THE INTEGRATION OF A SYSTEM OF PRICE AND QUANTITY STATISTICS WITH DATA ON RELATED VARIABLES

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This paper has two main points. First, the usefulness of the industry detail called for in the SNA would be increased if it were altered to facilitate the construction of price and quantity aggregates classified by stage-of-process sectors. Second, the price and quantity data so arranged should be augmented by data on behaviorally related variables classified the same way. The feasibility of the stage-of-process approach is demonstrated by a table showing the high degree to which the U.S. input–output table for 1967 can be triangularized. The analytical usefulness of the approach is demonstrated through analysis of changes in prices, output, unfilled orders and finished goods inventories for primary and for finished goods manufacturers.

In its framework for a system of national accounts, the United Nations Statistical Commission commended to member nations the development of integrated price and quantity statistics.[1] The economic concepts and definitions underlying these accounts have been thoroughly discussed and are well known. What has been less widely remarked is the industrial classification of sectors for which price and quantity data should be developed and the extent to which data for variables other than price and quantity should be provided for in the system. These two issues are the focus of this paper.

Perhaps the paper would never have been written were it not for the explosion of prices of raw commodities and primary manufactures in 1973 and 1974. This episode was provoked by the increase in crude oil prices by OPEC countries, worldwide shortages of agricultural products and an imbalance between demand and supply in primary manufacturing industries brought about by sharp and simultaneous expansion in many industrialized countries. These developments sent economists in many statistical offices, and policymakers who use their tools, scurrying to find answers to such questions as:

1. What has been the direct effect of the rise in prices of crude oil and farm food on final demand prices?
2. What has been the direct effect of the rise in prices of primary manufactures like copper wirebar on final demand prices?
3. What has been the indirect effect of all three sources of price change on final demand prices?
4. Was all or part of each of these price changes endogenous or exogenous?
5. Were the sources of these changes, be they endogenous or exogenous, of domestic or international origin?

[1] *A System of National Accounts, Studies in Methods*, series F, no. 2, rev. 3; United Nations, New York 1968.

The questions increase in difficulty, obviously. The first could be approximated using an input–output table of the sort called for in the SNA—agriculture, crude oil and natural gas and petroleum refineries are major groups specifically delineated. Of course it would have to be answered by assuming dollar-for-dollar or constant margin pass-through, and in a timeless world.

For primary manufacturing the question cannot be answered, even under the restrictions of the foregoing assumptions. Primary manufacturers are the first processors of raw materials. They cannot be identified at the major group (three digit) level, but rather at the next finer level of detail. Yet it was in these industries that bottlenecks arose that set off a very large rise in their prices. These industries at the major group level are combined with other industries that convert their output into semi-manufactures and finished products. Thus, the output of pulp and paper mills is combined with that of paper converters and the effect on prices of bottlenecks in the former is impossible to detect and trace. This issue is a major one of this paper and will be taken up in detail later.

Indirect effects of sectoral price changes, through wages and back to prices, cannot be traced or labeled with respect to time. This difficulty can be surmounted by incorporating a system of price and quantity statistics in an I–O framework into a macro econometric model. But such models frequently rely on data other than those directly incorporated in the SNA. This leads to the second issue in this paper which is highlighted by questions 4 and 5.

In order to determine whether a sectoral price change is endogenous or exogenous, the sector needs to be modeled. And this requires data from outside the SNA, such as wages, orders, unfilled orders and shipments.

Today's economic problems require a sectoral approach integrated with a macro approach. The point of this paper is that this can be accomplished within the SNA if:

1. Some changes are made in the industrial classification and
2. Other data bearing on the behavior of prices and quantities can be incorporated into the set of accounts.

The remainder of this paper is taken up with a discussion of these two issues with the U.S. economy taken as a frame of reference.

The Stage of Process Classification of Economic Activity

The basic building blocks for studies of the industrial structure of the U.S. economy are the four-digit industries defined in the U.S. Standard Industrial Classification(SIC). These definitions were developed to permit the classification of establishments—the producing units—by the type of activity in which they are primarily engaged. Such definitions provide the framework for the collection of data in Industrial Censuses and Annual Surveys. Data at the four-digit level are the basic building blocks on which are built the Input–Output tables that since 1958 have been estimated about once every five years for the U.S. economy.[2]

[2]In only one instance is data for a four digit industry further disaggregated in constructing the Input–Output table. Industry 2819 is split into two parts using Census Product Class codes. These codes were developed at the five digit level for product classes and at the seven digit level for products with numbering consistent with the primary output by each four digit SIC industry.

If the data were available in four-digit detail and with proper frequency, most research, be it on the dynamic behavior of prices or inventories or some other variable, could be carried out at that level of detail. The results could then be integrated and related to final demand through the use of the Input–Output tables which provide detail for some 484 sectors.[3] But the monthly or quarterly data necessary for many such studies are not available in four digit detail for the U.S. or other countries. In most research this constraint is dealt with by focusing at a higher level of aggregation within the SIC, sometimes three-digit, but most often two-digit.

But there are other ways to aggregate four digit industries, depending of course on the purpose of the research. One developed recently to facilitate the study of price behavior is to aggregate industries by stage of process (SOP).[4] So doing serves to capture the major avenues through which price changes are transmitted through the economy. Manufacturing industries are classified into groups depending on whether they are the first to process raw materials, the last to physically alter commodities or fall somewhere in between.

The feasibility of the SOP approach depends on the extent to which industries in the economy, when ordered by their sales to final demand, sell the remainder of their output to industries ranking above them rather than below them in the matrix of producers of intermediate output. Put another way, the feasibility of using a stage-of-process approach analytically depends on whether detailed input–output cells can be aggregated and ordered in such a way that one can form a matrix of interindustry transactions in which the flows below the main diagonal are small relative to those on or above the diagonal. To test the feasibility of the stage-of-process framework it was necessary to determine whether the 484 order Input–Output table (for 1967) could be so aggregated.

This experiment was done for the manufacturing sector of the I–O table which accounts for 355 of its 484 cells. The first step was to go through the cells and see if there existed a subset of manufacturing industries which accounted for the bulk of manufacturers' shipments to final demand. A set of 160 cells, roughly half of all manufacturing cells, was found which accounted for 86 percent of manufacturers' sales to final demand (Gross National Product) valued at producers' prices (excludes distribution margins). Ninety percent is accounted for when exports and inventory change are excluded. These same cells also accounted for 93 percent of manufacturers' sales to the Personal Consumption sector of GNP.[5] These cells are termed finished goods industries and are subdivided into the following categories: (1) consumer food, beverages and tobacco, (2) other consumer staples, (3) consumer home goods, (4) refined petroleum products, (5) automotive, (6) machinery and equipment except transportation equipment, and (7) ordnance, shipbuilding, aircraft and railroad equipment.

[3]Behavioral equations could be developed which would explain changes in I–O coefficients over time.

[4]Popkin, J., "An Integrated Model of Intermediate and Final Demand by Stage of Process: A Progress Report," *American Economic Review*, February 1977, pp. 141–147.

[5]Actually a somewhat different set of industries can be found which account for a larger share of both PCE and GNP. But the aim of the exercise was to arrive at classifications for which matching monthly time series on output, orders, shipments and inventories could be developed from Census and Federal Reserve Board data. The use of such data will be discussed later.

The next step was to search the I–O cells for a set of manufacturing industries that accounted for the bulk of purchases by manufacturers of the output of the mining, agriculture, forestry and fishing industries. Such purchases by the refined petroleum products and consumer food, beverage and tobacco categories were excluded from consideration because these two categories had already been classified as finished goods industries in the SOP framework.[6] A set of industries was found which account for the bulk—86 percent—of the purchases of mining and agricultural products (other than farm foods and tobacco and crude oil and natural gas) by the manufacturing sector. This set of industries is termed primary processing industries. They are broken down into eight components: (1) industrial chemicals and pigments, (2) lumber, (3) pulp and paperboard mills, (4) nonferrous metals, (5) blast furnaces and steel mills, (6) stone, clay and glass, (7) textiles, and (8) fertilizers. This sectoring serves to single out for analysis the sectors with which so-called bottleneck inflation was associated in the 1972—4 period.

The remaining manufacturing cells, 134 in number, are classified as intermediate.

Following this classification procedure the 355 manufacturing cells of the 484 order I–O table were collapsed into a sixteen-by-sixteen matrix. The 129 nonmanufacturing industries were assigned, at this point along SIC lines, to an additional 15 industry groups. Transportation was split into two parts, that supplying margin to intermediate transactions and that to final demand. The 484 order table was then collapsed into a 35 order transactions table when the several special sectors are added.[7]

Table I is a matrix of the distribution of purchased inputs and value added at producers' prices from the thirty-five sectors in the collapsed table. The rows and columns in such a table can be ordered in any way. The ordering is such as to capture all of the triangularity that exists in the table. On the second to last row of the table are found ratios of purchases from industries below the main diagonal to the total transactions, including value added, in the column. These ratios are measures of the importance of the cost of inputs below the main diagonal to the total cost, including profits, of producing each industry's output. They average only 8.5 percent, which reflects a high degree of triangularity. In the manufacturing block of the table in which research effort was focused on achieving triangularity, the ratio is even lower—6.0 percent.

Analysis of Table 1 reveals that of the total transactions found below the main diagonal 46 percent is attributable to three industries: business services, finance, insurance and real estate, and the dummy industry.[8]

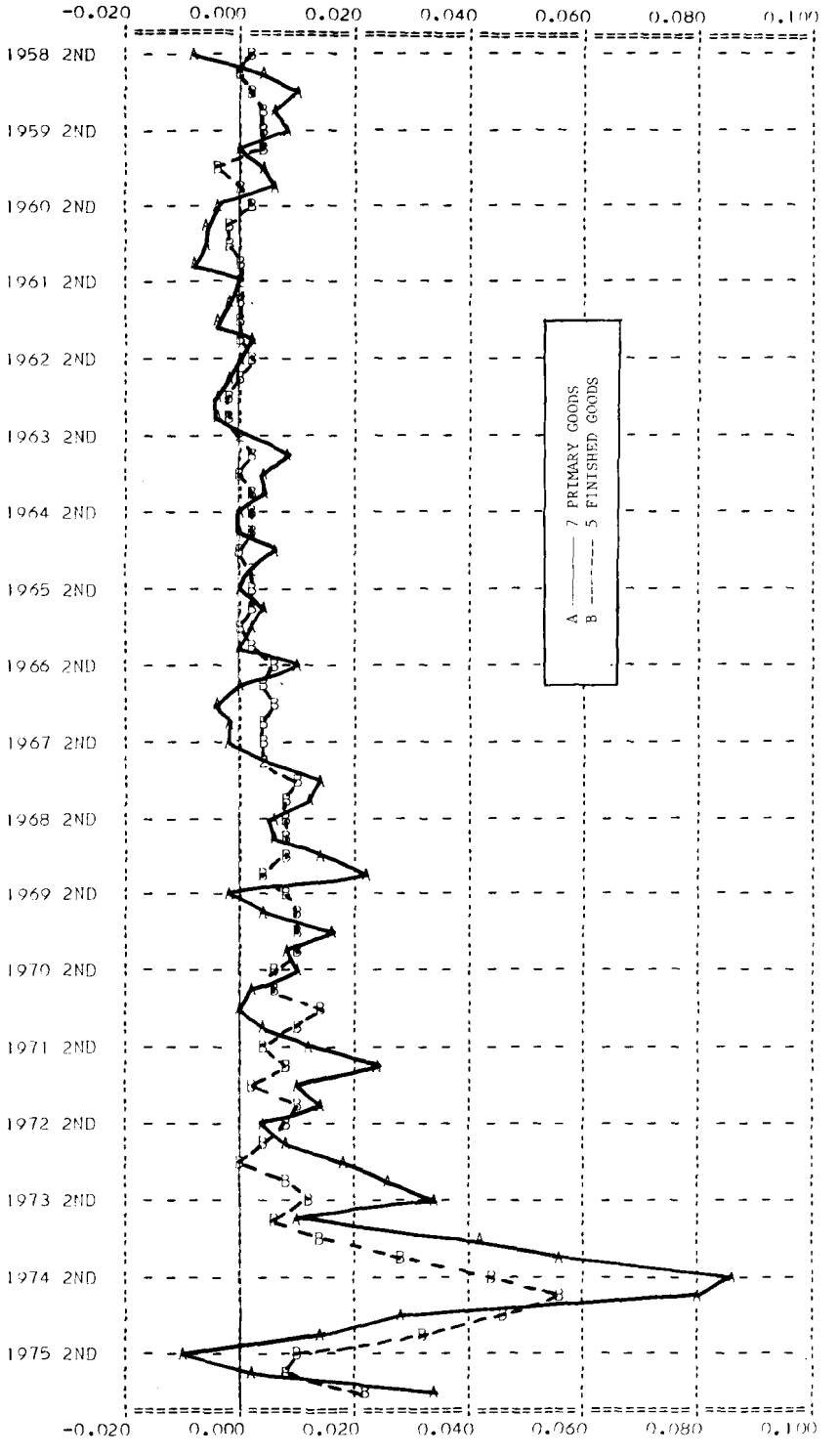
Two hints of the focus this analytical framework provides is given in Charts 1 and 2. Chart 1 contains data on the quarterly change in price for seven of the

[6]Petroleum refining can be considered in either the finished or primary category. For analytical purposes it is best to consider it a primary industry because of its sizable sales to other intermediate sector producers.

[7]The 4–digit SIC composition of each I–O cell is available upon request.

[8]In subsequent research imports or goods for which there are domestic substitutes and domestic transfers were allocated directly to purchasing industries in the same ratios as direct transactions. The dummy industry is thereby eliminated.

CHART 1.— QUARTERLY PERCENTAGE CHANGE IN PRICE



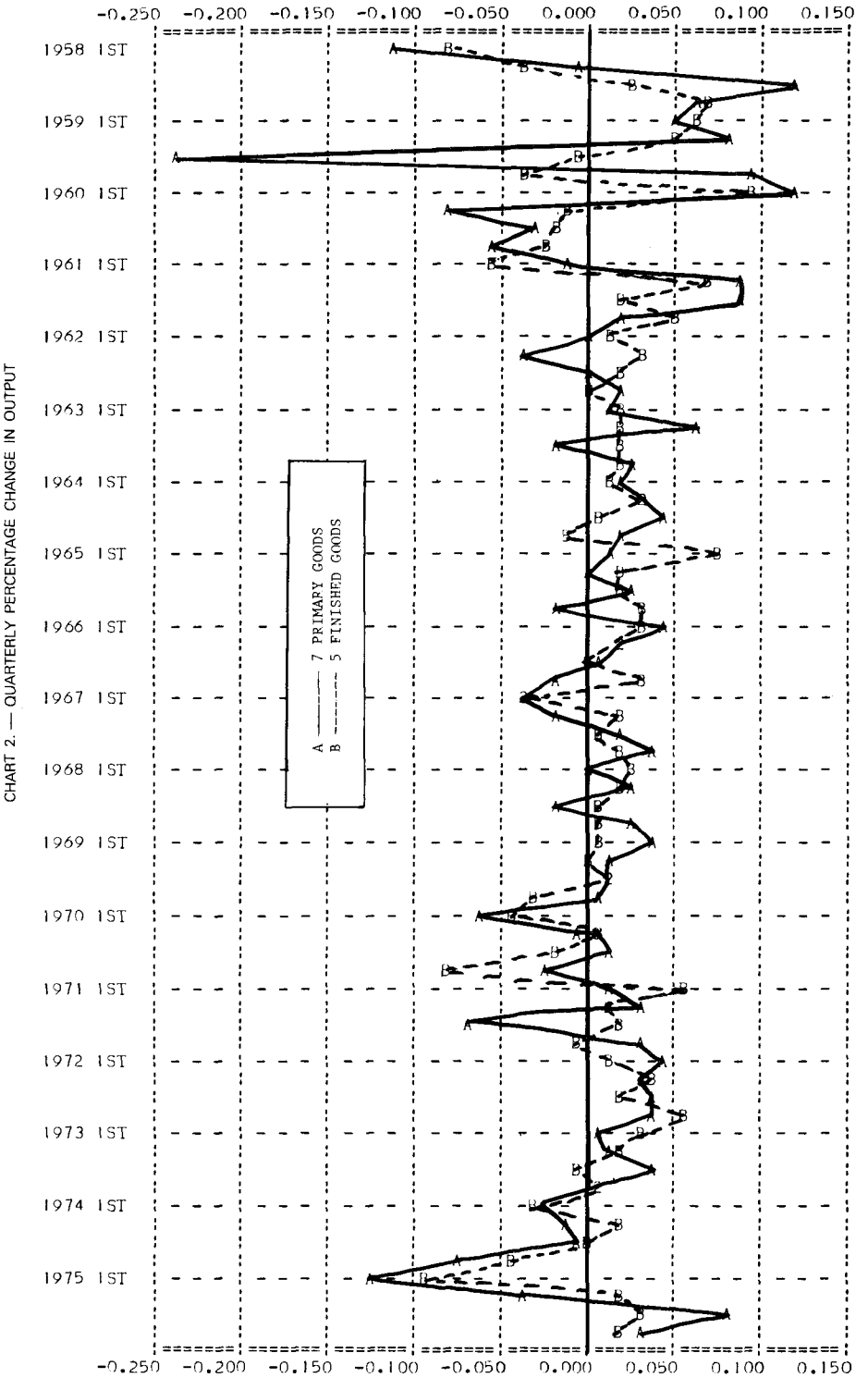


CHART 2. — QUARTERLY PERCENTAGE CHANGE IN OUTPUT

eight primary manufacturing sectors for the period 1958–75.[9] It contains similar data for the five nonfood, nonpetroleum finished goods industries. The greater amplitude and to some extent the lead of primary product price change over finished product price change is apparent. Primary product prices have been found to explain a significant part of finished goods prices, which, in turn contribute importantly to explaining movements in the GNP deflator for nonfood commodities and structures.

Chart 2 contains, for both the primary and finished sector, production as measured by the Federal Reserve Board.

Two aspects of the relationship between rates of change of primary and finished goods output are that at cyclical turning points they are coincident and the amplitude of the rate of change of the former exceeds that of the latter.[10] Since the difference between primary output and finished goods output reflects changes in manufacturers' inventories of what may be called partly finished goods (ignoring imports and exports of such goods), the difference in the relative behavior of the two series suggests that there is a need to make frequent adjustments in such inventories. Primary commodity output changes apparently facilitate those adjustments.

Inventories of partly finished goods accounted in 1967 for about half of the stockholdings of U.S. manufacturers. Of the remainder, one-fourth were holdings of unprocessed goods—raw material—by primary manufacturers and three-fourths were inventories of goods-in-process and fully finished goods held by finished goods manufacturers. Thus, classification of industries by stage-of-process yields a classification of inventories that is different from the two classification schemes currently used for inventories—by holding industry and by stage of fabrication. The stage of process approach captures the best features of both and can be characterized as a joint distribution of holdings by industry by stage-of-process. In so doing it highlights the stocks that exist along the output transmission path from raw materials to finished goods in the hands of final users. This classification, which is tantamount to disaggregating inventories by type of product wherever held, holds promise for leading to much needed improvements in our ability to predict inventory change.

The foregoing suggests that there is analytical usefulness in looking at price and quantity statistics arrayed by stage-of-process. For the U.S., disaggregation of the manufacturing sector into sixteen stage-of-process sectors appears to provide adequate detail given data availabilities for analyzing bottleneck potential and assessing its inflationary impact through time. Such disaggregation provides a more powerful analytical framework than the conventional disaggregation of the U.S. manufacturing industry into its twenty two-digit sectors. This is because the latter is aggregated over two or more stages of process and fails to capture dynamic structure.

[9]The fertilizer industry, which sells primarily to the domestic agricultural sector (11) and to other countries (40) is deleted.

[10]These aspects become more apparent if the effect of the auto strike of 1970—4 on finished goods output in that quarter and the ensuing one is taken into account. The sharp decline in primary output in 1959—3 and its rebound in 1959—4 reflects the steel strike in the fall of 1959.

TABLE 1

U.S. INPUT–OUTPUT TABLE FOR 1967: DISTRIBUTION OF TOTAL TRANSACTIONS

Consumer:	1	2	3	4	5	6	7	8	9
Producer:									
1. Imports	0.000	0.066	—*	0.001	0.006	0.072	0.004	0.007	0.001
2. Dummy		—	0.023	0.010	0.014	0.012	0.004	0.007	0.029
3. Business Services		—	0.060	0.044	0.034	0.016	0.008	0.013	0.064
4. Finance, Ins. and R.E.		—*	0.044	0.113	0.028	0.168	0.010	0.042	0.052
5. Communications		—	0.076	0.007	0.016	0.001	0.003	0.011	0.015
6. Crude Oil and Natural Gas		—	—	0.001	—	0.025	0.068	—	—
7. Utilities		—	0.004	0.005	0.008	0.011	0.185	0.004	0.006
8. Intermediate Transport		0.297	0.006	0.008	0.002	0.010	0.015	0.125	0.016
9. Wholesale Trade		—*	0.010	0.005	0.004	0.008	0.004	0.029	0.019
10. Petroleum Refining		0.001	0.002	0.005	0.003	0.002	0.007	0.039	0.011
11. Crude Food and Tobacco		0.009	—	0.015	—	—	—	0.001	0.002
12. Crude Nonfood		0.003	—*	0.001	—*	—*	0.024	—*	—*
13. Primary—Industrial Chem. and Pigments		—*	0.003	0.001	—*	0.010	0.001	0.001	0.003
14. Primary—Wood		—*	—	—*	—	—	—*	—*	0.001
15. Primary—Pulp and Paperboard Mills		—*	0.001	0.001	—*	—	—*	—*	0.001
16. Primary—Nonferrous Metals		0.010	—	—*	—*	—	—*	—*	0.001
17. Primary—Blast Furnaces and Steel Mills		0.012	—*	—*	—	0.008	0.001	—*	—*
18. Primary—Stone, Clay and Glass		—*	0.002	—*	—*	0.006	—*	—*	0.002
19. Primary—Textiles		0.004	—*	—*	—	—*	—*	—*	0.001
20. Primary—Fertilizers		—	—	0.001	—	—	—*	—*	0.001
21. Intermediate		0.187	0.095	0.007	0.007	0.029	0.005	0.023	0.030
22. Machinery and Equipment		0.008	0.013	0.004	0.009	0.013	—*	0.002	0.009
23. Automotive		0.001	0.001	—*	—	—	—*	—*	0.001
24. Consumer Home Goods		0.030	0.007	0.001	0.001	0.001	—*	—*	0.006
25. Consumer Staples		0.013	0.104	0.002	—*	—*	—*	0.002	0.008
26. Consumer Food and Tobacco		0.198	—	0.001	—	—	—*	0.001	0.013
27. Ord. Ship, R.R., and Aircraft		0.005	—*	—*	—	—	—*	0.005	0.002
28. Maintenance and Repair		—	0.005	0.045	0.025	0.032	0.030	0.025	0.001
29. Government Enterprises		—	0.011	0.014	0.004	—*	0.150	0.007	0.004
30. Nonbusiness Services		0.106	0.020	0.011	0.051	0.002	0.003	0.027	0.020
31. Final Transport		—	—	—	—	—	—	—	—
32. Retail Trade		0.047	0.009	0.009	0.005	0.004	0.001	0.011	0.016
33. Construction		—	—	—	—	—	—	—	—
34. Special		—	—	—	—	—	—	—	—
35. I.V.A.		—	—	—	—	—	—	—	—
36. Value Added	0.000	—	0.507	0.688	0.782	0.573	0.474	0.618	0.665
Column totals (Billion $)	0.0	15.8	57.3	161.4	22.5	15.0	37.3	17.3	64.8
Purchases from industries below the main diagonal as a proportion of total purchases and value added:	0.000	0.93	0.413	0.144	0.119	0.136	0.241	0.173	0.133
Purchases from industries below the main diagonal (Billion $)	0.0	14.7	23.7	23.2	2.7	2.0	9.0	3.0	8.6

*Between −0.00049 and +0.00049

TABLE 1 (*continued*)

10	11	12	13	14	15	16	17	18	19	20	21	22	23
0.040	0.009	0.121	0.027	0.057	0.123	0.091	0.050	0.020	0.042	0.017	0.018	0.024	0.007
0.002	0.001	0.007	0.011	0.003	0.022	0.041	0.024	0.008	0.005	0.006	0.012	0.013	0.003
0.029	0.021	0.025	0.028	0.015	0.022	0.012	0.025	0.026	0.011	0.019	0.022	0.023	0.013
0.033	0.050	0.059	0.027	0.014	0.012	0.012	0.007	0.026	0.012	0.020	0.018	0.021	0.007
0.001	0.002	0.001	0.003	0.002	0.002	0.002	0.002	0.005	0.002	0.002	0.004	0.007	0.001
0.448	—	—	0.002	—	—	—	—	—	—	—	—*	—	—
0.017	0.005	0.022	0.032	0.009	0.027	0.019	0.024	0.031	0.010	0.010	0.009	0.005	0.003
0.051	0.019	0.022	0.023	0.032	0.037	0.024	0.047	0.052	0.017	0.036	0.016	0.008	0.018
0.008	0.029	0.018	0.021	0.031	0.026	0.032	0.026	0.025	0.030	0.020	0.024	0.026	0.022
0.063	0.017	0.014	0.087	0.008	0.007	0.002	0.003	0.005	0.001	0.006	0.005	0.002	0.001
—	0.309	0.035	0.003	0.009	—	—	—	—	0.012	—	0.010	—	—
—*	0.003	0.074	0.032	0.075	0.013	0.048	0.082	0.068	0.062	0.062	0.003	—*	—
0.022	0.012	0.009	0.169	0.007	0.034	0.008	0.011	0.012	0.021	0.247	0.032	0.002	0.004
—*	—*	0.003	—*	0.297	0.104	0.003	0.002	0.005	0.002	—*	0.004	0.004	0.008
—	—*	—	0.002	0.001	0.147	—	—	0.004	0.001	0.001	0.037	0.002	—
0.002	—*	0.002	0.015	—*	—	0.388	0.020	0.004	—*	—	0.033	0.025	0.007
—*	—*	0.012	0.007	0.002	—	0.004	0.264	0.009	—	—	0.075	0.037	0.012
—*	—*	0.010	0.003	0.008	0.002	0.002	0.003	0.133	0.005	0.003	0.008	0.005	0.012
—	0.002	0.006	—*	0.001	0.008	—*	—	0.005	0.327	—	0.007	0.003	0.003
—	0.024	0.010	0.010	—*	—	—*	—	—*	—	0.216	—*	—*	—*
0.013	0.019	0.042	0.086	0.043	0.052	0.054	0.055	0.075	0.125	0.073	0.197	0.208	0.482
0.004	0.005	0.020	0.015	0.003	0.008	0.002	0.007	0.010	0.006	0.002	0.018	0.122	0.029
—	—*	0.001	—	—*	—	—*	—*	—	—	—	0.006	0.002	0.057
—*	0.001	—*	0.001	0.008	0.001	0.001	0.001	0.004	0.003	—*	0.005	0.016	0.009
0.003	0.002	0.001	0.011	0.002	0.001	0.001	0.001	0.002	0.011	0.009	0.006	0.003	0.019
—*	0.054	0.002	0.001	—*	0.008	—*	—	—*	0.002	0.002	0.005	—	—
—	—*	—*	—*	—*	—	—*	—	—*	—	—	0.003	0.014	0.002
0.014	0.010	0.009	0.007	0.005	0.009	0.003	0.009	0.009	0.003	0.004	0.003	0.003	0.002
0.001	—*	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.004	0.001	0.001	0.001
0.001	0.007	0.004	0.003	0.005	0.001	0.001	0.002	0.004	0.001	0.002	0.003	0.003	0.021
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—*	0.018	0.005	0.003	0.002	—*	0.001	0.001	0.002	0.001	0.002	0.004	0.006	0.001
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
0.249	0.382	0.464	0.369	0.361	0.332	0.248	0.332	0.457	0.289	0.236	0.409	0.419	0.255
25.8	60.6	13.2	20.0	13.4	10.9	22.6	27.6	13.6	19.2	3.5	161.8	66.3	31.7
0.060	0.157	0.137	0.183	0.081	0.091	0.070	0.080	0.113	0.153	0.098	0.054	0.048	0.055
1.5	9.5	1.8	3.7	1.1	1.0	1.6	2.2	1.5	2.9	0.3	8.7	3.2	1.7

TABLE 1 (*continued*)

Consumer:	24	25	26	27	28	29	30	31	32
Producer:									
1. Imports	0.045	0.004	0.024	0.007	0.001	0.020	0.001	0.060	—*
2. Dummy	0.007	0.010	0.005	0.012	0.007	0.006	0.017	0.006	0.005
3. Business Services	0.038	0.056	0.034	0.022	0.023	0.031	0.026	0.018	0.044
4. Finance, Ins. and R.E.	0.019	0.032	0.011	0.014	0.008	0.035	0.068	0.040	0.078
5. Communications	0.004	0.006	0.003	0.008	0.002	0.004	0.010	0.009	0.008
6. Crude Oil and Natural Gas	—	—	—	—	—	—	—	0.001	—
7. Utilities	0.005	0.004	0.006	0.005	—	0.073	0.022	0.008	0.021
8. Intermediate Transport	0.013	0.009	0.024	0.006	0.020	0.072	0.006	0.095	0.002
9. Wholesale Trade	0.035	0.023	0.030	0.014	0.033	0.009	0.024	0.020	0.007
10. Petroleum Refining	0.001	0.002	0.002	0.003	0.008	0.008	0.007	0.037	0.007
11. Crude Food and Tobacco	0.001	—*	0.263	—	0.001	0.003	0.004	0.001	—*
12. Crude Nonfood	0.001	0.003	0.005	—*	0.011	0.028	—*	—*	—
13. Primary—Industrial Chem. and Pigments	0.012	0.021	0.003	0.006	0.038	0.006	0.001	0.002	—*
14. Primary—Wood	0.027	0.001	—*	0.003	0.017	—	—*	—*	—*
15. Primary—Pulp and Paperboard Mills	0.002	0.029	—*	—	—	0.001	—*	—*	0.001
16. Primary—Nonferrous Metals	0.028	—*	—*	0.025	0.009	—*	—*	0.002	—
17. Primary—Blast Furnaces and Steel Mills	0.024	—*	—*	0.027	0.010	—*	—*	—*	—
18. Primary—Stone, Clay and Glass	0.009	—*	—*	0.002	0.034	—*	0.003	0.001	—*
19. Primary—Textiles	0.040	0.140	—*	0.001	—*	—*	—*	0.001	—*
20. Primary—Fertilizers	—*	0.001	—*	—*	—	0.001	0.001	—*	—*
21. Intermediate	0.185	0.092	0.093	0.119	0.116	0.012	0.058	0.023	0.017
22 Machinery and Equipment	0.017	0.002	0.001	0.052	0.020	0.002	0.005	0.003	—
23. Automotive	0.001	—*	—	—*	—*	—	—*	0.001	—
24. Consumer Home Goods	0.080	0.009	0.001	0.004	0.012	0.001	0.009	0.001	0.001
25. Consumer Staples	0.005	0.164	0.004	0.001	—*	0.004	0.024	0.002	0.013
26. Consumer Food and Tobacco	—*	0.003	0.210	—	—	0.005	0.005	0.004	—*
27. Ord. Ship, R.R., and Aircraft	0.001	—*	—	0.240	—	—*	—*	0.017	—
28. Maintenance and Repair	0.003	0.002	0.003	0.003	—*	0.102	0.011	0.024	0.004
29. Government Enterprises	0.001	0.006	0.001	0.001	—*	0.001	0.007	0.040	0.021
30. Nonbusiness Services	0.002	0.004	0.004	0.005	0.003	0.006	0.047	0.013	0.014
31. Final Transport	—	—	—	—	—	—	—	—	—
32. Retail Trade	0.003	0.004	0.002	0.008	0.041	0.002	0.011	0.006	0.004
33. Construction	—	—	—	—	—	—	—	—	—
34. Special	—	—	—	—	—	—	—	—	—
35. I.V.A.	—	—	—	—	—	—	—	—	—
36. Value Added	0.390	0.372	0.272	0.412	0.587	0.569	0.634	0.566	0.763
Column totals (Billion $)	31.1	58.3	99.8	39.9	23.4	17.3	93.8	35.9	98.6
Purchases from industries below the main diagonal as a proportion of total purchases and value added:	0.015	0.019	0.010	0.017	0.044	0.008	0.011	0.006	0.000
Purchases from industries below the main diagonal (Billion $)	0.05	1.1	1.0	0.7	1.0	0.1	1.0	0.2	0.0

*Between −0.00049 and +0.00049

TABLE 1 (*continued*)

33	34	35	37	38	39	40	41	42	43	44	45	46
0.001	0.019	0.000	0.020	0.006	−0.010	−7.948	0.040	0.056	—*	—	—*	—*
0.007	—	↑	0.003	−0.026	−0.012	0.113	−0.002	—*	0.004	0.003	—*	0.033
0.055	—		0.009	—	—	0.089	0.026	0.042	0.016	0.028	0.015	0.016
0.015	—		0.196	0.019	—*	0.130	0.002	0.010	0.009	0.011	0.005	0.017
0.004	—		0.016	0.010	—	0.027	0.006	0.007	0.004	0.003	0.007	0.009
—	—		—	—	0.026	0.016	—	—	—	—	—	—
0.001	—		0.028	—	—	0.014	0.004	0.003	0.027	0.007	0.009	0.013
0.027	—		—	—	—	—	—	—	—	—	—	—
0.041	—		0.054	0.033	0.051	0.500	0.016	0.013	0.009	0.012	0.009	0.005
0.011	—		0.021	—	0.053	0.146	0.013	0.007	0.004	0.003	0.005	0.003
0.003	—		0.012	—	0.104	0.556	—*	−0.004	0.001	0.002	0.001	0.002
0.008	—		0.001	—	0.030	0.223	—*	−0.067	—*	0.000*	—	—*
0.006	—		0.001	—	0.024	0.259	0.008	0.021	—*	0.002	—*	—*
0.057	—		0.001	—*	0.012	0.072	—*	—*	—*	—*	—*	—*
—	—		—*	—	0.014	0.110	—*	0.001	0.002	0.001	0.001	0.001
0.027	—		—*	—*	0.033	0.139	0.001	−0.002	—*	—	—	—
0.014	—		—*	—	0.050	0.083	0.003	—*	—*	—	—*	—
0.079	—		0.001	—	0.017	0.058	—*	—*	0.001	0.002	—*	—
—*	—		0.001	—	0.020	0.063	0.001	—*	—*	0.001	—*	—*
—	—		—*	—	0.008	0.039	0.001	0.001	—*	—*	—	0.002
0.164	—		0.018	0.059	0.160	1.077	0.055	0.031	0.011	0.010	0.007	0.009
0.025	—		—*	0.236	0.172	1.171	0.099	0.068	0.015	0.012	0.005	0.007
—*	—		0.034	0.083	−0.031	0.244	0.009	0.008	0.004	0.002	0.015	0.015
0.010	—		0.037	0.013	0.049	0.177	0.008	0.008	0.006	0.006	0.003	0.002
0.001	—		0.066	—	0.070	0.176	0.008	0.007	0.020	0.029	0.005	0.002
—	—		0.133	—	0.107	0.374	0.003	0.023	0.002	0.020	0.011	0.002
—	—		0.001	0.041	0.219	0.444	0.218	0.145	—	—	0.001	—*
—*	—		—	—	—	—	0.014	0.025	0.020	0.011	0.011	0.111
0.001	—		0.004	—	—	0.021	0.003	0.017	0.001	0.006	0.002	0.004
0.006	—		0.143	—	−0.006	0.065	0.026	0.064	0.001	0.175	0.014	0.009
—	—		0.023	0.008	0.023	0.758	0.042	0.017	0.016	0.008	0.006	0.007
0.041	—		0.169	0.026	—	0.010	—*	—*	−0.011	0.007	—	—*
—	—		—	0.492	—	0.003	0.014	0.128	0.156	0.129	0.042	0.475
—	—		0.005	—	—	1.790	0.380	0.371	0.683	0.510	0.824	0.257
—	—	0.000	—	—	−0.184	—	—	—	—	—	—	—
0.399	0.981	1.000	0.000	—	—	—	—	—	—	—	—	—
79.9	92.6	−1.8	490.7	110.4	10.0	5.1	71.3	19.5	39.5	13.3	6.3	29.3

0.000	0.000
0.0	0.0

Key to Final Demand Columns

37. Personal Consumption Expenditures
38. Gross Private Fixed Capital Formation
39. Net Inventory Change
40. Net Exports
41. Federal Govt. Purchases: Defense
42. Federal Govt. Purchases: Other
43. State and Local Govt. Purchases: Education
44. State and Local Govt. Purchases: Health, Etc.
45. State and Local Govt. Purchases: Safety
46. State and Local Govt. Purchases: Other

It follows that given resource limitations, it would be more useful to stress the development of data for a dozen and half or so stage-of-process industry categories than for the same number of SIC categories.[11]

Integration of Other Data

While Charts 1 and 2 are suggestive of the usefulness of a stage-of-process classification for price and quantity statistics, including, of course, inventory change, there is little to suggest that the behavior of prices and quantities can be explained by these two variables alone.[12] For example, the percentage changes in output of finished or primary goods during 1972–74 are not sufficiently unusual vis-a-vis their movements during the rest of the 1958–75 period to explain the sharp spurt in prices of primary manufactures during the 1972–74 period. If such economic behavior can be explained, one or more variables must be missing.

Chart 3 contains data on the change in unfilled orders for the seven primary and the five finished goods industries. It is clear from these data that from the first quarter of 1972 through the third quarter of 1974 there was a substantial build-up in unfilled orders that was unprecedented for the 1958–75 period. The 20 percent rate of increase in unfilled orders in the second quarter of 1973 was the highest except for that in the second quarter of 1959 before the steel strike. And the six quarter rise was the most sustained of the entire period.

In contrast, the rise in unfilled orders for finished goods was no sharper or prolonged than that of the 1964–6 period. During that period there were also some sharp increases in unfilled orders for primary goods but they were not nearly as sustained or pronounced as in 1972–73.

Another indicator that could be helpful in explaining price change is found in Chart 4. It is the ratio of output to deflated shipments for the seven primary and five finished goods industries. It is a proxy for the change in finished goods inventories for the groups of producers at each of the two stages of process.[13] During the seven quarters ending in 1974—1, there was substantial liquidation of finished goods inventories held by primary producers. Such inventories fell in five of those seven quarters and rose only slightly in one of the two showing gains. Throughout the rest of the period, there is a strong tendency for one quarter of liquidation to be followed by one quarter of accumulation. In contrast, finished goods inventories of finished goods producers were being accumulated in more than half of those quarters.

[11]In accomplishing such a task it appears more practical to fill in aggregates by sampling and then to develop measures for subcomponents than to begin by developing the latter and waiting until enough cells have been filled to measure the aggregate. The second approach is used more widely by statistical agencies and appears to slow the development of systems of price and quantity statistics.

[12]In fact it is well-known that two additional variables exogenous to a particular sector are needed to "exactly-identify" the influences of shifts in supply and demand in effecting the observed changes in prices and quantities.

[13]The ratio of output (X) to deflated shipments (S) can be viewed as:

$$\frac{X}{S}-1=\frac{X-S}{S}=\frac{\Delta I}{S}; \qquad \frac{X}{S}=1+\frac{\Delta I}{S},$$

where I stands for inventories of finished goods.

CHART 3. — QUARTERLY PERCENTAGE CHANGE IN UNFILLED ORDERS IN CONSTANT 1967 PRICES

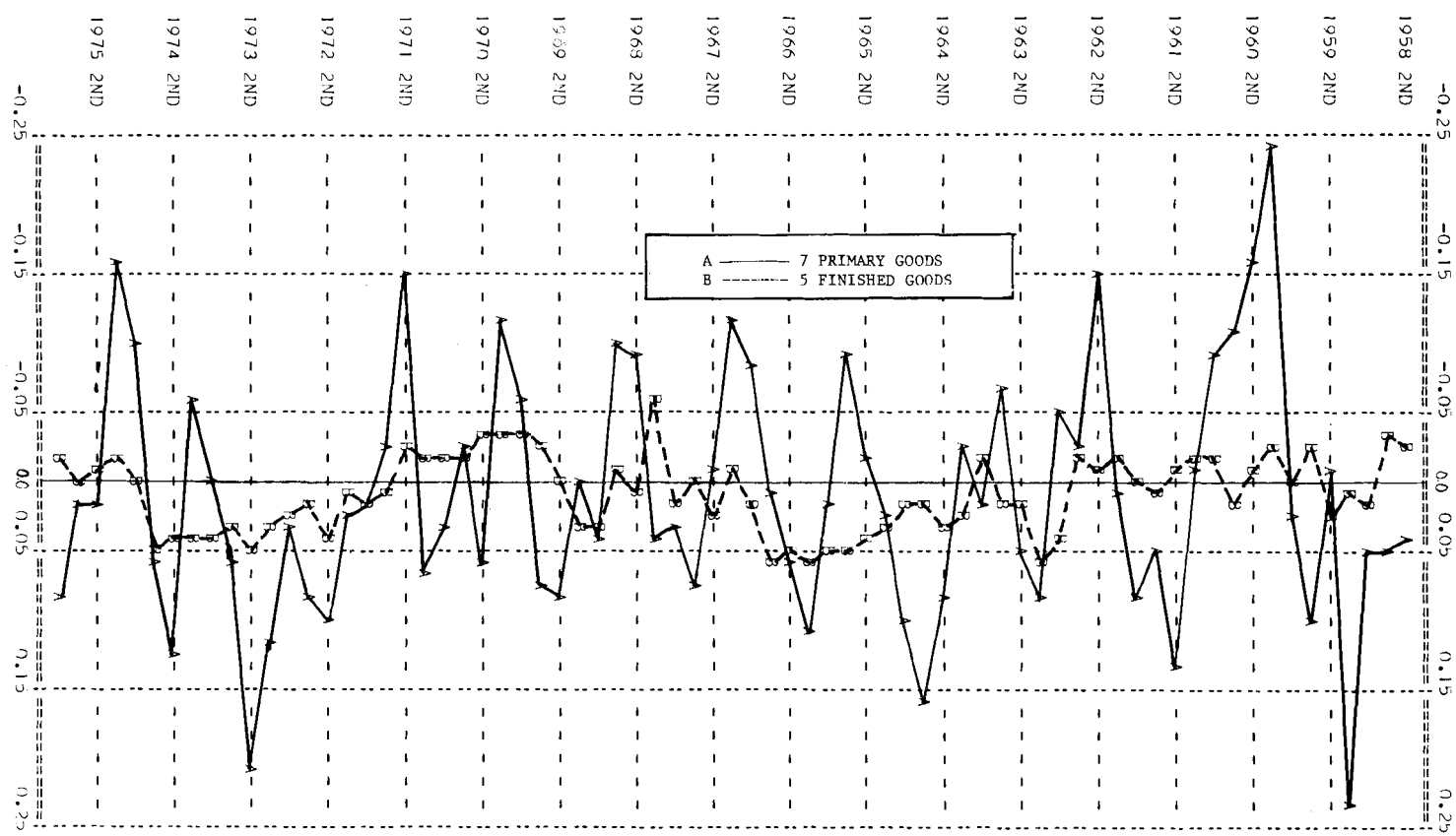
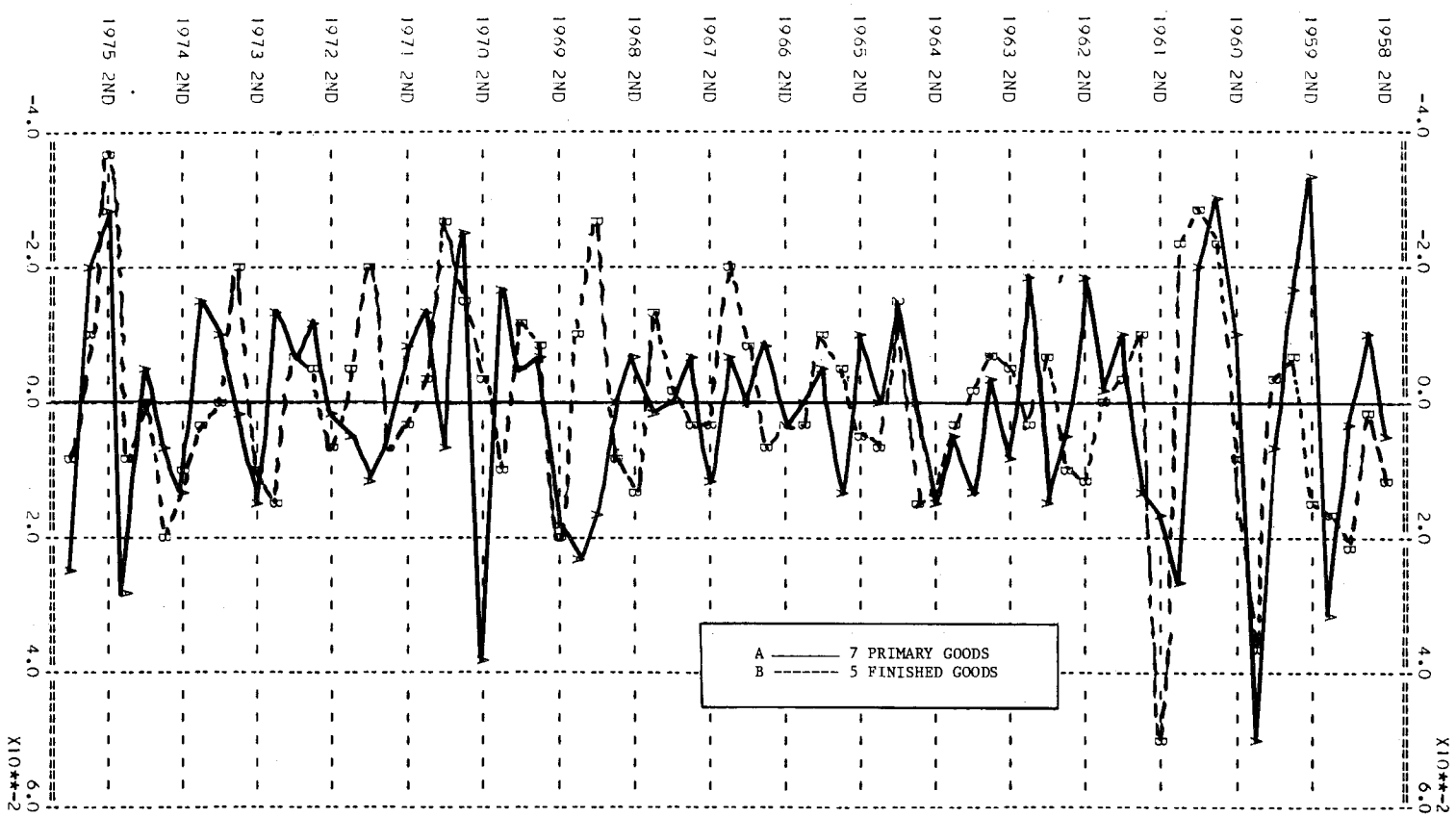


CHART 4. — QUARTERLY PERCENTAGE CHANGE IN THE RATIO OF OUTPUT TO SHIPMENTS IN CONSTANT 1967 PRICES



This analysis suggests, and more formal multivariate analysis shows, that when changes in unfilled orders and finished goods inventories are incorporated with changes in output relative to capacity, it is possible to explain more of the unusually large rise in primary product prices in 1972–74 than by using the latter variable solely.

The foregoing was meant to underscore the need to integrate other data into a system of price and quantity statistics if its usefulness is to be enhanced. In the process of building a model of intermediate and final demand by stage-of-process the following variables have been developed for the manufacturing sector on an industry basis, by stage-of-process, consistent with that for the price and quantity statistics. They are:

(1) New orders
(2) Unfilled orders
(3) Inventories (these are separated by stage of fabrication using methods described above)
(4) Shipments
(5) Manhours
(6) Wage rates
(7) Capital stocks (net, gross, depreciation and investment)
(8) Imports
(9) Exports
(10) Materials purchased.

The data base covers the period 1958–75. The first six variables, together with prices and outputs, are available monthly. The seventh is available quarterly, the eighth, ninth and tenth annually. The variables come from several sources and none are *per se* part of the national income and product accounts. Price and labor related measures are from the Bureau of Labor Statistics. Inventories, new and unfilled orders and shipments as well as the data measured annually are from the Census Bureau. Production is that of the Federal Reserve Board. Capital stocks and investment were developed from benchmarks prepared by Jack Fawcett Associates for the U.S. Interagency Growth Project.

On the first cut there are many inconsistencies in the data including the well known one, implicit in this data set, between physical quantity and deflated value added measures of production. Nonetheless, the results of using such data to build a model of the manufacturing sector that is integrated with a final demand model based on an NIPA framework and data are encouraging in terms of the outcomes achieved so far in estimating and simulating such a model.

The avenue of rearranging existing data to a stage-of-process classification and casting price, quantity and related data into that format appears promising in terms of enhancing the usefulness of systems of price and quantity data for the analysis of economic issues.