

Chapter 15. International Price Indexes

Background

The International Price Program (IPP) produces and disseminates data on the Nation's foreign trade. The IPP, as the primary source of data on price change in the foreign trade sector of the U.S. economy, publishes monthly indexes on import and export prices of U.S. merchandise and services.

In 1961, a report on Federal Price Statistics prepared by the National Bureau of Economic Research (NBER) for Congress' Joint Economic Committee suggested that responsibility for compilation of import and export price indexes be assigned to a federal statistical agency "to obtain the attention and resources for these indexes that we believe are essential." A further study undertaken for NBER by Professors Irving Kravis and Robert Lipsey gave more impetus to the project. In their study, "Price Competitiveness in World Trade," Kravis and Lipsey outlined the need for such measures and the feasibility of producing them. During this time, the Bureau's Division of Price and Index Number Research, largely because of its expertise in the development of other price measures, had also begun research on the feasibility of producing import and export price indexes. The International Price Program was a natural result of this research and was established in 1971.

The IPP produced its first annual international price indexes in 1973. Largely as a response to changing international economic conditions and the need on the part of both the Federal Government and the private sector to obtain these data on a more timely basis, collection and publication of international price indexes were begun on a quarterly basis in 1974. The IPP increased the commodity area coverage and detail of its indexes as more samples were initiated.

This expansion attempted to meet the needs of the user public while moving toward the goal of producing indexes that covered all goods. In early 1983, the IPP published its first general index for all imports for the quarter ended in December 1982. An index for all exports was published in early 1984 for the December quarter of 1983.

Once full coverage in the import and export goods categories was available, the Office of Management and Budget in 1982 placed the IPP indexes on its list of Principal Federal Economic Indicators together with the Consumer Price Index and Producer Price Index. The IPP continued to expand by introducing selected services indexes. Various transportation services indexes were added to the IPP in the late 1980s. Research is continuing on other international services as data and resources become available.

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Beginning in 1989, BLS began producing a limited number of indexes on a monthly basis. This was done primarily to permit the Bureau of the Census to publish their monthly merchandise trade statistics on an inflation-adjusted basis. The Census Bureau discontinued publishing its unit value indexes in July 1989 and began publishing constant dollar merchandise trade values deflated for the most part by the IPP measures in March 1990. With the release of March 1992 data, IPP added import locality of origin indexes, and in January 1993 began monthly publication of the major merchandise indexes.

Concepts

A central question in international economics is "how will trade affect the production of goods and services in the economy?"¹ This question leads immediately to the requirement that real or "inflation-adjusted" trade be measured. However, due to the variety and complexity of the goods and services involved in trading, it is not possible to measure the quantity of those goods and services in physical

¹Note that even if there is no change in aggregate production, trade can affect the mix of goods and services produced.

units. Instead, the quantities are approximated via deflation by dividing the aggregate export sales and import purchases by the export and import price indexes, respectively.

Subsequently, one can obtain a measure of real net exports (RNE) by subtracting the value of imports from the value of exports, after deflation to constant dollars. The current value of import flows ($R_{m,t}$) is deflated by the current import price index ($P_{m,t}$), and the current value of export flows ($R_{x,t}$) is deflated by the current export price index ($P_{x,t}$)

$$RNE_t = \frac{R_{x,t}}{P_{x,t}} - \frac{R_{m,t}}{P_{m,t}}$$

IPP import and export price indexes are produced primarily to deflate the various foreign trade statistics produced by the Bureau of the Census and the Bureau of Economic Analysis (BEA). As a result, IPP uses the Bureau of the Census concept of imports and exports which, with some minor adjustments, can also be used to deflate the foreign trade sector using Balance of Payments (BOP) or National Income and Product Accounts (NIPA) definitions. Export statistics measure the value of the total physical movement of products out of the United States. They include products exported from the U.S. customs territory, U.S. customs bonded warehouses, or U.S. foreign trade zones. Import statistics measure the value of products of foreign origin, goods of domestic origin returning to the United States unchanged, and goods assembled overseas with components originating in the United States. A good is considered a general import when it passes into a U.S. customs territory, a U.S. customs warehouse, or a U.S. foreign trade zone.

In addition to the price indexes for goods, IPP also constructs selected services indexes. These indexes include import and export services indexes, as well as international services indexes. Import and export services indexes conform to BOP definitions and measure the price trends for payments and receipts between the U.S. (including its territories such as the Virgin Islands and Puerto Rico) and foreign residents for international services transactions. A U.S. resident includes corporations, businesses, and individuals, but does not require either specific U.S. ownership or citizenship. International services indexes measure price trends for international services transactions regardless of the residency of the service providers and purchasers.

Data Sources

The target universe of the import and export price indexes consists of all goods and services sold by U.S. residents to foreign buyers (exports) and purchased from abroad by U.S. residents (imports). Ideally, the total breadth of U.S. trade in goods and services in the private sector would be represented in the universe. Items for which it is difficult to obtain consistent time series for comparable products, how-

ever, such as works of art, are excluded. Products that may be purchased on the open market for military use are included, but goods exclusively for military use are excluded. Currently, only selected services for transportation areas are included.

The import merchandise sampling frames are obtained from the U.S. Customs Service. The export merchandise sampling frames are obtained from the Canadian Customs Service for exports to Canada and from the Bureau of the Census for exports to the rest of the world. Data sources for services are researched and developed separately for each category. For example, the Department of Transportation provides the sampling frames for the air freight price indexes. The reference period for a sampling frame is generally the most recent available 12 months.

Sampling

The objective of the International Price Program sample design is to provide an unbiased measure of price change in each published index. A multistage design is used to select up-to-date specific import and export items that can be priced over time. The first stage selects establishments independently within each broad product category (stratum); an establishment can be selected in more than one category. The second stage selects detailed product categories within each establishment/stratum pair and is designed to support all of the IPP classification systems (described in the Publications section of this chapter). Each pair can be sampled multiple times, allowing for more quotes to be selected from detailed product categories with larger proportions of the stratum value traded by the establishment. Subsequent stages of subselection are conducted until a unique item that can be priced over time is achieved. The first two stages are completed at BLS using the appropriate sampling frame, and the final stages take place during the interview with the respondent.

The sample design is responsive to the constraints of both cost and respondent burden. Budget constraints determine the maximum number of establishments selected in a sample, and respondent burden limits² control the number of items priced by each establishment.

Unfortunately, the majority of detailed product categories sampled in the second stage do not contain items that are traded frequently enough to be consistently priced over time. IPP receives initial price data for approximately 40 percent of the sampled establishment/detailed categories.

The earliest IPP samples were based on judgmental selection of establishments and items whose price movement was considered representative of the respondent's other items in the same detailed product category. IPP began using a

²Burden limits are usually determined by the establishment's relative size, diversity, and consistency of trade in the stratum. These assignments, however, can be negotiated with the respondent.

probability sampling technique³ for the first two stages in 1976 and for the subsequent stages in 1982. In order to maximize productivity, efforts are made to ensure that frequent traders make up 95 to 99 percent of each sample.

Starting in 1989, IPP divided the import and export merchandise universes into halves. Samples for one import half and one export half are fielded each year, so both universes are fully re-sampled every 2 years. The sampled products are priced for approximately 5 years until they are replaced by a fresh sample of the same half-universe. Generally, each index is composed of two samples.

As of 1991 a selected item can be represented in the indexes up to 10 times per sample, an increase from a maximum of two times for older samples. This allows items with larger shares of the detailed product category to have more weight in the indexes and reduces the number of items for which the respondent needs to provide monthly prices.

Pricing

Items, item specifications, and initial prices are collected by the field economist during the interview. Most subsequent pricing is conducted by the BLS national office on a monthly basis for goods and a quarterly basis for services. The reporters can choose from different reporting mechanisms including surface mail, fax, or telephone. If data clarification is required or the form is not returned by the deadline, the firm may be contacted by phone.

Most of the prices that are used to calculate price indexes for the International Price Program are actual transaction prices in the foreign trade market. Respondents are asked to provide prices for actual transactions that occur as close as possible to the first day of the month. Other types of prices such as estimated or list prices may be accepted for calculation in the indexes, but prices for actual transactions that occur at any time during the month are preferable to non-transaction prices. Estimated prices are estimates of the price that would have been charged for a transaction as close to the beginning of the month as possible. Whenever discounts apply to the actual, estimated, or list price, they are deducted from the reported price to calculate a net price. The major types of discounts are cash, distributor, and quantity.

Generally, IPP accepts prices associated with intra-company transfers and production sharing. Intra-company transfers are typically items that are traded between affiliates or entities of the same company. IPP, however, only uses intra-company transfer prices that are market-based or market-influenced. Production sharing occurs when the responsi-

bility for producing a product is shared between either two (or more) independent companies or various affiliated units of the same company that are located in different countries.

Average prices are not generally accepted in the IPP survey, with the exception of selected commodities that are priced using secondary source data. Petroleum, ocean tanker freight, and grains data are examples of secondary source indexes that use weighted average prices in index calculation.

Import and export prices can be quoted in many different price bases. For imports, the preferred price basis is f.o.b. (free on board) foreign port. The f.o.b. foreign port price is the price free on board at the foreign port of exportation before insurance, freight, or duty are added. For exports, the preferred price basis is f.a.s. (free alongside ship), the price of the item at the U.S. port of embarkation. This includes insurance charges plus the cost of transporting the good from the place of manufacture to the exit port. In some product areas such as finished manufactures, firms frequently provide prices only on an f.o.b. factory basis. Although the f.o.b. foreign port and f.a.s. price bases are preferred, IPP will use other price bases such as cif for imports as long as the firms can provide consistent price series.

The goal of the International Price Program is to produce valid price indexes that track the price trends for consistent items over time. To do this, IPP sends respondents a pricing form that contains all the current information about the item, including a detailed item description and the trade factors. Item descriptions indicate the physical characteristics of an item and can change over time. The trade factors associated with each item include the units priced, the country of origin/destination, the discount structure, the class of buyer or seller, and for imports, the duty amount when appropriate. Like the item description, the trade factors can vary and significantly affect the price. Any change in an item's description or the trade factors is reviewed to determine their significance.

If the changes are substantive item substitution is made by linking. This insures that the index reflects only actual or "pure" price changes and is not moved by unadjusted quality changes. The linking principle is to calculate what the "old" item would trade for in the new time period. To do this, reporters are asked for the dollar amount attributed to the change. This value is then subtracted from the "new" item in the current time period.

When a completely new item series is added to a classification grouping, linking is not feasible. Instead, the relative importance of each item in the classification group is redistributed to include the new item, and the historical movement of the index is used to begin the series for the item. A change in the relative importance of an item also occurs when other items are dropped from an index without replacement.

An item may be replaced if the composition of the old item differs from the newly available item to the degree

³The technique used is commonly known as a systematic probability proportionate to size design.

that the comparison of the prices is not feasible. Each replacement item must be as closely related to the original item as possible and must fall into the same detailed item category.

When an item should be replaced but a new item is not available or the expected discontinuation date of the item being replaced is within the next 18 months, the International Price Program discontinues the item. Data on the deterioration of coverage is used to refine future sampling allocations to publishable strata.

Index Construction

The import and export price indexes are of the Laspeyres type and use two aggregation methodologies. At the lowest level, items are weighted within establishment/detailed categories. These relatives are combined across establishments and then aggregated to lowest level stratum indexes.

$$P_{ht} = \frac{\sum_k \sum_j \sum_i w_{kt} w_{jt} w_{it} \left(\frac{P_{it}}{P_{i0}} \right)}{\sum_k \sum_j \sum_i w_{kt} w_{jt} w_{it}}$$

where:

P_{ht} is the price index at period t for lowest level stratum h ,

w_{kt} is the weight at period t of detailed product category k within stratum h ,

w_{jt} is the weight at period t of establishment j within detailed product category k ,

w_{it} is the weight at period t of item i within establishment j and detailed category k , and

P_{it}/P_{i0} is the price relative of item i from period t to base period 0 .

The weights used for the lowest level stratum indexes are based on data from several samples and are derived from the dollar values on the sampling frames, divided by the corresponding probabilities of selection determined by the sample design. Each establishment/detailed category pair (collectively, the “weight group”) is considered to be a relatively homogeneous collection of items. Therefore, each set of items selected within a weight group also represents non-selected items within the weight group.

The index formula above is used for lowest level stratum price indexes as of January 1997. In prior years items were equally weighted within the detailed product category. Adding sampling weights at the item and company levels gives

a more accurate measure than equally weighting because the true importance of the largest companies and their products is reflected in the sample design and the estimator.

At the next step, lowest level stratum indexes are aggregated to successive upper index levels.

$$P_{Ht} = \frac{\sum_h w_{ht} P_{ht}}{\sum_h w_{ht}}$$

where:

P_{Ht} is the price index at period t for upper level index H , w_{ht} is the weight at period t of child⁴ index h ,

P_{ht} is the price index at period t for child index h .

The weights used for the upper level indexes are based on trade value figures compiled by the Bureau of the Census for the base year. Beginning with January 1997, the base year weights are from 1995 trade values. Price indexes from 1993 through 1996 use 1990 weights, indexes from 1985 through 1992 use 1985 weights, and data prior to 1985 use 1980 weights.

Publication

All reporting is voluntary and confidential; therefore, no index is published in such a way as to reveal the name, price, or price behavior of a particular respondent. A publishable index must contain three or more companies with at least one item having a usable price. For the vast majority of indexes, there are considerably more than three companies responding. Price data are collected every month for 20,000 to 25,000 goods and every 3 months for 1,500 to 2,000 service items.

The primary publication of the IPP is the monthly news release. The release contains summary text, import and export price indexes, and a technical note. The summary text provides a general description of price movements for aggregate merchandise and services areas as well as for imports by locality of origin.

The merchandise indexes are published using three different classification systems - Harmonized (HS), Bureau of Economic Analysis End Use (End Use), and the Standard International Trade Classification (SITC), Rev. 3. The HS, released by the Customs Cooperation Council, was designed to be an international system used for Customs tariff, statistical, and transport documentation purposes. The HS contains homogeneous product groups, is compatible with other classification systems, is familiar to survey respondents who provide import and export prices to the IPP since it is used for customs documentation, and is used for sampling,

⁴A child stratum is at one less level of aggregation than index H .

weighting, and collection of data. The SITC, also a commodity based system, was created by the United Nations and was the first classification system used by the International Price Program to publish its price indexes.

The SITC contains historical data of export and import price indexes going back to 1974 for some categories (as compared to 1993 for HS). The End Use system created by the BEA was designed to categorize items by use or consumption rather than by the more traditional stage of production. The End Use system also has historical data available, and aggregates at the upper level which are more equally weighted than the SITC. In addition, the End Use system is used for demand analysis and to deflate the national accounts.

The international services price indexes are published using two other definitions since services are not covered in the classification systems used for merchandise trade. The first definition is a BOP basis which represents transactions between United States residents and foreign residents. The second is an International basis which represents all transactions with U.S. importers or exporters, regardless of nationality.

The locality of origin indexes for imports cover merchandise trade and are classified by industrial origin. The indexes are calculated and published for Japan, Canada, the European Union, and the Asian Newly Industrialized Countries. In addition, these indexes are grouped according to status as "developed" or "developing." The indexes are available on a quarterly basis beginning December 1990 and on a monthly basis since January 1993.

The technical note included in the news release describes the classification systems and the methods used to calculate import and export price indexes. The technical note also describes guidelines for price data collection, the IPP revision policy, and appropriate uses of the indexes.

Historical index and percent change tables prepared at a more detailed level than the indexes shown in the monthly news release are available upon request. Import and export price indexes are published for a wide variety of commodity areas with several levels of detail. Currently, IPP publishes indexes for commodity areas with at least \$2 billion in annual import trade value or at least \$1.6 billion in annual export trade value based on 1995 data. Commodity areas that represent areas of trade with smaller dollar values are incorporated into the calculation of higher level indexes, but typically are not published separately.

IPP data users can access the Internet at <http://www.bls.gov> for a variety of information from the Bureau of Labor Statistics. The IPP homepage contains an electronic version of the news release as well as links to the LABSTAT database which contains the complete set of available data. All of the index series are also available for purchase on diskettes in an ASCII or spreadsheet format.

The Bureau's fax-on-demand service is another means to access data from the news release. The phone number is

(202) 691-6325. For this service, the news release is divided into five parts:

- 2810 Text
- 2815 End use and locality of origin tables
- 2820 SITC tables
- 2825 Services tables
- 2890 Technical note

In addition, users of IPP data can be added to a mailing list at no charge for the news release or any of the detailed tables.

Uses and Limitations

As mentioned above, the primary reason for producing import and export price indexes is to deflate (or adjust for inflation) the value of U.S. foreign trade. Deflating trade flows is a means of breaking down the change in the value of import and export trade into changes in prices versus changes in quantity. The import and export price indexes are used to deflate the monthly trade figures produced by the Bureau of the Census as well as the quarterly National Income and Product Accounts. These adjustments are crucial to estimating the real output of the U.S. economy as well as real consumption and real investment. Import and export price indexes have a number of additional uses, including measuring domestic inflation, studying long-term price trends, as inputs to forecasting future prices, as inputs into trade contracts and trade legislation, and in replacement cost accounting.

Foreign sector price statistics are also valuable when doing various elasticity studies. Price and income elasticities can be calculated in conjunction with one another in order to distinguish how much of trade volume changes are attributable to price effects and how much to income effects. Price elasticities measure how the quantity traded responds to price changes as measured by the import and export price indexes. Income elasticities measure how trade responds to changes in the real value of national income.

Another use of import and export price indexes is as an input to measuring U.S. industrial competitiveness. Different forms of economic competitiveness can be measured by calculating terms of trade indexes, deriving export price comparison ratios, or calculating import and export foreign currency indexes. Individual traders can look at the relevant import or export price index in their industry to compare how their price changes compare to average price changes.

One final use for import and export price indexes is to analyze the effect of exchange rates on prices. Pass-through rates can be calculated using the price indexes to measure how much of an exchange rate change is passed-through to either an import price or an export price.

Producing indexes used primarily as deflators, however, affects the interpretation of the indexes when used for other

purposes. For example, import price movements can often be an indicator of future domestic inflation because many final goods and inputs to domestic production are imported. Because import price indexes only measure the value of a product at a port (either domestic or foreign), special care must be taken when using these data to assess the effect of import prices on domestic inflation levels. First, the f.o.b. (free on board) foreign port series excludes international freight charges. Second, both an f.o.b. foreign port and a c.i.f. (cost, insurance, freight) U.S. port price series exclude duty as well as costs associated with domestic intermediaries (e.g., wholesalers and retailers). All of these factors may affect the final selling price. For purposes of deflating imports, however, duties are excluded from prices before the indexes are calculated. This exclusion, therefore, affects any use of the indexes to measure price changes that focuses on the entire transaction price, which would include any taxes levied.

Import and export price indexes are not seasonally adjusted. Consequently, price trends for commodities with seasonal patterns may require longer time spans for proper analysis.

Another issue concerns the appropriate exchange rate to use in converting from a foreign currency price to a dollar price, when items are priced in foreign currencies (approximately 15 to 20 percent of non-oil imports currently are priced in foreign currencies). The International Price Program uses an exchange rate factor which represents an average for the month immediately preceding the pricing month. How closely this figure approximates the exchange rate actually used in the valuation of the item depends upon the volatility of exchange rate movements. IPP will continue to assess these as well as other issues as they arise concerning the construction of import and export price indexes to ensure that measurement objectives are met.

Technical References

Ferguson, Gwyn R. and Tamara M. Ciapponi. "A Response Model for the International Price Program." *Proceedings of the Joint Statistical Meetings*, Toronto. 1994.

Kravis, Irving B., and Robert Lipsey. *Price Competitiveness in World Trade*. National Bureau of Economic Research, New York. 1971.

Lang, Larry and Jeanie Mah. "Accommodating Differing Classification Systems in a Sample Design." Interna-

tional Conference on Establishment Surveys, Buffalo. 1993.

National Bureau of Economic Research, Price Statistics Review Committee. "Report on the Price Statistics of the Federal Government." New York. 1961.

U. S. Department of Labor, Bureau of Labor Statistics. "International Price Program Concepts." Washington, DC Forthcoming in 1997.