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A Framework for Analysis of the Industrial Origin of Income, Product, Costs, and Prices

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Introduction

In the long history of meetings sponsored by the Conference on Research in Income and Wealth, this is the first meeting to be entirely devoted to the subject of the industrial composition of income and product. This delay has not been due to a lack of interest in the subject matter but rather to a lack of data which could be used for such an analysis. Estimates of the industrial composition of national income have, of course, been available for almost as long a period as the aggregate estimates of national income. However, such estimates represent only one element of a comprehensive and systematic body of data needed for the analysis of the industrial composition of income and product. In the past few years, the data "gap" has been narrowed considerably with the broadening of the national accounts to include estimates of current- and constant-dollar gross product on an industry basis,[1] and an input–output table [2] which is consistent with the national income and product accounts.

[1] Jack J. Gottsegen, *Revised Data on GNP by Major Industries,* Office of Business Economics, U.S. Department of Commerce, May 1966. This is a working paper containing unpublished estimates of current- and constant-dollar GNP and price indexes, by industry. The estimates incorporate revisions to the measures previously published by OBE and provide additional industry detail. (See *Survey of Current Business,* October 1962 and September 1964.) The working paper by Gottsegen as well as additional worksheet detail have been made available by OBE to the authors of the papers for this conference. The OBE estimates of in-

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There are two complementary approaches to the analysis of the industrial origin of income and product (and implicit costs and prices). One approach starts with the measures of aggregate gross national income (charges against gross national product) and product as the sum of income and product originating in each sector in the economy. The analysis flowing from this approach is concerned with the various producing industries' contribution to the level and change in aggregate gross national income, product, costs, and prices, and the factors underlying such changes.[3] The OBE estimates of industry current- and constant-dollar product and implicit price indexes are basic to such an analysis.

An alternative approach starts with the expenditure side of the national accounts and traces through for total final demand and each component, i.e., consumption, investment, government expenditures for goods and services, and net exports, the contribution (value added) of each industry to the detailed final-demand expenditures and the proportionate share of the industry's gross income payments, costs, and prices, "embodied" in the various components of final demand. This approach requires the use of both industry income and product data, and input–output information.

Much of the recent empirical work on the industrial origin of income and product has been largely concerned with the first approach.

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dustry real product are based, in part, on the earlier work by Alterman and Jacobs in a paper given at the twenty-fifth meeting sponsored by the Conference on Research in Income and Wealth. See Jack Alterman and Eva E. Jacobs, "Estimates of Real Product in the United States by Industrial Sector, 1947–55," *Output, Input, and Productivity Measurement*, Studies in Income and Wealth 25, Princeton for NBER, 1961.

[2] Morris R. Goldman, Martin L. Marimont, and Beatrice Vaccara, "The Interindustry Structure of the United States, A Report on the 1958 Input–Output Study," *Survey of Current Business*, November 1964; also, National Economics Division staff, "The Transactions Table of the 1958 Input–Output Study and Revised Direct and Total Requirements Data," *Survey of Current Business*, September 1965.

[3] The framework for the analysis of costs, prices, and output within a consistent structure of industry and national income and real product measures is based, to a considerable extent, on the work of Charles L. Schultze. Schultze's work was initially developed as an extended comment on the Alterman-Jacobs paper at the 1958 meeting of the Conference on Research in Income and Wealth (Studies in Income and Wealth 25). The approach was further developed and expanded by Schultze in "Prices, Costs and Output, 1947–57," Committee for Economic Development, 1960. Also, see Charles L. Schultze and Joseph Tryon, "Prices and Costs in Manufacturing Industries," Study Paper No. 17, Study of Employment, Growth and Price Levels, U.S. Joint Economic Committee, 1960.

This paper, after a brief review of this approach, is primarily devoted to a discussion of how the estimates of industry current- and constant-dollar gross product can be used, along with input–output information, to provide a link between final demand and industry income, product, costs, and prices.

Industrial Origin of Aggregate Income and Product

As background for the discussion which follows, it may be useful here to review the conceptual basis for the measures of GNP by industry. Since much of this may be familiar to members of the conference, only the main elements will be noted. Further detailed information may be found in the OBE working paper and articles in the *Survey of Current Business,* and in the studies by Schultze.

In the conventional income and product accounts, GNP is derived by two alternative methods. As a measure of the market value of all final goods and services produced by the economy, it is derived as the sum of expenditures for consumption, investment (including change in business inventories), government services, and net exports. GNP is also derived as the sum of income payments to the factors of production (labor compensation, profits, proprietors' income, rent, interest) plus nonfactor charges (indirect business taxes, depreciation, etc.). The two measures are identical in concept, but because they are derived independently they may differ because of a statistical discrepancy.

As a measure of the market value of final goods and services, GNP may be affected by the change in prices as well as changes in physical volume of goods and services purchased by final users. For analytical purposes and in order to derive a measure of "real" growth in the economy, the current-dollar estimates of GNP are deflated in considerable detail in order to obtain a measure of constant-dollar GNP. Dividing the index of current-dollar GNP by the constant-dollar index yields an implicit price index.

Gross national product can also be derived as the sum of each industry's contribution to the nation's total output of goods and services. Because an industry's gross product or value added represents its unduplicated contribution to total output, it may be measured as the value of production less the contribution to its production made by

other industries, i.e., materials and services purchased on current account from other industries.

The industry's contribution to GNP may also be derived by summing its factor payments and nonfactor costs of production, which is comparable to the measure of total GNP obtained from the income side of the accounts. The sum of the industries' gross products—measured by either method—is equal to total GNP.

The current-dollar measure of an industry's gross product derived as the sum of its factor payments and nonfactor costs is not directly convertible to a constant-dollar measure because the components (employee compensation, profits, interest, etc.) cannot be expressed in quantity and unit price suitable for this purpose.

The alternative definition of industry gross product as the difference between output and input of materials, business services, and other current account items is therefore used as the basis for deriving estimates of industry real product. Each industry's current-dollar sales (including inventory change) and purchases of intermediate materials and services are deflated separately and the difference between the estimates of constant-dollar production and cost of materials, etc., is constant-dollar industry gross product. In practice, it is not always possible to develop industry-real-product measures by this conceptually correct method and various alternative methods are used. The methods actually used are described in the OBE working paper on GNP, by industry, and statement on concepts and methodology.

The industry measures of current- and constant-dollar gross product provide the basis for the analysis of the industrial composition of aggregate gross national income and product. Estimates of the contribution of each industry to the change in current- and constant-dollar GNP can be derived by weighting the change in each industry with its relative contribution to GNP in the base period.

The change in the factor and nonfactor composition of aggregate current-dollar GNP, developed from the income side of the national accounts, can be further analyzed to determine how much of the changing composition of gross income is due to shifts within industries and how much to changes in the relative importance of industries.

On the real-product side of the accounts, measures of output per man-hour can be derived by developing man-hour data in each industry consistent with the real-product measure. The gain in industry and

national real output can then be factored into increases in man-hours and increases in labor productivity (output per man-hour). Further, the over-all gain in productivity can be analyzed to determine how much of the increase is attributable to increases in each industry and how much to the shift in relative importance of industries between low- and high-productivity industries.

The industry current- and constant-dollar gross product measures also lend themselves to an analysis of the industrial origin of the over-all change in unit costs and prices. The division of the current- by the constant-dollar estimates of industry gross product yields a price index of gross product. This price index differs from the usual concept of price of a particular commodity or service. The ordinary price index reflects all costs and not just those originating within the industry in question. The price index of industry value added or gross product is equal to the market price of the industry's product minus the unit cost of purchased raw materials, supplies, services, etc.

The development of price and real-product measures for each industry makes it possible to determine how much of the change in current-dollar gross product, at both the industry and total economy level, is due to the real-product increase and how much to price change.

In addition, since the price index is obtained by dividing current-dollar by constant-dollar gross product and since current-dollar gross product is the sum of all costs (broadly defined to include profits) originating in the industry, the price index can be distributed into the various cost elements of which it is composed—employee compensation, profits, capital consumption allowances, etc. This is done by dividing the index for each cost element by the real-gross product index.

Having derived price indexes for each industry, it is possible to weight the indexes by the relative importance of the industries in the total economy and construct a general price index for the entire economy or major subgroups. The general price index can then be distributed into elements representing the contribution of each industry, and into the various cost components.

The analysis can be broadened by using measures of man-hours and capital stock consistent with the industry income and real product estimates. The use of man-hour estimates to derive output per man-hour measures has been indicated previously. The man-hour estimates

can also be used, along with measures of labor compensation, to derive industry indexes of labor compensation per man-hour. The change in unit labor costs at the industry level and for the economy as a whole can then be analyzed in terms of the increase in compensation per man-hour relative to the increase in labor productivity. The change in aggregate unit labor costs, earnings, and labor productivity can be further analyzed to determine how much of the over-all change is due to changes at the industry level and how much to the change in the relative importance of industries—the shift effect.[4]

A similar analysis can be developed to distribute the change in property income per unit into the change in property income per dollar of capital stock (constant dollars) and the capital-output ratio. The aggregate change in property income per unit can also be analyzed from the viewpoint of changes at the industry level and the effect of interindustry shifts on the aggregate ratio.[5]

There are several problem areas in the analysis of the industry income and real-product estimates which should be mentioned. These will be noted only briefly since some of them are discussed in other papers in this volume. These include the problems of allocating income of proprietors between labor compensation and property income, the incomparability of the time series on capital consumption and profits because of the effect of changing accounting methods and tax legislation on depreciation, and finally the problems of interpreting implicit price deflators and the appropriate weights required to partition the change in an aggregate measure among the component elements.

The need for allocating proprietor income between labor compensation and property income is a perennial problem in the analysis of changes in income shares and the relationship of labor and nonlabor unit costs to price change. The problem arises because a relative decline in the proportion of self-employed in the labor force and the corresponding relative increase in wage and salary employees would result in an increase in unit labor cost even though there may be no change in compensation per man-hour or in the productivity of all workers. There is no consensus among economists as to the appropriate method of splitting proprietors' income between labor and property

[4] See the paper by Leon Greenberg and Jerome A. Mark, "Industry Changes in Labor Costs," in this volume.

[5] See the paper by John W. Kendrick, "Industry Changes in Nonlabor Costs," in this volume.

income. The problem is mentioned in this paper, not to suggest a particular method of allocation but to emphasize the need to take this factor into account, either qualitatively or quantitatively, in the analysis of the industrial origin of income, product, costs, and prices.

Another area in which the data, as published, may lead to misinterpretation is the estimate of the capital consumption allowance and its effect on profits. Depreciation, the major component of the capital consumption allowance, is in concept the allowance for replacing the capital "used up" in the course of production. In practice, it is affected by the changing accounting procedures and tax laws, including various forms of accelerated depreciation. As a result, the estimates of depreciation do not reflect a consistent concept or method and it is difficult to interpret the unadjusted data in unambiguous terms. The lack of consistent depreciation estimates also affects the data on profits since profits are derived as the residual component of income. Consistent estimates of depreciation have been developed by OBE, based on various alternative assumptions regarding depreciation methods and these estimates are being revised as part of the continuing work of OBE in the capital investment area.[6] Here again, the comment on the particular problem area serves to point up the need to qualify or adjust the results to take this factor into account, rather than suggesting a specific method or set of depreciation rates for handling the problem.

Regarding the interpretation of the implicit GNP deflator, it is well known that such a price index has changing weights and technically can only be used to measure the change in price between the base year and a given year. Comparisons between given years reflect the change in product mix as well as the change in price. In practice, the GNP deflator is interpreted as though it were a fixed-weight price index, on the assumption that the effect on prices of the change in output mix is relatively minor.

The industry price deflators derived at the industry level by dividing the current-dollar by the constant-dollar GNP measures also are Paasche-type price indexes, i.e., changing-quantity weights. They can, however, be combined with fixed weights to provide partial information on the extent to which the over-all price index may be affected by changing weights. Such an index has been developed for this

[6] Murray Brown, "Depreciation and Corporate Profits," *Survey of Current Business*, October 1963, pp. 5–12.

paper. The changing-weight industry price deflators have been combined with 1958 gross-output weights to derive a partial fixed-weight (Laspeyres) price index.

The partial fixed-1958-weight price index cannot be compared directly with the published GNP deflator because the sum of the industry current- and constant-dollar measures developed by OBE does not correspond exactly to the published GNP estimates. The sum of industry current-dollar GNP is, of course, equal to aggregate factor and nonfactor payments for the economy as a whole. This differs from the total GNP by the amount of the statistical discrepancy. On the real-product side of the accounts, the industry estimates are developed independently, and since no industry estimate is derived as a residual, the sum of the industry real-product estimates does not necessarily agree with the published constant-dollar GNP total. As a result of the differences between the sum of industry GNP and published GNP, the implicit deflators may also differ. In order to make a direct comparison with the fixed-weight price index developed for this comparison, a modified GNP deflator has been derived which adjusts for the differences noted above and is consistent with the sum of the industry current- and constant-dollar GNP estimates.[7]

A comparison of the GNP price change for the 1947–58 and 1958–64 subperiods, based on the various indexes, is shown in Table 1 below. The various measures have been arranged to determine whether the "earlier" or "later" period for the weights affects the price change.

The comparison does indicate that the difference between published GNP and the sum of industry current- and constant-dollar GNP can affect the resulting price comparison. A more meaningful analysis would therefore limit the comparison to the measures which are consistent with industry GNP. The differences between the fixed- and changing-weight indexes are quite small—about one-tenth of 1 per cent per year, on the average.

If one analyzes the two derived measures in terms of earlier versus later year weights, the changes are consistent with the expectation that price changes based on weights of the earlier period would show relatively higher rates of increase. This corresponds to the assumption that output is inversely related to price and that industries with less (more)

[7] The modified changing-weight price index was developed solely for comparison with the fixed-weight price index and is not to be considered as a substitute for the published GNP deflator.

TABLE 1

Comparison of GNP Price Changes, Measures of Price Change Arranged in Terms of Earlier and Later Period Weights, 1947–58, 1958–64

	1947–58	
Earlier period weights		
Published	implicit 1947 weights	34.0
Derived	implicit 1947 weights	37.2
Later period weights		
Derived	explicit 1958 industry weights	36.2
	1958–64	
Earlier period weights		
Derived	1958 fixed weights	9.1
Later period weights		
Derived	implicit 1964 weights	8.5
Published	implicit 1964 weights	8.9

Note: Derived estimates consistent with industry GNP measures.

than average increases in output would also have more (less) than average increases in price.

A further analysis of the two measures on an annual basis indicates reasonably close correspondence, except for the 1950–51 period, which was affected by the Korean War and related inflation. It should be noted that the fixed-weight price index developed for this comparison is only a partial fixed-weight measure and reflects changing weights within industries. With expansion of industry detail it may be possible to develop a more conceptually correct Laspeyres price index.

Finally, there is the problem of determining the appropriate weights to be used in the statistical analysis of the industrial origin of income, product, costs, and prices so that the component elements are additive and can be used to measure how much each component "contributed" to the change in the aggregate measure. Specifically, what are the appropriate weights for determining how much of the change in total current-dollar GNP is due to the increase in real product of the component industries and how much to the change in price of industry gross product? As noted earlier, the usual price index derived by di-

viding current-dollar GNP by the constant-dollar GNP measure yields a price index which has opposite weights from that of the production index. As a result, the variables which are held constant in the production and price indexes refer to different time periods. In the published real-GNP estimates and implicit deflators, the real-GNP estimates are based on holding 1958 prices constant, the price deflators have changing weights. The deflators therefore measure the change in price between the base period and the given year, of the given year's mix of final goods and services. Conceptually, the change in production and price derived from these indexes cannot be added to explain the change in total current-dollar GNP. In order to be able to answer the question of how much each component has contributed to the change in a particular aggregate, the weights for each component should be based on the same time period.

As a practical matter, failure to use appropriate weights for the purpose of apportioning a change to contributing factors will distort the results only if the change in the relative importance of the weights is substantial. Testing for the significance of changing weights provides the information required to partition the change into components which can be added to "explain" the total.

Even with weights for each component based on the same time period, the components may not add to the total because of the contribution of the "interaction" among the components to the aggregate change. The need to explicitly estimate the "interaction" effect and the various methods of then allocating the contribution of the "interaction" effect among the components is discussed in various articles and studies and need not be treated here in detail.[8]

Industry Income and Real-Product Origin of Final-Demand Expenditures

The OBE estimates of current- and constant-dollar GNP, by industry, provide a major body of comprehensive and consistent information basic to an analysis of the industry composition of aggregate level and change in gross national income, product, costs, and prices.

[8] Irving H. Siegel, *Concepts and Measurement of Production and Productivity*, Bureau of Labor Statistics, U.S. Department of Labor, 1952, pp. 86–92; Harlowe Osborne and Joseph B. Epstein, "Corporate Profits Since World War II," *Survey of Current Business*, January 1956, p. 20.

The industry income and product estimates, however, are limited to the supply side of the accounts—there is no direct link to the detailed final-demand side of the national accounts. The analysis of the relationship between the industrial structure of production and the changing composition of final demand requires information from another part of the expanded national accounts—the input–output tables. The input–output tables also provide the means for tracing through the industrial origin of changes in costs and prices of final goods and services.

Input–output tables provide information on what each industry in the economy buys from other industries, as well as from itself, to produce its own output. The total-requirements form of the input–output table links together the interindustry sales-purchase relationships (input–output coefficients) to show how much output (direct and indirect) is generated in each industry to meet the final demand for a dollar's worth of expenditures for the products of each industry. Given information on (a) the changing composition of final-demand components and detailed expenditures for consumption, investment, etc., consistent with the industry classification system and definitions of the input–output table and (b) input–output relationships which link final-demand expenditures and industry output, it is possible to analyze the changing industrial structure of real output in the economy in terms of how much is due to the changing composition of final demand and how much to the change in input–output relationships. Such an analysis is hampered, however, by lack of consistent detailed information, classified by input–output categories, on changes in the structure of final demand and input–output relationships. The paper by Beatrice N. Vaccara and Nancy W. Simon, "Factors Affecting the Postwar Industrial Composition of Real Product-Final Demand and Technical Coefficients," in this volume, helps narrow this data gap and analyzes the factors underlying the changing industrial structure of real product, based on a reconciliation and comparison of the 1947 and 1958 input–output tables. The publication in the near future by OBE of a 1961 input–output table should provide additional information to broaden the time horizon for this type of analysis.

The input–output information can also be used, along with the industry income and real-product estimates, to analyze the industrial origin of final-demand prices. Although this approach is implicit in input–output price models, it has not been developed empirically in a

comprehensive and systematic manner.[9] The remainder of this paper is devoted to a discussion of the methodology involved and a presentation of the results of exploratory work based on this approach.

The approach can be stated rather simply. If information is available on how much each industry contributes, in terms of value added (gross product), to final goods and services, and information is also available on the change in price of industry gross product, then it follows that the industrial origin of the change in price of goods and services purchased for consumption, investment, etc., can be determined. Since the price change for each industry can be further distributed into specific cost elements, e.g., unit labor costs, unit depreciation costs, it is also possible to analyze how much of the change in price of final goods and services is contributed by each category of factor and nonfactor costs.

This approach has been used to analyze the industrial origin of the change in costs and prices of final-demand expenditures between 1958 and 1964. The availability of an input–output table for 1958 was the reason for selecting 1958 as the base period. The year 1964 was chosen simply because it was the latest year covered by the OBE estimates of industry income, real product, and prices. The 1958–64 period was selected as the basis for the analysis due to availability of data and convenience rather than because it represents a "normal" period for the analysis of costs and prices. It should be noted, however, that the price change for the period was quite modest—about 1.5 per cent per year.

Because the data from the two sources of information used differ in industry detail, they have been aggregated to a common grouping of industries. There are forty-two industry groups in all, representing a consolidation of the more detailed manufacturing industries in the input–output table to two-digit SIC industry groups generally, and some consolidation of the industry GNP estimates in the nonmanufacturing area.

The common classification system derived for this purpose is shown in Table 2, along with SIC codes and input–output industry numbers. It should be noted that a comparison of the industry "value added"

[9] For further information on input–output price models see Wassily Leontief, *Input–Output Economics,* 1966, Sections 3 and 7.7; also, United Nations, *Problems of Input–Output Tables and Analysis,* Studies in Methods, Series F, No. 14, 1966, pp. 17–21, 89–102.

TABLE 2

Industrial Classification Used for Analysis of Industrial Origin of Final Demand

Industry Number and Title	SIC	Input-Output Number
1 Farms	01, 02	1, 2
2 Agricultural, forestry, & fishery services	07-09	3, 4
3 Metal mining	10	5, 6
4 Coal mining	11, 12	7
5 Crude petroleum and natural gas	13	8
6 Nonmetallic mining	14	9, 10
7 Contract construction	15-17	11, 12
8 Food	20	14
9 Tobacco	21	15
10 Textile mill products	22	16, 17, 19
11 Apparel	23	18
12 Paper	26	24, 25
13 Printing and publishing	27	26
14 Chemicals	28	27-30
15 Petroleum refining	29	31
16 Rubber and misc. plastics	30	32
17 Leather	31	33, 34
18 Lumber and products	24	20, 21
19 Furniture	25	22, 23
20 Stone, clay, and glass	32	35, 36
21 Primary metals	33	37, 38
22 Fabricated metal products	34	39-42
23 Machinery, except electrical	35	43-52
24 Electrical machinery	36	53-58
25 Transportation equipment, except motor vehicles	37 (-371), 19	60, 61, 13
26 Motor vehicles	371	59
27 Instruments	38	62, 63
28 Misc. manufacturing	39	64
29 Transportation	40-42, 45-47	65
30 Communication, except radio and TV	48 (-483)	66
31 Radio and TV	483	67
32 Electricity, gas, and sanitary services	49	68
33 Trade	50, 52-59	69
34 Finance and insurance	60-64, 66, 67	70
35 Real estate	65	71
36 Services	70, 73, 75, 76	72-77
37 Federal gov't enterprises		78
38 State and local gov't enterprises		79
39 Imports		80
40 General gov't employee compensation		84
41 Rest of the world		85
42 Domestics		86

shown in the input–output table does not correspond exactly with value added for the corresponding industry derived from the industry GNP estimates. There are a number of reasons for these differences, but the largest differences are due to the modification in the input–output system of construction, from an industry basis (contract construction) to an activity basis. The transfer of force account construction from the industries where the work is done to the construction activity category has the effect of increasing the value added in construction and reducing it in the original industries. The effect on the aggregate price change of using unit cost and price indexes derived from the industry GNP estimates, with weights derived from the input–output tables is discussed later in the paper.

The conventional input–output total-requirements table, as previously indicated, shows the total output generated in each industry per dollar of final-demand expenditures. The sum of total transactions generated is, of course, larger than the initial final-demand expenditure because it reflects the duplication of the value of materials and the value of products made from these materials, rather than just the value added by each industry. The first stage in the methodology, therefore, is to convert industry output in the total-requirements table from a gross duplicated output to a value-added basis.

Expenditures for final goods may exceed the aggregate "value added" contributed by the various industries to the final product, if part of final demand for the product is met from imports, e.g., automobiles, or some of the materials used to make the final product are imported, e.g., steel.

In order to trace the industrial origin of the value of final goods and services, the modified form of the total-requirements table shows the total value added (direct and indirect) generated in each industry, plus imports, per dollar of final-demand expenditures for the products of each industry.

The difference between the original and modified total-requirements tables is illustrated in Table 3, which compares total output and value added generated in each industry per $1,000 (producers' value) of final-demand expenditures for the products of the motor vehicle industry. The value of imports is the same in both tables, but the value of production (sales, including inventory change) and value added differ considerably, depending on whether an industry's output consists largely of its own contribution (value added) or whether pur-

TABLE 3

Comparison of Total Output (Direct and Indirect) and Value Added Generated in Each Industry Per 1,000 Dollars of Final-Demand Expenditures for Products of Motor Vehicle Industry, 1958

Industry Number	Total Output	Value Added
1	$ 10.37	$ 4.56
2	1.21	.50
3	17.58	6.13
4	9.66	5.65
5	9.43	5.89
6	3.06	1.69
7	14.75	9.04
8	8.62	2.17
9	.42	.20
10	39.58	9.76
11	1.91	.74
12	27.62	10.09
13	18.99	8.89
14	51.12	20.15
15	14.69	2.94
16	48.10	21.88
17	.96	.52
18	6.97	2.27
19	1.11	.47
20	29.16	15.48
21	253.66	98.37
22	119.81	50.75
23	68.55	31.97
24	55.61	24.72
25	7.36	3.04
26	1,427.08	406.72
27	9.01	4.07
28	4.52	1.80
29	66.08	39.77
30	9.38	7.98
31	3.43	1.96
32	26.36	12.92
33	80.93	58.72
34	20.51	11.49
35	24.20	17.48
36	69.16	32.90
37	6.74	2.94
38	5.89	3.21
39	60.00	60.00
40		
41		
42		
Total	$2,633.59	$1,000.00

chased materials, parts, services, etc. represent the major part of the value of the industry's output, and the value added is relatively small.

The gross duplicated transactions, covering all industries generated by an initial expenditure for motor vehicles is about 2.6 times as large as the initial expenditure. This compares to an average of almost two to one for the economy as a whole. The latter figure is derived by dividing the grand total of industry output (sales, including inventory change) by value added (GNP) for the economy as a whole. For the motor vehicle industry (Industry 26), the value of gross duplicated output of the industry, including motor vehicle parts produced and consumed within the industry, is about 3.5 times the value added of the industry.

Given information on the value-added content by industry of specific categories of final goods and services, and detailed estimates of final-demand expenditures (bill of goods) classified by industry, estimates of how much each industry has contributed to total final demand and major components can be derived.

Using the data on final-demand expenditures from the 1958 input–output table and the total-requirements–value-added table, estimates of the value-added content by industry of final-demand expenditures have been developed for personal consumption expenditures and other major components of final demand. The distribution of the industrial origin of personal consumption expenditures is shown in Table 4 and compared to the industrial composition of consumption based on the industry of final production. The latter distribution is derived from the published estimates of consumption, classified by producing industry, as shown in the 1958 table.

Before discussing the composition of personal consumption expenditures, based on the final-value and value-added concepts, some explanation of the conventions of the input–output system is required. In the input–output system, trade is considered a marginal industry with purchasers buying goods and services directly from producers. Output of goods and services is stated in producers' prices. Expenditures, therefore, consists of three components—(a) value of product purchased at producers' prices, (b) value of "purchases" by the consumer of the services of trade, and (c) transportation. The latter two items represent the gap between producers' and purchasers' value.

Consistent with the input–output conventions, the largest "purchase" shown in Table 4 is from trade (Industry 33), covering the trade

TABLE 4

Comparison of Industrial Composition of Personal Consumption Expenditures, Final-Value (Producers' Prices), and Value-Added Content, 1958

Industry Number	Final Value (Producers' Prices) (1)	Value-Added Content (2)	Col. 2 Minus Col. 1 (3)
1	1.57	5.92	4.35
2	.10	.32	.22
3	--	.09	.09
4	.09	.30	.21
5	--	1.69	1.69
6	.01	.13	.12
7	--	2.16	2.16
8	15.76	5.31	-10.45
9	1.47	.89	-.58
10	.88	1.17	.29
11	3.85	1.85	-2.00
12	.31	1.24	.93
13	.84	1.49	.65
14	1.36	2.17	.81
15	2.50	.88	-1.62
16	.45	.68	.23
17	.90	.61	-.29
18	.05	.30	.25
19	.88	.40	-.48
20	.12	.55	.43
21	.01	1.16	1.15
22	.24	.99	.75
23	.17	.66	.49
24	1.56	1.19	-.37
25	.31	.27	-.04
26	3.17	1.49	-1.68
27	.28	.34	.06
28	.87	.57	-.30
29	2.99	4.38	1.39
30	1.35	2.09	.74
31	--	.20	.20
32	2.78	2.72	-.06
33	21.21	19.20	-2.01
34	4.07	4.43	.36
35	13.78	13.78	--
36	13.60	11.99	-1.61
37	.22	.47	.25
38	.11	.69	.58
39	1.33	4.41	3.08
40	--	--	--
41	-.40	-.40	--
42	1.21	1.21	--
Total	100.00	100.00	--

Note: Detail may not add to total due to rounding.

margins on all goods purchased by consumers. The contribution of the trade industry, defined as trade margins, to personal consumption expenditures amounted to over 21 per cent of the total in 1958. It is somewhat lower when the contribution of trade to personal consumption expenditures is measured in terms of value added.

The differences between the two concepts of the industrial composition of final demand are perhaps best illustrated by reference to the contribution of food processing (Industry 8) and farms (Industry 1) to personal consumption expenditures.

Most food purchased for consumption is processed food, and only a relatively small proportion represents direct purchases from the farm, e.g., fresh fruits and vegetables. Considered from the viewpoint of what the consumer buys directly from final producers (at producers' prices), almost 16 per cent of the consumers' dollar goes for processed food products. Direct purchase of farm products accounts for less than 2 per cent. However, in terms of the value-added content of consumption expenditures, the distribution is modified considerably. The percentage of the consumer's dollar accounted for by food processing is reduced to slightly more than 5 per cent and the percentage accounted for by agriculture is increased to almost 6 per cent. The increase in the latter figure is, of course, due to taking account of the value-added content of farm products processed by the food products industry, as well as the agricultural products, e.g., cotton, which are raw materials for the textile industry, and are embodied ultimately in apparel purchased by consumers.

Estimates of the value-added content of final-demand expenditures by industry have also been developed for the other major components of final demand and for the total "bill of goods." These estimates are shown in Table 5. Inventory change is not shown separately, but is included in total final-demand expenditures.

The treatment of imports in the table requires some clarification. The estimates for the separate components of final demand include an estimate for the import content of final expenditures. "Import content" covers items which are purchased directly as imports, e.g., food, automobiles; and imported materials such as steel and crude oil, which are refined or processed and used to make the final products. Since GNP measures the sum of domestic value added plus net income from abroad, the import content of the separate components of final demand should

TABLE 5

Industrial Origin (Value-Added Content) of Final-Demand Expenditures, 1958
(percentage distribution)

Industry Number	Total	Personal Consumption Expenditures	Fixed Investment	Fed. Gov't	State & Local Gov't	Gross Exports
1	4.66	5.92	.73	1.50	.57	6.88
2	.28	.32	.27	.03	.08	.36
3	.20	.09	.46	.44	.18	.44
4	.36	.30	.38	.19	.30	1.33
5	1.49	1.69	.97	.98	.97	1.96
6	.27	.13	.74	.21	.44	.44
7	6.46	2.16	21.72	4.09	16.29	1.15
8	3.72	5.31	.26	.20	.35	2.06
9	.64	.89	.02	.01	.01	1.14
10	.87	1.17	.26	.27	.15	.77
11	1.23	1.85	.05	.07	.13	.33
12	1.12	1.24	1.03	.61	.67	1.46
13	1.33	1.49	.96	.66	1.00	1.01
14	2.19	2.17	1.56	1.88	1.60	4.73
15	.81	.88	.53	.54	.53	1.08
16	.70	.68	.80	.56	.41	.98
17	.37	.61	.04	.05	.02	.21
18	.64	.30	1.97	.36	1.08	.50
19	.46	.40	.99	.16	.36	.11
20	1.09	.55	3.24	.72	1.76	.95
21	2.35	1.16	6.57	3.17	2.44	4.83

(continued)

TABLE 5 (concluded)

Industry Number	Total	Personal Consumption Expenditures	Fixed Investment	Fed. Gov't	State & Local Gov't	Gross Exports
22	1.84	.99	4.99	1.60	2.19	2.24
23	2.48	.66	9.42	2.81	1.12	6.46
24	2.15	1.19	4.61	4.38	.97	2.88
25	2.02	.27	1.46	12.87	.15	2.35
26	1.52	1.49	2.58	.58	.53	1.86
27	.55	.34	.88	1.15	.27	.78
28	.50	.57	.38	.16	.32	.35
29	4.60	4.38	4.44	3.40	2.69	8.95
30	1.77	2.09	1.37	.78	.86	.97
31	.20	.20	.22	.11	.16	.19
32	2.21	2.72	1.17	1.04	1.29	1.12
33	15.42	19.21	12.08	3.83	4.50	8.27
34	3.31	4.43	1.42	.68	1.05	1.25
35	10.01	13.79	3.70	1.60	1.72	3.58
36	9.22	11.99	3.74	3.90	3.24	3.76
37	.40	.47	.26	.19	.22	.34
38	.58	.69	.34	.36	.28	.40
39	--	4.41	3.37	7.09	1.68	4.04
40	8.72	--	--	37.31	47.43	--
41	.45	-.40	--	-.57	--	17.48
42	.78	1.21	--	--	--	--
Total	100.00	100.00	100.00	100.00	100.00	100.00

Note: Inventory change, by industry, is not shown separately but included in total column. Imports are not shown separately but are reflected in the total column as an offset to the import content of final-demand components. Detail may not add to totals due to rounding.

be excluded from total GNP. In the GNP accounts, this is done by subtracting total imports from total exports to derive the net export figure. In Table 5, exports are shown on a gross basis, before deduction of imports. Imports are not shown separately in the table as an offset to exports, but are excluded from the total "bill of goods" to be consistent with the measure of GNP.

A comparison of the value-added content, by industry, of the various components of final demand indicates substantial variation among the components. The contribution of agriculture to final demand is important for personal consumption expenditures and exports, but not for investment and government expenditures. Conversely, construction constitutes a substantial portion of fixed-investment expenditures and state and local government expenditures for goods and services, but obviously it is not a major item of consumption expenditures. Transportation equipment (excluding motor vehicles) and ordnance represents the largest single component, after the direct government payroll, of federal government expenditures for goods and services, but it does not represent a major portion of expenditures for any other category of final demand.

As previously indicated, industry value added is also the sum of industry factor payment and nonfactor costs. Given information on the distribution of industry value added by income shares, capital consumption allowances, and indirect business taxes, the value-added content of final-demand expenditures can be further distributed into these primary inputs. Primary inputs are defined to cover the factor and nonfactor payments plus imports.

The OBE estimates of the distribution of industry current-dollar GNP by income shares and nonfactor costs have been used to distribute the industry-value-added content of final-demand expenditures into primary-input content. The results for personal consumption expenditures in 1958 are shown in Table 6. The estimates show how much of the consumer's dollar is ultimately paid out in the form of employee compensation, profits, depreciation, etc. Further, they show how much of the aggregate payment to employees, for example, is in the motor vehicle industry, the food products industry, trade, etc. Similar distributions are provided for each category of income payment and nonfactor costs. Imports are shown as a single item.

Similar estimates of primary-input content have been developed for

TABLE 6

Primary-Input Content (Gross Income, Indirect Business Taxes, and Imports) of Personal Consumption Expenditures, by Industrial Origin, 1958
(percentage distribution)

Industry Number	Total Primary Inputs	Employee Compensation	Net Interest	Capital Consumption Allowance	Indirect Business Taxes	Profits	Proprietors' Income	Rent Income & Subsidies	Imports
1	5.92	.74	.24	1.08	.31	.02	3.81	-.28	--
2	.32	.15	*	.04	.01	*	.12	--	--
3	.09	.05	-*	.01	*	.03	*	--	--
4	.30	.22	*	.03	.01	.04	*	--	--
5	1.69	.38	*	.43	.11	.71	.06	--	--
6	.13	.08	*	.03	*	.02	*	--	--
7	2.16	1.56	*	.13	.05	.08	.34	--	--
8	5.31	3.08	.02	.35	1.07	.69	.10	--	--
9	.89	.13	.01	.01	.59	.15	*	--	--
10	1.17	.94	.01	.08	.02	.11	.01	--	--
11	1.85	1.59	-*	.04	.02	.11	.09	--	--
12	1.24	.80	.01	.13	.03	.26	.01	--	--
13	1.49	1.16	-*	.07	.03	.17	.06	--	--
14	2.17	1.23	.01	.27	.05	.60	.01	--	--
15	.88	.55	-*	.13	.50	-.30	*	--	--
16	.68	.46	*	.05	.08	.08	.01	--	--
17	.61	.54	*	.02	.01	.03	.01	--	--
18	.30	.20	*	.03	.01	.04	.02	--	--
19	.40	.33	*	.02	.01	.03	.01	--	--
20	.55	.35	-*	.06	.01	.12	.01	--	--

(continued)

TABLE 6 (concluded)

Industry Number	Total Primary Inputs	Employee Compensation	Net Interest	Capital Consumption Allowance	Indirect Business Taxes	Profits	Proprietors' Income	Rent Income & Subsidies	Imports
21	1.16	.79	.01	.14	.03	.19	*	--	--
22	.99	.78	*	.06	.02	.11	.02	--	--
23	.66	.50	*	.05	.02	.08	.01	--	--
24	1.19	.90	*	.05	.06	.18	*	--	--
25	.27	.23	*	.01	*	.03	*	--	--
26	1.49	.96	-.01	.13	.28	.13	*	--	--
27	.34	.26	*	.02	.01	.05	*	--	--
28	.57	.43	*	.03	.02	.07	.02	--	--
29	4.38	3.03	.09	.55	.40	.18	.17	-.04	--
30	2.09	1.01	.06	.19	.32	.51	*	--	--
31	.20	.14	*	.02	*	.04	*	--	--
32	2.72	.95	.23	.53	.31	.68	.02	--	--
33	19.20	10.72	.04	1.09	3.03	1.36	2.96	--	--
34	4.43	3.04	-1.47	.20	.34	1.89	.43	--	--
35	13.78	.63	2.45	2.58	2.55	.28	.59	4.70	--
36	11.99	7.22	.08	.90	.37	.20	3.22	--	--
37	.47	.82	--	--	.01	--	--	-.36	--
38	.69	.32	--	--	--	--	--	.37	--
39	4.41	--	--	--	--	--	--	--	4.41
40	--	--	--	--	--	--	--	--	--
41	-.40	-*	-.06	--	--	-.34	--	--	--
42	1.21	1.21	--	--	--	--	--	--	--
Total	100.00	48.48	1.72	9.56	10.69	8.63	12.11	4.39	4.41

Notes to Table 6

Note: Employee compensation consists of wages, salaries and supplements. Net interest is the net interest component of national income. Capital consumption allowances consist of depreciation and accidental damage to fixed business property. Indirect business taxes consist of indirect business tax and nontax liability and business transfer payments. Profits are corporate profits after inventory valuation adjustment. Proprietors' income is self-explanatory. Rental income and subsidies consist of rental income of persons and surplus of government enterprises, less subsidies. Imports are the import content of final demand expenditures. Individual final demand components have estimates of import content; total reflects negative entry in GNP for imports (not shown separately) and therefore has no import content. *Less than .005. Detail may not add to total due to rounding.

each major component of final demand and the results are summarized in Table 7. The distribution of primary inputs by type is compared for each major component of final demand and total final demand. Again, imports appear in the distribution of individual final-demand components but not in the distribution of the total. Here, too, the distribution varies considerably among the individual components. The employee compensation content of state and local government expenditures for goods and services is 80 per cent of the total but less than 50 per cent of personal consumption expenditures. Capital consumption allowances represent a higher proportion of the primary-input content of personal consumption expenditures than of fixed investment or government expenditures. Profits constitute a major component of gross exports, but this is due to the fact that it includes income from rest of the world.

The detailed information developed on the value-added and primary-input content of final-demand expenditures, classified by industry, provides the basis for an analysis of the origin of the change in costs and prices of final-demand expenditures. These data can be used as weights, along with the estimates of industry unit costs and prices derived from the OBE current- and constant-dollar GNP estimates, including the worksheet detail, to develop estimates of the change in price for each component of final demand and total final demand. Since the price change is derived as a weighted average of the change in price of component industries, the aggregate price change can, in turn, be analyzed in terms of its industrial origin. A similar analysis can be developed in terms of primary-input content.

TABLE 7

Primary-Input Content (Gross Income, Indirect Taxes, and Imports) of Final-Demand Expenditures, 1958
(percentage distribution)

Item	Total	Personal Consumption Expenditures	Fixed Investment	Federal Government	State and Local Government	Gross Exports
Employee compensation	58.4	48.5	62.9	75.0	80.0	45.3
Net interest	1.5	1.7	.7	.4	.3	3.3
Capital consumption allowance	8.6	9.6	7.9	4.5	4.4	8.1
Indirect business taxes	8.9	10.7	6.3	3.2	3.1	6.9
Profits	9.0	8.6	9.5	5.5	4.9	23.4
Proprietors' income	10.4	12.1	8.1	3.8	5.1	8.2
Rent and subsidies	3.2	4.4	1.2	.5	.5	.8
Imports	--	4.4	3.4	7.1	1.7	4.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Note: Inventory change is not shown separately but included in total column. Imports not shown separately but reflected in total column as an offset to import content of final-demand components.

Based on this approach, estimates of the industrial origin of the change in price of final-demand expenditures have been developed for each major final-demand category. The estimates for personal consumption expenditures are shown in Table 8. The value-added content of 1958 consumption, classified by industry, is used as weights, along with the change in price of industry value added, to derive the change in price between 1958 and 1964 of total consumption expenditures. The derived increase in price over this period is 7.2 per cent. This is exactly the same figure as that shown in the OBE published deflators for major components of final-demand expenditures. It should be noted that the derived personal consumption expenditure price change has 1958 weights; the published deflator has implicit 1964 weights. It is reassuring, however, to find that, at least at the aggregate level, the difference in weights and the difference in method of derivation have not yielded different results.

The over-all change in price of the 1958 mix of consumer goods and services can be distributed according to industry of origin, using the industry value-added weights and the change in price of industry value added. The weighted contribution of each industry to the total price change in consumer goods and services is also shown in Table 8. Of the 7.2 per cent increase, about 2.5 percentage points were contributed by the increased price of business and personal services; another 1.2 percentage points by the real estate industry (rent) and about 1 percentage point by trade. The remaining 2.5 percentage points were distributed broadly among the other industries. It should be noted that the reduction in the price of value added in agriculture contributed to a decline of about .5 in the price index, which meant that the gross increase in the rest of the increase accounted for 3 percentage points of the total increase.

The weighted contribution of each industry can also be analyzed to determine whether an industry contributed more or less than its proportionate share of the total increase. This is done by converting the weighted contribution of each industry to the total price change into a percentage distribution. The percentage share of each industry in the total price change (which is taken as 100 per cent), can then be compared to its relative contribution to total consumption expenditures in the base period 1958. For example, business, personal, and professional services accounted for 12 per cent, in terms of value added, of

TABLE 8

Industrial Origin of the Change in Prices of Personal Consumption Expenditures, 1958–64

Industry Number	Value-Added Content 1958 % Distribution	% Change Implicit Deflator 1958–64	Weighted Contribution to Change in Personal Consumption Expenditures and Price	% Distribution of Contribution to Price Change
1	5.92	-1.5	-.52	-7.18
2	.32	14.6	.05	.69
3	.09	-.6	.00	--
4	.30	-3.2	-.05	-.69
5	1.69	.3	.01	.14
6	.13	14.8	.02	.28
7	2.16	26.3	.57	7.87
8	5.31	9.1	.48	6.63
9	.89	3.6	.03	.41
10	1.17	3.6	.04	.55
11	1.85	7.2	.13	1.80
12	1.24	-.5	-.04	-.55
13	1.49	12.8	.19	2.62
14	2.17	-.5	-.07	-.97
15	.88	18.9	.17	2.35
16	.68	-1.6	-.06	-.83
17	.61	12.8	.08	1.10
18	.30	3.8	.01	.14
19	.40	10.6	.04	.55
20	.55	.7	.00	--
21	1.16	7.4	.09	1.24
22	.99	5.9	.06	.83
23	.66	7.5	.05	.69
24	1.19	-1.8	-.12	-1.66
25	.27	7.7	.02	.28
26	1.49	-.8	-.07	-.97
27	.34	6.1	.02	.28
28	.57	3.3	.02	.28
29	4.38	-.1	-.02	-.28
30	2.09	2.7	.06	.83
31	.20	27.9	.06	.83
32	2.72	2.5	.07	.97
33	19.21	5.0	.96	13.26
34	4.43	17.0	.75	10.36
35	13.79	8.9	1.23	16.99
36	11.99	20.6	2.47	34.12
37	.47	12.1	.06	.83
38	.69	16.7	.12	1.66
39	4.41	1.9	.08	1.10
40	--	--	--	--
41	-.40	1.9	-.01	-.14
42	1.21	21.2	.26	3.59
Total	100.00	7.2	7.24	100.00

Note: Detail may not add to totals due to rounding.

total consumption expenditures in 1958, but contributed about 34 per cent of the total price change. Similarly, real estate accounted for about 14 per cent in 1958 and contributed about 17 per cent of the over-all price change. Trade had a 19 per cent weight but contributed only 13 per cent of the price increase. Agriculture contributed less than its share to the price change; a minus 7 per cent compared to its contribution of 6 per cent to total consumption expenditures in 1958.

In the same way that the value-added content of final-demand expenditures can be further distributed into employee compensation and other components of value added, the industrial origin of the change in price can be further analyzed in terms of unit labor costs and other elements of costs originating in each industry. These can then be combined with the base-year weights, to determine how much of the aggregate price change reflects increased unit labor costs, unit profits, etc.[10]

Using the estimates of primary-input content, by industry, of personal consumption expenditures shown in Table 6 and the unit cost changes derived from the OBE industry GNP data, estimates of the primary-input content of the 1958–64 change in price of consumer goods and services have been derived. The changes in factor and nonfactor costs, initially developed at the industry level, have been summarized for total consumption expenditures and are shown in Table 9. The same method is used, as in the previous table, to analyze how much of the 7.2 per cent increase during the 1958–64 period was contributed by each item of cost.

The results indicate that unit costs for interest, indirect business taxes, and profits increased substantially more than the over-all increase in price. Unit employee compensation, and capital consumption costs also increased more than price, but by a smaller margin. Proprietors' income and rental income per unit actually declined. However, the decline in proprietors' income per unit may be due to the shift, within industries of the composition of employment from proprietors to wage and salary employees.[11] This might also account for part of the increase in unit labor costs relative to price. The effect on unit labor costs of the

[10] Given information on the change in industry output per man-hour and compensation per man-hour, the aggregate change in unit labor costs of final goods and services can be factored into the two components.

[11] Shifts among industries are not a factor because the relative importance of industries is held constant with 1958 weights.

TABLE 9

Primary Input Content of the Change in Price of Personal Consumption Expenditures, 1958–64

Item	Primary Inputs 1958 (% Dist.)	% Change Unit Costs 1958–64	Weighted Contribution to Change in Price	% Distribution of Contribution to Price Change
Employee compensation	48.5	8.4	4.1	56.6
Net interest	1.7	50.3	.9	12.1
Capital consumption allowance	9.6	10.3	1.0	13.6
Indirect business taxes	10.7	14.8	1.6	22.0
Profits	8.6	18.6	1.6	22.4
Proprietors' income	12.1	-9.9	-1.2	-16.7
Rent and subsidies	4.4	-18.1	-.8	-11.1
Imports	4.4	1.9	.1	1.1
Total	100.0	7.2	7.2	100.0

shift in composition of employment is discussed in the paper by Greenberg and Mark in this volume.

The relative changes in unit costs are combined with base-year weights, to indicate how much each component has contributed to the price change. For example, increased employee compensation costs per unit accounted for 4.1 percentage points of the 7.2 per cent price increase. Profits contributed 1.6 percentage points. The contribution to the price change is put in different perspective if the increase is compared to the relative importance of the cost item in the base period. Employee compensation constituted 49 per cent of the primary-input content of consumer expenditures in 1958 and accounted for 57 per cent of the price increase. Profits represented slightly less than 9 per cent of primary inputs in 1958, but accounted for 22 per cent of the price change. Net interest was 1.7 per cent in the base period, but contributed 12 per cent of the price increase. The more than proportionate increases for most of the primary-input components are offset by the actual declines in proprietor and rental income.

Similar estimates have been prepared for fixed investment and total final demand showing how much each category of factor and nonfactor costs has contributed to the price change of final goods and services.

Finally, to determine whether the derived price changes for total final demand and major components are approximately in line with the published implicit deflators for these components, the derived price changes for the 1958–64 period are summarized in Table 10, along with the change derived from the published deflators. The comparison can only be approximate for various reasons. As indicated in the first section of the paper, the GNP deflator, based on the industry GNP estimates, differs from the published deflator because of the statistical discrepancy on the income side of the accounts and the gap, on the real-product side of the accounts, between constant-dollar GNP and the sum of industry real gross product. The two estimates show approximately the same change, 8.9 per cent, based on the published deflator, and 8.5 per cent derived on the basis of the industry GNP estimates. Further, the implicit deflators have 1964 weights, the derived price indexes have 1958 weights. At the aggregate level, the industry implicit price indexes, combined with 1958 industry gross product weights, showed an increase of 9.1 per cent compared to the 8.5 per cent increase, based on 1964 weights.

TABLE 10

Comparison of Published[a] and Derived Final-Demand Price Changes, 1958–64

Item	Published Implicit Expenditures Wts. 1964	Derived Industry Gross Product Wts. 1964	Derived Industry Gross Product Wts. 1958	Input-Output Value-Added Wts. 1958
Total	8.9	8.5	9.1	9.5
Personal consumption expenditures	7.2	--	--	7.2
Fixed investment	7.8	--	--	9.3
Federal expenditures for goods and services	12.9	--	--	13.3
State and local expenditures for goods and services	19.3	--	--	20.4
Gross exports	1.5	--	--	3.1

Note: Price change for business inventory change and imports is not shown separately but included in total.

[a]*Survey of Current Business*, August 1965, Table 17, p. 52.

There is one other factor which affects the comparison. The industry value-added estimates used to derive the price change of final demand expenditures were based on the 1958 input–output value added estimates. As previously noted, these do not correspond exactly with the industry gross product estimates in the OBE working paper on industry GNP. The major difference is in construction, but this has one of the largest implicit price changes. The difference in industry gross-product and value-added weights results in a higher GNP price index, based on the 1958 input–output value-added weights; 9.5 per cent compared to the 9.1 per cent with industry GNP weights.

Keeping these differences in mind, the resulting comparison shows a reasonably close correspondence between the published deflators and the derived price indexes. The derived estimates are roughly in the right order of magnitude and in all cases are either the same as the published deflator or slightly higher. The difference in the price change for fixed investment is due to the high implicit deflator for construction, which raises some question as to the reasonableness of the current- and constant-dollar GNP estimates for this industry.

Limitations and Comment

In interpreting the results of this exploratory study, a number of limitations must be taken into account. The derivation of the basic industry real-product estimates by OBE presents particularly difficult problems for those industries where the "double deflation" method was actually used. The separate deflation of output and total intermediate input to derive a residual—real net output—means that the residual may be affected by errors in both the real-gross-output and input estimates. The validity and "reasonableness" of the industry-real-gross-product estimates are discussed in the paper by Gottsegen and Ziemer, "Reconciling Industry Real Product and Industrial Production" in this volume.

The estimates of current-dollar GNP, by industry, and its distribution among the various factor and nonfactor costs also present some problems. Perhaps the most difficult problem is that of adjusting the various items, such as profits and capital consumption allowances, which are initially on a company basis, to an establishment basis to be consistent with the industry output measure. This adjustment is made in the OBE estimates, but the lack of detailed information needed for this purpose may affect the distribution of gross income and the related estimates of unit costs for specific industries.

The detail provided by the new industry GNP estimates is substantially greater than that previously published, but it still represents quite broad industry groups, particularly in manufacturing. This puts some limitations on their use in the analysis of the industrial origin of income, products, costs, and prices. The primary metals group, for example, combines steel, aluminum, copper, and other primary metals in one group. The price change for the group is a weighted average of the differential price changes of the various primary metals. The pri-

mary metals value-added content in the individual components of final demand may have different "mixes" of ferrous and nonferrous metals, but the primary metals implicit price index is weighted by the total industry mix. The application of the same implicit price index to the primary metals value-added content for each final-demand component may, therefore, lead to some error.

The use, in the analysis, of the same industry price index for each component of final demand may be another source of error if the price change varies depending, for example, on whether the product is sold to domestic consumers or is exported.

Finally, the statistical analysis of how much each industry and its component cost elements have "contributed" to the change in price of final goods and services should not be interpreted to imply cause and effect relationships. Prices in a given industry, and during a particular period may rise because costs rise, but it is equally possible that costs may rise because prices are going up. The phrase, "contributed to the price increase," should therefore be interpreted as a statement of statistical relationship, not a causal relationship.

With these limitations in mind, it is hoped that the framework provided in this paper for the analysis of the interrelationship among industry income, product, costs and prices, and final-demand expenditures and prices may provide the basis for further exploration and improvement.

COMMENT

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Alterman's paper represents a significant and very useful effort to analyze the relation of implicit price changes in different industrial sectors to the final uses of output. The basic technique involves the creation of constant-price output measures for each industrial sector based on deflating the cost of inputs and outputs separately, and then dividing this derived constant-price measure into the current value of gross product in order to obtain an implicit price deflator for each industrial sector. Weighting this set of implicit price deflators by the relative importance of the different industries yields an average implicit price deflator for the economy as a whole. Thus, the contribution

of each industry to the over-all price change in the economy as a whole can be analyzed, as well as the implicit price effect of each industry on the different categories of final-output prices, by taking into account through input–output relations the contribution of each industry to the various categories of final output.

Several of Alterman's results are very interesting indeed. First, it is very comforting that he finds the difference between the Paasche and Laspeyres weighting schemes over a period of eight years or so not to be highly significant. Although this conclusion is not new, it is reassuring to have it borne out in connection with the development of implicit price indicators. Second, I was very much impressed with the closeness of the published OBE end-use implicit price indexes and those obtained by Alterman which were estimated on an input–output basis using industry-originating implicit price deflators. Such comparisons give one a little more faith in the consistency of the price observations for final products and for intermediate products.

However, there are also some elements of the results which are quite disturbing. According to Alterman's results, over 80 per cent of the price increase which occurred between 1958 and 1964 was accounted for by the price behavior of five industries: contract construction, trade, finance and insurance, real estate, and services. These are, of course, precisely the industries where the measurement of prices is weakest and least meaningful. In some of these industries it is necessary to assume that output prices move directly with input prices, with zero productivity change over time. One cannot help but wonder, therefore, whether much of our empirical measurement of prices may not result from our theoretical deficiencies, and whether the measurement of the price behavior of the different sectors, and in fact of the economy as a whole, may not be based upon assumptions which are grossly invalid, rather than upon meaningful data. These observations, however, are not directly related to Alterman's techniques. He, like everyone else, has merely assumed that the basic price information which is reported is meaningful.

There are, however, some methodological questions which can be raised regarding Alterman's approach. He is attempting to bridge the gap between the price behavior of the economic system seen as a whole and the more disaggregated implicit price behavior of specific industries. Although he cautions against using his results to impute

causality to the contributing factors, there is a general tendency to use the results from such an analysis as an explanation of price behavior in the economy. Alterman's technique has serious limitations for this purpose. The method of deriving constant-price product originating and its relation to current-price product originating yields a price index which is the net result of many different elements buried in the data. Value theory has in the past been based upon a consideration of the *total* output of the firm and the various costs incurred in the production of such *total* output. The theory of the firm does not apply if output is defined as value added rather than total value of product. Producers are in fact sensitive to raw material prices and changes in technology which alter raw material inputs. Consolidating the accounts to exclude raw materials obscures important behavior relationships. Basing the analysis of price behavior on value added is not dissimilar in concept to analyzing the net exports of a country without taking into account separately the behavior of imports and the behavior of exports. In order to understand and explain price behavior in any ultimate sense, it will be necessary to analyze how the individual production units respond to different kinds of change, such as changes in the level of demand, changes in costs, changes in productivity, etc. The price behavior of the economy as a whole will of course be the combined result of the different kinds of price behavior at the microeconomic level and the manner in which the aggregation of such price behavior affects the economy. In this connection the use of input–output is of course essential. Though consolidated implicit price behavior may be derived for each industrial sector and for the final uses of output, the result is a consolidated aggregate of "micro-behavior" and the aggregation process, not an explanation of micro-behavior.

Nevertheless, Alterman's analysis does raise a large number of interesting and provocative questions and provides material for further investigation. He is to be congratulated for tackling the problem of the price behavior of the economy as a whole. This approach is a considerable improvement over the simplistic view which suggests that the price change taking place in the economy represents over-all demand and cost situations which permeate all sectors of the economy in much the same degree.