

**Imported Inputs and Industry Contributions to Economic Growth:
An Assessment of Alternative Approaches**

Erich H. Strassner, Robert E. Yuskavage, and Jennifer Lee

U.S. Department of Commerce
Bureau of Economic Analysis

Washington, DC

Paper prepared for the NAPA/UpJohn Conference on
Measurement Issues Arising from the Growth of Globalization
Washington, DC
November 6-7, 2009

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I. Introduction

Over the past decade imports have become an increasingly important source of supply for both U.S. consumers and producers, partly due to changes in the relative prices of imported and domestic goods. From 1997-2007, imports as a share of all goods and services consumed in the U.S. increased from 18 percent to 23 percent. This aspect of globalization has affected the size and structure of the U.S. economy, especially the manufacturing sector, but it has also complicated the task of measuring economic growth and industry performance. Policymakers and researchers are concerned that increased outsourcing to lower-cost offshore suppliers has affected key economic measures such as output, value added, and labor input. Difficulties in measuring price change for imported goods can affect measured growth in real gross domestic product (GDP). Similarly, problems identifying outsourcing-related activities could affect measures of industry contributions to economic growth and productivity in manufacturing and other sectors.

For several decades, imports have been the major source of U.S. supply for final consumer goods such as apparel, toys, shoes, motor vehicles, and consumer electronics, and for certain kinds of business investment goods. More recently, the import share has increased for final goods such as furniture and other household products, with important implications for the

¹ Previous work by the authors has examined the role of outsourcing and imported inputs primarily using data available from BEA's Annual Industry Accounts. These earlier studies were conducted to determine whether the existing data could shed light on the topics of domestic outsourcing, offshore outsourcing, and the role of imported inputs at the industry level. For more information, see Yuskavage et al. The authors thank Brian C. Moyer of BEA for helpful comments. We are grateful for William Zeile's assistance in explaining the International Accounts' databases on multinational companies. We also thank Gabriel W. Medeiros of BEA for great assistance in preparing estimates presented in the paper.

measurement of domestic consumption prices. Another recent trend has been strong growth in the use of imported intermediate materials by U.S. manufacturing industries, partly at the expense of domestic goods. A significant portion of this trade occurs among affiliated parties within U.S. multinational companies. This form of offshore outsourcing--substitution of imported for domestic materials--has raised questions about the measurement of real value added by industry and its impact on real GDP growth.

Limitations in the measurement of imports have somewhat different implications for the various approaches typically used by statistical agencies to measure GDP.² Only the final expenditures approach and the production approach provide measures of both nominal and real GDP. Because imports are subtracted using either approach, import growth has important measurement implications. In the final expenditures approach, which is featured by the U.S., real GDP is an aggregate of personal consumption expenditures, private equipment and structures, government consumption and investment, and exports less all imports, both final and intermediate. In the production approach, which is the featured approach in many other countries, real GDP is an aggregate of the real value added originating in all industries, including government. Value added equals gross output less intermediate inputs, which include imported inputs. As a result, under the production approach, only the imports consumed in intermediate uses are subtracted. In recent years, intermediate goods and services have accounted for slightly more than 50 percent of all imports.

Economists have expressed concern that substitution by U.S. consumers and producers towards lower-priced imported goods from developing countries may not be fully reflected in the official import price indexes used for calculating real GDP based on the final expenditures

² The three major approaches are the final expenditures approach, the income approach, and the production approach.

approach, and that as a consequence, growth in real GDP and productivity may be overstated (Mandel). This potential bias can be explored using both the expenditure and production approaches to measuring real GDP. To the extent that the recent growth in lower-priced imported goods has affected intermediate and final uses assessing the impact using the production approach may be revealing.

Data from the Bureau of Economic Analysis's (BEA) Annual Industry Accounts can be used to identify not only the uses of imported goods (intermediate vs. final) but also the overall importance of imported products by measuring their value relative to the value of comparable domestically-produced goods. For this paper, we use data from the BEA's Annual Industry Accounts and from BEA's surveys of multinational companies (MNCs) to determine how growth in imported intermediate inputs has affected growth in real value added by industry (real GDP growth), and to assess the impact of alternative assumptions about the use of imports and the behavior of import prices.

In this paper, we calculate real value added by industry and real value added for all industries (real GDP) using alternative assumptions about industry use of imports and the behavior of imported input prices. In the current (baseline) methodology, the allocation of imports to industries is based on an "import comparability" assumption. This assumes that the portion of intermediate inputs attributable to imports is calculated as a percentage of the total purchase value, using the economy-wide ratio of commodity imports to the total domestic supply of the commodity. Alternative assumptions about the use of imports by selected industries are based on BEA's data on imports by the U.S. Parent's of foreign affiliates and unaffiliated parties. For the deflation of imported intermediate inputs, the current methodology relies primarily on import price indexes compiled by the Bureau of Labor Statistics (BLS). Alternative assumptions

about import price change are made to determine a threshold required for import-price biases to impact real GDP, the manufacturing sector, and selected manufacturing industries.

The remainder of this paper is presented in four sections. Section II provides background on how the industry accounts can be used to measure outsourcing and the role of imported inputs at the industry level, how BEA's import use tables are compiled, and how imported inputs are used in constructing real value added by industry. Section III includes a brief description of BEA's International Economic Accounts, including the MNC data, and explains how the MNC-based import-use tables are compiled. Section IV presents empirical results that compare the current (baseline) estimates from the Annual Industry Accounts with results from the MNC-based import-use tables. This section also describes results based on different assumptions about the behavior of import prices. Section V concludes with a brief summary and recommendations for improving data on imported inputs by industry and import price indexes.

II. Annual Industry Accounts

The Annual Industry Accounts are a useful analytical framework for simulating the impact of alternative assumptions about imports for several reasons. These accounts provide an annual time series of nominal and real gross output, intermediate inputs, and value added for 65 industries defined according to the 1997 North American Industry Classification System (NAICS) (Moyer et al). They provide an internally consistent set of industry production accounts that are integrated conceptually and statistically with final expenditures and GDP from the National Income and Product Accounts (NIPAs).

The Annual Industry Accounts are estimated within the framework of balanced make and use tables, which allows for integrated analysis of industry output, inputs, employment, final

demand, and imports. The annual input-output (I-O) accounts provide a time series of detailed, consistent information on the flows of goods and services that both comprise industry production processes and that are included in final expenditures. Estimates of the supply of commodities are prepared at nearly the same level of detail as in the benchmark I-O accounts and are then aggregated to the higher publication level used for the annual industry accounts. The GDP by industry accounts feature estimates of nominal and real value added by industry. Value added is defined as an industry's gross output (sales or receipts and other operating income) minus its intermediate inputs (energy, materials, and purchased services). Intermediate inputs are acquired from either domestic or foreign sources (imports). Price and quantity indexes of gross output, intermediate inputs, and value added are published for industries, industry groups, and broad sectors in the GDP by industry accounts.

Significant improvements in the measurement of intermediate purchases in the 1997 benchmark made the Annual Industry Accounts more suitable for identifying and measuring outsourcing and the role of imported inputs than in the past.³ A broader set of purchased services was collected for establishments in the manufacturing, mining, and construction sectors, and more detailed data on purchased services for more industries in the trade and services sector were collected from an expanded Business Expenses Survey.⁴ Estimates of materials and energy inputs by industry were also based on detailed economic census data for manufacturing and on broader input category data for non-manufacturing industries.

The expansion of the Annual Industry Accounts in 2005 to provide additional information on the composition of intermediate inputs by industry made these accounts more

³ The 1997 benchmark I-O accounts were based almost entirely on detailed data on outputs and inputs collected by the Census Bureau in the 1997 economic census. For more information, see Lawson et al.

⁴ As a result of the expansion in source data, a much larger share of total intermediate purchased services was based on economic census data than in past benchmarks.

analytically useful to study trends in the use of energy, materials, and purchased services inputs (Strassner et. al.). The balanced I-O use table provides the product detail needed to aggregate estimates of intermediate inputs into cost categories useful for economic analysis.⁵ Each cost category includes both imported and domestically produced goods and services, and each category is valued in purchasers' prices, which include domestic transport costs, wholesale trade margins, and sales and excise taxes.

On an annual basis, a wide array of source data is used to update the benchmark estimates for the annual time series. Nominal value added by industry estimates are available annually for the compensation of employees, taxes on production and imports less subsidies, and the gross operating surplus. Annual survey data are available from the Census Bureau for updating industry gross output for all of the manufacturing industries and for most of the services industries, including the industries that provide outsourcing-related services. Annual data are also available from the NIPAs for updating estimates of final expenditures.

Data, however, are not available annually to update estimates of intermediate inputs by industry. Instead, BEA's procedures for annual updates of intermediate inputs rely partly on the assumption that the real (constant-price) use of intermediate inputs relative to the industry's real gross output has not changed from the prior year.⁶ An industry's real intermediate inputs are initially updated based on changes in its real gross output. The nominal value of its intermediate inputs for the current year is further adjusted based on price changes for the detailed commodity inputs. Balancing constraints are imposed to ensure that the use of commodities by all industries

⁵ These estimates are prepared by applying a KLEMS production framework to BEA's estimates of industry production.

⁶ This is often described as the "constant industry technology" assumption.

equals the supply of commodities, after accounting for final uses from the NIPAs.⁷ These procedures are used for each year's set of accounts. Updated KLEMS estimates by industry are likewise based on the updated commodity input estimates.

An important step in updating the Annual Industry Accounts is the development of import-use tables to allow for the separate deflation of domestic and imported inputs in the calculation of real value added.⁸ Intermediate inputs at a detailed product level are disaggregated to obtain the domestic and imported portions of intermediate inputs included in each KLEMS input cost category. For each detailed commodity used by an industry, the portion attributable to imports is calculated as a percentage of the total purchase value, using the economy-wide ratio of commodity imports to the total domestic supply of the commodity.⁹ Although this assumption is necessary, the import content of specific types of goods and services could vary by industry as a result of factors such as affiliation status, location, product mix, relative prices, or technology. BEA uses this approach because of the lack of actual data on the use of imports by industry.¹⁰

This distinction between domestic and imported inputs allows for differences in the behavior of prices for imported and domestic products to be accounted for when separate price indexes are available.¹¹ For domestic materials and for energy, the price indexes are mostly BLS producer price indexes (PPIs), Department of Energy implicit price deflators, and price indexes from other sources that are considered reliable. Many of the services input price indexes are also

⁷ The annual I-O accounts use final expenditure categories from the NIPAs as controls during the bi-proportional balancing of the use tables. An additional balancing constraint is that the sum of nominal value added across all industries must equal GDP.

⁸ Fisher-ideal index number formulas are used to prepare chain-type indexes for gross output, intermediate inputs, and value added by industry, and for higher-levels of aggregation. For more information, see the technical appendix in Moyer et al.

⁹ For example, if imports represent 35 percent of the domestic supply of semiconductors, then the estimates in the import use table assume that imports comprise 35 percent of the value of semiconductors in each industry that uses semiconductors.

¹⁰ This "import comparability assumption" is often used in studies of the impact of imports on intermediate inputs.

¹¹ Domestic prices are used to deflate imported inputs in cases where import prices are unavailable.

obtained from BLS PPIs, but some are based on other sources that are not as reliable, either because of quality change or due to assumptions about labor productivity.¹² Price indexes for imported materials are largely based on the BLS International Price Index program. Price indexes for imported services are much more limited in their coverage.

III. International Accounts

BEA's international transactions accounts (ITAs) provide monthly, quarterly and annual estimates of transactions between U.S. and foreign residents.¹³ The ITAs include a current account, a capital account, and a financial account. The two major components of the current account are (1) exports of goods and services and factor income receipts and (2) imports of goods and services and factor income payments. The difference between these two components, plus net unilateral current transfers, equals the balance on the current account. The capital account includes capital transfers such as debt forgiveness. The two major components of the financial account are (1) changes in net U.S.-owned assets abroad and (2) changes in net foreign-owned assets in the U.S. These components are the major source of change in the U.S. net international investment position.

BEA also produces comprehensive statistics on U.S. direct investment abroad and foreign direct investment in the United States that are required for compiling the ITAs and for the analysis of MNCs. BEA's data on MNCs are potentially very useful for assessing assumptions about the use of imported goods by industries because these companies account for about 60 percent of U.S. imports of total intermediate inputs. While imports of goods in the ITAs are

¹² Expansion of the BLS PPI program in the services sector during the 1990's has resulted in better coverage and improved quality, but gaps and limitations remain.

¹³ Transactions between the U.S. and its territories, Puerto Rico, and the Northern Mariana Islands are not treated as foreign transactions in the ITAs.

based primarily on data compiled by the Bureau of the Census from import shipping documents, the data on imports of goods reported to BEA on the MNC surveys conform well to Census Bureau concepts and definitions. Imports of services in the ITAs are estimated from a variety of sources, primarily BEA's surveys of U.S. and foreign MNCs and BEA's surveys of U.S. international services transactions between unaffiliated parties. For this study, we used annual data on U.S. imports of goods and services shipped to the U.S. Parents by both their foreign affiliates and other unaffiliated parties.

BEA's surveys are mandatory and collect selected data for transactions between the U.S. parents of MNCs and both their foreign affiliates and unaffiliated parties and transactions between the U.S. affiliates of foreign MNCs and both their foreign parent companies and certain other affiliated foreign firms. These data play an important role in compiling the ITAs and in providing additional detail on cross-border trade in services and on services provided by the affiliates of MNCs. Because U.S. MNCs are typically very large firms, the combined data for U.S. parents and U.S. affiliates of foreign MNCs account for a significant share of domestic economic activity, especially in the goods-producing sector of the economy. These combined company data, when classified by industry, provide valuable insights into the industry distribution of imports.

For this paper, alternative import use tables were constructed using data from BEA's surveys of MNCs.¹⁴ Companies in these surveys are classified according to the International Survey Industry (ISI) classification system, a system developed by BEA that is based on the North American Industry Classification System (NAICS). The MNC surveys provide information on total imports by U.S. parent firms (from both affiliated and unaffiliated parties)

¹⁴ The estimates are based on special tabulations prepared by BEA's Direct Investment Division (DID). DID provided access to databases which allowed the authors to identify and tabulate imported goods and services directly.

classified by the U.S. parent's industry, and imports by U.S. parent firms from foreign affiliates classified by the foreign affiliate's industry. For the "benchmark" survey years, additional product information on imports is provided. These broad product categories are listed below:

- Food, live animals, beverages, and tobacco
- Crude materials, inedible, except fuels
- Mineral fuels, lubricants, and related materials
- Chemicals and related products
- Industrial machinery and equipment
- Office machines and automatic data processing machines
- Telecommunications, sound equipment, and other electrical machinery and parts
- Road vehicles and parts
- Other transportation equipment
- Other products

Linking the foreign affiliate to its' U.S. parent provides the basis for a commodity and industry classification for the import-use framework. Industry classification is based on the ISI industry of the U.S. parent and commodity classification is based on the ISI industry of the foreign affiliate. To develop this mapping, imported products from the foreign affiliate were compared to the ISI industry of the foreign affiliate. In most cases, the ISI industry of the foreign affiliate aligns well with the product imported. For example, a foreign affiliate classified in pharmaceuticals and medicines manufacturing (ISI 3254) ships products categorized in chemicals and related products (NAICS 325). Because industry classifications are not available for unaffiliated parties, imports from unaffiliated firms are assumed to resemble those of affiliated firms. The import use tables based on ISI industry categories were converted to the 1997 NAICS-based structure used for the Annual Industry Accounts. Import shares for commodities purchased by each industry were calculated as the ratio of the commodity import value for that industry and the total import value for that industry. In total, the MNC-based imports accounted for about 60-65 percent of all imported intermediate inputs presented in the Annual Industry Accounts.

IV. Empirical Results

The existing framework and methodology for the Annual Industry Accounts was used to prepare a set of baseline estimates that can be compared with the results of simulation exercises that incorporate alternative assumptions about import use and prices. These results focus on industries that are the largest users of imported goods, such as computers and electronic products and chemicals manufacturing. Assumptions about both the use of imports and the behavior of import prices are important because an industry's real value added is calculated as the difference between real gross output and real intermediate inputs.¹⁵

Table 1 shows that, in the aggregate, the import comparability assumption provides results that are largely consistent with actual data on the use of imports by industry from BEA's MNC surveys. These results indicate that the assumptions underlying the industry distributions of imported inputs in the Annual Industry Accounts give reasonable results at aggregate levels, but that improvements are possible at more detailed industry levels. Some differences in the results at detailed levels are attributable to the fact that the data from the International Accounts are classified by industry on an enterprise basis, whereas data from the Annual Industry Accounts are classified by industry on an establishment basis. Within both the goods- and services-producing sectors, some large share differences for industry groups are offset at higher levels of aggregation, suggesting the possibility that the differences are attributable largely to differences in classification.

¹⁵ Estimates of real value added by industry are affected by both the source of the inputs and the import price indexes used for deflation. For example, if the computer manufacturing industry uses more imported semiconductors than assumed and if import prices are falling faster than domestic prices, or if the actual price of imported semiconductors is falling faster than the official import price index, then real intermediate input is understated and real value added is overstated in the computer manufacturing industry.

Table 1. Import Shares by Industry, 2002
 (Comparison of International Accounts and Annual Industry Accounts Import-Use Tables)

(Percent)

Industry Group	International Accounts	Annual Industry Accounts
Manufacturing	20.7	16.8
Distributive services/1/	3.3	7.0
Information	4.2	5.3
Finance, insurance, real estate, rental, and leasing	0.9	5.0
Professional and business services	2.3	3.9
Other industries/2/	6.5	6.4
Addenda		
Private goods-producing industries/3/	17.7	14.9
Private services-producing industries/4/	3.5	5.4

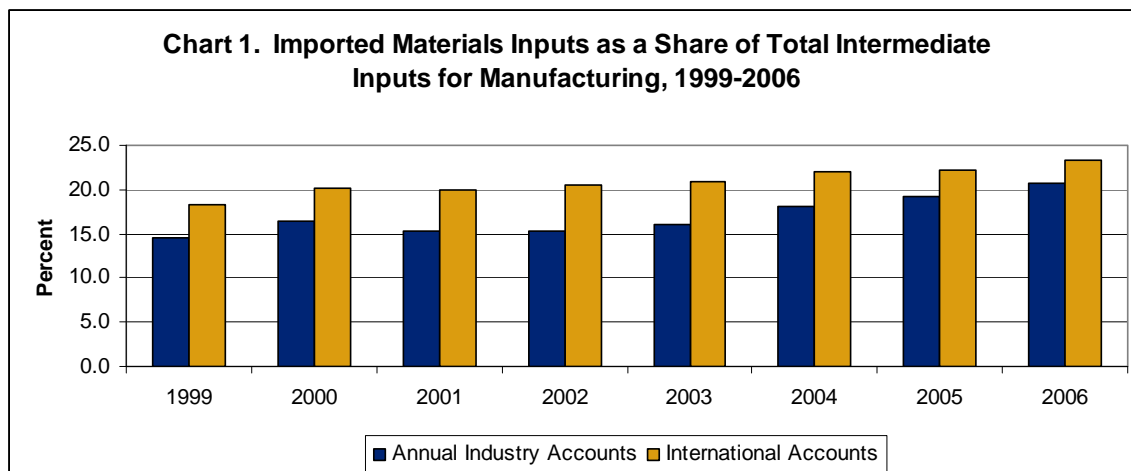
/1/ Consists of w holesale trade; retail trade; transportation and w arehousing

/2/ Consists of agriculture, forestry, fishing, and hunting; mining; construction; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services, except government

/3/ Consists of agriculture, forestry, fishing, and hunting; mining; construction; and manufacturing.

/4/ Consists of utilities; w holesale trade; retail trade; transportation and w arehousing; information; finance and insurance; real estate and rental and leasing; professional, scientific and technical services; management of companies and enterprises; administrative and w aste management services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services, except government.

Over the period 1999-2006, import shares of materials for manufacturing based on the MNC data are consistently higher than those constructed for the industry accounts using the import comparability assumption; however, the pattern of growth between the two series is similar (Chart 1). On average, the MNC data suggest that the Annual Industry Accounts understate import shares of materials inputs by about 4 percentage points per year for manufacturing.



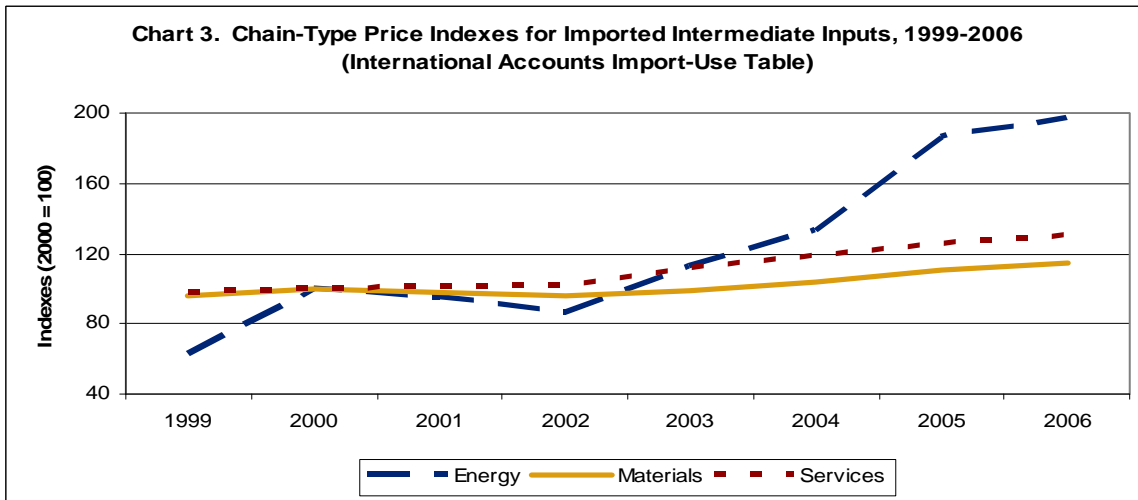
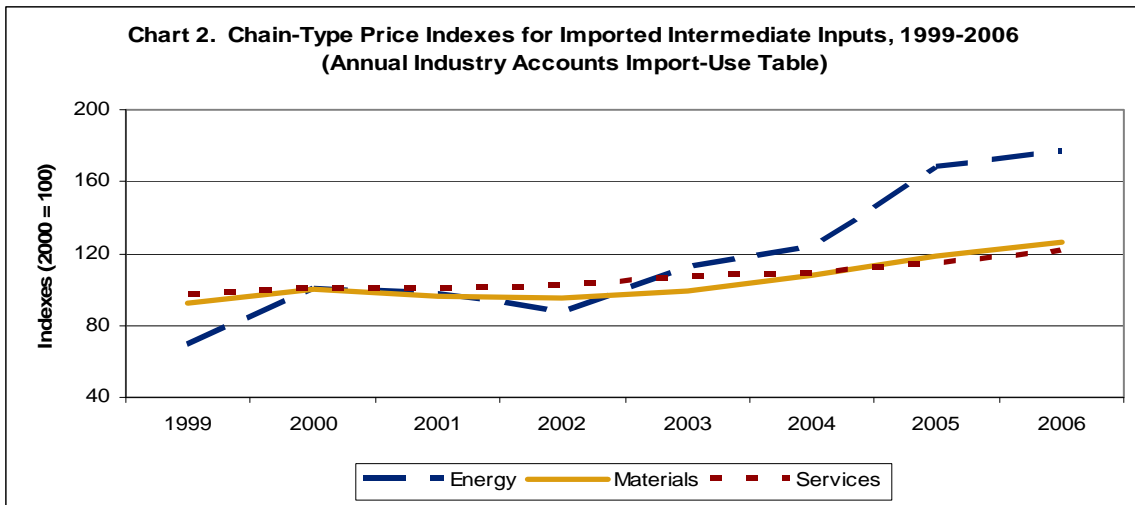
Within manufacturing, the composition of imported inputs for materials shows some variation. Table 2 presents import shares for manufacturing at the commodity level constructed for the Annual Industry Accounts compared with those constructed using MNC data. There are notable differences in import shares across the board. For 10 of the largest Annual Industry Accounts' publication-level commodities within manufacturing, the largest differences are shown for oil and gas extraction and computers and electronic products. Most other commodities show much smaller differences.

Table 2. Imported Input Shares for Manufacturing Commodities, 2002
(Comparison of International Accounts and Annual Industry Accounts Import-Use Tables)

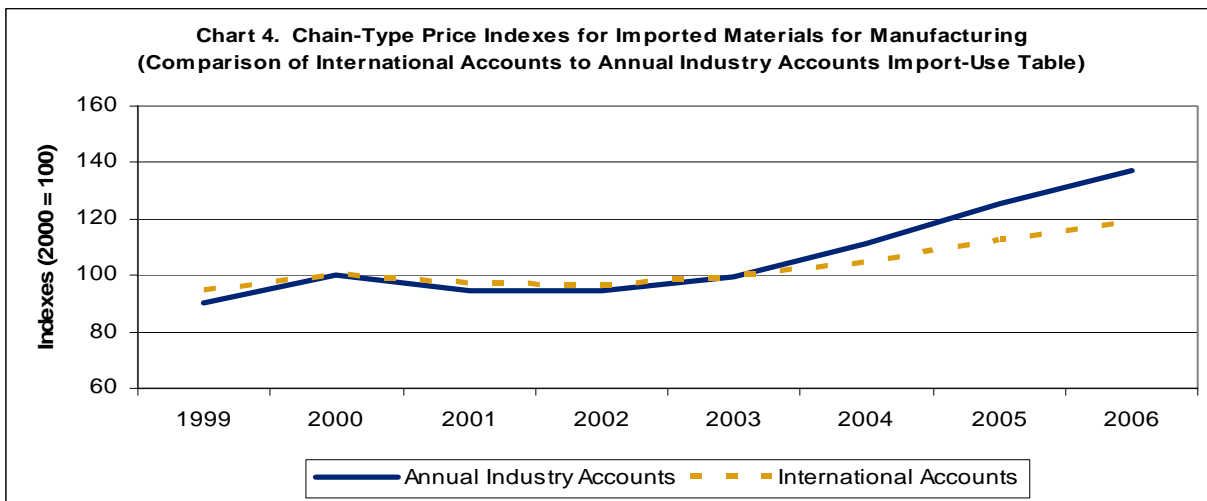
(Percent)

Commodity	International Accounts	Annual Industry Accounts
Oil and gas extraction	36.9	63.6
Computer and electronic product manufacturing	70.6	42.9
Primary metal manufacturing	8.5	20.7
Chemical manufacturing	26.4	13.4
Machinery manufacturing	26.2	29.0
Fabricated metal product manufacturing	3.8	10.2
Paper manufacturing	2.6	13.8
Electrical equipment, appliance, and component manufacturing	24.7	35.2
Food manufacturing	9.9	12.2
Wood product manufacturing	16.2	24.0

One would expect that changing the mix of intermediate inputs sourced from domestic versus foreign production could lead to important differences in price growth for imported intermediate inputs. Charts 2 and 3 show chain-type price indexes for economy-wide energy, materials, and purchased services inputs based on import shares developed for the Annual Industry Accounts and those based on the MNC data. Price growth for imported energy inputs and purchased services inputs increases at a slower pace using data from the Annual Industry Accounts; price growth for materials inputs increases at a faster rate.

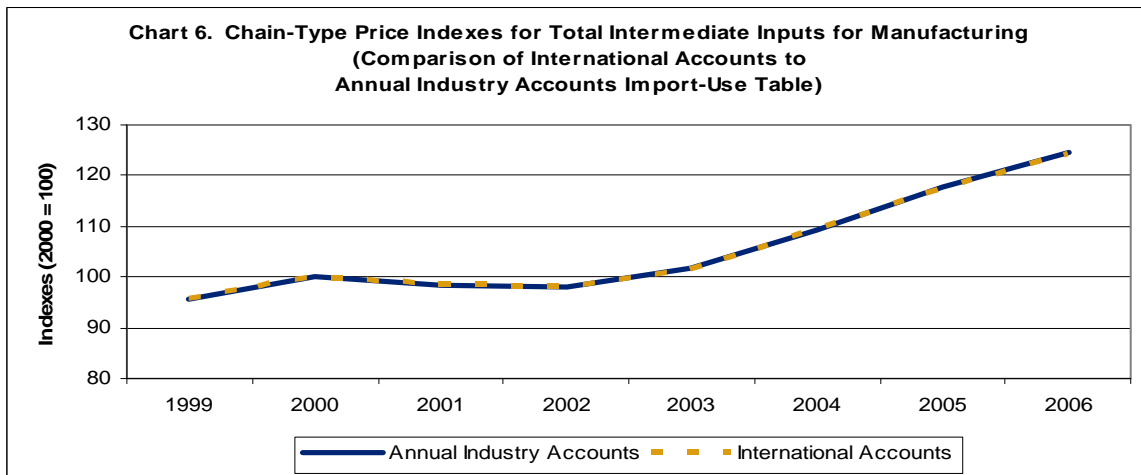
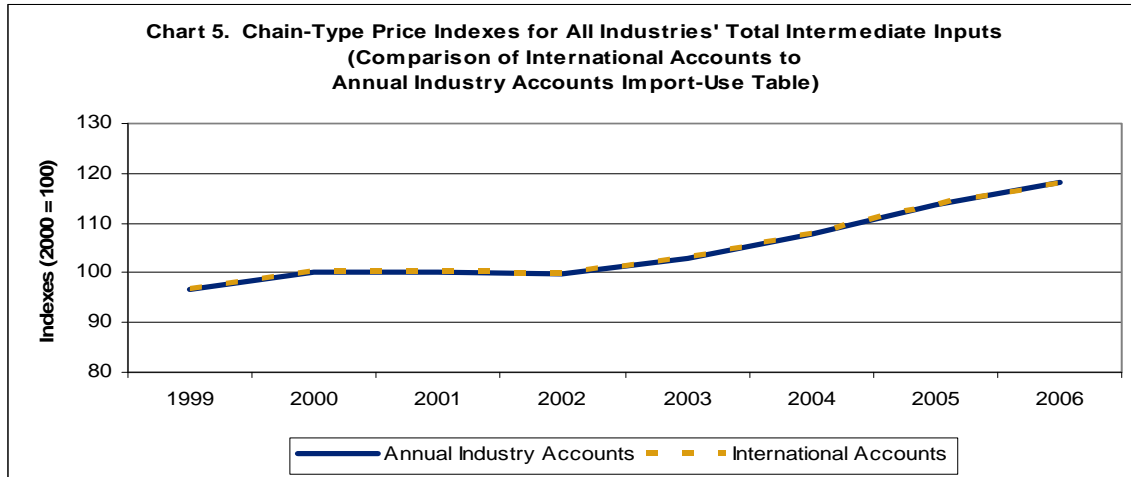


Within manufacturing, the trend for materials inputs is more focused. Over 1999-2006, price growth for imported materials inputs for manufacturing increases at a faster pace using data constructed for the Annual Industry Accounts than that based on the MNC data (Chart 4). The slower materials price growth resulting from higher overall import-shares for materials constructed with MNC data, coupled with BEA's existing import prices, suggest real intermediate inputs in the annual industry accounts may be understated and, therefore, that real value added for manufacturing is overstated.¹⁶



However, because existing import-price data is incomplete, changing the sourcing mix for intermediate inputs does not impact the price indexes for intermediate inputs for all industries or, even, the manufacturing sector (Charts 5 and 6). Some differences do exist for high-import industries, such as computer and electronic products, where existing good-quality import price data is used to deflate the import content of intermediate inputs.

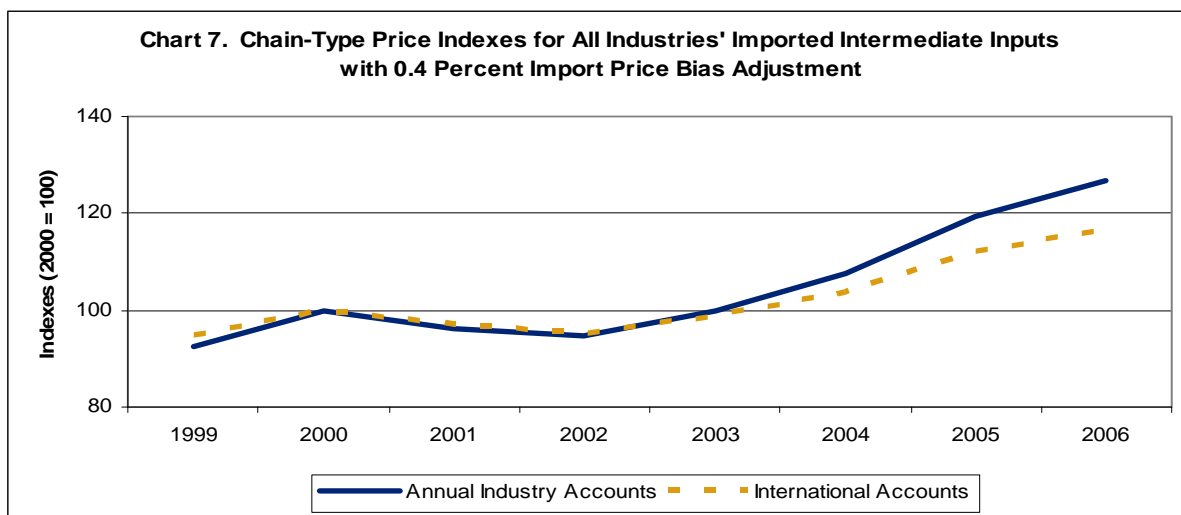
¹⁶ In addition to materials inputs, real intermediate inputs growth is a function of the source and price mix for energy and purchased services inputs. Therefore, compositional effects within intermediate inputs would have to be examined to determine how real intermediate inputs have changed. Nevertheless, manufacturing is a high importer of materials inputs relative to imports of energy and purchased services inputs.

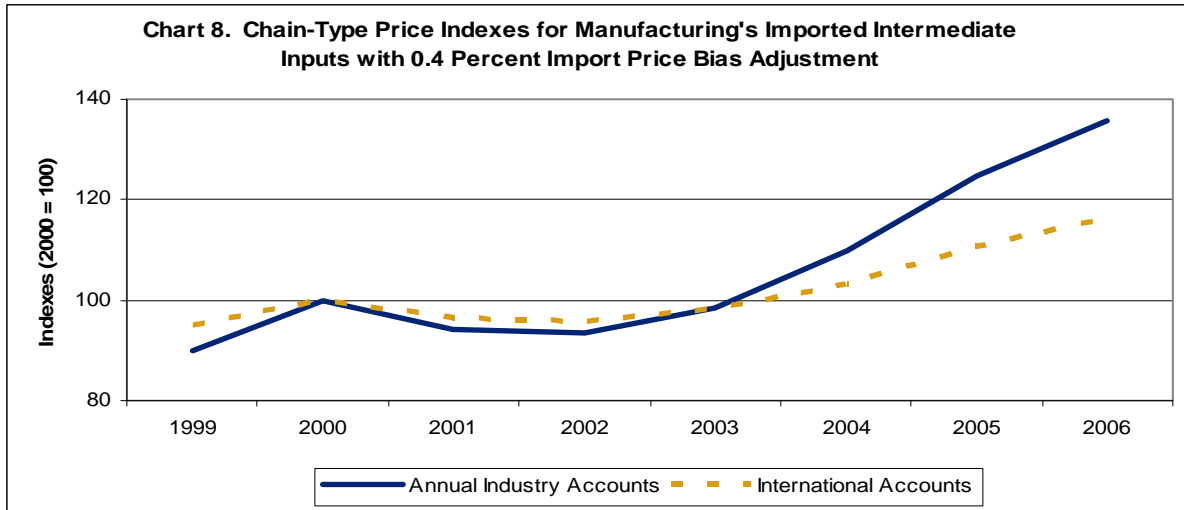


The limited availability of import price data, overall, is the primary reason that changing the mix of import shares does not impact the aggregate growth rates. There are 1,028 item-level building blocks used to deflate imported intermediate inputs in the Annual Industry Accounts, but only 57 percent have import prices available for use in the separate deflation of intermediate inputs. The remaining item-level goods and services are deflated with domestic price indexes. The mix of import price coverage also differs by sector, with about 58 percent coverage for the Goods sector and 50 percent for the Services sector. Finally, import price coverage does not necessarily imply a good match, as many of the item-level building blocks covered are deflated with an aggregate import price index.

Given data limitations for import price indexes available from the U.S. statistical system, we conducted several simulations to determine the threshold of import-price biases that are required to affect real value added growth across all industries (real GDP), manufacturing, and a selected number of manufacturing industries. As a first step, we adjusted the domestic prices used to deflate the import content of intermediate inputs by applying the average price differential that exists for item-level detail when both domestic and import price indexes are available. This difference averaged about 0.4 percent per year.

This bias adjustment translates into notable differences in price growth for imported intermediate inputs for All Industries and manufacturing. Over 1999-2006, price growth for economy-wide imported intermediate inputs increases at an average annual rate that is about 1.5 percentage points slower when import shares are based on MNC data instead of the Annual Industry Accounts. Price growth is about 3 percentage points slower for manufacturing (Charts 7 and 8). The impact, however, on real GDP growth and real value added for manufacturing is negligible: real GDP grew at an average annual rate of 2.5 percent using MNC-based import data, compared to 2.6 percent for the Annual Industry Accounts, and real value added growth for manufacturing grew 1.9 percent and 2.0 percent, respectively.





Finally, we applied a series of bias adjustments, ranging from a 1-percent to 5-percent overstatement of import prices, to determine the thresholds required to affect real GDP growth, and real value added growth for manufacturing, computer and electronic products, chemical manufacturing, and machinery manufacturing. The 1-to-5 percent bias adjustments were applied to all existing import prices and to the domestic prices that are used to deflate the import content of imported intermediate inputs for goods and services that do not have import-price coverage.¹⁷ The results in Table 3 show average annual growth rates for real value added based on the various bias adjustments applied to the existing Annual Industry Accounts import-use tables and those constructed using MNC data.

Overall, each one-percent bias adjustment to import prices led to an average annual decrease of 0.08 percentage points for All Industries, 0.33 for manufacturing, 0.46 for computer and electronic products, 0.22 for chemicals, and 0.24 for machinery manufacturing, when using import shares based on the Annual Industry Accounts. One-percent bias adjustments, when using import shares based on MNC data, led to an average annual decrease of 0.08 percentage

¹⁷ Each bias adjustment decreased import prices used in the deflation by 1 to 5 percent.

points for All Industries, 0.39 for manufacturing, 0.60 for computer and electronic products, 0.27 for chemicals, and 0.18 for machinery manufacturing.

Table 3. Average Annual Growth Rate for Real Value Added by Industry with Price Adjustments, 1999 - 2006
(Comparison of International Accounts and Annual Industry Accounts Import-Use Tables)

(Percent)

Industry	Baseline	0.04%	1%	3%	5%
All Industries					
Annual Industry Accounts	2.6	2.6	2.5	2.4	2.2
International Accounts	2.6	2.5	2.5	2.3	2.2
Manufacturing					
Annual Industry Accounts	2.2	2.0	1.8	1.2	0.5
International Accounts	2.0	1.9	1.6	0.9	0.1
Computer and electronic products manufacturing					
Annual Industry Accounts	17.2	17.1	16.8	15.8	14.9
International Accounts	17.2	17.1	16.8	15.6	14.4
Machinery manufacturing					
Annual Industry Accounts	1.4	1.3	1.2	0.7	0.2
International Accounts	1.4	1.3	1.2	0.9	0.5
Chemical manufacturing					
Annual Industry Accounts	2.6	2.6	2.4	2.0	1.5
International Accounts	2.5	2.4	2.2	1.7	1.1
Oil and gas extraction					
Annual Industry Accounts	-3.4	-3.5	-3.5	-3.7	-3.8
International Accounts	-3.2	-3.2	-3.3	-3.4	-3.6

V. Summary and Conclusion

In the Annual Industry Accounts, imports of intermediate inputs are constructed using the import comparability assumption for purposes of separately deflating domestic and imported intermediate inputs in the calculation of real value added. An analysis of import shares for the Annual Industry Accounts compared to import shares constructed using actual source data from the International Accounts shows that the import comparability assumption provides a good approximation of imported intermediate use. Differences at detailed levels, however, may be the result of using MNC company data rather than establishment-based data. In addition, while MNC imports account for about 60 to 65 percent of total imported intermediate inputs in the

Annual Industry Accounts, it is possible that import usage differs among the smaller firms that account for the remaining 35 to 40 percent. The possible impact of this coverage difference may be worth examining more closely.

Most notably, data from the International Accounts suggest that growth in real imported materials inputs is likely understated in the Annual Industry Accounts. However, this understatement does not currently lead to large differences in real value added growth for all industries (real GDP) or for manufacturing because of the limited availability of import price data used to deflate the import-content of intermediate inputs. A simulation of a range of bias adjustments for import prices used in deflation suggests that better import price measurement will improve the accuracy of real value added by industry; however, the overall magnitude of the bias adjustments would need to be about 6.5 percent to affect real GDP growth by at least one-half of a percentage point, irrespective of whether import shares are from the Annual Industry Accounts or based on data from the International Accounts.

Further study is required to develop a better understanding of how imported inputs affect industry output, employment, real value added, and contributions to GDP. More research is also needed to determine the sensitivity of these results to the assumptions used by BEA for the Annual Industry Accounts with respect to the classification of imported goods and services, the distribution of goods and services by using industry, and the behavior of import prices. BEA will continue to review these assumptions and will further investigate company-based data from the International Accounts that could help evaluate the assumptions underlying the industry distributions. BEA is also interested in working with the BLS International Price Program to try to develop improved price indexes for the deflation of imported intermediate inputs in both the NIPAs and Annual Industry Accounts. BEA is also interested in the idea of input-price indexes

that are proposed by the BLS. These input price indexes could be used to deflate total intermediate inputs without concern for the sourcing mix. Input price indexes, in conjunction with domestic price indexes, could be used to calculate imported price indexes, allowing for the continued study of imported intermediate inputs.

BEA plans to investigate these differences in more detail with the goal of obtaining improved industry distributions of imported intermediate inputs in the Annual Industry Accounts. Better grounding of these assumptions is important not only for understanding the role of imported inputs in the U.S. economy, but also for developing more reliable quantity and price indexes for intermediate inputs and value added by industry.

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