on the overly conservative assumption that all overhead costs plus profits figure in cost inventory.

Food, beverages and tobacco

Price series for inclusion in this index were obtained by the following procedure. The main raw material (or materials) consumed in each minor industry in the *Census of Manufactures,* 1937 were assigned weights determined by computing for each raw material the factor:

$$\text{Weight } a = \frac{I_1}{I} \times \frac{C_{a1}}{C_1} + \frac{I_2}{I} \times \frac{C_{a2}}{C_2} + \cdots \frac{I_n}{I} \times \frac{C_{an}}{C_n}$$

where

$I_1, I_2 \cdots I_n$ = value of inventories (average of Dec. 31, 1936 and 1937) held in census minor industries 1 to n using commodity A as a raw material

$C_{a1}, C_{a2} \cdots C_{an}$ = value of commodity A consumed in industries 1 to n in 1937

$C_1, C_2 \cdots C_n$ = total value of materials included in the index consumed in industries 1 to n.

Shortenings and cocoa beans were excluded when it was found that the weight attributable to each was less than 1 percent. Ten commodities were included with weights adjusted and rounded so that their sum came to 1: granulated sugar, New York, .04; raw sugar, 96°, New York, .09; cottonseed oil, New York, .04; fruits and vegetables index, .17; wheat, no. 2, hard, Kansas City, .09; wheat flour, standard patents, Minneapolis, .03; corn, no. 3, yellow, Chicago, .19; milk, fluid, Chicago, .05; livestock and poultry index, .17; tobacco, leaf, warehouse sales, average for preceding 12 months, .13.

The weight of an index representing non-raw materials elements in cost, if available, would have been .154.

Before weighting, price relatives were converted to the base: average of last four months in 1936 and 1937 = 100.

The months included in the index of cost were September-December.

Paper and pulp products

Three types of industry are included in this group: pulp, paper, and paper products. The group index was, therefore, constructed by combining indexes representative of the raw materials used by each. The weights were the values of inventories held by the minor industries in each group (Census of Manufactures, 1937).

The price index for each group is a weighted average of the prices of raw materials used at each level. The weights for pulp

and paper were values of materials consumed. The weights for the two prices combined to yield an index for paper products were obtained by apportioning total 1937 consumption of paper in the manufacture of converted paper products according to whether the final products of the various minor industries were paper or paper board.

Lumber instead of log prices were used in the pulp branch.

	COMMODITIES AND BLS PRICE SERIES	WEIGHT
A	Pulp	
	Spruce, Eastern, Boston	.06
	Yellow, mill, Ponderosa, common	.03
	Hemlock, Northern, No. 1, Chicago	.03
B	Paper	
	Wood pulp, domestic, mill, Mechanical, No. 1	.07
	Wood pulp, domestic, mill, Sulphite, news grade unbleached	.21
	Wood pulp, domestic, mill, Kraft, No. 1	.17
	Wood pulp, domestic, mill, Soda, bleached	.04
C	Paper products	
	Book paper	.18
	Paper board, 85 lb. best linen	.21
	Total	1.00

A weight of 16 percent would have been attributed to an index of non-raw materials cost elements in this group had the requisite data been available. The months included in the index of cost were September-December.

Rubber and related products

This group consists exclusively of manufacturers who make products from crude rubber.

The index was constructed by combining the BLS price index of crude rubber, weighted by .8, with that of auto tires and tubes, weighted by .2. The weight relevant to inventories of raw materials and goods in process was assigned to the index of crude rubber prices. The weight attributable to inventories of finished goods was distributed between the two component indexes on the basis of the relative importance of raw materials and other direct costs in the total direct costs of producing rubber products as determined from 1937 Census data.

The months included in the index of cost were September-December.

Chemicals and allied products

The index for this group consists entirely of prices representing the chief raw materials used by the various census minor industries in the *Statistics of Income* chemicals group. Had indexes representative of non-raw materials cost elements been included, their weight would have been 25.5 percent.

The chief raw materials, determined from census and other sources, were combined by a process similar to that used in the food, beverages and tobacco group.

The months included in the index of cost were August-December.

BLS PRICE SERIES	BLS NO.	WEIGHT
Flaxseed	49	.0131
Coconut oils	183	.0175
Bituminous coal	346	.0365
Natural gasoline	357	.0204
Crude petroleum	365	.3768
White lead	548	.0319
Lithopone	550	.0154
China wood oil	551	.0210
Linseed oil	552	.0340
Asphalt	559	.0144
Nitric acid	587	.0113
Sulphuric acid	592	.0268
Ammonia	596	.0348
Salt	623	.0984
Soda ash	625	.0313
Caustic soda	627	.0221
Sulphur	630	.0270
Tallow	631	.0498
Wood pulp	748	.0127
Fertilizer materials	Index	.0411
Miscellaneous		.0332
FROM AGRICULTURAL STATISTICS		
Cotton seed		.0268
Soybeans		.0037
Total		1.0000

Textiles and textile products

Minor industries constituting this group were first placed in one of three subgroups: industries consuming fibers, yarns, or cloth. Indexes for each subgroup were weighted by the value of inventories held by minor industries in each group. Prices of the vari-

ous fibers and yarns consumed in the first two subgroups were weighted by factors computed in a fashion similar to that used for foods, beverages and tobacco. Since in the third subgroup the raw materials used could not be allocated easily among the various types of cloth, prices representative of the chief types were weighted by the value of fibers consumed in the country.

BLS PRICE SERIES	WEIGHT
Cotton, middling	19.7
Wool, medium grades	4.7
Rayon, 150, 2d quality[a]	0.9
Raw silk, double extra, crack, 13-15, 78%	3.6
Cotton yarn, carded, mill, 22/1, cones	9.9
Wool yarn, mill, 2/40's, half-blood, weaving	19.8
Rayon yarn, 150, 2d quality	6.9
Silk yarn, domestic, mill, 60/2	4.2
Cotton cloth index[b]	11.8
Wool goods index[c]	9.8
Rayon and silk goods index[d]	7.8
Jute, raw, medium grades, N.Y.[e]	0.9
Total	100.0

[a] Yarn price used to represent unspun rayon.

[b] Computed by NBER by excluding yarn prices from the BLS index of cotton goods.

[c] Computed by NBER by excluding yarns from the BLS index of woolen and worsted goods.

[d] BLS index used to represent cloths made of rayon and silk.

[e] Used to represent jute cloth.

Had an index of non-raw materials costs been included, it would have borne about 16 percent of the total weight. The months included in the index of cost were August-December.

Lumber and wood products

The final index for this group is a combination of two indexes: one designed to represent the unit value of inventories of industries drawing their raw materials directly from the forests, the other of industries drawing their raw materials from the first group. The two indexes were combined by weighting by the total inventories held by each group.

The first group (lumber and timber, excelsior, turpentine, and rosin) is dominated by the lumber and timber industry which held almost 99 percent of the total inventories held by the three indus-

tries. An index for lumber and timber was, therefore, deemed representative of the first group.

The index for the lumber and timber, excelsior, and turpentine industries is a combination of an index of labor costs per unit (computed by adjusting the NICB index of hourly earnings in the lumber and millwork industry to biennial census levels for wages and salaries per unit of output) and the BLS index of lumber prices. Labor costs per unit were weighted by the value of inventories of raw materials and by the portion of the inventories of finished goods equal to the percentage that cost of raw materials consumed in the industry bore to the value of the product. The lumber price index was weighted by the portion of the value of finished goods that was equal to the value added divided by the value of product of the three industries. The index for the other industries in the forest products group was the BLS index of lumber prices. The two indexes were combined by weighting by inventories held in the three basic industries and in other industries, respectively. For the group as a whole labor costs per unit were weighted by .54 and lumber prices by .46.

Other non-raw material cost elements in the woodworking industries would have received 10.4 percent of the total weight had an index representative of the behavior of these costs been available. The months included in the index of cost were September-December.

C ALTERNATIVE DEFLATORS OF INVENTORY VALUES IN THE LEATHER AND LEATHER PRODUCTS INDUSTRY

Before revising Kuznets' inventory value deflators for manufacturing groups generally, we constructed several other indexes for the leather and leather products group. The original index used in *Commodity Flow and Capital Formation* is the BLS price index of hides and leather products, a combination of indexes of hides and skins, leather, shoes (factory), and other leather products. Each in turn is a combination of several price series. The weights throughout are census values of product. The figure taken to represent the cost of inventories held at the year end is an average of the annual average, weighted one-third, and that for October, weighted two-thirds.

Our other indexes were designed to see what differences would be caused by:

1) Weighting the same indexes by values of inventories and allowing for the importance of the cost of hides and skins in the cost of leather and of the cost of leather in the value of shoes and other leather products. The indexes for hides and skins and leather were taken to be representative of raw materials costs at the two stages of fabrication. The indexes for leather and those for shoes and other leather products were taken to be representative of non-raw materials costs at the two stages. The weights for the four indexes were, therefore:

Hides and skins: $\frac{I_a'}{I} + \left[\frac{I_a''}{I} \times \frac{R_a}{C_a}\right]$

Leather: $\left[\frac{I_a''}{I} \times \frac{W_a}{C_a}\right] + \frac{I_b'}{I} + \left[\frac{I_b''}{I} \times \frac{R_b}{C_b}\right] + \frac{I_c'}{I} + \left[\frac{I_c''}{I} \times \frac{R_c}{C_c}\right]$

Shoes: $\frac{I_b''}{I} \times \frac{W_b}{C_b}$

Other leather products: $\frac{I_c''}{I} \times \frac{W_c}{C_c}$

Symbols:

I = Total value of inventories held by the leather and leather products group

I_a' = Inventories of raw materials and goods in process held by leather manufacturers

I_a'' = Finished goods held by leather manufacturers

R_a = Value of raw materials consumed by leather manufacturers

W_a = Wages and salaries paid by leather manufacturers

C_a = Cost of raw materials plus wages and salaries paid by leather manufacturers

Same symbols with subscripts b and c refer to inventories and costs of manufacturers of shoes and other leather products, respectively.

2) Using inventory weights, but substituting indexes of labor cost per unit of product for indexes of prices of finished products to

represent non-raw materials cost elements in the value of inventories of finished goods. The weights were computed on the same principle as in (1). The weight attaching to inventories of finished goods was distributed among the relevant raw materials prices and the index of labor costs on the basis of the importance of raw materials and other direct costs respectively.

The labor cost indexes were computed by adjusting the movement of NICB indexes of hourly earnings in the leather tanning and finishing industry and in the boot and shoe industry to biennial data on labor costs per unit of product. The biennial index was constructed by dividing an index of wages and salaries based on Census of Manufactures figures in these industries by Fabricant's indexes of physical output.

3) Using a weighting scheme as in (2), but other indexes of labor costs per unit. Labor costs per unit were estimated by dividing BLS indexes of payrolls in the leather tanning and boot and shoe industries by FRB indexes of production in these industries, the latter adjusted to biennial census data.

4) Weighting raw materials prices in the leather industry (hides and skins) and in the leather products industry (leather) by the total value of inventories held by the two sets of manufacturers.

The details of the construction of these deflators are given in Table 99.

TABLE 99

Construction of Deflators for the Leather and Leather Products Industry

VARIANT 1	WEIGHT
BLS Price Indexes	
Hides and skins	.398
Leather	.034[a]
Leather	.483[b]
Boots and shoes	.069
Other leather products	.016

VARIANT 2	WEIGHT
BLS hides and skins	.398
Labor costs in leather mfg. (based on hourly earnings)	.034
BLS leather prices	.483
Labor costs in leather products mfg. (based on hourly earnings)	.084

VARIANT 3

Same as 2 except that labor cost indexes were computed by dividing indexes of payrolls by indexes of physical output.

VARIANT 4

BLS Price Indexes	
Hides and skins	.43
Leather prices	.57

[a] In leather group.

[b] In leather products group.

For purposes of comparison, the make-up of Kuznets' deflator and that of Variant 1, which uses the same price series but assigns them inventory rather than value of product weights, are given in Table 100.

TABLE 100

Kuznets' and Variant 1 Weights

	KUZNETS'	VARIANT 1
Hides and skins	.2080	.398
Leather	.2236	.517
Boots and shoes	.4749	.069
Other leather products	.0935	.016

The shift in the basis of weighting roughly doubles the weight allotted to hides and skins and leather and makes the other two series about one-eighth as important as in Kuznets' index.

The computations indicated that the months chosen for the averages had negligible effect on the outcome. Differences traceable to the selection of price series and to the relative weights were more noteworthy. Table 101 shows the value of corporate inventories in the leather and leather products groups 1925-35 when corrected by Kuznets' deflator and by deflators 1 to 4 assuming that inventories are valued at cost or market, whichever is lower. The index of cost is constructed in each case by computing an average of prices in October, weighted two-thirds, plus the annual average, weighted one-third.

TABLE 101

Leather and Leather Products Industry
Corporate Inventories, 1929 Prices

	KUZNETS	VARIANT 1	VARIANT 2	VARIANT 3	VARIANT 4
1925	390.8	392.1	384.7	383.1	392.9
1926	443.5	453.3	445.4	445.9	455.3
1927	426.0	413.8	412.6	414.5	411.4
1928	428.8	414.9	416.5	412.7	412.7
1929	426.1	432.8	431.0	425.7	434.1
1930	444.4	501.5	496.7	586.9	513.4
1931	394.7	478.6	470.8	464.7	496.7
1932	331.7	437.2	440.0	434.5	463.2
1933	325.3	376.7	378.4	380.1	386.9
1934	323.8	401.4	403.4	403.4	417.4
1935	336.2	367.0	372.8	373.7	372.8

Data for 1935 adjusted to 1933 basis of classification by means of ratio of data for 1934, computed on 1933 basis of classification, to data for the same year computed on revised basis of classification: 105.3.

D ERRORS INVOLVED IN THE ASSUMPTION ABOUT PREVALENCE OF MARKDOWNS

In Section 2, A, above, I discussed the prevalence of markdowns of inventory values to replacement costs when these stand at a level lower than accounting costs at year ends. I there set forth the grounds for my opinion that markdowns are taken for tax purposes by at least a small majority of manufacturing firms—perhaps by a substantial majority. The measures in the text are based exclusively upon inventory series corrected for changes in prices upon the assumption that markdowns are always made when replacement values are below cost. How serious are the errors engendered by this assumption?

Since at least half of all inventories held by manufacturers appear to have been subject to markdown, the extreme limit of the errors can be tested by comparing inventories deflated upon the assumption that markdowns are universal with inventories deflated upon the assumption that they are applied to only half the value of stocks in each industry. We first compare inventory values themselves, then net changes (first differences) in them.

1 *Comparison of inventory series*

Inventories of all manufacturers in 1929 prices as revealed by price corrections carried out upon the two extreme assumptions described above resemble each other very closely. The one serious divergence, in 1920 when prices changed rapidly, caused the direction of change in inventories to differ in 1920-21.

The percentage that disagreements in direction of change were of the total number of comparisons is slightly under 5 for total manufacturing, and about the same for individual groups taken together (Table 102). In no groups were there disagreements in as many as 15 percent of the comparisons.

2 *Comparison of net changes in inventories*

When we compare net changes in inventories, the situation is somewhat less favorable. For total manufacturing, the values for individual years often diverge widely. The two series, however, moved in different directions only three times in 20 comparisons. The cyclical conformity, moreover, is almost perfect after the

TABLE 102

Manufacturers' Inventories Corrected for Price Changes upon Different Assumptions about the Prevalence of Markdowns

	NO. OF COMPARISONS OF DIRECTION OF CHANGE	NO. OF DISAGREEMENTS	DISAGREEMENTS AS % OF TOTAL COMPARISONS
INVENTORIES			
Total manufacturing	21	1	4.8
Foods, beverages & tobacco	21	1	4.8
Textiles & textile products	21	2	9.5
Leather & leather products	21	1	4.8
Rubber & related products	21	0	0
Lumber & wood products	21	0	0
Paper, printing & publishing	21	3	14.3
Chemicals & allied products	21	1	4.8
Stone, clay & glass products	21	0	0
Metals & metal products	21	0	0
Miscellaneous	19	2	10.5
Sum of 10 groups	208	10	4.8
NET CHANGES			
Total manufacturing	20	3	15.0
Foods, beverages & tobacco	20	3	15.0
Textiles & textiles products	20	3.5[a]	17.5
Leather & leather products	20	1	5.0
Rubber & related products	20	0	0
Lumber & wood products	20	1	5.0
Paper, printing & publishing	20	2.5[a]	12.5
Chemicals & allied products	20	1	5.0
Stone, clay & glass products	20	0	0
Metals & metal products	20	1	5.0
Miscellaneous	18	0	0
Sum of 10 groups	198	13	6.6

[a] When one series does not change between one year end and the next while the other does, the disagreement is counted as one-half.

period of extreme price disturbance, 1918-23, except in 1932-33. And the differences in the timing at the trough in 1932-33 and at the peak in 1936-37 offset each other.

Disagreements appeared in more than 15 percent of the comparisons only in textiles, and the total number of disagreements for all ten groups together was only 6.6 percent of total comparisons. The possibility of serious error from this source is small in the inventories series and not much greater in the case of net changes.