Research Spotlight

Offshoring and Import Price Measurement

Selected Research From the Conference on "Measurement Issues Arising From the Growth of Globalization"

By Susan N. Houseman

OVER THE last decade, there has been a marked shift in the sourcing of consumer products and intermediate inputs from domestic suppliers to foreign suppliers—a phenomenon commonly referred to as offshoring. Reflecting this development, import growth greatly outpaced that of exports, resulting in a widening trade deficit in the 2000s. Moreover, emerging economies largely accounted for the growth of imports, signaling a fundamental shift in the composition of U.S. trading partners (chart 1). In recent years, China became the largest exporter to the United States, surpassing Canada.

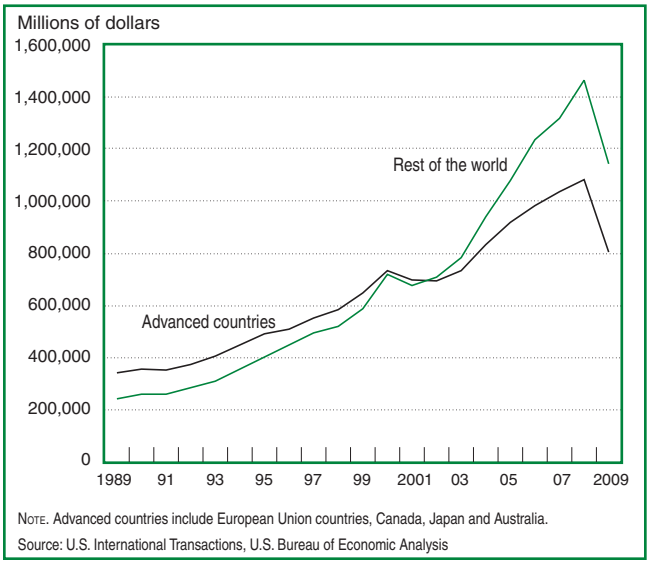
It is widely believed that low prices in emerging economies have driven the growth in import share and that this phenomenon has contributed to lower inflationary pressures in the U.S. economy (Greenspan 2004). As currently constructed, however, import price indexes generally do not capture price declines, often large, associated with such shifts in sourcing. This and related problems in the construction of import price indexes have prompted concerns that the real (constant-dollar) growth in imports has been understated and that, as a result, domestic productivity and real output growth measures have been overstated.

New research commissioned with funding from the Bureau of Economic Analysis (BEA) and the Alfred P. Sloan Foundation examined three aspects of the issue: (1) What is the precise nature of the price measurement problem? (2) Is there concrete evidence of biases to import price indexes and to output and productivity measures? and (3) What are the solutions? Findings from this research, which were presented at the conference "Measurement Issues Arising From the Growth of Globalization" in Washington, DC, in November 2009 are summarized in this article.[1]

1. This article is based on selected research findings reported in Houseman and Ryder (2010).

Susan N. Houseman is a senior economist with the Upjohn Institute for Employment Research. She and Kenneth F. Ryder of the National Academy of Public Administration directed the conference on "Measurement Issues Arising From the Growth of Globalization." *She would like to thank Marshall B. Reinsdorf and Robert E. Yuskavage for their helpful comments on a draft of this article.*

Chart 1. Imports by Country Type



NOTE. Advanced countries include European Union countries, Canada, Japan and Australia.
Source: U.S. International Transactions, U.S. Bureau of Economic Analysis

Why Import and Export Prices Matter

In a global economy, accurately measuring the prices of imports and exports is critical to computing key domestic output and productivity measures. To see the connection between imports and measures of domestic output, consider the measurement of gross domestic product (GDP), the value of goods and services produced in a country. In official U.S. statistics, GDP is generally measured using the so-called "expenditure" approach. The values of personal consumption expenditures (C), private investment (I), and government expenditures (G) are summed. To deduce the value of goods and services produced domestically, exports (X) are added to domestic expenditures while imports (M) are subtracted, yielding the familiar formula:

$$GDP = C + I + G + X - M.$$

To compute real GDP growth, all domestic expenditures and export and import values must be properly deflated to control for price changes. With the value of trade ($X + M$) in the U.S. economy reaching the equivalent of 25 to 30 percent of GDP in recent years, properly deflating import and export values is critical to the accurate measurement of real GDP growth. If the import price index does not adequately capture the true price declines associated with the shift in sourcing to low-cost foreign suppliers, as is argued in this article,

then the real growth of imports will be understated. In other words, the real growth of imports, as measured, will not fully reflect the real value of domestic products for which they substitute. And if the growth in the real value of imports is understated, real GDP growth will be overstated, all else being the same.

Similarly, import price indexes are critical in computing the growth of real value added in industry statistics. Intermediate inputs, including imported intermediate inputs, must be netted out from shipments in computing value added. BEA estimates that about 40 percent of imported commodities are used as intermediate inputs by businesses and that the import share of these inputs has grown dramatically since the late 1990s. To measure the real growth of industry value added, sales and input costs must be deflated. Currently, input price deflators are constructed from domestic prices, as measured by the producer price index (PPI), and from import prices, as measured by the International Prices Program at the Bureau of Labor Statistics (BLS). Any overstatement of the input price index, as would occur if import price indexes fail to capture price declines associated with shifts to lower cost foreign suppliers of intermediate inputs, will result in an understatement of the real growth of intermediate inputs and an overstatement of the real growth of industry value added.

Any understatement of real input growth also will directly lead to an overstatement of various measures of productivity growth. Conceptually, multifactor productivity for an industry or sector represents the part of the growth in real gross output that cannot be explained by the growth in real inputs (capital, labor, energy, materials, and services). If real input growth is understated because input prices do not capture declines associated with shifts in sourcing to low-wage countries, then multifactor productivity will be overstated. Labor productivity measures industry or sector value added per unit of labor input. If the measure of the growth of real value added is inflated because of offshoring, then the growth of labor productivity will be overstated. In other words, to the extent that price declines associated with shifts in sourcing to low-wage countries are not captured in import price indexes, offshoring, to some degree, will result in a mechanical increase in multifactor and labor productivity growth.

The Nature of the Price Measurement Problem

BLS is responsible for collecting price data and constructing price indexes that are used to deflate purchases made by consumers, businesses, and the government sector in the construction of various statistics published in the industry and national income accounts. The survey underlying the consumer price index (CPI) samples prices of items at retail outlets, the Producer Prices Program surveys establishments for the prices producers receive for a sample of goods and services sold, and the International Prices Program surveys importers and exporters on the prices they pay or receive for a sample of items imported or exported.

To understand the cause of the bias from shifts in sourcing, it is important to note that BLS takes great care to ensure that it is pricing the same item over time. Conceptually, each observation used in the construction of a particular price index represents the period-to-period price change of an item as defined by very specific attributes and reported by a specific establishment. A consequence of efforts to carefully control for product attributes in the collection of price data is that price indexes generally do not capture price reductions resulting from the entry and market share expansion of low-cost suppliers. Although this problem in price indexes has been widely discussed in literature on the CPI, where it is termed "outlet substitution bias," the implications for other price indexes have received relatively little attention.

Consider the case of a low-cost foreign supplier that enters the U.S. market and captures market share from domestic suppliers. Hypothetically, price declines realized by consumers or, in the case of intermediate inputs, by domestic producers in switching from a high-cost domestic supplier to a low-cost foreign supplier could be fully captured in the import price index under certain conditions: the foreign supplier enters the U.S. market with a price comparable to that of domestic competitors, the expansion of the foreign supplier's market share reflects contemporaneous price declines relative to the domestic supplier that occur after entry, and the new foreign supplier is picked up in the import price sample before any decline in its price.

More likely, however, the price declines associated with the shift by consumers and businesses from a high-cost domestic supplier to a low-cost foreign supplier will not be fully captured in import price indexes (Diewert and Nakamura 2009; Houseman et al. forthcoming; Reinsdorf and Yuskavage 2009). The lag between the time when the low-cost supplier enters the U.S. market and when its product is picked up in the import prices sample may be significant. Additionally, the foreign supplier is apt to enter the U.S. market with a lower price relative to domestic competitors, and even if the foreign product is integrated immediately into the import price sample, the relevant price change of the imported good—the quality-adjusted price difference between the domestic product and imported product—will be missing in the first period.

Moreover, the problem in the import price index may not be fully resolved even after the new supplier's product is incorporated into the import prices sample and its

used to construct price deflators implicitly assume that consumers and firms adjust purchases instantaneously to changes in relative prices. In practice, the entry of a low-cost supplier may be accompanied by some period of disequilibrium during which differences in price levels between the high-cost supplier and the low-cost supplier persist, and the low-cost supplier gains market share as its product becomes known, its reliability established, and purchasers' contracts with the high-cost supplier expire. Under such dynamics, the gains in market share would not reflect contemporaneous changes in relative prices, and in the case of offshoring, the price decline associated with the purchasers' shift from a high-cost domestic supplier to a low-cost foreign supplier would not be captured in the import price index. As a result, more rapid rotation of new products or products from new suppliers into the prices survey sample—a common proposal for improving price statistics—will not necessarily reduce the bias from shifts in sourcing.

As noted above, import price indexes are used in conjunction with the PPI to construct industry-level input price indexes. Diewert and Nakamara (2009) show that the bias to the input price index from shifts in sourcing is proportional to the growth in the low-cost suppliers' market share and to the percent discount offered by the low-cost supplier. Although the focus of the conference on "Measurement Issues Arising From the Growth of Globalization" was on biases arising from the substitution of foreign products for domestic products, shifts in sourcing from high-cost domestic suppliers to low-cost domestic suppliers can also result in biases to input price indexes.[2]

Evidence on the Potential for Problems in Price Indexes From Offshoring

The potential for bias to import and input price indexes is larger, the greater the gain in import share and the larger the price differential between imported and comparable domestic products. Research presented at the conference examined whether these preconditions for significant biases to import and input price indexes existed in recent years. The growth of imports for final consumption, as well as of imported intermediate inputs, was rapid in the decade leading up to the recent recession. For example, between 1997 and 2007, the estimated import share of materials inputs used by manufacturers rose from under 17 percent to 25 percent. For all private industries, the import share of all intermediate inputs rose from 8 percent to more than 10 percent, and the import share of materials intermediate inputs increased from 15 percent to 21 percent between 1998 and 2006 (Eldridge and Harper 2010).

Moreover, at the same time that import shares were increasing, low-wage countries, most notably China, accounted for the preponderance of the growth. Although it is not feasible to construct price differences between foreign products and comparable domestic products using price data collected by BLS, case studies provide some evidence on the magnitude of the cost savings from shifts in sourcing. Byrne, Kovak, and Michaels (2009) find sizable cross-country differences in the prices of identical semiconductor wafers. Compared with prices of semiconductor wafers produced in U.S. foundries, prices averaged about 40 percent lower in China and about 25 percent lower in Singapore. In a detailed comparison of production costs for aluminum wheels in the United States and Mexico, Klier and Rubenstein (2009) find that overall costs were 19 percent lower in Mexico and that savings on processing costs were 36 percent. The magnitudes of the discounts found in these careful case studies are consistent with reported discounts in the business literature.

Anomalous patterns in the growth rates of import price indexes compared with those of domestic price indexes provide prima facie evidence of a problem. It is widely believed that the growth in import share in consumer and intermediate goods has been driven by lower prices and that low-priced imports have played an important role in dampening domestic inflation (Greenspan 2004). Therefore, we might expect to see growth of the import price indexes that is lower than that of domestic price indexes for comparable products. Yet, the price index for personal expenditure goods rose slower than the import price index for consumer goods after 2002, suggesting that import price indexes may have missed price declines associated with widespread shifts in sourcing of consumer goods to suppliers in low-wage countries in recent years (Reinsdorf and Yuskavage 2009). Similar patterns are evident in comparisons of import price deflators and domestic price deflators for manufacturing materials intermediate inputs. In spite of the rapid growth of the import share of materials intermediate inputs and the shift in sourcing of imported intermediate inputs to emerging economies, the import materials intermediate inputs price index grew faster than the domestic materials price index in the 2000s (Houseman et al. forthcoming). These anomalous patterns are only partly explained by measurable differences in the product composition of the import and domestic indexes.

2. Outlet substitution bias is an example of a shift in sourcing from high-cost to low-cost domestic suppliers. Diewert and Nakamura (2009) show that at the elemental level the characterization of the bias to the input price index that results when producers shift sourcing of intermediate inputs is identical to the characterization of the bias to the CPI from outlet substitution.

2000s (Houseman et al. forthcoming). These anomalous patterns are only partly explained by measurable differences in the product composition of the import and domestic indexes.

Evidence from simulations suggests that the effects of biases to the input price index from offshoring on productivity and real value-added growth may have been significant for goods-producing industries. For example, from 1997 to 2007, failure to measure price drops associated with shifts in sourcing to foreign suppliers of materials intermediate inputs could have led to overstatements of average annual multifactor productivity growth by 0.1 to 0.2 percentage point and of real value-added growth by 0.2 to 0.5 percentage point (Houseman et al. forthcoming). The latter represents about 10 to 20 percent of real value-added growth in manufacturing. Excluding the computer sector, which accounts for a small share of manufacturing value added, the bias from offshoring may have accounted for a fifth to a half of the growth in real value added in the rest of the sector.

Conference research did not produce estimates of the size of the bias to productivity and output measures from shifts in sourcing to low-cost foreign suppliers for the aggregate economy. Biases may have been less pronounced in many service industries than in manufacturing and other goods-producing industries. Yet, if services offshoring expands rapidly in the near future, as some predict, the absence of accurate price deflators might impart significant biases in industries, particularly service industries, where service inputs are heavily used.

Solution: Correcting the Bias Through a Buyer's Index

BLS has proposed a straightforward solution to the bias to the input price index from shifts in sourcing: construct a true input price index based on a survey of buyers (Alterman 2009). In principle, the purchaser of the inputs should be able to report price changes in products irrespective of the source. Although the study of this price index problem was motivated by recent shifts in sourcing from high-cost domestic suppliers to low-cost foreign suppliers, other types of shifts in sourcing are common and also could potentially lead to biased input price indexes. The proposed survey would address biases in the input price index for shifts in sourcing among domestic suppliers as well as among domestic and foreign suppliers.

The construction of an input price index directly from a survey of input purchasers offers a couple of additional advantages over the current methodology for constructing an input price index. BEA uses the PPI as a measure of domestic input prices. However, the PPI is an output price index, and the weighting used in its construction is unlikely to accurately capture movements of domestic input prices (Diewert 2007). Additionally, as noted, BEA constructs industry input price indexes by weighting domestic and import price indexes. However, because the destination of imports in the economy is not tracked, the appropriate weights are unknown. In constructing input price indexes, BEA assumes that industries use a particular imported good or service in proportion to their overall use of the product. For example, under the so-called import comparability (or proportionality) assumption, if an industry accounts for 5 percent of the use of a product in the economy, it is assumed that the industry uses 5 percent of the imports of that product. Assessments of the validity of that assumption have found evidence of sizable discrepancies for some industries (Feenstra and Jensen 2009; Strassner, Yuskavage, and Lee 2009). Thus, in addition to capturing price changes associated with shifts in suppliers, the proposed index would circumvent the need for using the PPI and the import comparability assumption and so should result in a more accurate weighting of product price changes.

Although the proposed input price index is conceptually a straightforward solution, there may be practical impediments to conducting a survey of input purchasers. Of particular concern is whether purchases of inputs will be insufficiently frequent to support the construction of an input index in this way for some products (Alterman 2009). The feasibility of constructing a true input price index by surveying purchasers can only be determined through a pilot study, which has been proposed by BLS.

The immediate benefit of addressing this bias to the input price index is improved statistics in the BEA industry accounts. One drawback of the proposed input price index is that it will not directly address biases in the import price indexes, so it will not address biases to real GDP growth, as measured using the expenditure approach, from shifts in sourcing.[3] If a new input price index is implemented, research will be needed to explore ways in which information from this index can be used to inform the statistical agencies about the bias to GDP.

3. In principle, real GDP growth could be constructed using the value-added approach, which requires information on value added in all sectors of the economy. The expenditure-side approach is preferred because the quality of the data needed for its construction is generally better.

Conclusion

Research presented at the conference on "Measurement Issues Arising From the Growth of Globalization" concluded that widespread substitution of low-cost imports for domestic products in recent years may have imparted a significant bias to import and input price indexes and to measures of real value added and productivity growth in industries engaging in extensive offshoring.

The bias to price indexes from offshoring is one of several measurement problems arising from the growth of globalization that were examined in conference research.[4] Because of rapid globalization and changing supply chains, inaccuracies in the import comparability assumption coupled with long lags in updating information on the structure of U.S. industry (from benchmark input-output tables) may have reduced the accuracy of some economic statistics in recent years. In addition, trade in services is rapidly expanding, reflecting the role of the Internet and other technological developments in communications. The lack of industry detail in domestic services and services trade data, of data on export and import service prices, and of longitudinal occupational data for the U.S. economy hamper accurate measurement of services trade flows and analysis of their impacts on the U.S. economy and workers.

The pace of globalization is unlikely to abate in the near future; neither will our need to assess the impact of this continued expansion. Filling these data gaps is critical for such assessments and will require at least modest increases in funding for international statistics.

4. Research findings on these measurement problems also are summarized in Houseman and Ryder (2010). The research papers may be accessed at www.bea.gov/papers/pdf/bea_2010_conference%20papers_final.pdf.

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