Chapter 14.
Producer Prices

The Producer Price Index (PPI) measures average changes in prices received by domestic producers for their output. Most of the information used in calculating producer price indexes is obtained through the systematic sampling of virtually every industry in the mining and manufacturing sectors of the economy. By contrast, although PPI coverage of the service sector of the economy is expanding, it remains incomplete. The PPI program also includes data from other sectors as well: agriculture, fishing, forestry, utilities (natural gas and electricity), and construction.

As of January 2010, the PPI program included the following indexes:

- Price indexes for approximately 500 mining, forestry, utility, construction, and manufacturing industries, including more than 4,500 indexes for specific products and product categories;
- More than 1,000 indexes covering approximately 150 industries in the services sector and other sectors that do not produce physical products;
- More than 4,000 commodity price indexes organized by product, service, and end use;
- Major aggregate measures of price change, including product durability and stage-of-processing (SOP) classification schemes.

Together, these elements constitute a system of price measures designed to meet the need for both aggregate information and detailed applications, such as following price trends in specific industries and products.

IN THIS CHAPTER

Background

Known until 1978 as the Wholesale Price Index, or WPI, the PPI is one of the oldest continuous systems of statistical data published by the Bureau of Labor Statistics (BLS), as well as one of the oldest economic time series compiled by the Federal Government. When it was first published in 1902, the index covered the years from 1890 through 1901. The origins of the index can be found in an 1891 U.S. Senate resolution authorizing the Senate Committee on Finance to investigate the effects of the tariff laws "upon the imports and exports, the growth, development, production, and prices of agricultural and manufactured articles at home and abroad."[1]

The first index published, with base period 1890–99, was

[1]Senate Committee on Finance, *Wholesale Prices, Wages, and Transportation*, Senate Report No. 1394, "The Aldrich Report," Part I, 52nd Congress, 2d session, March 3, 1893; and U.S. Department of Labor, *Course of Wholesale Prices*, 1890–1901, Bulletin No. 39, March 1902, pp. 205–09.

an unweighted average of price relatives for about 250 commodities. Since that time, many changes have been made in the sample of commodities, the base period, and the method of calculating the index. A system of weighting was first used in 1914, for example, and major expansions of the sample and reclassifications were implemented in 1952 and 1967.

The PPI program's original intent was to measure changes in prices received for goods sold in primary markets of this country. The conceptual framework and economic theory guiding the program's evolution, though more implicit than explicit, concentrated on obtaining the price received by either a domestic producer or an importer for the first commercial transaction.

A major limitation of the traditional methodology was its reliance on judgmental sampling of commodities and producers; that is, commodities and producers were selected without the use of probability-based statistical methods. This practice resulted in a system that was too heavily composed of volume-selling products made by larger firms. Therefore, the PPI did not adequately reflect the behavior of the multitude of products whose individual transaction values might have been small, but that collectively accounted for a sizable portion of the economy. Another result of judgment sampling was that the output of many industries was completely overlooked. Before the transition to the current methodology began, products covered by the PPI program accounted for only about half of the total value of output by the mining and manufacturing sectors. The practice of assigning equal weight to price reports from each producer of a given commodity, regardless of any disparity in size among these firms, may have caused some distortions.

Another limitation of the traditional PPI methodology was its commodity orientation, which, while important, was not compatible with the industry orientation of most other Federal economic time series. The PPI's unique commodity classification scheme made it difficult to compare producer price movements with data for most other economic variables, which at that time were expressed in terms of the Standard Industrial Classification (SIC). With the release of data for January 2004, the SIC was replaced by the North American Industry Classification System (NAICS).

These and other weaknesses in the PPI program, combined with increased development of the theory of price indexes in preretail markets, spurred several changes in terminology and operations during the 1970s. The 1978 change in the program name from Wholesale Price Index to Producer Price Index, for example, was intended to reemphasize the fact that the PPI program continues to be based on prices received by producers from whoever makes the first purchase. Also in 1978, the new nomenclature was accompanied by a shift in the BLS's analytical focus from the All Commodities Price Index (which was popularly called *the* Wholesale Price Index) to the Finished Goods Price Index and the other commodity-based SOP price indexes. This overhaul was phased in gradually, until the transition to the current methodology was essentially completed in January 1986.

Description of Survey

Universe

The PPI universe consists of the output of all industries in the goods-producing sectors of the U.S. economy—mining, manufacturing, agriculture, fishing, and forestry—as well as natural gas, electricity, construction, and goods competitive with those made in the producing sectors, such as waste and scrap materials. Imports are no longer included within the PPI universe; however, the BLS International Price Program publishes price indexes for both imports and exports. (See chapter 15.) Domestic production of goods specifically made for the military is included, as are goods shipped between establishments owned by the same company (termed *interplant* or *intracompany* transfers).

The output of the services sector and other sectors that do not produce physical products also is conceptually within the PPI universe. As of January 2009, the PPI program covered more than three-quarters of the service sector's output, publishing data for selected industries in the following industry sectors: wholesale and retail trade; transportation and warehousing; information; finance and insurance; real estate brokering, rental, and leasing; professional, scientific, and technical services; administrative, support, and waste management services; health care and social assistance; and accommodation.

Prices

One crucial task in designing a price index is defining what constitutes the "price" whose changes are to be measured. A seemingly simple question such as "What is the price of steel?" is unanswerable until it is made more specific.

For industries in sectors other than wholesale and retail trade, the PPI price is defined as the net revenue accruing to a specified producing establishment from a specified kind of buyer for a specified product shipped, or service provided, under specified transaction terms on a specified day of the month. This definition points out several price-determining variables that must be clarified before a cooperating business establishment can report a meaningful price for any of its products to the BLS. For example, if a company charges more for a red widget than a white one, color is one of the price-determining variables; if all widgets sell for the same price, regardless of color, color is not a price-determining variable.

Because the PPI is meant to measure changes in net revenues received by producers, changes in excise taxes—revenues collected on behalf of the Federal, State, and local governments—are not reflected in the index. But changes in rebate programs, low-interest financing plans, and other sales promotion techniques are reflected to the extent that these policies affect the net proceeds ultimately realized by the producer for a unit sale. If an auto manufacturer offers retail customers a rebate of $500, the manufacturer's net proceeds are reduced by $500, and the PPI for new cars would reflect a lower price. However, if an automobile dealer offers its customers an additional rebate whose cost is absorbed by the dealer rather than the manufacturer, the rebate would not

affect the PPI for auto manufacturing, but would be included in the PPI for automobile dealers. (The Consumer Price Index, of course, *would* reflect a customer rebate, regardless of whether it was sponsored by the manufacturer or the dealer.)

In contrast to prices received by the goods sector and most service industries, establishments engaged in wholesale and retail trade purchase goods primarily for resale to other businesses and the consumer. The PPI views wholesalers and retailers as suppliers of services (rather than goods), because little, if any, transformation of these goods takes place. This approach implies that the output of a wholesale or retail trade establishment is the difference between its selling price of a good and the acquisition price for that same item. The resulting gross margin prices reflect the value added by the establishment for services such as marketing, storing, and displaying goods in convenient locations and making the goods easily available for customers to purchase.

The statistical accuracy of producer price indexes depends heavily on the quality of the information voluntarily provided by respondents. BLS emphasizes to cooperating businesses the need for reports of realistic transaction prices, including all discounts, premiums, rebates, allowances, and so forth, rather than list or book prices. The use of list prices in the PPI program has been the exception rather than the rule. Even before the conversion to the current methodology, a BLS survey showed that only about 20 percent of traditional commodity indexes were based on list prices. Inasmuch as the current methodology is more systematic than the older methodology in concentrating on actual transaction prices, the use of list prices is even less frequent now.

Neither order prices nor "futures" prices are included, because the PPI tries to capture the price for output being shipped in that same month, not during some other time. Changes in transportation costs are reflected in industry price indexes only when the producing company delivers the product itself without hiring a third-party shipper.

Most prices refer to one particular day of the month, namely, the Tuesday of the week containing the 13th of the month; this pricing date can range between the 9th and the 15th. There are exceptions for some products, however: for example, a number of farm products are priced on a day of the week other than Tuesday. Although most prices reported to the BLS are the prices of selected producers, free on board (f.o.b.) point of production, some prices are those quoted on organized commodity exchanges or at central markets; this practice is used most often for farm products.

Product change and quality adjustment

The same product usually is priced month after month; therefore, it is necessary to provide a means for bridging over changes in detailed specifications so that only real price changes will be measured. An adjustment is especially important when a product is replaced by a new one. Even when companies report their prices on the basis of altered transaction selling terms (for example, price per 1,000 sold instead of price per 100) or when there is a change in the number or identity of companies reporting to BLS, routine steps are taken to ensure that only true price changes influence the index.

When a company respondent reports a price that reflects a physical change in a product, the BLS uses one of several quality adjustment methods. The *direct comparison method* is used when the change in the physical specification is so minor that no product cost differences result; in this instance, the new price is compared directly with the last reported price under the former specifications and the affected index reflects any price difference.

When changes in physical characteristics of a product cause product cost differences, however, the BLS attempts to make an accurate assessment of real price change by taking account of quality differences systematically. The *explicit quality adjustment method* is especially important for automobiles, machinery, and other types of goods that undergo periodic model changes. For these goods, the usual method of quality adjustment involves the collection of data from companies in the PPI sample reporting on the costs they incurred in connection with the quality change. For example, if the price of a new-model car is $500 more than the previous model year's version and $200 of that increase is due to the extra product cost and normal margin associated with the addition of government-mandated safety equipment, then the real price has risen by only $300. In that case, the change in the passenger car index will reflect only that amount, not the nominal price rise of $500.

Unfortunately, it is not always possible to obtain a value for quality adjustment. If, for instance, the respondent is unable to estimate the difference in production cost between an old item and a new one, or if an explicit comparison between an entirely new product and a previous product is not feasible, then no quality adjustment value will be forthcoming. In such cases, the BLS may have to assume that any difference in price between the old and the new items is due entirely to differences in quality; the BLS, therefore, employs the *overlap method* (if possible). Under this method, the BLS collects prices for both the old and the new item over a designated period and chooses a particular month as the overlap month. The difference between the prices of the two items in the overlap month is assumed to represent the value of the difference in quality between the items. For purposes of calculating the official price index, the BLS uses price changes for the old item through the overlap month, but thereafter follows price changes only for the new item.

In some instances, when the reporter fails to provide information about the resource costs of changes in product attributes, a different yardstick is employed to measure these missing values. For example, it has been very difficult to estimate the value of improvements or deteriorations in products, such as computers and semiconductors, manufactured by companies included in "high-tech" industries. These industries frequently develop new products that are technologically superior, yet cost less to produce. This situation contrasts sharply with those which call for a conventional quality adjustment methodology, which

assumes that increased resource costs for producing a product are necessary for improved performance. The inverse relationship between cost changes and quality changes in high-tech industries requires many different techniques for the construction of an index, especially in the area of quality adjustment.[2] An alternative quality adjustment technique that uses hedonic regressions has been incorporated into PPI adjustment processes.[3] Hedonic regressions estimate the functional relationship between the characteristics embodied in the products in a market and the products' prices. Such regressions yield estimates of "implicit prices" for specified product characteristics; these estimates may be used to value the quality improvement resulting from changes in the various characteristics embodied in a product. The value of the quality improvement can then be removed from the reported price change to obtain a measure of the pure price change that is appropriate for the PPI.

Classification

The PPI family of indexes consists of several major classification systems, each with its own structure, history, and uses. However, indexes in all classification systems draw from the same pool of price information provided to the BLS by cooperating company reporters. The three most important classification structures are (1) industry, (2) commodity, and (3) SOP.

Industry classification. A Producer Price Index for an industry is a measure of changes in prices received for the industry's output sold outside the industry (that is, its net output). Measures—or indexes—of price change classified by industry form the basis of the program. These indexes reflect the price trends of a constant set of goods and services that together represent the total output of an industry. Standardized industry index codes provide comparability with a wide assortment of industry-based data for other economic phenomena, including productivity, production, employment, wages, and earnings.

For more than 20 years, the PPI program made use of the SIC system as the structure for the collection and presentation of price data. However, the system received increasing criticism about its inability to handle rapid changes in the U.S. economy. Recent developments in information services, new forms of health care provision, an expansion of services, and high-tech manufacturing are examples of industrial changes that could not be studied under the SIC system.

The PPI program began publishing price data organized in accordance with NAICS with the release of data for January 2004. Developed in cooperation with Canada and Mexico, NAICS represents one of the most profound changes in statistical programs focusing on emerging economic activities. NAICS uses a production-oriented conceptual framework to group establishments into industries on the basis of the primary activity in which they are engaged. Establishments using similar raw-material inputs, similar capital equipment, and similar labor are classified under the same industry.

In general, there may be as many as three kinds of product price indexes for a given industry. Every industry has primary product indexes that show changes in prices received by establishments in the industry for products made primarily, but not necessarily exclusively, by that industry. The industry under which an establishment is classified is determined by those products which account for the largest share of the establishment's total value of shipments. In addition, most industries have secondary product indexes that show changes in prices received by establishments in the industry for products made chiefly in some other industry. Finally, some industries may have miscellaneous receipts indexes to show price changes in other sources of revenue received by establishments within the industry.

Commodity classification. The commodity classification structure of the PPI organizes products by similarity of end use or material composition, regardless of whether the products are classified as primary or secondary in their industry of origin. This system is unique to the PPI and does not match any other standard coding structure, such as the NAICS or the U.N. Standard International Trade Classification (SITC). The historical continuity of index series, the needs of index users, and a variety of ad hoc factors were important in developing the PPI commodity classification.

The commodity classification system is organized as a hierarchical structure that starts with major commodity groupings (2-digit level of aggregation). Each major commodity grouping includes (in descending order of aggregation) subgroups (3-digit level), product classes (4-digit level), subproduct classes (5- and 6-digit level), item groupings (7-digit level), and individual items (8-, 9-, and 10-digit levels).

Commodity-based SOP classification. Commodity-based SOP price indexes regroup commodities at the subproduct class (six-digit) level, according to the class of buyer and the amount of physical processing or assembling the products have undergone.

Finished goods are defined as commodities that are ready for sale to the final-demand user—either an individual consumer or a business firm. In national income accounting terminology, the Finished Goods Price Index roughly measures changes in prices received by producers for two portions of the gross national product: (1) personal consumption expenditures on goods and (2) capital investment expenditures on equipment. Within the Finished Goods Price Index, the consumer foods category includes unprocessed foods, such as eggs and fresh fruits, as well as processed foods, such as bakery products and meats. The finished energy goods component includes those types of energy to be sold to households—primarily

[2]See James Sinclair and Brian Catron, "An experimental price index for the computer industry," *Monthly Labor Review*, October 1990, pp. 16–24.

[3]Since January 1991, the Bureau has published a computer price index incorporating these new quality adjustment procedures. In addition, series for other high-tech industries related to computers may incorporate these new techniques of adjusting for embodied technological change.

gasoline, home heating oil, residential gas, and residential electricity. The category for consumer goods other than foods and energy includes durables, such as passenger cars and household furniture, and nondurables, such as apparel and pharmaceutical preparations. The capital equipment index measures changes in prices received by producers of durable investment goods, such as heavy motor trucks, tractors, and machine tools.

The category of intermediate materials, supplies, and components consists partly of already processed commodities that require further processing. Examples of such semifinished goods include flour, cotton yarn, steel mill products, and lumber. The intermediate goods category also encompasses nondurable, physically complete goods purchased by business firms as inputs for their operations. Examples include diesel fuel, belts and belting, paper boxes, and fertilizers.

Crude materials for further processing are defined as unprocessed commodities not sold directly to consumers. Crude foodstuffs and feedstuffs include items such as grains and livestock. The crude energy goods category consists of crude petroleum, natural gas to pipelines, and coal. Examples of crude nonfood materials other than energy include raw cotton, construction sand and gravel, and iron and steel scrap.

Many major commodity-based SOP price indexes exist continuously back to 1947. However, some special groupings within this system (such as finished goods less foods and energy) were first calculated in the 1970s and have no historical record before then.

Other. There are several additional classification structures within the PPI family of indexes. For example, producer price indexes are available by durability of product. The allocation of individual commodities to durability-of-product categories (such as durable manufactured goods and total nondurable goods) is based on the U.S. Census Bureau definition: products with an expected lifetime of less than 3 years are classified as nondurable, while products with a longer life expectancy are considered durable goods. Special commodity grouping indexes (such as indexes for fabricated metal products and selected textile mill products) rearrange PPI commodity data into different combinations of price series. In 1986, BLS began publishing indexes that measure changes in prices of material inputs to construction industries.

Most PPIs, whether commodity oriented or industry oriented, are national, rather than regional, in scope. However, regional price indexes are published for a few selected items, such as electric power distribution, for which regional markets are the rule rather than the exception.

Data sources and collection methods

An industry as a whole is the basic starting point for sampling, and each industry has an individually designed and tailored sample. The first step in selecting a sample is to construct a frame that includes all the establishments classified within that industry. The primary source for compiling this list of the universe of establishments is the Unemployment Insurance system, because most employers are legally required to participate in it. Supplementary information from other publicly available lists is used to refine the industry's frame of establishments. For example, for service-sector industries in particular, it is sometimes necessary to use frames other than the list from the Unemployment Insurance system, so that additional establishment data can be analyzed.

The next step in constructing an industry sample consists of clustering establishments into price-forming units. Each member of a price-forming unit must belong to the same industry; establishments in a profit center that belong to another industry are excluded in this step. An establishment is defined as a production entity in a single location. Two establishments may occupy the same or adjacent space if they are separable by physical identification, recordkeeping, or both. Establishments are the units for which production and employment data usually are collected; however, in many cases, establishments are not the appropriate unit for the collection of producer price data. For example, several establishments owned by a single firm may be operated as a cluster and constitute a profit-maximizing center. In such cases, the business maximizes profits for the cluster as a whole, rather than for any one establishment. A profit-maximizing center is then the price-forming unit.

Once a list of price-forming units in an industry has been compiled, the list may be stratified by variables appropriate for that industry. The criterion for identifying the sampling strata is whether price trends may be different for different values of a variable. For example, the size of the production unit may cause differences in production technologies and thus different responses to changes in demand or input costs. Some industries may be characterized by geographically independent markets, which may become strata. Within each stratum, units are usually ordered by size to ensure a proportionate distribution of the sample.

The next step is to assign the number of units to be selected in each stratum. This number may be in direct proportion to the value of shipments by units in each stratum. However, if there is evidence that some strata have more heterogeneity in price change, those strata will be assigned a greater proportion of the total sample than their simple shipment values would require. Each price-forming unit is selected systematically, with a probability of selection proportionate to its size. Ideally, the proper measure of size would be the total revenue of the unit; however, in practice, employment is used as a proxy, because employment information is more readily available.

Once an establishment or cluster of establishments is selected for pricing, a BLS field economist visits the unit to solicit its cooperation. The management of the unit is assured that its assistance is completely voluntary, that any information it agrees to provide to the BLS will be used for statistical purposes only, and that the BLS will hold that information in confidence to the full extent permitted by law.

If the establishment agrees to participate in the PPI program, the BLS field economist proceeds to select those

transactions which are to be priced through time from among all of the unit's revenue-producing activities. A probability sampling technique called *disaggregation* is used to select the transactions. The disaggregation procedure assigns, to each category of items shipped and to each category of other types of receipts, a probability of selection proportionate to the value of the category within the reporting unit. The categories selected are broken into additional detail in subsequent stages, until unique items or unique types of other receipts are identified.

Even after a physically unique item has been selected, it is usually necessary to disaggregate further. If the same physical item is sold at more than one price, then the conditions which determine that price—such as the size of the order, the type of customer, and so forth—also must be selected on the basis of probability. This method for identifying the terms of sale (or transaction terms) both ensures that the same type of transaction is priced over time and eliminates any bias in the selection of the terms of sale. To view a sample PPI survey initiation questionnaire, link to **http://www.bls.gov/ppi/bls_form_1810e.pdf**.

To minimize the reporting burden on cooperating establishments, the disaggregation process just described usually is completed within 2 hours in the initiation interview. Subsequently, reporting establishments agree to supply prices for those items selected on an agreed-upon schedule—usually monthly, but sometimes less often. BLS Form 473P (**http://www.bls.gov/ppi/bls_form_473p.pdf**) is used for reporting producer prices. The degree of cooperation generally remains high, although some companies decline to participate from the beginning and others may drop out of the program.

The publication of company-specific data in identifiable form is prohibited in the statistical and research work of the BLS. Data from firms participating in the PPI survey are protected to ensure the respondent's confidentiality even within the BLS, so that only those few staff members with an absolute need to know can identify a respondent. Furthermore, the BLS has publication criteria that prevent the inadvertent revelation of a respondent's identity to the public through movements in a published index.

The BLS sample of each industry's producers and output must be updated every few years to account for changing market conditions. This procedure, called *resampling*, takes place relatively often for industries marked by dynamic changes in production technology or industry structure. More stable industries need to undergo resampling less frequently. In practice, many of the reporting establishments and products included in the sample may be the same both before and after resampling.

Data processing

Producer Price Indexes are the output of a series of computer subsystems that automate most operations. Although previously limited to relying upon mainframe computers, PPI data processing now relies on microcomputer and local area network (LAN) technologies.

After BLS field representatives secure the cooperation of each reporting establishment, the product descriptions, terms of transaction, prices, and company contact information are entered into the data collection system. The BLS regional and national office staffs are then able to review these data electronically to ensure consistency and completeness. At that point, survey forms that are tailored specifically to each establishment can be prepared. These forms are sent to the reporting establishment on a regular basis.

In the BLS's repricing system, the survey forms returned by the respondents are scanned by an optical character reader, which logs in each form and captures the essential data elements. BLS economists then verify the price information and check for changes that might have been missed by the character reader. The repricing system makes possible the collection and processing of the current prices of more than 100,000 items, as well as any changes in the price-determining characteristics of those items.

Using data from the repricing system, the estimation system calculates indexes and generates a variety of outputs for the BLS Internet site and for printed statistical tables.

These automated data-processing systems for the PPI facilitate the accuracy and timeliness of published PPI data and protect the confidentiality of data supplied by the respondents.

Estimating Procedures

Index calculation

In concept, the Producer Price Index is calculated according to the modified Laspeyres formula

$$I_t = \frac{\sum Q_a P_t}{\sum Q_a P_o} \times 100,$$

where

I_t is the price index in the current period;
P_o is the price of a commodity in the comparison period;
P_t is the current price of the commodity; and
Q_a represents the quantity shipped during the weight-base period.

An alternative formula more closely approximates the actual computation procedure:

$$I_t = \frac{\sum Q_a P_o \left(P_t / P_o \right)}{\sum Q_a P_o \left(P_{t-1} / P_o \right)} \times I_{t-1}.$$

In this form, the index is the weighted average of price relatives—that is, price ratios for each item P_t/P_o. The expression Q_a P_o represents the weights in value form, and the elements P and Q (both of which originally relate to period a, but are adjusted for price change to period o) are not derived separately. When specifications or samples change, the item relatives must be computed by linking (multiplying) the relatives for the separate periods for which the data are precisely comparable.

Weights

If the Producer Price Index system were composed merely of indexes for individual products, with no grouping or summarization, there would be no need to devise a comprehensive weight structure. However, given the desire for numerous indexes for groupings of individual products, there is a need for a weight system that will let more important products have a greater effect on movements of groupings. Without a weighting structure, a 10-percent rise in gasoline prices would have no more significance than a 10-percent rise in greeting card prices.

Product and commodity aggregation weights. A price index for even the most finely detailed commodity or product (usually termed a *cell index)* cannot be calculated without applying a policy for weighting the individual prices reported to the BLS for each item. Reports from some establishments are given more weight than those from others, in accordance with value-of-shipments data provided to BLS field representatives during the initiation interviews with reporting establishments. The data are adjusted by BLS probability selection techniques.

To calculate product and commodity indexes for levels of aggregation above the cell index, the BLS compiles weights on the basis of values of shipments derived from information provided by the Census Bureau and a few other sources.[4] Product index weights (i.e., industry based indexes), however, are based only on values of shipments for those aggregations of products made within the same industry; thus, shipment values for the same products made in other industries are not counted.

Industry net output weights. In compiling price indexes for six-digit NAICS industries, as well as for more highly aggregated industry group indexes, the BLS employs net output values of shipments as weights. Net output values of shipments include only shipments from establishments in one industry to establishments classified in other industries or to final demand. By definition, then, net output values of shipments differ from gross values of shipments by excluding shipments among establishments within the same industry, even if those establishments are owned by separate and independent firms. The meaning of net output depends on the context of the index grouping. The net output for total manufacturing, for example, would be the value of manufactured output shipped outside the entire manufacturing sector—for example, to the construction sector or to consumers. In addition to the value-of-shipments data supplied by the U.S. Department of Commerce's Census of Manufactures, the BLS constructs appropriate net output price indexes through the use of data on detailed industry flows from input-output tables compiled by the Department of Commerce's Bureau of Economic Analysis and from other detailed industry data. Currently, industry price indexes are calculated primarily with 2002 net output weights and input-output relationships.

Weights for traditional commodity groupings. Weights for individual commodity price indexes and, in turn, for commodity grouping price indexes are based on gross values-of-shipments data, as compiled by the Census Bureau and a few other sources. This is in contrast to the net output weights used for industry indexes. These commodity weights represent the total selling value of goods produced or processed in the United States, f.o.b. production point, exclusive of any excise taxes. Since January 1987, values of shipment between establishments owned by the same company (termed *interplant transfers*) have been included in commodity and commodity grouping weights; interplant transfers had been excluded from the weight structure before then.

Commodity and commodity grouping weights are updated periodically to take into account changing production patterns. Since January 2007, these weights have been derived from the total value of commodities reported in the 2002 economic censuses. From January 2002 to December 2006, the 1997 economic censuses were used. Between January 1996 and December 2001, the 1992 economic censuses were the basis for commodity grouping weights. From January 1992 through December 1995, 1987 values of shipments formed the foundation for commodity and commodity grouping weights. From January 1987 through December 1991, 1982 weights were used. Between January 1976 and December 1986, 1972 weights were used. Updated weights are incorporated into the PPI system in a manner that does not require the recalculation of indexes for earlier periods.

BLS does not publish the actual values used as weights, but does publish what is called a *relative importance* for each commodity and commodity grouping. The relative importance of an item represents its basic value weight, including any imputations, multiplied by the relative of price change from the weight date to the date of the relative importance calculation, expressed as a percentage of the total value weight for the all-commodities category. Data showing the relative importance of commodity groupings with respect to the three major stages of processing also are available. The BLS calculates relative importance data for December of each year. Except when entirely new weights are introduced from the latest industrial censuses, or when a sample change affects a given grouping, relative importance data usually change from one December to another solely because of relative price movements. The relative importance of a commodity will rise if its price rises faster than the all-commodities index; conversely, a commodity whose price falls or rises more slowly than the all-commodities index will show a smaller relative importance. The BLS does not, however, use published relative importance data as fixed

[4] Information currently used for calculating weights throughout the PPI family of indexes is taken largely from the following censuses conducted by the Census Bureau of the U.S. Department of Commerce: (1) *Census of Manufactures*, (2) *Census of Mineral Industries* (which includes oil and gas production), (3) *Census of Agriculture*, and (4) *Census of Service Industries*. Other current weight sources include the Energy Information Administration of the U.S. Department of Energy and the National Marine Fisheries Service of the U.S. Department of Commerce.

inputs to the calculation of monthly price indexes. Rather, each commodity's actual weight value fluctuates each month in accordance with its previous price movements. Theoretically, the BLS could calculate and publish a new set of relative importance data every month. Relative importance data for any given commodity grouping also change when the grouping's components are subjected to a sample change.

Commodity-based SOP indexes. For commodity-based SOP indexes, weights are allocated to detailed SOP indexes at the subproduct class (that is, six-digit) level of commodity code series. These detailed SOP indexes are in turn aggregated to broader SOP indexes, such as the index for finished goods, and also to SOP indexes for special groupings, such as the index for finished goods excluding foods and energy. Allocations of subproduct classes to detailed SOP indexes appear in a table of relative importance data published on the PPI home page of the BLS Web site (**ftp://ftp.bls.gov/pub/special.requests/ppi/**).

The value weight of a single subproduct class may be allocated among several different commodity-based SOP categories to reflect different classes of buyers. For example, a portion of the value weight of the citrus fruits index has been assigned to the index for crude foodstuffs and feedstuffs to represent the proportion of citrus fruit sold to food processors; most of the rest of the value weight for this grouping has been assigned to the index for finished consumer foods. The allocations of these value weights to various SOP categories currently are based on input-output studies for 2002 conducted by the Bureau of Economic Analysis. The relative value weights within any subproduct class are the same as the relative value weights for subproduct classes within the commodity classification scheme.

Missing prices

If no price report from a participating company has been received in a particular month, the change in the price of the associated item will, in general, be estimated by averaging the price changes for the other items within the same cell (that is, for the same kind of products) for which price reports have been received.

Rounding policy

Whenever rounding is performed to prepare PPI data for publication, indexes are rounded to the tenths decimal place. To derive monthly or annual average indexes, the BLS bases its calculations on unrounded data; index figures are rounded during the final step only. Before 1991, annual averages for index series based on commodity code data were calculated with the use of the rounded published indexes for the individual months; this is no longer the case. Annual averages for industry and product indexes always have been based on unrounded indexes.

When the BLS displays percent changes in association with any index data, the changes are calculated on the basis of the published rounded indexes.

Seasonal adjustment

PPI series are selected for seasonal adjustment if statistical tests indicate that the series are subject to seasonality and if there is an economic rationale for the observed seasonality. Both indexes and rates of change can be published on a seasonally adjusted basis.

Direct and aggregative adjustment. Commodity code series are seasonally adjusted by applying the X-12 ARIMA procedure, based on a multiplicative model, to data for the latest 8 calendar years.[5] Seasonal factors for the latest full calendar year are used to generate adjusted data for the current year. Commodity-based SOP series and selected subgroup and product class indexes, however, are adjusted by the indirect or aggregative method, which is more appropriate than direct adjustment for broad categories whose component series show strongly different seasonal patterns. Under the aggregative method, first direct adjustment is applied to indexes at lower levels of detail and then the adjusted detail is aggregated up to yield the broad, higher level index. (For detailed series that have not been selected for seasonal adjustment, the original, unadjusted data are used in the aggregation process.)

To derive directly adjusted seasonal indexes, unadjusted, unrounded index data are divided by rounded seasonal factors; the resulting seasonally adjusted index data are then rounded for publication.

Intervention. Some index series show erratic behavior that can cause problems in making an accurate seasonal adjustment. An index series whose underlying trend has undergone a sharp and long-lasting shift will generate distorted results when put through the X-12 ARIMA procedure. Shifts in trend have been observed, for example, when petroleum prices have reacted to major policy changes instituted by the Organization of Petroleum Exporting Countries (OPEC)—a recurring event that takes place at infrequent and irregular intervals. Another kind of distorting change may occur when the seasonal pattern itself changes, as often happens when many firms within an industry decide to change the months of the year in which they will institute their regular price increases.

In order to compensate for those instances in which such distortions are both substantial and identifiable, an established method of intervention analysis, developed at the BLS, sometimes is applied.[6] In recent years, the BLS has used intervention analysis in seasonal adjustment for various energy products, passenger cars, and aircraft. Broad SOP indexes that are adjusted by the aggregative method and that have been affected by such distortions are corrected by applying intervention analysis to those component detailed series in which the problem has been observed.

[5] A general description of how seasonal adjustment procedures typically are applied at the BLS is given in appendix A at the end of this handbook.

[6] See J. A. Buszuwski and S. Scott, "On the Use of Intervention Analysis in Seasonal Adjustment," in *Proceedings of the Business and Economics Section* (Alexandria, VA, American Statistical Association, 1988).

Analysis and Presentation

Analysis

In 1978, as the transition to the current methodology began, the BLS also shifted its analytical focus. Prior to that time, the BLS economic analysis had focused on the index for All Commodities and the index for Industrial Commodities, as well as other indexes for highly aggregated major commodity groupings. During the 1970s, however, when price changes were particularly volatile, it became clear that these indexes were subject to a bias from the multiple counting of price changes. In brief, a multiple-counting bias means that price changes for components that go through many stages of processing have an excessive influence on aggregate index series. This problem is common among highly aggregated traditional commodity groupings because they are calculated from price changes of commodities at several stages of the production process, wherein each individual price change is weighted by its total gross value of shipments in the weight-base year.

To illustrate the multiple-counting problem, suppose that the price of cotton rises sharply. If the price increase is passed through by spinners of cotton yarn, then by weavers of gray cotton fabric, then by producers of finished cotton fabric, and, finally, by shirt manufacturers, the single price increase for the raw material cotton would have been included five times in the All Commodities index and four times in both the Industrial Commodities index and the major commodity grouping index for textile products and apparel. Inasmuch as prices throughout the economy are always changing at different rates, multiple counting can result in rates of change for aggregated price indexes that are highly misleading, both because prices of raw materials tend to be more volatile than prices of finished goods and because gross output values are used as weights for major commodity groups. (Less aggregated commodity grouping indexes that cover only one SOP are not affected by this multiple-counting defect.)

Commodity-based SOP indexes are currently the central classification structure used by the BLS for analyzing producer price trends in the general economy because they minimize the multiple-counting problem. In particular, since 1978, the BLS has stressed the Finished Goods Price Index as the single most important index. This index measures inflation in consumer and capital goods, upon which demand for materials and other inputs depends. Both the Finished Goods Price Index and the Crude Materials for Further Processing Index are largely free of multiple-counting problems, because they are rather strictly defined. The Intermediate Materials, Supplies, and Components Index, however, is a residual category, encompassing everything that cannot fit into one of the other two major SOP categories. This index, therefore, includes several different steps in the production process (three in the preceding example involving cotton) and is affected by the multiple-counting problem.

Presentation

Producer price indexes usually are issued in the second or third week of the month following the reference month. The specific monthly dates for each year are announced prior to the beginning of each calendar year and are determined by the pricing date of the previous month. All PPIs are available at the time of the release, 8:30 a.m., and are considered officially published at that time. Data may be obtained over the Internet or by contacting the PPI program staff.

In 1995, the BLS began posting PPI time-series data, news releases, and technical materials to its Web site (**http://www.bls.gov/ppi**). The PPI home page provides mechanisms that permit users to download, in either HTML or text format, nearly all current and discontinued PPI time-series data. The Web site also provides access to PPI news releases, which focus on the SOP categories and the commodity indexes that lead changes in the SOP indexes. Over time, many PPI reference files, as well as explanatory documents, also have been added to the Web site.

The monthly *PPI Detailed Report* is available on the PPI Web site on the day PPI data are issued. This report includes most indexes within the PPI family of indexes that are not seasonally adjusted. The *Detailed Report* also shows yearly percent changes, unadjusted monthly percent changes, and a few seasonally adjusted indexes and percent changes. In addition, the publication contains a narrative section explaining the most significant price movements within major SOP and industry groups for that month. When appropriate, special technical articles discuss the latest changes in the PPI sample (usually effective in January and July of each year), updates in seasonal adjustment factors or weights, or other changes in methodology or presentation. Occasionally, a longer article provides a more in-depth explanation of the economic background underlying recently observed price movements. This monthly periodical does not include information on actual dollar prices for any item.

Seasonally adjusted data. Because price data are used for different purposes by different groups, the BLS publishes seasonally adjusted, as well as unadjusted, data each month. For economic analysis of price trends, seasonally adjusted data usually are preferred because they are designed to eliminate the effect of changes that normally occur at about the same time and with about the same magnitude each year. Among such changes are price movements resulting from (1) normal weather patterns, (2) regular production and marketing cycles, (3) model changeovers, (4) seasonal discounts, and (5) holidays. Data that are seasonally adjusted can therefore reveal long-term or cyclical trends more clearly.

The economic analysis that the BLS conducts for PPI data normally is based on seasonally adjusted data. Unadjusted data are used for analysis when a series has not been selected for seasonal adjustment. Because seasonal adjustment is a tool for enhancing economic analysis, index series that the BLS deemphasizes for the purpose of economic analysis are deliberately not calculated on a seasonally adjusted basis. In particular, those producer price indexes which are subject to the multiple-counting problem described earlier, such as the All Commodities index and the indexes for the major

commodity groups, are not available on a seasonally adjusted basis.

The unadjusted versions of PPI data are of primary interest to those who need information that can be more readily related to the dollar values of transactions. For example, unadjusted data are used in price escalation clauses of long-term sales or purchase contracts.

The latest 5 years of seasonally adjusted data are revised at the beginning of each year. The revision is carried out in addition to the 4-month revision, discussed next, which applies to all PPI data, seasonally adjusted or unadjusted. The newly revised 5-year histories for seasonally adjusted data are made available with the release of January data in mid-February of each year.

Revised data. All unadjusted PPIs are routinely subject to revision only once, 4 months after their original publication, to reflect late reports and corrections by company respondents. Once revised, indexes are considered final. The BLS does not use the term "preliminary" to describe the originally released PPI numbers, because "preliminary" usually describes data that are based on a small sample of information and that typically are subject to large revisions. When PPIs are first released, they typically are based on a substantial portion of the total number of returns that eventually will be received from respondents; hence, subsequent revisions normally are minor, especially at the more highly aggregated grouping levels. "First published" and "originally released" are more appropriate terms than "preliminary." Changes in previously published data caused by a processing error are so indicated in a notice on the PPI Web site or in the *PPI Detailed Report*; such occurrences are rare.

Calculating index changes. Movements of price indexes from one month to another usually should be expressed as percent changes, rather than as changes in index points, because the latter are affected by the level of the index in relation to its base period, while the former are not. Each index measures price changes from a reference period defined to equal 100.0. The current standard base period for most commodity-oriented PPI series is 1982, but many indexes that began after 1982 are based on the month of their introduction. The following tabulation shows an example of the computation of index point changes and percent changes based on data for December 2006 and December 2007:

Index point change

December 2007 Finished Goods Price Index	170.4
Minus December 2006 Finished Goods Price Index	160.5
Equals index point change	9.9

Index percent change

Index point change	9.9
Divided by December 2006 Finished Goods Price Index	160.5
Equals	0.062
Multiplied by 100	0.062 × 100
Equals percent change	6.2

An increase of 20 percent from the base period in the Finished Goods Price Index, for example, is shown as 120.0 and can be expressed in dollars as follows: "Prices received by domestic producers of a systematic sample of finished goods have risen from $100 in 1982 to $120 today." Likewise, a current index of 166.7 would indicate that prices received by producers of finished goods today are two-thirds higher than in 1982.

From time to time, the BLS updates its standard base period. The change to the base 1982 = 100 occurred in January 1988; before that, 1967 was used as the standard base year. For reasons explained earlier, any change in the standard reference base period leaves calculations of the percent change for any index virtually unaffected. However, care must be taken to ensure that indexes referring to one base period are not being incorrectly compared against indexes for the same series expressed with reference to a different base period.

Uses and limitations

Producer Price Indexes are used for many purposes by government, business, labor, universities, and other kinds of organizations, as well as by members of the general public.

Economic indicator

The Finished Goods Price Index is one of the Nation's most closely watched indicators of economic health. Movements in this index often are considered to presage similar changes in inflation rates for retail markets, as measured by the BLS Consumer Price Index. Still, there are many reasons that short-term movements in the PPI and the CPI may diverge. For example, by definition, the Finished Goods Price Index excludes services, which constitute a major portion of the CPI. Similarly, the PPI does not measure changes in prices for imported goods, whereas the CPI includes imports. Conversely, the CPI does not capture changes in capital equipment prices, a major component of the Finished Goods Price Index. Finally, large swings in producer prices for foods and other items may be considerably dampened by the time retail prices are measured.

Other commodity-based SOP price indexes besides the Finished Goods Price Index also are used for general economic analysis. Because prices for food and energy have tended to be so erratic in recent years, some economists prefer to focus attention on an index that measures prices for finished goods other than foods and energy as a better measure of the so-called core or underlying rate of inflation. The Index for Intermediate Materials, Supplies, and Components is followed closely as an indicator of material cost pressures that may later appear in the Finished Goods Price Index or the CPI. The Index for Crude Materials Other than Foods and Energy is quite sensitive to shifts in total demand and can be a leading indicator of the state of the economy; its limited scope, however, makes it less reliable as an indicator of future inflation in general. The SOP structures are especially well suited for analysis of the inflation transmission process.[7]

[7] See Jonathan Weinhagen, "An empirical analysis of price transmission by stage of processing," *Monthly Labor Review*, November 2002, pp. 3–11

Deflator

Producer Price Index data for capital equipment are used by the U.S. Department of Commerce to calculate the gross domestic product (GDP) deflator and many of its components. PPI data at all levels of industry and commodity aggregation can be used to deflate dollar values expressed in current dollars to constant-dollar values for a variety of economic time series, such as inventories, sales, shipments, and capital equipment replacement costs. To illustrate the deflation concept, suppose that nominal values of shipments for a given industry have doubled over a 10-year span. If the PPI for that industry has tripled over the same span, then the "real" (that is, inflation-adjusted) value of shipments for that industry actually has declined; higher prices would more than account for the doubling of dollar shipment values, and physical volume would have implicitly fallen.

Private business uses

Private business firms use PPI data to assist their operations in a variety of ways, in addition to using the data for general economic analysis or deflation as just discussed. PPIs frequently are cited in price escalation clauses of long-term sales or purchase contracts as a means of protecting both the buyer and the seller from unanticipated surges or drops in prices. For example, an escalation clause might specify that the price for *x* number of widgets being sold by company *A* to company *B* each year will go up or down by a specified fraction of the percentage of change in material costs, as measured by one or more specified producer price indexes (often in conjunction with the change in a measure of labor costs, such as the Employment Cost Index). Hundreds of billions of dollars in contract values are tied to PPIs through these price escalation clauses, which are common in both government and private-sector contracts.

Private companies also can use PPI data to compare changes in material costs they incur against changes in the PPI for the material in question. By the same token, they can compare changes in the prices they charge for their own output with changes in the PPI for the same kind of product. PPI information also is employed in econometric models, in forecasting, in market analysis, and in academic research. PPIs are frequently used in last-in, first-out (LIFO) inventory accounting systems by firms wishing to avoid the kind of "phantom profits" that might appear on their books with a first-in, first-out (FIFO) system.

Discontinued data

Those wishing to follow PPI data for a particular series over a prolonged timespan should be aware that the BLS is more likely to discontinue highly detailed indexes than aggregated indexes. During the industry resampling process described earlier, for example, an industry-level index commonly maintains continuity, whereas indexes for detailed products within that industry may be discontinued and replaced by items that are new or that previously had not been selected for tracking. BLS publication of finely detailed indexes also may be vulnerable to temporary suspension of publication, due to low response rates. When a detailed index disappears, either temporarily or permanently, the BLS routinely recommends that users who had been following that index either choose another detailed index within the same product grouping or switch their attention to a more highly aggregated grouping index.

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