New stage of process price system developed for the Producer Price Index

The new industry-based system applies input/output transaction relationships to the measurement of industrial price change

ROBERT GADDIE AND MAUREEN ZOLLER

A new industry-based stage of process price index system was first published with the release of the Producer Price Index for January 1988. This new index system for the first time combines the industry price indexes developed through the Producer Price Index revision with inter-industry transaction data from the Department of Commerce Input/Output Tables of the United States to create a rigorous input/output price model of the industrial economy. Development and publication of this new set of industry-based stage of process indexes accomplishes one of the major objectives of the Producer Price Index revision.[1] This revision began in 1977 and now covers virtually all of the nearly 500 Standard Industrial Classification (SIC) industries in the mining and manufacturing sectors of the economy.

In addition to the new industry-based stage of process price system, the Bureau is continuing to publish the traditional commodity-based stage of processing system, which has been the focus of Producer Price Index presentation and analysis since 1978.

The new industry-based stage of process system consists of the following specific indexes:

1. Four major output indexes
   a. Crude processors
   b. Primary processors
   c. Semifinished processors
   d. Finished processors
2. Four major input indexes with two major subindexes for inputs to final demand
   a. Inputs to primary processors
   b. Inputs to semifinished processors
   c. Inputs to finished processors
   d. Inputs to final demand
      (i) Inputs to personal consumption
      (ii) Inputs to capital investment

These new indexes reflect the following advancements in concept and approach:

- Explicit conceptual definition of the type of index produced. In this new system, each index is explicitly either an index of output from or an index of input to a defined economic activity.
- Rigorous allocation of industries to processing stages, using inter-industry shipments flow data developed from the Input/Output Tables of the United States.
- Use of net output and net input weighting to eliminate multiple counting of price change within the stage of process system.

This article discusses the economic interest and conceptual foundation of stage of process indexes, the algorithms for assignment of industries to processing stages, and the detailed methods of weighting and calculation.

Economic interest

Although a single number often is used to summarize the rate of inflation in the economy, there are, at any given

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time, a variety of rates of price change which characterize different industries and economic sectors. In 1987, for example, the widely cited Producer Price Index (PPI) for Finished Goods rose 2.1 percent. However, in the same year, passenger car prices fell 3.1 percent while gasoline prices climbed 20.5 percent. Also in 1987, the index for Crude Materials moved up 8.8 percent and that for Intermediate Materials, Supplies, and Components increased 5.5 percent.

A major challenge in constructing price indexes is to develop an index system that summarizes this diversity of price change into meaningful analytic constructs. The Bureau's chief mechanism for accomplishing this is the stage of process structure, which has been its primary vehicle for publication and analysis of industrial price change since 1978.

The basic idea of a stage of process system is that the economy can be subdivided into distinct economic segments which can be arranged sequentially so that the outputs of earlier segments become inputs to subsequent ones, up through final demand. As a simple example, one economic sector may produce wheat, which is input to another that produces flour, which is input to another that produces bread. To the extent that such a sequential system of processing stages can be defined, it is possible to trace the transmission of price change through the economy and to develop information on both the timing and magnitude of price passthroughs to final demand.

The stage of process approach is of particular interest when inflationary pressures are first reflected in crude commodities. This was certainly the case with the oil price shocks of the 1970's, but there has long been concern among economists about how price changes in basic industries such as steel are transmitted to other industries and economic sectors.

At the time of the 1973–74 oil price shock, the Bureau's major publication vehicle for producer prices was the "All Commodities" index, which included the full range of priced items irrespective of their degree of fabrication. This index became subject to considerable criticism as oil prices surged because the crude oil price increase was multiplied as it passed through into the cost structures of, first, refined petroleum products manufacturers and then to other producers as the higher energy prices were embodied in their cost structures.[2]

With a stage of process approach, this multiple counting of price change in the same index is limited. In addition, the actual transmission of the crude changes is more easily discerned than when it is masked in a single All Commodities index number.

In 1978, the Bureau shifted its publication emphasis from the All Commodities index to the commodity-based stage of process system. The latter set of indexes had been calculated for many years as an analytic aid. In the commodity-based stage of process system, products priced in the PPI were allocated to three stages of process based on their degree of fabrication and end use. Because industry indexes were not available in the PPI system, it was impossible to create aggregates that would specifically reflect inputs and outputs of defined economic sectors. But it was at least possible to separate out major stages of a product's fabrication to mitigate multiple counting of price change. The Finished Goods index was emphasized because it measured the prices of goods nearest final consumption. The Crude and Intermediate indexes served both as price measures for less fabricated goods and as possible indicators of future movements in Finished Goods prices as price changes were passed through the economy.

While the emphasis on the stage of process system was certainly an analytic advancement from summarizing all price change in a single index number, the commodity-based stage of process system still contains some multiple counting, particularly within the Intermediate Materials index, and is not analytically rigorous in composition or input/output definition. Therefore, the Bureau undertook an effort to produce a stage of process system which would reflect the actual input/output flow of transactions in the economy and which would totally eliminate multiple counting of price change.[3] The new industry-based stage of process system is the result of that effort.

Conceptual design

An industry-based stage of process design places industries in processing stages based on their transaction relationships to other industries. For example, the agricultural industries sell wheat to the flour milling industry which sells flour to the bakery industry. In an industry-based stage of process system, these industries would be placed in sequential stages, because that is the way the sales and the cost impacts flow.

The industry-based stage of process structure is explicitly based on an input/output matrix as displayed in table 1. The left hand column of table 1 consists of all the producing industries in the economy, plus imports. Along the top of the table are arrayed the same economic sectors, along with final demand. Each box or cell within the matrix represents the output of the category in the left-hand column which is consumed by the category at the top of the column. For example, cell "C" represents the output of primary goods producers which is consumed by producers of semifinished goods.

An output index for primary producers will include all of the transactions in cells "A" through "H," except cell "B," which represents the value of sales of primary producers to other primary producers. Alternatively, an input index for primary producers will cover transactions in cells "I," "J," "K," and "L" in the column below primary producers. Again, cell "B" is excluded because it contains only internal sales among primary producers.

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Table 1. Generalized stage of processing input/output table, all industries

Producing industry	Consuming industry				Final demand			
	Crude	Primary	Semifinished	Finished	Personal consumption expenditures	Capital investment	Exports	Government purchases
Imports		I						
Crude		J						
Primary	A	B	C	D	E	F	G	H
Semifinished		K						
Finished		L						

as the real world problems that may occur in constructing one. As mentioned previously, the fundamental idea of a stage of process system is that there are identifiable and distinct economic sectors which can be arranged sequentially so that the outputs of earlier segments become inputs to subsequent ones up through final demand. Therefore, in an ideal stage of process system, all shipments would occur in the cells just above the shaded diagonal. For example, in an ideal stage of process system, all of the value of output of primary producers would be in cell "C" and all of the value of input to semifinished processors would be in cell "C." Unfortunately, the real world is more complex.

Variations from the ideal stage of process flow take the following forms:

- *Backflow* occurs when part of the output of a given stage of process is consumed by an earlier stage of process. Cell "A" in table 1 represents backflow because output of primary producers is consumed by crude producers. For example, the refined petroleum industry is a primary producer but crude goods industries all use petroleum products such as gasoline. The value of these sales is a backflow.
- *Internal flow* occurs when part of the output of a given stage of process is consumed within that stage of process. Cell "B" in table 1 represents internal flow because it is both output and input to primary producers. The refined petroleum industry also sells gasoline to other primary industries. The value of these sales is an internal flow.
- *Skips* occur when part of the output of a given stage of process is consumed by stages of process beyond the one next forward. Cell "D" in table 1 represents a skip because part of the output of primary producers is consumed by finished producers, a category two stages forward from primary. Continuing the petroleum example, the refined petroleum industry sells a portion of its products directly to finished goods producers. The value of these sales is a skip.
- *Leakages* occur if some portion of output does not appear as input anywhere in the system. This cannot occur if the stage of process system is comprehensive of all transactions, but it is of interest because leakage does occur in partial systems. For example, PPI pricing at this time does not include motor freight (trucking). Therefore, in a stage of process design based on the current PPI price universe, the sales of gasoline and diesel fuel to the trucking industry will simply "leak" out of the system. These outputs will not appear as inputs because the trucking industry which consumes them is not priced.

Much of the discussion of stage of process design emphasizes minimization of backflow as the primary goal. Backflow is a substantial problem, because it introduces circularity into what is supposed to be a sequential system. Additionally, if output is flowing backward, it obviously impairs the forward directionality of the index system which is crucial to its analytic usefulness.

The existence of internal flow has some of the same effects. While internal flow does not cause circularity in the system, it does reduce its forward directionality. Equally as important if not more so, large internal flows would tend to indicate a faulty taxonomy. That is to say, if industries within a stage of process are substantially shipping to each other, there probably are within that stage of process two or more real processing stages which should be separated.

The PPI industry stage of process design takes both backflow and internal flow into account by emphasizing the goal of maximum net forward flow. In terms of table 1, this means that the system should maximize the value of shipments appearing above and to the right of the shaded diagonal.

Skips and leakages present a somewhat different set of problems. While they do not affect directionality of the system, they do create difference between the output of one processing stage and inputs to the next. Leakages are a particularly significant problem because current PPI pricing is substantially limited to mining, manufacturing, and agriculture. Pricing of the service sector is spotty and is only slowly being expanded.

Because skips and leakages cannot at this time be avoided, the PPI stage of process system explicitly provides material input indexes for each stage of process beyond

crude producers. Input indexes also compensate for whatever problems of backflow remain after forward flow is maximized. The difference between the output index of one processing stage and the material input index to the next can be evaluated specifically by comparing these indexes in the PPI system.

Categorization of industries

The PPI stage of process design began with the determination that there should be four stages of process:

- Crude producers
- Primary producers
- Semifinished producers
- Finished producers

This categorization reflects a considerable amount of experience with stage of process index problems. It particularly reflects concern that the Intermediate Materials component in the traditional three-stage PPI system is too broad and is masking significant internal differences. In addition, through the course of allocating industries to processing stages, the magnitude of internal flow was specifically evaluated. The relatively small amount of internal flow achieved indicates that a four-part division is appropriate.

The key set of data needed to allocate industries to processing stages is comprehensive information on the pattern of inter-industry shipments. The basic source of this information is the Input/Output Tables of the United States published by the U.S. Department of Commerce. The input/output tables show all output of goods and services produced by industry and show the goods and services each industry consumes. Using an assumption that firms are indifferent as to the industry of origin for the goods and services they buy, these tables can be recalculated into a matrix of inter-industry shipments. These data can then be used to rigorously evaluate the flow characteristics of any given stage of process allocation. This was done using the 1977 Input/Output tables, which were the most recent available for detailed (537-industry) input/output industry definitions.

Because final demand is predefined and all of the other processing stages are to be defined through the allocation process, the first step in stage of process allocation is to identify those input/output industries shipping to final demand. Those that ship exclusively to final demand must be finished goods producers, because they would have no backflow, no internal flow, and only forward flow to final demand. There are, however, many other industries that do not ship exclusively to final demand but ship a large percentage of their product to final demand. The question then becomes, which of these industries should be allocated to the group of finished goods producers?

To make that determination, a frequency distribution was constructed for all industries showing the proportion of their net shipments that go to final demand. Clearly, industries shipping more than 95 percent of their output to final demand should be classified as finished goods producers and the frequency diagram showed similar numbers of industries shipping 75 to 85 percent and 86 to 95 percent of their output to final demand. The number of industries in the intervals shipping below 75 percent to final demand fell sharply, however. Therefore, as a first cut, all industries that shipped 75 percent or more of their output to final demand were classified as finished producers.

This process was then repeated for earlier stages of process. To determine the first cut for semifinished producers, for example, a frequency distribution was prepared showing shipments of unallocated industries to final demand and to industries previously identified as finished. Through this process, a breakpoint of 60 percent was identified, so that semifinished producers were those industries which shipped 60 percent of their output to finished producers and final demand but shipped less than 75 percent of their output to final demand alone.

A forward breakpoint of 60 percent was also identified for primary producers. Crude producers were the industries left over after the other stages of process were defined.

The result of this series of preliminary allocations was a base stage of processing allocation which could then be iteratively improved by analyzing the net forward flow contribution of individual industries. The specific mechanism for this analysis was calculation of the net forward flow effect for each industry if it were placed in each processing stage with all other industry allocations remaining unchanged. Optimally, an industry should be assigned to the processing stage in which its net forward flow contribution is largest.

The net forward flow effect for each individual industry was expressed as the following:

1. The sum of forward shipments of the industry and the inputs received from prior stages of process, minus
2. The sum of backward shipments of the industry and the inputs received from forward stages of process.

Using this procedure, the allocations were iteratively improved until further reassignments could not significantly improve net forward flow. When the net forward flow statistics between two stages of process were very close for an individual industry, however, there was a preference for placing the industry with other similar industries and to limit problems with skips.

Table 2. Percentages of producing industry output consumed by stage of process, all industries

Producing industry	Consuming industry				
	Crude	Primary	Semifinished	Finished	Final demand
Crude	14.5	30.8	9.5	15.7	29.4
Primary	7.5	11.8	25.9	20.8	34.0
Semifinished	6.2	4.3	7.4	38.8	43.3
Finished	1.1	1.3	1.1	3.1	93.3

Table 3. Percentages of producing industry output consumed by stage of process, processor component only

Producing industry	Consuming industry				
	Crude	Primary	Semifinished	Finished	Final demand
Crude	17.8	53.3	8.8	4.6	15.5
Primary	7.7	13.8	34.3	23.0	21.2
Semifinished	4.9	3.3	8.2	44.6	38.9
Finished	1.8	1.1	1.5	6.3	89.3

Table 2 shows the flow characteristics of the final PPI stage of process design. The percentages shown in the table represent that part of the output of each row stage consumed by each column stage. Using primary producers as an example, the flow pattern is as follows:

- 7.5 percent of the output of primary producers is consumed by crude producers. This is a backflow.
- 11.8 percent of the output of primary producers is consumed by primary producers. This is an internal flow.
- 80.7 percent of the output of primary producers is consumed by forward stages of process (25.9 percent by semifinished, plus 20.8 percent by finished, plus 34.0 percent by final demand). This is forward flow.

The total flow statistics for the entire stage of process structure are: backflow, 5.01 percent; internal flow, 7.86 percent; forward flow, 87.13 percent; and shipments to the next forward stage of process, 57.30 percent.

This system exhibits extremely strong directionality with very small backflow. In addition, the relatively small percentages of internal shipments indicate that the four-stage taxonomy is effectively isolating processing stages. However, there remains a problem with skips, because only 57.30 percent of shipments are going to the next forward processing stage. This serves to underline the importance of specific input indexes as components of the stage of process system.

In addition to considering the flow characteristics of a complete model involving all industries in the economy, the PPI design has to consider the flow characteristics of a more limited model which corresponds to the industries now priced. Although the PPI is moving to increase its coverage of the service sector, the bulk of PPI pricing remains in agriculture, mining, and manufacturing. The set of stage of process indexes that the Bureau is able to produce at this time thus is limited to "processors," or those industries that are primarily engaged in the physical transformation of goods. The net shipments of processors accounted for 42 percent of the total net value of output of all producing industries in the economy, according to the 1977 input/output tables.

A flow analysis was calculated for the processor component alone to evaluate the allocation design for the specific set of industries that would be covered by currently available Producer Price Indexes. The flows in this analysis represent shipments by processors to all industries (processors and nonprocessors) and to final demand. The results appear in table 3. The summary flow statistics: backflow, 5.76 percent; internal flow, 10.59 percent; forward flow, 83.66 percent.

The flow pattern for processors alone is nearly as good as for all industries. The PPI system thus can be rather straightforwardly constructed in two steps. The first step is to produce input and output indexes for processors alone and for processors' input to final demand, using currently available Producer Price Indexes. The second step is to construct a set of indexes for nonprocessors and for the total economy as PPI index coverage is expanded. The new stage of process indexes just introduced reflect completion of the first step of the long-term construction of this system.

Output indexes for processors

The result of the allocation process described above was to place each of the 537 input/output industries in its appropriate stage of process. To create PPI output price indexes, it is necessary to match the PPI four-digit industry net output indexes[4] to those input/output industries that are processors, and then to weight them appropriately.

The Department of Commerce publishes a general concordance between the input/output industry classification and the Standard Industrial Classification. This leads to unique assignment of most four-digit PPI industries which are based on the SIC system. For those remaining cases in which there was not a one-to-one match between input/output and PPI industries, the PPI industries were assigned to the input/output industry that appeared to reflect the bulk of the PPI industry's shipments value. Through this process, each PPI four-digit industry was assigned to one, and only one, stage of process. The final allocation of PPI industries by stage of process appears in exhibit 1.

The industries are weighted into the stage of process total based on their 1982 net output value of shipments. The net output value includes only that portion of output value which goes to industries in other stages of process and excludes shipments among industries within a stage of process. Net output weighting eliminates multiple counting of price change by weighting only those prices that affect other economic sectors. The specific methodology for the industry weights within a stage of process is to multiply the 1982 total value of industry shipments, generally available from either the 1982 Census of Manufactures or Census of Mineral Industries, by a net output ratio calculated from the input/output tables. The net output ratio is the proportion of industry shipments that goes to industries outside the stage of process.

The net output weights are then applied to the PPI four-digit industry indexes, as currently published in table 5 of the Bureau's publication *Producer Price Indexes*, to calculate aggregate indexes by stage of process. Several sub-

indexes also are produced within each stage of process which correspond to important economic characteristics. For example, separate subindexes are produced for foods processors, energy processors, nondurable goods processors, and durable goods processors. The output indexes by stage of process will be published as table 12 in *Producer Price Indexes*. An example of the output index system appears here as table 4.

Input indexes for processors

Construction of input indexes by stage of process is somewhat more complicated than construction of output indexes. In the output indexes, all of an industry's production is assigned to one, and only one, stage of process. In the input indexes, however, a single industry's products may be consumed at several processing stages. In addition, different products within an industry's product line may be consumed by different stages of process. For example, gasoline produced by the petroleum refining industry may be consumed at all stages of process while jet fuel would be predominantly consumed by the processing stage that included airlines.

The input index design, therefore, has to specifically deal with these two issues:

- What proportion of a particular industry's products is consumed by a given stage of process?
- What particular mix of those products is consumed by that given stage of process?

The answer to the first question can be estimated from the input/output tables. Because the input/output tables show consumption of products by commodity category, the pro-

Table 4. Producer Price Indexes and percent changes for the net output of industry by stage of process
(June 1987=100)

Grouping[1]	Relative importance, December 1987	Unadjusted Index[2]			Unadjusted percent changes					
					12 months ending February 1988	3 months ending—				January 1988 to February 1988
		October 1987[2]	January 1988[2]	February 1988[2]		May 1987	August 1987	November 1987	February 1988	
Net output from:										
Crude processors	100.000	101.2	101.8	101.9	5.3	2.6	2.2	−0.3	0.7	0.1
Crude agricultural and feed processors	9.132	96.3	105.1	108.0	(3)	(3)	(3)	8.8	8.1	2.8
Crude agricultural processors	5.438	93.3	103.2	108.8	28.3	18.0	−12.9	12.3	11.1	5.4
Crude feed processors	3.694	100.9	108.0	106.7	11.6	2.9	0.6	4.0	3.6	−1.2
Crude mining processors	48.054	99.3	96.0	95.4	−2.5	1.5	3.3	−4.7	−2.5	−0.6
Crude manufacturing processors less feeds	42.814	104.6	108.0	108.5	(3)	(3)	(3)	3.2	2.8	0.5
Crude nondurables processors	32.093	103.2	105.7	107.0	9.9	2.0	2.3	2.2	3.1	1.2
Crude durables processors	10.721	109.1	115.7	113.6	17.8	3.1	5.0	6.5	2.2	−1.8
Primary processors	100.000	101.4	100.6	100.7	3.4	2.2	2.3	−0.1	−1.0	0.1
Primary agricultural and food processors	15.578	98.1	98.0	98.4	(3)	(3)	(3)	−2.7	1.9	0.4
Primary agricultural processors	13.684	97.7	96.8	97.7	0.9	5.4	−2.3	−4.5	2.6	0.9
Primary food processors	1.894	100.7	107.9	103.7	13.3	9.1	−3.3	12.1	−4.2	−3.9
Primary mining processors	0.940	100.1	101.4	101.3	2.7	1.2	0.3	0.1	1.1	−0.1
Primary manufacturing processors less foods	83.482	102.1	101.1	101.1	(3)	(3)	(3)	0.6	−1.7	0.0
Primary nondurables processors	51.105	102.0	99.1	99.1	2.5	2.0	4.5	−0.2	−3.6	0.0
Primary durables processors	32.377	102.4	104.4	104.4	5.2	0.7	1.1	1.6	1.8	0.0
Semifinished processors	100.000	100.5	102.2	101.9	3.0	1.0	0.0	1.3	0.7	−0.3
Semifinished agricultural and food processors	22.299	98.7	101.2	99.0	(3)	(3)	(3)	2.6	−1.8	−2.2
Semifinished agricultural processors	2.919	97.9	114.1	94.6	−3.3	−1.0	−6.4	34.5	−22.4	−17.1
Semifinished food processors	19.380	98.8	99.5	99.5	1.9	2.8	−1.1	−1.1	1.4	0.0
Semifinished manufacturing processors less foods	77.701	101.0	102.5	102.7	(3)	(3)	(3)	0.9	1.4	0.2
Semifinished nondurables processors	22.684	101.4	103.4	104.0	5.1	0.9	0.7	1.1	2.3	0.6
Semifinished durables processors	55.017	100.8	102.1	102.2	2.9	0.6	0.4	0.8	1.1	0.1
Finished processors	100.000	101.2	101.6	101.9	2.4	0.5	0.4	0.6	0.9	0.3
Finished foods processors	19.785	100.4	100.8	101.0	2.6	1.2	0.9	−0.5	1.0	0.2
Finished mining processors	1.953	103.4	105.3	108.2	7.7	0.0	1.7	1.2	4.6	2.8
Finished manufacturing processors less foods	78.263	101.3	101.7	102.0	(3)	(3)	(3)	0.9	0.8	0.3
Finished nondurables processors	19.588	101.9	103.6	104.1	4.7	0.5	1.4	0.5	2.3	0.5
Finished durables processors	58.674	101.2	101.1	101.3	1.4	0.2	−0.1	1.1	0.2	0.2
Special groupings:										
Crude energy processors	46.413	99.3	95.9	95.3	(3)	(3)	(3)	−4.9	−2.5	−0.6
Crude processors less energy	53.587	103.0	107.3	108.1	(3)	(3)	(3)	4.0	3.5	0.7
Crude processors less agriculture	94.562	101.7	101.7	101.5	(3)	(3)	(3)	−1.0	0.2	−0.2
Crude processors less agriculture and feeds	90.868	101.7	101.5	101.3	(3)	(3)	(3)	−1.1	0.0	−0.2
Crude processors less agriculture, feed, and energy	44.454	104.4	107.7	108.2	(3)	(3)	(3)	3.1	2.8	0.5
Primary energy processors	21.376	102.2	93.3	92.5	(3)	(3)	(3)	−2.4	−10.8	−0.9
Primary processors less energy	78.624	101.2	102.7	103.0	(3)	(3)	(3)	0.7	1.8	0.3
Primary processors less agriculture, food, and energy	63.046	102.1	103.9	104.2	(3)	(3)	(3)	1.6	1.8	0.3
Finished processors less food	80.215	101.4	101.8	102.1	(3)	(3)	(3)	0.9	0.8	0.3

[1] Indexes in this table are derived from the industry indexes in table 5 of the Bureau of Labor Statistics periodical *Producer Price Indexes*. Industries are allocated to stages of process based on inter-industry shipment patterns from the 1977 input/output relationships.

[2] All data are subject to revision 4 months after original publication. Data are not seasonally adjusted.

[3] Not available.

Table 5. Producer Price Indexes and percent changes for net material inputs to industry stage of process and final demand
(June 1987=100)

Grouping[1]	Relative importance, December 1987	Unadjusted Index[2]			Unadjusted percent changes					
		October 1987[2]	January 1988[2]	February 1988[2]	12 months ending February 1988	3 months ending— May 1987	August 1987	November 1987	February 1988	January 1988 to February 1988
Net material input to:										
Primary processors	100.000	102.0	100.0	100.3	5.4	3.5	4.6	−0.3	−2.3	0.3
Foods and agricultural products	12.388	97.1	105.1	107.2	18.7	10.0	−6.3	7.7	7.0	2.0
Crude food and agricultural products	5.634	93.0	101.4	107.8	27.7	18.8	−13.9	12.4	11.0	6.3
Processed foods	6.754	100.8	108.3	106.6	11.6	3.0	0.5	4.0	3.6	−1.6
Energy	37.539	100.8	90.0	89.8	−4.5	3.6	10.3	−6.5	−10.6	−0.2
Goods less food and energy	50.072	104.2	107.0	107.1	10.1	2.0	2.6	3.3	1.8	0.1
Mining products less energy	1.592	97.1	97.7	97.4	0.2	1.2	−0.5	−0.6	0.1	−0.3
Nondurables less food and energy	30.522	103.2	104.8	105.7	8.6	1.7	2.6	2.3	1.7	0.9
Durables	17.958	106.8	111.9	110.8	13.8	2.3	3.0	5.6	2.3	−1.0
Semifinished processors	100.000	101.3	102.5	103.0	5.3	2.4	0.7	0.2	2.0	0.5
Foods and agricultural products	26.290	97.2	96.2	97.7	2.1	5.9	−2.0	−4.7	3.3	1.6
Crude food and agricultural products	24.253	96.9	95.6	97.4	1.7	5.8	−2.0	−5.5	3.7	1.9
Processed foods	2.037	100.6	103.4	101.2	6.5	5.1	−1.1	5.0	−2.3	−2.1
Energy	1.844	102.3	93.8	91.8	−2.9	3.4	9.1	−2.4	−11.7	−2.1
Goods less food and energy	71.865	102.9	105.3	105.4	6.7	0.9	1.5	2.3	1.8	0.1
Mining products less energy	1.003	100.3	102.1	102.1	3.9	1.3	0.7	0.3	1.5	0.0
Nondurables less food and energy	31.444	102.4	104.1	104.6	6.1	0.8	1.6	1.9	1.7	0.5
Durables	39.418	103.4	106.4	106.2	7.4	1.0	1.5	2.7	2.0	−0.2
Finished processors	100.000	101.2	102.6	102.4	3.3	0.7	0.5	1.5	0.6	−0.2
Foods and agricultural products	11.830	100.3	103.1	100.1	1.5	1.4	−1.7	4.5	−2.5	−2.9
Crude food and agricultural products	3.839	102.3	107.9	98.7	−3.8	−3.0	−3.0	15.5	−11.5	−8.5
Processed foods	7.991	99.5	101.0	100.7	4.0	3.5	−1.1	−0.2	1.8	−0.3
Energy	0.726	102.3	93.9	91.9	−2.9	3.3	9.1	−2.6	−11.5	−2.1
Goods less food and energy	87.445	101.3	102.6	102.8	3.5	0.5	0.7	1.1	1.2	0.2
Mining products less energy	0.063	101.3	104.5	104.5	5.4	0.4	1.7	0.8	2.5	0.0
Nondurables less food and energy	30.698	102.0	103.7	104.4	5.5	0.6	1.0	1.8	2.0	0.7
Durables	56.688	101.0	101.9	102.0	2.6	0.6	0.4	0.8	0.8	0.1
Final demand	100.000	101.0	101.1	101.0	(3)	(3)	(3)	0.7	−0.3	−0.1
Consumers	71.917	100.9	100.9	100.6	2.1	1.3	1.0	0.5	−0.7	−0.3
Foods and agricultural products	26.906	99.7	100.8	99.6	0.9	1.3	−0.2	0.8	−1.0	−1.2
Crude food and agricultural products	2.505	100.1	110.6	96.2	−5.8	−1.8	−4.3	20.9	−17.1	−13.0
Processed foods	24.402	99.6	99.9	99.9	1.5	1.6	0.1	−0.9	0.7	0.0
Energy	6.060	100.6	91.1	90.0	−2.6	5.3	9.0	−3.8	−11.9	−1.2
Consumer goods less food and energy	38.950	101.9	102.6	103.0	3.6	0.6	0.6	1.1	1.3	0.4
Mining products less energy	0.003	101.3	102.1	102.1	1.1	−1.5	0.5	2.7	−0.6	0.0
Nondurables less food and energy	22.481	101.8	103.8	104.3	5.0	0.7	1.2	0.6	2.5	0.5
Durables	16.466	102.0	101.1	101.1	1.6	0.6	−0.4	1.9	−0.5	0.0
Capital investment	28.083	101.1	101.7	102.0	2.2	0.3	0.2	0.8	0.9	0.3
Special groupings:										
Final demand less foods and agricultural products	73.093	101.5	101.3	101.5	(3)	(3)	(3)	0.6	0.0	0.2
Final demand less energy	93.910	101.0	101.8	101.7	(3)	(3)	(3)	0.9	0.5	−0.1
Final demand less food and energy	67.004	101.6	102.2	102.6	(3)	(3)	(3)	1.0	1.1	0.4
Consumer goods less energy[4]	91.573	101.0	101.9	101.6	(3)	(3)	(3)	1.1	0.3	−0.3
Consumer goods less foods and agricultural products[4]	62.587	101.7	101.0	101.1	(3)	(3)	(3)	0.4	−0.7	0.1
Nondurable consumer goods less foods[4]	39.687	101.5	101.0	101.2	(3)	(3)	(3)	−0.4	−0.7	0.2

[1] Indexes in this table are derived from the product indexes in table 5 of the Bureau of Labor Statistics publication *Producer Price Indexes*. These indexes are composed of the goods used by the industries in each of the industry stage of process output indexes as shown by the 1977 input/output relationships. These material inputs include only domestic input and do not include any imported materials which may be used.

[2] All data are subject to revision 4 months after original publication. Data are not seasonally adjusted.

[3] Not available.

[4] Percent of final input to consumers.

portionate use is simply the total commodity consumption of industries within the processing stage divided by the total use of the commodity by all industries. The gross commodity weights for the input indexes thus are the 1982 commodity value of shipments, usually from the Census of Manufactures or Census of Mineral Industries, multipled by the proportionate use ratio calculated as above from the input/output tables.

One further step is then required to calculate the final input index weights. The focus of interest in input indexes is in flows into the stage of process, not internal transactions within the stage of process. Therefore, the commodity usage of each processing stage must be reduced by a net input ratio. The net input ratio, calculated from the input/output tables, reflects the proportion of commodity inputs that is received from industries outside the processing stage of interest. For example, the net input ratio for petroleum products would be high in all processing stages except the one that includes the petroleum refining industry.

The total weight available in a given stage of process input index for a single four-digit SIC commodity is:

1. The 1982 total value of four-digit SIC commodity shipments, multiplied by

Exhibit 1. Final allocation of Producer Price Index industries by stage of process

SIC	Industry
	Crude processors
0115	Corn
0116	Soybeans
1011	Iron ores
1021	Copper ores
1031	Lead and zinc ores
1041	Gold ores
1044	Silver ores
1051	Bauxite and other aluminum ores
1061	Ferroalloy ores
1094	Uranium, radium, and vanadium ores
1099	Metal ores, n.e.c.
1111	Anthracite
1112	Anthracite mining services
1211	Bituminous coal and lignite
1213	Bituminous coal and lignite mining services
1311	Crude petroleum and natural gas
1321	Natural gas liquids
1389	Oil and gas field services, n.e.c.
1452	Bentonite
1453	Fire clay
1454	Fuller's earth
1455	Kaolin and ball clay
1459	Clay and related minerals, n.e.c.
1472	Barite
1473	Fluorspar
1474	Potash, soda, and borate minerals
1475	Phosphate rock
1476	Rock salt
1477	Sulfur
1479	Chemical and fertilizer mineral mining, n.e.c.
1481	Nonmetallic minerals (except fuels) services
1492	Gypsum mining
1496	Talc, soapstone, and pyrophyllite
1499	Miscellaneous nonmetallic minerals
2048	Prepared animal feeds, n.e.c.
2298	Cordage and twine
2393	Textile bags
2411	Logging camps and logging contractors
2448	Wood pallets and skids
2611	Pulp mills
2631	Paperboard mills
2646	Pressed and molded pulp goods
2753	Engraving and plate printing
2782	Blankbooks and looseleaf binders
2791	Typesetting
2793	Photoengraving
2794	Electrotyping and stereotyping
2795	Lithographic platemaking services
2812	Alkalies and chlorine
2813	Industrial gases
2816	Inorganic pigments
2819	Industrial inorganic chemicals, n.e.c.
2821	Plastic materials and resins
2823	Cellulosic manmade fibers
2824	Noncellulosic organic fibers
2843	Surface-active agents
2861	Gum and wood chemicals
2865	Cyclic (coal tar) crudes and intermediates, organic dyes and pigments
2869	Industrial organic chemicals, n.e.c.
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2875	Fertilizers, mixing only
2879	Agricultural chemicals, n.e.c.
2893	Printing ink
3274	Lime
3295	Minerals and earths, ground or treated
3313	Electrometallurgical products
3331	Primary copper
3332	Primary smelted and refined lead
3333	Primary zinc
3334	Primary aluminum
3339	Primary nonferrous metals, n.e.c.
3341	Secondary nonferrous metals
3398	Metal heat treating
3399	Primary metal products, n.e.c.
3412	Metal barrels, drums, and pails
3565	Industrial patterns
3624	Carbon and graphite products
	Primary processors
0111	Wheat
0112	Rice
0131	Cotton
0132	Tobacco
0133	Sugar crops
0211	Beef cattle feedlots
0212	Beef cattle, except feedlots
0213	Hogs
0214	Sheep and goats
0241	Dairy farms
0251	Boiler, fryer, and roaster chickens
0252	Chicken eggs
0253	Turkeys and turkey eggs
0254	Poultry hatcheries
0259	Poultry and eggs, n.e.c.
0271	Fur-bearing animals and rabbits
0272	Horses and other equines
0279	Animal specialties, n.e.c.
0912	Unprocessed fin fish
1411	Dimension stone
1422	Crushed and broken limestone
1423	Crushed and broken granite, n.e.c.
1429	Crushed and broken stone, n.e.c.
1442	Construction sand and gravel
1446	Industrial sand

Exhibit 1. Continued—Final allocation of Producer Price Index industries by stage of process

SIC	Industry
	Primary processors (cont)
2046	Wet corn milling
2075	Soybean oil mill products
2076	Vegetable oil mills, n.e.c.
2241	Narrow fabric mills
2269	Finished yarn, raw stock, braided goods and narrow fabric, except knits and wool
2281	Spun yarn, except wool
2282	Texturing, throwing, and winding mill products: cotton, manmade fibers and silk
2283	Wool yarn
2291	Felt goods, except woven felt and hats
2294	Processed textile waste
2296	Tire cord and fabric
2297	Nonwoven fabrics and related products
2299	Textile goods, n.e.c.
2421	Sawmills and planing mills
2441	Nailed wood boxes and shook
2449	Wood containers, n.e.c.
2492	Particleboard
2499	Wood products, n.e.c.
2621	Paper mill products except building paper
2641	Paper coating and glazing
2642	Envelopes
2645	Die-cut paper and board
2651	Folding paperboard boxes
2652	Setup paperboard boxes
2653	Corrugated and solid fiber boxes
2654	Sanitary food containers
2655	Fiber cans, drums and similar products
2661	Building paper and building board mills
2751	Commercial printing, letterpress
2752	Commercial printing, lithographic
2754	Commercial printing, gravure
2761	Manifold business forms
2822	Synthetic rubber
2851	Paints and allied products
2891	Adhesives and sealants
2895	Carbon black
2899	Chemicals and chemical preparations, n.e.c.
2911	Petroleum refining
3031	Reclaimed rubber
3079	Miscellaneous plastic products
3211	Flat glass
3221	Glass containers
3229	Pressed and blown glass, n.e.c.
3231	Products of purchased glass
3241	Hydraulic cement
3264	Procelain electrical supplies
3291	Abrasive products
3292	Asbestos products
3293	Gaskets, packing, and sealing devices
3297	Nonclay refractories
3299	Nonmetallic mineral products, n.e.c.
3312	Blast furnaces and steel mills
3315	Steel wire and related products - mfpm
3316	Cold finishing of steel shapes - mfpm
3317	Steel pipe and tubes - mfpm
3321	Gray iron foundries
3322	Malleable iron foundries
3324	Steel investment foundries
3325	Steel foundries, n.e.c.
3351	Rolling, drawing, and extruding of copper
3353	Aluminum sheet, plate, foil, and welded tube products
3354	Aluminum extruded products
3355	Aluminum rolling and drawing, n.e.c.
3356	Rolling, drawing, and extruding nonferrous metals, except copper and aluminum
3361	Aluminum foundries
3362	Brass, bronze, and copper foundries
3369	Nonferrous foundries, n.e.c.
3423	Hand and edge tools, n.e.c.
3451	Screw machine products
3452	Bolts, nuts, screws, rivets, and washers
3462	Iron and steel forgings
3463	Nonferrous forgings
3469	Metal stampings, n.e.c.
3471	Metal plating and polishing
3479	Metal coating and allied services
3499	Fabricated metal products, n.e.c.
3544	Special tools, dies, jigs, fixtures and industrial molds
3545	Machine tool accessories
3562	Ball and roller bearings
3592	Carburetors, pistons, piston rings, and valves
3599	Machinery, except electrical, n.e.c.
3953	Marking devices
3955	Carbon paper and inked ribbons
	Semifinished processors
0134	Irish potatoes
0161	Vegetables
0171	Berry crops
0172	Grapes
0173	Tree nuts
0174	Citrus fruits
0175	Deciduous tree fruits
0176	Melons
0183	Greenhouse and nursery products
2011	Meat packing plants
2018	Poultry dressing, poultry and egg processing
2023	Condensed and evaporated milk
2026	Fluid milk
2041	Flour and other grain mill products
2044	Rice milling

Exhibit 1. Continued—Final allocation of Producer Price Index industries by stage of process

SIC	Industry
	Semifinished processors (cont)
2061	Raw cane sugar mills
2062	Cane sugar refining
2063	Beet sugar processing
2066	Chocolate and cocoa products
2074	Cottonseed oil mill products
2077	Animal and marine fats and oils
2079	Shortening and cooking oils
2083	Malt and malt byproducts
2084	Wines, brandy and brandy spirits
2085	Distilled liquor, except brandy
2087	Flavoring extracts and sirups, n.e.c.
2092	Fresh or frozen packaged fish
2095	Coffee
2099	Food preparations, n.e.c.
2141	Stemmed and redried tobacco
2211	Cotton broadwoven fabric
2221	Synthetic fiber and silk broadwoven fabric
2231	Wool weaving and finishing
2257	Circular knit fabrics
2258	Warp knit fabrics
2261	Finished cotton broadwoven fabric
2262	Finished synthetic fiber and silk broadwoven fabric
2271	Woven carpets and rugs
2272	Tufted carpets and rugs
2279	Carpets and rugs, n.e.c.
2284	Thread mills
2292	Lace goods
2293	Padding and upholstery filling
2295	Coated fabrics, not rubberized
2394	Canvas and related products
2395	Pleating, stitching, and tucking
2396	Automotive trimmings, apparel findings, and related products
2397	Schiffli machine embroideries
2399	Fabricated textile products, n.e.c.
2426	Hardwood dimension and flooring
2429	Special product sawmills, n.e.c.
2431	Millwork
2434	Wood kitchen cabinets
2435	Hardwood veneer and plywood
2436	Softwood plywood
2439	Structural wood members, n.e.c.
2452	Prefabricated wood buildings and components
2491	Wood preserving
2517	Wood tv and radio cabinets
2519	Household furniture, n.e.c.
2531	Public building and related furniture
2541	Wood partitions and fixtures
2643	Bags, except textile bags
2649	Convered paper products, n.e.c.
2711	Newspaper publishing
2721	Periodical publishing
2732	Book printing
2741	Miscellaneous publishing
2789	Bookbinding and related work
2831	Biological products
2833	Medicinal chemicals and botanical products (in bulk)
2834	Pharmaceutical preparations
2892	Explosives
2951	Paving mixtures and block
2952	Asphalt felts and coatings
2992	Lubricating oils and greases
3011	Tires and inner tubes
3041	Rubber and plastics hose and belting
3069	Fabricated rubber products, n.e.c.
3111	Leather tanning and finishing
3131	Boot and shoe cut stock and findings
3251	Brick and structural clay tile
3253	Ceramic wall and floor tile
3255	Clay refractories
3259	Structural clay products, n.e.c.
3261	Vitreous plumbing fixtures
3262	Vitreous china food utensils
3271	Concrete block and brick
3272	Concrete products
3273	Ready mixed concrete
3275	Gypsum products
3281	Cut stone and stone products
3296	Mineral wool
3357	Nonferrous wire drawing and insulating
3411	Metal cans
3425	Hand saws and saw blades
3429	Hardware, n.e.c.
3431	Metal sanitary ware
3432	Plumbing fixture fittings and brass goods
3433	Nonelectric heating equipment
3441	Fabricated structural metal
3442	Metal doors, sash and trim
3443	Fabricated plate work
3444	Sheet metal work
3446	Architectural and ornamental metalwork
3448	Prefabricated metal buildings
3449	Miscellaneous metal work
3465	Automotive stampings
3466	Metal crowns and closures
3493	Steel springs, except wire
3494	Valves and pipe fittings
3495	Wire springs
3496	Miscellaneous fabricated wire products
3497	Metal foil and leaf
3498	Fabricated pipe and fabricated pipe fittings
3519	Internal combustion engines, n.e.c.
3534	Elevators and moving stairways
3536	Hoists, cranes and monorails
3561	Pumps and pumping equipment

Exhibit 1. Continued—Final allocation of Producer Price Index industries by stage of process

SIC	Industry
	Semifinished processors (cont)
3563	Air and gas compressors
3564	Fans and blowers
3566	Speed changers, drives, and gears
3568	Power transmission equipment, n.e.c.
3579	Office machines, not elsewhere classified, and typewriters
3585	Refrigeration and heating equipment
3589	Service industry machinery
3612	Transformers
3613	Switchgear and switchboard apparatus
3621	Electric motors and generators
3622	Industrial controls
3623	Welding apparatus, electric
3629	Electrical industrial apparatus, n.e.c.
3639	Household appliances, not elsewhere classified
3641	Electric lamps
3643	Current-carrying wiring devices
3644	Noncurrent-carrying wiring devices
3645	Residential lighting fixtures
3646	Commercial lighting fixtures
3647	Vehicular lighting equipment
3648	Lighting equipment, n.e.c.
3671	Electron tubes, all types
3674	Semiconductors and related devices
3675	Electronic capacitors
3676	Resistors for electronic applications
3677	Electronic coils, transformers, and other inductors
3678	Connectors for electronic applications
3679	Electronic components, n.e.c.
3691	Storage batteries
3694	Electrical equipment for internal combustion engines
3699	Electrical equipment and supplies, n.e.c.
3714	Motor vehicle parts and accessories
3724	Aircraft engines and engine parts
3728	Aircraft parts and auxiliary equipment, n.e.c.
3764	Guided missile and space vehicle propulsion units and propulsion unit parts
3769	Guided missiles and space vehicle parts and auxiliary equipment
3822	Environmental controls
3841	Surgical and medical instruments and apparatus
3842	Surgical, orthopedic and prosthetic appliances and supplies
3843	Dental equipment and supplies
3861	Photographic equipment and supplies
3915	Jewelers' materials and lapidary work
3962	Artificial flowers
3963	Buttons
3964	Needles, pins, and fasteners
3991	Brooms and brushes
3993	Signs and advertising displays
3995	Burial caskets
3996	Hard surface floor coverings
3999	Manufacturing industries, n.e.c.
	Finished processors
1081	Metal mining services
1381	Drilling oil and gas wells
1382	Oil and gas exploration services
2013	Sausages and other prepared meats
2021	Creamery butter
2022	Natural and processed cheese
2024	Ice cream and frozen desserts
2032	Canned specialties
2033	Canned fruits and vegetables
2034	Dried and dehydrated fruits, vegetables and soup mixes
2035	Pickles, sauces and salad dressings
2037	Frozen fruits and vegetables
2038	Frozen specialties
2043	Cereal breakfast foods
2045	Blended and prepared flour
2047	Dog, cat, and other pet food
2051	Bread, cake, and related products
2052	Cookies and crackers
2065	Confectionery products
2067	Chewing gum and gum base
2082	Malt beverages
2086	Soft drinks
2091	Canned and cured seafoods
2097	Manufactured ice
2098	Macaroni, spaghetti, and noodles
2111	Cigarettes
2121	Cigars
2131	Chewing and smoking tobacco and snuff
2251	Women's hosiery knit on 300 needles or more and women's knee-high socks
2252	Hosiery, n.e.c.
2253	Knit outerwear
2254	Knit underwear and nightwear
2259	Knitting mills, n.e.c.
2311	Men's and boys' suits and coats
2321	Men's and boys' shirts (except work shirts) and nightwear
2322	Men's and boys' underwear
2323	Men's and boys' neckwear
2327	Men's and boys' separate trousers
2328	Men's and boys' work clothing
2329	Men's and boys' clothing, n.e.c.
2331	Women's, misses', and juniors' blouses, waists and shirts
2335	Women's, misses', and juniors' dresses
2337	Women's, misses', and juniors' suits and coats
2339	Women's, misses', and juniors' outerwear, n.e.c.
2341	Women's and children's underwear and nightwear
2342	Brassieres and allied garments
2351	Millinery

Exhibit 1. Continued—Final allocation of Producer Price Index industries by stage of process

SIC	Industry
	Finished processors (cont)
2352	Hats and caps, except millinery
2361	Girls', children's, and infants' dresses, blouses and shirts
2363	Girls', children's, and infants' coats and suits
2369	Girls', children's, and infants' outerwear, n.e.c.
2371	Fur goods
2381	Fabric dress and work gloves
2384	Robes and dressing gowns, except children's
2385	Waterproof outer garments
2386	Leather and sheep lined clothing
2387	Apparel belts
2389	Apparel and accessories, n.e.c.
2391	Curtains and draperies
2392	Housefurnishings n.e.c.
2451	Mobile homes
2511	Wood household furniture, except upholstered
2512	Upholstered wood household furniture
2514	Metal household furniture
2515	Mattresses, bedsprings and sleep furniture
2521	Wood office furniture
2522	Nonwood office furniture
2542	Metal partitions and fixtures
2591	Drapery hardware and blinds and shades
2599	Furniture and fixtures, n.e.c.
2647	Sanitary paper products
2648	Stationery products
2731	Book publishing
2771	Greeting card publishing
2841	Soap and other detergents
2842	Specialty cleaning, polishing and sanitation preparations
2844	Toilet preparations
2999	Petroleum and coal products, n.e.c.
3021	Rubber and plastic footwear
3142	House slippers
3143	Men's footwear
3144	Women's footwear
3149	Footwear, except rubber, n.e.c.
3151	Leather gloves and mittens
3161	Luggage
3171	Women's and children's handbags and purses
3172	Personal leather goods, except women's handbags and purses
3199	Leather goods, n.e.c.
3268	Pottery products, n.e.c., including fine eathenware food utensils
3421	Cutlery
3482	Small arms ammunition, 30 mm and under
3483	Ammunition, except small arms, n.e.c.
3484	Small arms, 30 mm and under
3489	Ordnance and accessories, n.e.c.
3511	Turbines and turbine generator sets
3523	Farm machinery and equipment
3524	Lawn and garden equipment
3531	Construction machinery
3532	Mining machinery and equipment
3533	Oilfield and gasfield machinery and equipment
3535	Conveyor and conveying equipment
3537	Industrial trucks and tractors
3541	Machine tools, metal cutting types
3542	Metal forming machine tools
3546	Power driven hand tools
3547	Rolling mill machinery
3549	Metalworking machinery, n.e.c.
3551	Food products machinery
3552	Textile machinery
3553	Woodworking machinery
3554	Paper industries machinery
3555	Printing trades machinery
3559	Special industry machinery, n.e.c.
3567	Industrial process furnaces and ovens
3569	General industrial machinery, n.e.c.
3573	Electronic computing equipment
3574	Calculating and accounting machines
3576	Scales and balances except laboratory
3581	Automatic merchandising machines
3582	Commercial laundry equipment
3586	Measuring and dispensing pumps
3631	Household cooking equipment and parts
3632	Household refrigerators and freezers
3633	Household laundry equipment
3634	Electric housewares and fans
3635	Household vaccum cleaners
3636	Sewing machines
3651	Radio and tv's, phonographs, and related equipment
3652	Phonograph records and prerecorded tapes
3661	Telephone and telegraph apparatus
3662	Radio and television communication equipment
3692	Primary batteries, dry and wet
3693	X-ray and electromedical equipment
3711	Motor vehicles and passenger car bodies
3713	Truck and bus bodies
3715	Truck trailers
3716	Motor homes built on purchased chassis
3721	Aircraft
3731	Ship building and repairing
3732	Boat building and repairing
3743	Railroad equipment
3751	Motorcycles, bicycles, and parts
3761	Guided missiles and space vehicles
3792	Travel trailers and campers
3795	Full-tracked armored vehicles
3799	Transportation equipment, n.e.c.
3811	Engineering and scientific instruments
3823	Industrial process control instruments
3824	Fluid meters and counting devices

Exhibit 1. Continued—Final allocation of Producer Price Index industries by stage of process

SIC	Industry	SIC	Industry
	Finished processors (cont)	3914	Silverware, plated ware and stainless steel ware
		3931	Musical instruments
3825	Electrical measuring and integrating instruments	3942	Dolls
3829	Measuring and controlling devices, not elsewhere classified	3944	Games, toys, and children's vehicles, except dolls and bicycles
3832	Optical and analytical instruments	3949	Sporting and athletic goods, n.e.c.
3851	Ophthalmic goods	3951	Pens, mechanical pencils, and parts
3873	Watches, clocks, and watchcases	3952	Lead pencils and art goods
		3961	Costume jewelry and costume novelties, except precious metal
3911	Jewelry, precious metal		

n.e.c. = not elsewhere classified. mfpm = manufactured from purchased materials.

2. The proportionate use of that commodity by the industries in the stage of process, multiplied by
3. The net input ratio for that commodity in that stage of process.

If one is willing to assume that the industries within the relevant stage of process consume all specific products within a four-digit SIC classification proportionately, the total four-digit commodity index could be used directly in calculating an input index. In many cases, that is a reasonable assumption. While the PPI industry index system does not currently contain indexes that are explicitly "wherever made," the primary products commodity indexes published below the four-digit SIC industry indexes in table 5 of *Producer Price Indexes* cover the great majority of commodity shipments. These indexes thus can be used in constructing input indexes without substantially compromising coverage in most cases.

In reviewing the input consumption patterns of stages of process, it was discovered that the consumption of specific products within a general commodity classification was sometimes not proportionate. As an example, within the general classification of motor vehicles, automobiles are more likely to go to personal consumption expenditures and heavy trucks are more likely to go to capital investment. Because the potential for these types of differentiations is virtually endless, the PPI design adopted two guiding principles in looking below the four-digit SIC commodity classification structure:

- A breakout below the four-digit SIC level will occur only when there is clear evidence of different usage patterns and the difference has substantial effect. The effect judgment is subjective but, in general, the PPI design attempted to avoid introducing index complexity when it was unlikely to affect the published input index.
- Breakouts will be based on objective data to the maximum possible extent. This required use of multiple additional data sources, the most important of which were motor vehicle consumption data from the Commerce Department's Bureau of Economic Analysis and petroleum consumption data from the Department of Energy.

The final input indexes thus consist of SIC-based commodity indexes at the four-digit level, and occasionally lower levels aggregated by net input weights on a 1982 value basis.

Input indexes are published for the stages of process beyond the crude category and for final demand. As in the case of the output indexes, a variety of subindexes are also published separating durables and nondurables and other significant product types. The input indexes appear as table 13 of *Producer Price Indexes*, an example of which appears here as table 5.

It should be noted that the subdivisions in the input index design are commodity classifications, which are somewhat different than the industry classifications in the output index design. For example, an industry that produces mostly durable products but some nondurable products will reside completely within durables on the output index structure. In the input index structure, however, the durable products will appear under durables and the nondurable products will appear under nondurables.

Comparison with current indexes

The new industry-based stage of process system outlined above currently is being published along with the traditional commodity-based stage of process structure which has been the focus of Producer Price Index presentation and analysis. The new index system initially cannot be seasonally adjusted because sufficient historical data do not yet exist to allow accurate adjustment.

Clearly, there are significant differences between the current commodity-based stage of process system and the new industry-based system. The most obvious, of course, is that the new industry model has four stages of process while the commodity model has three. The most profound conceptual difference, however, is that the industry-based system is a transaction flow model of input/output indexes

while the traditional stage of process system is a commodity transformation model based on degree of fabrication and end use.

The new industry-based stage of process system allocates industries to one, and only one, processing stage. It then measures price change of inputs to and outputs from the set of industries composing each stage of process. The traditional commodity stage of process structure allocates commodities based on their degree of fabrication and end use. The indexes in the traditional stage of process structure are not specifically designed as either input or output indexes.

Nevertheless, these two assignment mechanisms lead to similar results in many cases. Wheat, flour, and bread are assigned to sequential processing stages in both the traditional commodity and new industry stage of process structures. This reflects both the degrees of fabrication in the production of bread and the way transactions actually flow between industries in the economy.

However, one way in which differences may occur can be seen in the treatment of food grains, such as wheat versus feed grains such as corn. In an index structure based on degree of fabrication, food grains and feed grains look similar. They are both raw agricultural products.

On the other hand, food grains and feed grains are not the same in terms of the way they get to final consumption. Wheat, for example, takes the direct route of wheat-flour-bread mentioned above. In contrast, corn goes to final demand through an additional step because it is primarily input to livestock production, another raw agricultural industry.

In the traditional commodity system, food grains, feed grains, and livestock appear at the same stage of process because they are all raw agricultural products. In the industry-based structure, food grains and livestock appear at the same stage of process because their paths to final demand are similar, and feed grains appear at an earlier stage of process. This reflects the fact that changes in feed grain prices are likely to take longer to get to final demand than would changes in food grain prices.

These important differences in how the new industry-based and the traditional commodity-based stage of process systems are constructed make it difficult to match up indexes from the two systems. In the case of Finished Goods, the third stage in the traditional commodity system, a close match in the industry system does exist, however. The traditional Finished Goods index explicitly defines as finished products those products that go to final demand for personal consumption expenditures and capital investment. The index weights within Finished Goods reflect commodity usage by personal consumption expenditures and capital investment. That is the same conceptual basis as for the industry-based input index for final demand.

This is not to say that the industry-based input index to final demand will behave precisely the same as the current Finished Goods index. The calculation methods are somewhat different and coverage varies to some extent. The overall conceptual designs of the input index to final demand and the Finished Goods index, however, are essentially the same.

At the earlier stages of process in the commodity system there are no precise industry-based analogs. The current PPI Crude Materials index, for example, is neither a conceptual nor operational match to the crude processors output index in the industry system. Neither does the commodity-based Intermediate Materials, Supplies, and Components index have a precise industry-based equivalent.

The major analytic innovation of the industry-based stage of process system, therefore, resides not at the end point, which is similar to the commodity system, but in the index sequences that trace price flows through the economy. In these areas, the precise definition of input and output indexes, the rigorous allocation of industries based on interindustry shipment flows, and the use of net input and net output weighting, can be expected to substantially enhance the analytic power of the Bureau's stage of process system for producer prices. □

FOOTNOTES

[1] John F. Early, "Improving the measurement of producer price change," *Monthly Labor Review*, April 1978, pp. 7–15.

[2] William Nordhaus and John Shoven, "Inflation 1973: The Year of Infamy," *Challenge*, May/June 1974, pp. 14–22.

[3] Two papers prepared by the Washington-based consulting firm of Joel Popkin and Company contributed significantly to the conceptual development of the industry-based stage of process design: "A Stage-Of-Process Price Index Framework," July 1980; and "Recommendations For Detailed Classification and Aggregation Structure For The Revised Producer Price Index In a Stage-Of-Process Framework," May 1983.

[4] For a discussion of the concepts and methodology of industry net output indexes, see Early, "Improving the measurement"; and *BLS Handbook of Methods*, Bulletin 2285 (Bureau of Labor Statistics, 1988), chapter 7, "Producer Prices."