

**Outsourcing and Imported Inputs in the U.S. Economy:  
Insights from Integrated Economic Accounts**

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# Outsourcing and Imported Inputs in the U.S. Economy: Insights from Integrated Economic Accounts

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## I. Introduction

One of the interesting features of the dynamic U.S. economy over the past 25 years has been continued growth in the outsourcing of intermediate inputs, primarily services but also goods, as firms seek to reduce costs, improve productivity, and increase profits. Clearly the outsourcing of services, especially business, professional, and support services, has contributed to the growth of the service sector, but outsourcing has also triggered changes in the goods-producing sector as firms seek lower-cost suppliers of material inputs from home and abroad. Volatile prices for energy inputs, especially imported petroleum, have significantly affected the costs and profits of many U.S. industries in recent years. The growth of imported material and services inputs has raised concerns about the effects of import substitution on the domestic industries that supply the outsourced inputs. However, the National Academy of Public Administration recently concluded that a better understanding of *domestic* outsourcing could help improve our understanding of offshore outsourcing.

Unfortunately, no apparent consensus exists in the economics profession on how to define outsourcing and international standards provide little guidance on how to treat outsourcing in national economic accounts. Partly as a result of this void, the data that are available for studying outsourcing-related issues are quite limited. A recent study (Dey, Houseman, and Polivka) concluded that despite evidence pointing towards significant growth in outsourcing, available data are not adequate for understanding its implications for changes in employment structure and labor policy. In a recent review of problems associated with using the current System of National Accounts (SNA) for measuring productivity, Diewert (2007) described data enhancements that are needed for understanding the implications of outsourcing for particular industries. While Diewert's

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main concern was the measurement of multifactor productivity (MFP), several of the improvements that he suggested would also enhance the data available for outsourcing.

Offshore outsourcing has received considerable attention recently, but economists and policymakers have sought for some time to understand how outsourcing overall--both onshore and offshore--affects the U.S. economy. Some researchers are concerned that difficulties in the measurement of outsourcing-related activities may lead to faulty assessments about the economy's performance and about productivity growth at the industry level. For many economists, outsourcing is fundamentally about industry production processes and how firms acquire the mix of inputs needed to produce their output. Because outsourcing often involves the substitution of purchased services and materials for labor inputs, it can have important implications for labor productivity measurement. Outsourcing also affects industry shares of gross domestic product (GDP), contributions to real economic growth, and the location of domestic production.

Despite the growth of outsourcing over the past 25 years, official international guidelines such as the SNA have offered little guidance for identifying, measuring, and presenting outsourcing-related activities in national, industry, and regional economic accounts. Such guidance could be very useful for statistical agencies and policymakers grappling with the implications of the growth of offshore outsourcing or concerned about the regional effects of increased domestic outsourcing. While the 1993 SNA does not directly address outsourcing, it at least points out the importance of properly measuring industry inputs in the context of industry production accounts and supply-use tables. The proposed 2008 revision of the SNA provides a basis for addressing outsourcing measurement issues by recommending the preparation of MFP measures at the industry level in a capital-labor-energy-materials-services (KLEMS) framework, similar to Diewert's suggestions.<sup>2</sup>

Lack of guidance in the 1993 SNA for measuring outsourcing and industry-level productivity may partly reflect that the rapid growth of business services for intermediate use, especially outside of manufacturing, did not occur until the 1980's, and that

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<sup>2</sup> The proposed SNA chapter on the production account includes a paragraph related to outsourcing. It acknowledges that it is increasingly common for producers to change the way in which a production activity is completed and that contracting out activities to other producers changes the pattern of intermediate inputs.

consistent and reliable data were not readily available for recognizing the effects of this growth on all sectors of the economy. Growth in the use of purchased business services in several U.S. industrial sectors was not widely noticed until a full set of industry production accounts were introduced in 2000 by the U.S. Bureau of Economic Analysis (BEA). Studies of outsourcing before then were mostly based on data that were limited to manufacturing, provided little reliable detail on services inputs, and did not distinguish between imported and domestically-produced intermediate inputs.

Outsourcing by U.S. firms continues to grow and has become an important factor affecting domestic industry output and employment, industry contributions to growth, the use of imports, and the location of production. Recent data for 2006 show that the share of U.S. GDP accounted for by domestic providers of outsourcing services increased to nearly 12 percent from 7 percent in 1982. Outsourcing became more prevalent as part of the restructuring that accompanied recovery from the recessions of the early 1980's and it further accelerated during the latter half of the 1990's with the growth of information and communications technology services. Imports for intermediate use by industries have continued to grow and now account for about 50 percent of all U.S. imports. Because U.S. firms outsource some services offshore to foreign entities, imports of business, professional, and technical services have steadily increased.

In this paper, published and unpublished data from BEA's annual industry accounts are used to shed additional light on the growth of outsourcing and imported inputs in the U.S. economy. These integrated industry accounts provide insights that cannot be obtained solely from aggregate national accounts data. The integrated industry accounts, which were first released in June 2004, are well-suited for studying important developments in the economy, such as outsourcing, because the rich industry-level data on production, employment, and prices are tightly integrated with the national economic accounts data for final uses and imports. BEA further enhanced the usefulness of the accounts for such studies in 2005 by expanding them to include the KLEMS framework for measuring and presenting data on industry intermediate inputs.

In an earlier paper, using data through 2004, we explained how offshore outsourced activities are classified in BEA's international, national, and industry accounts, highlighted some of the issues associated with using data from the industry

accounts for studying off-shoring, and provided estimates of the magnitude of services offshore outsourcing by U.S. industries (Yuskavage, Strassner, and Medeiros). One of the main conclusions of that paper was that despite recent strong growth in the use of imported services by several industries, its overall magnitude was still very small. Although the use of imported goods by U.S. industries is much greater than imported services, that paper did not address imported goods because its focus was on services offshoring. The earlier paper also just scratched the surface of the issue of domestic outsourcing, leaving further exploration as an area for future research.

This paper extends the results of the earlier study using revised published data and newly developed unpublished data that include two more years of recovery from the downturn of 2001 to determine if the industry-specific trends have continued and to look more closely into domestic outsourcing. This paper also expands the scope of the analysis by developing unpublished industry estimates for imported goods, such as energy and materials, to better understand how industry use of these goods has changed during a period of tremendous growth in both petroleum and non-petroleum merchandise imports. Finally, the paper demonstrates how the KLEMS framework that was recently adopted by BEA and that is recommended for the revised SNA can be used to improve the measurement of outsourcing and imported inputs.

#### *Overview of Findings*

In BEA's annual industry accounts, gross output represents the market value of an industry's production and it is measured in both nominal and real terms. Intermediate inputs represent the energy, materials, and purchased services used in combination with labor and capital inputs to produce gross output. From 1997-2006, the intermediate input intensity of gross output--defined as real intermediate input per unit of real gross output--increased slightly for all private industries in the U.S. economy as the labor intensity of gross output declined sharply. Intermediate input intensity declined in the private goods-producing sector, mostly because of durable goods manufacturing, but it increased sharply in the private services-producing sector. After 2002, as the recovery from the 2001 downturn gained strength, intermediate input intensity increased in both the goods- and services-producing sectors. This growth reflected strong contributions from purchased services, including outsourcing-related services, and imported materials.

Outsourcing is an important part of the production process in both the goods and services-producing sectors. For this paper, outsourcing is defined as a subset of purchased services for functions that an establishment could perform for itself using its own resources. Examples include maintenance and repair, warehousing, accounting, computer services, advertising, and research and development. In 2006, outsourcing accounted for about 24 percent of all intermediate inputs and about 44 percent of purchased services inputs. Outsourcing relative to intermediate inputs was much higher in the services sector, where it accounted for about 30 percent of intermediate inputs, than in the goods sector where it accounted for about 15 percent. Although these nominal shares have remained stable since 1997, real (price-adjusted) purchased services and real outsourcing have both increased significantly faster than real materials and energy inputs. Real purchased services that are *not* defined as outsourcing, however, such as telecommunications and financial services, have grown even faster than outsourcing-related services.

Imported inputs also play an increasingly important role in the U.S. economy. The share of intermediate inputs accounted for by imports increased significantly for all private industries, rising from 8.3 percent in 1997 to 10.6 percent in 2006. Import shares in 2006 were 17.3 percent in the goods-producing sector and 5.8 percent in the services-producing sector. For manufacturing, the import share was 20.0 percent. Most of the growth in the import share for private industries occurred after 2002. The import share of outsourcing--an indicator of offshore outsourcing--increased steadily but was still very low at 2.3 percent in 2006. Import shares increased for purchased services, energy, and materials. Nearly all of the growth in the intermediate input intensity of gross output was due to imports, as real imported inputs grew much faster than real domestic inputs.

#### *Outline of the Paper*

The remainder of this paper is presented in four sections. Section II discusses different types of outsourcing in the U.S. economy, explains the concept of outsourcing adopted for this study, and describes how the measurement of outsourcing-related activities is shaped by definitions and conventions of the U.S. statistical system. Section III discusses how some long-standing gaps in U.S. industry data hampered the study of outsourcing while it was growing during the 1980's, describes how BEA's annual

industry accounts evolved to become a useful statistical framework for studying outsourcing, identifies the strengths and limitations of the current estimates, and outlines ongoing efforts to improve the accuracy of these estimates. Section IV provides empirical results based on both published and unpublished data from BEA's annual industry accounts; these results focus on changes since 1997 in intermediate input intensity, outsourcing, and imported inputs for broad industry groups. Section V is a summary and conclusion that includes recommendations for improving outsourcing-related data.

## **II. Treatment of Outsourcing in Economic Statistics**

In order to better understand the strengths and limitations of the existing data for studying outsourcing, it is useful to consider how outsourcing activities are treated in U.S. economic statistics and how their treatment has changed over time. For this purpose, it is necessary to define outsourcing more precisely and to address issues related to the different types of statistical units from which economic data are collected. Many economic studies view outsourcing as a special case of specialization in production, whereby firms deconsolidate their production processes over time and engage in a form of vertical disintegration.<sup>3</sup> As part of this process, new firms or plants may arise, perhaps in different physical locations, to produce intermediate inputs such as parts or materials that were previously provided within the firm.

This process of vertical disintegration applies to goods and to services used as intermediate inputs and it typically results in the formation of new business entities or leads to a larger volume of transactions between existing businesses. For example, manufacturing firms at one time produced not only finished products such as automobiles and toasters but also, within the same firm or even at the same plant, the parts and other materials required as inputs. Specialization might then have resulted in the formation of two different establishments, one producing the parts and materials and the other producing the finished product. From the perspective of the firm, this change could be viewed as a type of outsourcing.

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<sup>3</sup> See Abraham and Taylor (1996) for an analysis and discussion of the reasons that firms outsource activities.

For some purposes, outsourcing describes a process in which a manufacturing firm that once produced final products no longer does so and now contracts out their manufacture or assembly to other manufacturing firms. A related form of this process occurs when a company establishes divisions or subsidiaries in new locations, including overseas, that perform operations that were once performed elsewhere in the company. Yet another manifestation of outsourcing is a firm that once employed its own staff to provide support services but now “contracts out” or purchases these services from other firms. Finally, outsourcing sometimes describes the substitution of imported inputs for domestically-produced inputs, even with no change in the structure of the company.

*Concept of Outsourcing.* The concept of outsourcing adopted for this paper has a strong establishment-based production orientation and is based on changes over time in the composition of inputs used by an industry to produce its output. Outsourcing is viewed as the change in an industry's production process that results in the substitution of certain types of purchased services (domestic or imported) and imported materials for labor and domestically-produced materials. Because only a subset of purchased services is treated as related to outsourcing, detailed commodity time series data for both nominal values and price indexes are critical. Outsourcing for this paper does not include the substitution of domestically-produced materials for labor as a result of increased specialization in manufacturing because this aspect of outsourcing does not appear to be prominent in today's economy.

In contrast to many previous studies, this paper does not treat an industry's total purchased services, or even just its purchases of business services, as the measure of outsourcing. Rather, outsourcing is defined in terms of a broad subset of specific purchased services that an establishment can choose in the short run either to produce and consume on its own or to acquire from other establishments, affiliated or otherwise. Examples of these types of services include maintenance and repair, warehousing and storage, information services, business and professional services, and administrative and support services. Other types of purchased services inputs, such as utilities, telecommunications, and financial services, have not been produced in-house on any significant scale for the last several decades. Possible reasons include the need for large investment in specialized equipment and structures, required staff expertise, and



regulatory requirements. Including these types of services would most likely overstate the level and perhaps even the growth of outsourcing.

For this study, outsourcing does not include manufacturing companies contracting out the manufacture of products that were at one time produced by establishments owned by the company. This type of outsourcing manifests itself as the transformation over time of a manufacturing company into a distribution or wholesale trade company as the primary activity of the enterprise changes from selling products manufactured by its own plants to selling products manufactured by others. A U.S. company that primarily distributes (resells) products that are made overseas and then imported into the U.S. would be classified in wholesale trade, even if it owns the foreign manufacturing plant. While this type of outsourcing changes the composition of U.S. corporations in terms of the establishment-based industries in which they are engaged, it does not generally affect the composition of inputs for establishment-based industries, which is the focus of this paper.

*Company vs. Establishment.* An important issue for studying outsourcing and for trying to understand how outsourcing-related activities are classified in economic statistics is the nature of the statistical unit used for data collection and analysis. In the U.S. statistical system, establishments and companies are the statistical units for which most data classified by industry are widely available. Establishments are units, such as a plant, mine, store, or office where productive activities occur, and they are classified by industry according to their primary activity. Companies, which are sometimes described as enterprises, are organizational units consisting of one or more establishments under common ownership and control, and their industry classification depends on their degree of horizontal diversification. The industrial classification of the company thus depends on the classification of the establishments that account for the largest portion of its economic activity.

Primarily for this reason, industrial statistics for the U.S. and for most other countries are based on establishment data rather than company data. Establishment data provide more meaningful economic time series because they are not affected by mergers, acquisitions, or other changes in corporate organization or ownership. For example, General Motors Corp. at one time owned establishments that were classified in several

manufacturing industries related to motor vehicles, but it also owned establishments that were classified in data processing, financial services, and leasing. For the purpose of presenting company data on an industry basis, General Motors would have been classified in the motor vehicle assembly industry because that activity accounted for most of its sales. As a result, all of the sales, payroll, employment, and other data for General Motors would also have been classified as motor vehicle manufacturing, when some of the data were actually for other manufacturing industries and for services industries.

Postner (1991) highlights the implications of company-establishment differences for measuring outsourcing by demonstrating that the choice of statistical unit can affect both the identification of outsourcing and the measurement of its overall magnitude. He notes that the two traditional approaches to the identification problem are the industrial organization approach, which is grounded in economic theory and is based on the economic concept of the ownership unit (the “firm”), and the input-output approach, which is essentially empirical and is based on the production unit, or the establishment. Postner points out that the level of outsourcing activity would tend to be larger when measured on an establishment basis rather than a company basis because the company can contract out activities (i.e., acquire inputs) from other establishments of the same company. Companies can reallocate resources and shift activities from one unit to another but total company activity would not change and no changes would be observed in external transactions. With establishment data, however, such restructuring could appear as increased economic activity between establishments that are classified in different industries.

*Auxiliary Establishments.* Large companies usually consist of both operating establishments that produce market output for sale outside the company and auxiliary establishments (ancillary units) that provide captive services for other establishments of the same company. The most common type of auxiliary is a central administrative or headquarters unit that provides administrative and general management support services to the entire company. These units may be in different locations from the operating establishments and they often have large payrolls and significant employment. Other significant types of auxiliaries include research and development, trucking, warehousing,

accounting, auditing, and bookkeeping services, data processing, and repair and maintenance services.

The North American Industry Classification System (NAICS) that is used for BEA's annual industry accounts provides advantages for studying outsourcing in the U.S. economy, partly because of its treatment of auxiliaries. NAICS improves on the Standard Industrial Classification (SIC) as a classification system because it more consistently classifies establishments into industries on the basis of similar production processes, recognizes new and emerging industries, and provides greater detail for the services sector, which includes most of the industries that provide outsourcing services. Under NAICS, auxiliaries are classified according to the type of service they provide, rather than according to the industry of the establishments they serve, as they were under the SIC system. In BEA's industry accounts, the gross output of auxiliaries is imputed and measured by their operating expenses, the same method that is used to value the output of non-profit organizations and other entities with no market output.

In many cases, the services that are provided by the auxiliaries could also be purchased in the market from independent establishments that are classified in the same industry as the auxiliary but that are owned by other companies located elsewhere in the U.S. or abroad. Contracting out to company-owned suppliers offers advantages for some firms and disadvantages for others, but one advantage is that it allows a company to maintain control over the provision of important services. Using company-based industry data, the intra-company flows of services between auxiliaries and the establishments they serve would not be observed. These flows are observed in BEA's establishment-based industry accounts, however, because of the classification and valuation conventions used for the accounts. Some would argue, though, that establishment-based industry data overstate outsourcing because the inputs are provided by affiliated entities and may not be acquired in arms-length market-oriented transactions.

*Source Data for Industry Accounts.* BEA's annual industry accounts use data from a wide variety of sources in combination with fairly intricate estimation procedures to arrive at a consistent time series of industry output and input measures in both nominal and real terms. In addition to the output and input data from the Census Bureau's economic censuses that are used for the benchmark I-O accounts, BEA uses annual

industry output data from the Census Bureau, wage and salary, employment, and price index data from the Bureau of Labor Statistics, and data on corporate profits and other components of an industry's gross operating surplus from the Internal Revenue Service. Because industry outputs and inputs are defined on a product or commodity basis, price indexes are used to deflate outputs and inputs for calculating real value added. Detailed commodity data for imports from the I-O accounts and final expenditures category data from the National Income and Product Accounts (NIPAs) also play an important role.

For the concept of outsourcing adopted for this study, the two most important features of the U.S. statistical system for understanding how outsourcing appears in industry economic statistics are (1) the classification of transactions and activities in the economic census source data used for the benchmark I-O accounts and (2) the definitions and conventions used for the industry accounts that determine how the economic census and other source data are used. Because these two aspects of the statistical system largely determine the structure of the data available for measuring outsourcing, it is important to understand how the definitions and conventions apply to actual economic transactions. Attachment A sketches the evolution of the hypothetical ABC Toaster Company to illustrate how changes over time in a company's activities and structure would be reflected in the source data used for BEA's industry accounts and how the resulting estimates could then be used to identify and measure outsourcing-related activities.

### **III. Outsourcing and Inputs in BEA's Industry Accounts**

Along with a lack of guidance for defining and measuring outsourcing, data limitations have also hampered the measurement of outsourcing at the industry level. It is not clear if the lack of guidance reflects difficulties identifying suitable data, or if the lack of data has resulted from little direction from the research and measurement communities. For example, a set of U.S. industry production accounts for all industries that could be used to begin identifying outsourcing on a consistent time series basis were not available until 2000 (Lum et. al.), and even then the new data did not provide detail on the composition of intermediate inputs.

Although BEA provided benchmark input-output (I-O) accounts about every five years going back to 1947, these I-O accounts have been difficult to use for historical

analysis because they were not consistent over time, were released with significant lags, and were available only as nominal (current-dollar) estimates. Studies of outsourcing conducted in the 1980s and 1990s relied primarily on data from the Census Bureau and the Bureau of Labor Statistics (BLS) for manufacturing and on unpublished data from BLS for non-manufacturing industries.<sup>4</sup> These data sets, however, provided little if any detail for services relative to manufacturing, did not include separate data for imported inputs, relied on limited price indexes for services, and were not necessarily consistent with real GDP from the NIPAs.

During the 1980's, when outsourcing of services started to become a more prominent feature of the U.S. economy and interest in studying outsourcing was growing, BEA's Gross Product Originating (GPO) by Industry series was one of the few comprehensive government data sets available for studying industry behavior and performance. As with the other industry data sets that were available to researchers, however, the GPO data set had certain limitations. In the late 1980's, it was criticized for using a methodology that was not adequate for capturing important changes taking place in the structure of the economy, such as the increased use of services as inputs and the increased use of imported intermediate inputs (Mishel). While the criticisms largely pertained to using the data for productivity measurement and for assessing sectoral contributions to real GDP growth, they also applied directly to using the data for studying outsourcing.

#### *A. Improvements in GDP by Industry Data*

In the late 1980's and early 1990's, researchers frequently lamented the relatively poor state of industry-level data for studying productivity, and these complaints often focused on the lack of reliable input data. The same concerns about data quality also applied to studying outsourcing because of the close relationship between outsourcing and input substitution. Several papers that were presented at the May 1990 Conference on Research in Income and Wealth (CRIW) meetings on output measurement in the service sector directly addressed these data quality and measurement issues and ultimately influenced the course of data improvement efforts.

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<sup>4</sup> For examples of studies that made use of the data sets available in earlier periods, see Jorgenson, Gollop and Fraumeni (1987), Fixler and Siegel (1999), and tenn Raa and Wolff (2000). Fixler and Siegel used the BLS data to explicitly address the impact of outsourcing on productivity growth in the services sector.

Griliches and Siegel were concerned that an apparent recovery in manufacturing multifactor productivity growth in the early 1980's based on BLS data may have been misleading or even inaccurate due to data limitations similar to those directed at BEA's GPO dataset. The authors cited Mishel's criticisms that real inputs used by manufacturing were likely understated due to outsourcing to the service sector and due to outsourcing of manufacturing activities to foreign establishments. Griliches and Siegel went to great lengths to develop detailed, consistent measures of real (constant-price) inputs related to both domestic and foreign outsourcing for detailed manufacturing industries. They concluded that the recovery in measured manufacturing MFP growth could not be attributed to either domestic or foreign outsourcing and that their results were not consistent with Mishel's hypothesis, lending some support to the reliability of BEA's GPO estimates.

Nevertheless, at the time of the conference BEA was already pursuing improvements to the GPO data series, partly in response to Mishel's criticisms. Although it was not clear that the cited limitations seriously affected the reliability of the GPO estimates, BEA decided that improvements to the methodology were still needed. At the same CRIW conference, Mohr reported on BEA's initial plans for introducing these improvements and presented some preliminary results. The most important improvements included updating and enhancing the conversion of company-based value-added components from a company to an establishment-industry basis, expanding the use of the double-deflation method for estimating real value added to more services industries, and improving the deflation of intermediate inputs by (1) introducing more services commodity detail from the input-output accounts and (2) separating inputs into domestic and imported components for separate deflation.

While these improvements were made in direct response to the criticisms, Mohr indicated they would also significantly enhance the value of BEA's data for productivity measurement and analysis. By extension, these improvements would also lay the initial groundwork for improving the measurement of outsourcing in BEA's industry accounts. BEA made further improvements to the GPO data series throughout the 1990s. Revised estimates that incorporated some of the improvements were released in January 1991 and a more complete set of estimates that included limited use of superlative index number

methods was released in June 1993. While these estimates incorporated expanded use of the double-deflation method for services industries, the data were still not entirely adequate for some of these industries. During the 1990's BEA also improved the timeliness of the estimates and started making greater use of the newly re-established annual input-output accounts to improve the measurement of intermediate inputs.

In June 2000, BEA released a comprehensive revision of its annual industry accounts that provided for the first time a complete set of gross output, intermediate inputs, and value added estimates for all industries in both nominal and real terms. Annual quantity and price indexes based on Fisher Ideal index number methods were also provided. The use of the double-deflation method for all industries not only improved the quality and reliability of the real value added by industry estimates, it also increased the consistency of aggregate real value added for all industries with real GDP from the NIPAs. This would prove to be an important factor in later studies that sought to measure the contributions of industries to aggregate productivity and economic growth.<sup>5</sup>

While the improvements in coverage, quality, and detail that took place during the 1990's were not specifically designed for studying outsourcing, the needs expressed by academic researchers and policymakers for better overall industry-level data played a large role in shaping the scope and direction of the improvements and in encouraging statistical agencies to push the limits of the existing data. BEA's original motivation was to develop improved measures of real value added by industry, but the same improvements needed to achieve better input measures also opened new possibilities for measuring outsourcing. Expanded detail on the composition of intermediate inputs, especially services inputs and imported inputs, translated directly into an improved data set for studying outsourcing. Greater commodity detail led to improved real inputs but it also provided opportunities to define and measure outsourcing in more meaningful ways.

#### *B. Development of Integrated Annual Industry Accounts*

An important development in the evolution of data available for measuring outsourcing was BEA's June 2004 release of the integrated GDP-by-industry and annual input-output (I-O) accounts (Moyer et. al). These integrated annual industry accounts

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<sup>5</sup> See Triplett and Bosworth (2004) for an example of how the expanded GDP-by-Industry Accounts were used for productivity measurement in the services sector.

(AIAs) provided an internally consistent set of industry production accounts that was integrated statistically and conceptually with estimates of final expenditures from the NIPAs. The availability of these new estimates for the first time allowed integrated analysis of industry output, inputs, employment, final demand, and imports. Although I-O use tables had been available in the past, they were not a consistent time series and did not include constant-price (real) estimates. The AIAs opened wider possibilities for studying relationships between final demand and industry output.

In the AIAs, industries are defined according to the 1997 version of NAICS, and include estimates for 61 private industries and four government classifications. The GDP-by-industry accounts feature nominal and real value added by industry estimates. 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. The related annual I-O accounts provide a time series of detailed, consistent information on the flows of goods and services that comprise industry production processes and that are included in final expenditures. These accounts provide more detail than the GDP-by-industry accounts on the commodities included in gross output and intermediate inputs.

### *C. Expansion of Intermediate Inputs to KLEMS*

As described above, BEA's AIAs include the integrated GDP-by-industry and annual input-output (I-O) accounts. In the annual I-O accounts, 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 less detailed publication level used for the annual industry accounts. These time series are estimated within the framework of balanced make and use tables and are consistent with the NIPA estimates of final expenditures and industry estimates of gross output and value added. The additional layers of internal consistency in the AIAs increase the overall reliability of the estimates of intermediate inputs by industry.

The AIAs were expanded in 2005 to provide additional information on the composition of intermediate inputs by industry, allowing these accounts to be used to



study trends in the use of energy, materials, and purchased services inputs (Strassner et. al.). The balanced I-O use table, which shows the commodity composition of intermediate inputs by industry and final demand by category, provides the product detail needed for aggregating estimates of intermediate inputs into cost categories useful for economic analysis. These estimates were prepared by applying a KLEMS production framework to BEA's estimates of industry production. Each of the cost categories 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. BLS recently adopted BEA's measures of energy, materials, and purchased services for use in their industry multifactor productivity program, further enhancing consistency between the BEA and BLS industry estimates.

#### *D. Role of Benchmark I-O Accounts and Annual Updates*

BEA's AIA time series are based on the most recent benchmark input-output (I-O) accounts. Because these benchmark accounts play a major role in determining the industry distribution of output and the commodity composition of intermediate inputs, it is important to understand both the strengths and the limitations of the benchmark estimates. Also, because these detailed benchmark accounts are prepared only every five years using the most recent economic census data, BEA uses special procedures to update the composition of industry outputs and inputs annually until the next benchmark becomes available. For example, the estimates presented in this paper are based on the 1997 benchmark I-O accounts, the first set of I-O accounts prepared on the NAICS basis. In addition, the time series nature of these estimates emphasizes the need for reliable price indexes for the deflation of both gross output and intermediate inputs.

##### *1. Benchmark Intermediate Inputs*

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, the first census conducted on a NAICS basis. Significant improvements in the measurement of intermediate purchases of services in the 1997 benchmark is one of the reasons that the AIAs are more suitable for identifying and measuring outsourcing than in the past. 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 (BES). 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. 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.

Despite the greater use of economic census data in the 1997 benchmark, several measurement challenges remained, and two types of purchased services related to outsourcing are worth noting. As described above, NAICS treats auxiliaries as separate establishments and classifies them by industry according to the service they provide rather than according to the industry they serve. This new treatment of auxiliaries had a significant effect on the 1997 benchmark I-O accounts. Because these establishments were recognized and treated as operating (producing) establishments, it was necessary for BEA to prepare gross output estimates for them. BEA defined the gross output of auxiliaries as their total operating expenses, following BEA's convention for measuring the output of non-profit organizations and other entities that produce non-market output.

The largest impact of this new treatment of auxiliaries was in the management of companies and enterprises industry (NAICS category 55). The gross output of this industry and parts of other industries that also include auxiliaries was allocated as an intermediate service to using industries, with the allocations based on economic census data on the industries served by auxiliaries. This new treatment considerably expanded the magnitude of purchased services in the 1997 benchmark because the gross output of auxiliaries was \$340 billion (Lawson et. al.). In prior I-O benchmarks, which were based on the SIC treatment of auxiliaries, the expenses of auxiliaries were treated as though they were the expenses of the industries they served. Because the largest auxiliary expense is for compensation of employees, this new treatment affected the composition of inputs for industries served by auxiliaries, reducing employee compensation and raising the value of services acquired from the auxiliaries.

The treatment of contract labor and employment services such as temporary placement agencies and professional employer organizations (employee leasing) is another important outsourcing-related measurement issue. In the benchmark I-O

accounts, the gross output of the employee leasing firms that provide employees to clients typically includes the compensation of the employees provided plus a commission or fee. Based on economic census data, the compensation of the leased employees is included in the employee leasing industry, which is part of the professional and business services sector. Client industries that use leased employee services consume these services as intermediate inputs; that is, Census-based compensation for these industries does not include the leased employees working on their premises. In contrast, BLS strives to include the employment and payroll of leased employees in the client industries where they work and provide labor services. As a result, questions often arise about the consistency of the reporting of these expenses in both the Census and BLS data.

Employment services, which are one part of the total package of purchased services that firms acquire as part of their overall outsourcing strategy, amounted to about \$90 billion in the 1997 benchmark I-O accounts. Houseman (2007) argues that the growth of employment services has obscured the role of labor in the production process, understating the quantity of labor input in manufacturing and overstating it in non-manufacturing. Houseman also argues that, because of how BLS compiles the estimates, both domestic and foreign outsourcing have important implications for productivity measurement. Employment services can be a significant intermediate input for some manufacturing industries, so she is also concerned about the indirect techniques used for the benchmark I-O accounts to allocate some components of these services to the appropriate manufacturing industries.

## *2. Annual Updates, Imports, and Deflation*

Because BEA's AIAs are prepared using considerably less detailed available source data and in a much shorter time frame than the benchmark accounts, certain assumptions and indirect procedures are needed to update the benchmark estimates. 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 and

imports. However, data are not available annually for updating estimates of purchased services by manufacturing industries and purchased materials used by non-manufacturing industries.

BEA's procedures for annual updates 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, sometimes described as a "constant industry technology" assumption. An industry's real intermediate inputs are thus initially updated based on changes in its real gross output, and the nominal value of its intermediate inputs for the current year is further adjusted based on price changes for the detailed commodity inputs. As with the benchmark accounts, constraints are imposed so that the use of commodities by all industries equals the supply of commodities, after accounting for final uses from the NIPAs. The commodity composition of NIPA final expenditures is assumed to be the same as in the benchmark year. These procedures are used for each year's set of accounts after finalizing the annual I-O use table from the prior year. Updated KLEMS estimates by industry are likewise based on the updated commodity input estimates.

For this paper, BEA's published KLEMS-based intermediate input cost categories have been disaggregated to obtain estimates, by industry, of the imports included in each input cost category. These import use tables have been developed by BEA because of the lack of actual data on the use of imports by industry, a limitation that also applies to the benchmark I-O accounts. For each detailed commodity used by an industry, the portion attributable to imports was calculated as a percentage of the total purchase value, using the economy wide share of imports in the total domestic supply of the commodity. 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. These import shares are first developed for the benchmark use table using very detailed product data, and they are updated annually at the same level of product detail. This "import comparability assumption" is often used in studies of the impact of imports on intermediate inputs.

Separate use tables for imports and for domestically-produced supply allow the use of separate domestic and import price indexes for deflation. For this study, quantity

and price indexes were developed by industry for both the import and domestic portions of energy, materials, and purchased services and also for the broad and narrow definitions of outsourcing. Quantity indexes were obtained by deflating each input category's nominal value with Fisher-Ideal aggregate price indexes. These aggregate price indexes were calculated using detailed price indexes that are matched with the detailed products in the I-O use tables.

The detailed commodity price indexes are obtained from several sources. 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 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. 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. 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.

#### *E. Enhancing the Integrated Annual Industry Accounts*

Plans are underway at BEA to further enhance the accuracy of the AIAs by making improvements to both the benchmark estimates and the annual updating procedures. These improvements include revising the AIAs to incorporate the 2002 benchmark I-O accounts that were released in September 2007 (Stewart et. al.), incorporating annual expense data from Census Bureau surveys during annual updates (Smith and Mayerhauser), and introducing new data from BEA's surveys of multinational companies on imports of services from affiliated companies. Taken together, these efforts will provide opportunities to strengthen the estimates of intermediate inputs and KLEMS within the context of the integrated AIAs and should improve the usefulness of these accounts as an analytical tool.

As part of the next comprehensive revision of the AIAs, scheduled to be released in late 2009, the 2002 benchmark I-O accounts will be incorporated into the AIA time series. A notable improvement introduced in the 2002 benchmark I-O accounts was enhanced integration with the 2002 AIAs that resulted from "reconciling" separate

estimates of gross operating surplus obtained from these accounts (Rassier et. al.). One advantage of this reconciliation was improved estimates of intermediate inputs in the benchmark I-O accounts from incorporating objective information on the quality of source data underlying the estimates of intermediate inputs and gross operating surplus. BEA's new reconciliation model--based on a generalized least squares framework--adjusts intermediate input and gross operating surplus estimates in a way that takes source data reliability into account, within a balanced I-O framework.

Also as part of the 2009 comprehensive revision of the AIAs, BEA will begin to incorporate intermediate input expense data from the Census Bureau's Annual Survey of Manufactures and Services Annual Survey. For the first time, BEA will incorporate Census annual source data as broad expense category controls in preparing estimates of intermediate inputs for the AIAs. While detailed estimates of intermediate inputs will still in part reflect the constant industry technology assumption, using Census source data on business expenses will be another step toward developing annual time series that are based more on objective source data and less on assumptions and indirect procedures.

Another improvement that BEA plans to make during the 2009 comprehensive revision stems from one of the recommendations made by the National Academy of Public Administration (NAPA) following its investigation into data needed for studying offshore outsourcing. NAPA (2006) recommended that BEA collect more detail on the types of services included in transactions between affiliated multinational companies. These transactions are currently classified as "noncomparable imports" in the industry accounts and are not allocated by commodity for the I-O use tables. Greater detail on the nature of the services that foreign companies provide to their U.S. affiliates would allow BEA's import use tables to provide more information on the commodity composition of outsourced offshore services. BEA collected these data for the first time in its 2006 benchmark survey of international services transactions and these data will be incorporated into the annual industry accounts during the next comprehensive revision.

#### **IV. Intermediate Inputs, Outsourcing, and Imports**

Intermediate inputs clearly play an important role in the U.S. economy, accounting for nearly 50 percent of the gross output of all private industries and for more

than 60 percent of the gross output of the goods-producing sector. Purchased services inputs' share of gross output for all private industries increased steadily from 22.6 percent in 1997 to 26.0 percent in 2006, partly because of the growth in outsourcing. While most inputs are still produced domestically, imported intermediates have grown rapidly during this period, increasing at an average annual rate of 8.8 percent. As a result, the import share of intermediate inputs increased from 8.3 percent in 1997 to 10.6 percent in 2006. Most of this increase occurred in the goods-producing sector, where the import share of inputs increased from 12.0 percent to 17.3 percent.

Since 1997, aggregate real output in the U.S. economy has grown much faster than employment, reflecting strong growth in labor productivity. For all private industries, real gross output per full-time equivalent employee increased at an average annual rate of 2.2 percent from 1997-2006, accelerating from 1.9 percent during 1997-2002 to 2.5 percent during 2002-2006. The acceleration of gross output labor productivity growth occurred in both the private goods-producing and private services-producing sectors. While much of the faster growth in labor productivity was due to capital deepening and multifactor productivity (MFP) growth, intermediate input deepening--growth in real intermediate inputs per employee--also made an important contribution.

This section explores some of the reasons for the strong growth in real intermediate inputs in the U.S. private sector, focusing on the contributions of outsourcing and imported inputs after 2002. Tables 1-8 at the end of the paper present nominal shares and real growth rates for 16 broad industry groups for the period 1997-2006 and for two sub-periods. The analysis starts with 1997 because that is the first year for the integrated annual industry accounts. The period 1997-2006 includes the last three years of the previous business-cycle expansion, the downturn that started in 2001, and the recovery that started in late 2001 and continued at least through 2007. Data are presented before and after 2002 because of interesting developments after 2002 in the growth of real gross output and intermediate inputs. For example, although the recovery started in November 2001, real gross output did not increase significantly until 2003. In addition, 2003 was the first full year of very large price increases for energy inputs, a development that has significantly affected cost shares of intermediate inputs and the use of real inputs.

BEA's AIAs have expanded the possibilities for studying relationships among important industry-level variables and GDP. With the estimates presented in this paper, outsourcing can be studied in a broader economic context and in a more thorough manner than in the past. Data that were available in the past for studying outsourcing did not provide complete coverage of all sectors, provided little detail on intermediate inputs, and were not necessarily consistent with GDP from the NIPAs. The estimates of outsourcing and imported inputs are based on unpublished data that were developed for this paper in order to supplement the published estimates of energy, materials, and purchased services. The unpublished data are consistent with the published estimates because they are based on the same underlying detail.

Because our previous paper focused on using BEA's industry data to measure offshore outsourcing of services, it just scratched the surface of the much larger issue of measuring domestic outsourcing. This paper identifies and measures domestic outsourcing by adopting a broader definition and by extending the results to 2006 to better understand changes during the recovery and across industries in both outsourcing and the use of imported inputs. This study also includes estimates of imported materials and energy to illustrate the potential effects of import competition on the output of domestic industries and domestic labor productivity. The prior study ended with data for 2004, just two years after the downturn of 2001. This study uses revised data through 2004 and it includes the strong expansion years of 2005 and 2006.

The next three subsections present results based on trends in nominal cost shares for purchased services and outsourcing, energy and materials, and imported inputs, respectively. The fourth subsection presents results based on intermediate input intensities calculated from quantity indexes for gross output and intermediate inputs.

#### **A. Purchased Services and Outsourcing**

Some studies equate outsourcing with purchased services and often cite increased outsourcing as the major reason for the long-term trend growth in purchased services inputs. Because the two measures are not necessarily equivalent, however, it is important to distinguish outsourcing-related services from other types of purchased services. Partly because no agreement prevails on which types of services constitute outsourcing, our



previous study defined outsourcing somewhat narrowly to include business, professional, and technical (BPT) services but did not include other types of purchased services.

This narrow definition included NAICS commodities 5112 (packaged software), 514 (information and data processing services), 54 (professional, scientific, and technical services), and 561 (administrative and support services). It also included imports of BPT services by U.S. firms from their foreign affiliates, which are classified as noncomparable imports in the I-O accounts. For the most part, these services are the kinds that firms choose either to provide within the establishment using their own employees or to acquire from external suppliers. Other types of services, such as utilities, communications, and finance, are not as likely to be provided within the establishment on an own-account basis.

In this paper, we adopt a broader definition of outsourcing that includes the BPT services described above but that also includes maintenance and repair services, certain kinds of transportation and warehousing services, and services associated with the management of companies and enterprises.<sup>6</sup> This broad definition results in a measure of outsourcing that is about 20 percent larger than one based on the narrow definition, but in contrast it grows a bit more slowly over the period. Other types of purchased services are not included in either definition of outsourcing because most of the other services are not subject to the same kinds of decisions in today's economy about in-house versus contracted-out sourcing. Attachment B provides a list of the detailed I-O commodities included in the broad definition of outsourcing.

Using this broad definition, we find that outsourced input costs accounted for nearly 12 percent of gross output and about 44 percent of purchased services inputs for all private industries in 2006 (table 1, second and third set of columns).<sup>7</sup> Outsourcing increased as a share of purchased services for all private industries from 1997-2002 but it declined after 2002. Outsourcing's share of gross output in 2006 was higher for services-producing industries (12.5 percent) than for goods-producing industries (9.1 percent).

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<sup>6</sup> Nearly all of the output of NAICS industry 551114 consists of auxiliary services provided to other establishments of the same company and it accounts for about five percent of outsourcing. Some would exclude these services because the activities represent intra-company transfers and are not based on market transactions. They are included in the broad definition of outsourcing because some if not all of these services would be purchased from outside of the company if they were not provided by the auxiliaries.

<sup>7</sup> Using the narrow definition from the earlier study, outsourcing accounted for about 37 percent of purchased services.

Professional and business services had the highest outsourcing share of gross output (17.6 percent) followed closely by retail trade (16.2 percent). Utilities' share was the smallest at 2.2 percent, but outsourcing accounted for a relatively large share of its purchased services (60.1 percent).

### **B. Energy and Material Inputs**

Energy and materials input estimates are presented in this paper along with the estimates of purchased services and outsourcing. In BEA's published KLEMS data from the annual industry accounts, all of the domestic commodities that are classified as purchased services are the primary product of one of the services-producing industries. Some secondary products of goods-producing industries that are classified as services on a commodity basis are also included in purchased services.<sup>8</sup> For energy and materials inputs, a similar correspondence exists between the classification of the inputs and the industries that produce them as primary products, but some important exceptions occur that depend on the nature of the product and how it is used in the industry's production process. As a result, the same product can be classified as either energy or material depending on the using industry.

For the most part, materials consist of commodities that are the primary products of industries classified in agriculture, manufacturing, selected mining, and construction industries. Goods (and services) consumed in final uses such as private equipment and software are not included as either material or purchased-services inputs. Materials also include crude petroleum and other raw energy products that are transformed into products for sale. Most fuel mineral products and the products of electric and natural gas utilities are classified as energy for KLEMS if they provide power for operating equipment or for transporting materials. Because crude petroleum used by the refining and coal products industry is classified as materials rather than energy, the sharp increase in crude petroleum prices since 2002 has had a significant impact on the material inputs shares of manufacturing and the goods-producing sector.

Materials costs accounted for 19.3 percent of nominal gross output for all private industries in 2006, down from 21.9 percent in 1997, and energy costs accounted for 2.1 percent of nominal gross output, up slightly from 1.9 percent in 1997 (table 2). Not

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<sup>8</sup> None of the primary products of goods-producing industries are classified as purchased services.

surprisingly, the materials cost share of gross output for private goods-producing industries (45.2 percent) was much larger than for private services-producing industries (7.4 percent). Increases in energy's cost share since 2002 were nearly entirely due to the large relative price increases. Some of the growth in the materials cost share was due to the increase in crude petroleum prices, especially in manufacturing. The energy cost share of transportation and warehousing increased after 2002 from 7.6 percent to 12.0 percent. This reflects the rapid rise in the prices of transportation fuels.

### **C. Imported Intermediate Inputs**

Unpublished estimates of total imported intermediate inputs by establishment-based industry are presented for the first time in this paper. Previously, unpublished estimates were provided only for imported purchased services and for outsourcing-related BPT services. These estimates of imported inputs by industry are based on BEA's unpublished annual import use tables compiled on an establishment-industry basis (before redefinitions). As described above, these use tables are compiled using the import comparability assumption for more than 1,000 detailed "comparable" imported products and by assigning the noncomparable imports from affiliated entities to specific using industries based on data from BEA's surveys of multinational companies.

Commodity imports at detailed product levels were aggregated, for each industry, into the broad categories of energy, materials, and purchased services, as defined for the KLEMS estimates, and into the broad and narrow categories of outsourcing-related services, as defined above for this paper. Nearly all of the noncomparable imports were classified as purchased services in the KLEMS estimates, and a large portion of these were also classified as outsourcing-related services. Imports are valued at domestic port value and include cross-border transport costs, insurance, and import duties.

Imported intermediate inputs increased from \$553 billion in 1997 to \$1,198 billion in 2006. Their share of total U.S. imports in 2006 was 53.9 percent, largely unchanged from 53.5 percent in 1997. For all private industries, the import share of intermediate inputs increased from 8.3 percent in 1997 to 10.6 percent in 2006 (table 3). For private-goods producing industries the import share increased from 12.0 percent in 1997 to 17.3 percent in 2006. The increase for private services-producing industries was much smaller, rising from 5.0 percent to 5.6 percent. Manufacturing's share increased

from 13.5 percent to 20.0 percent, mostly due to rising prices for imported crude petroleum. Other private industry groups with relatively high import shares are mining (14.0 percent), utilities (13.8 percent), and transportation and warehousing (12.2 percent).

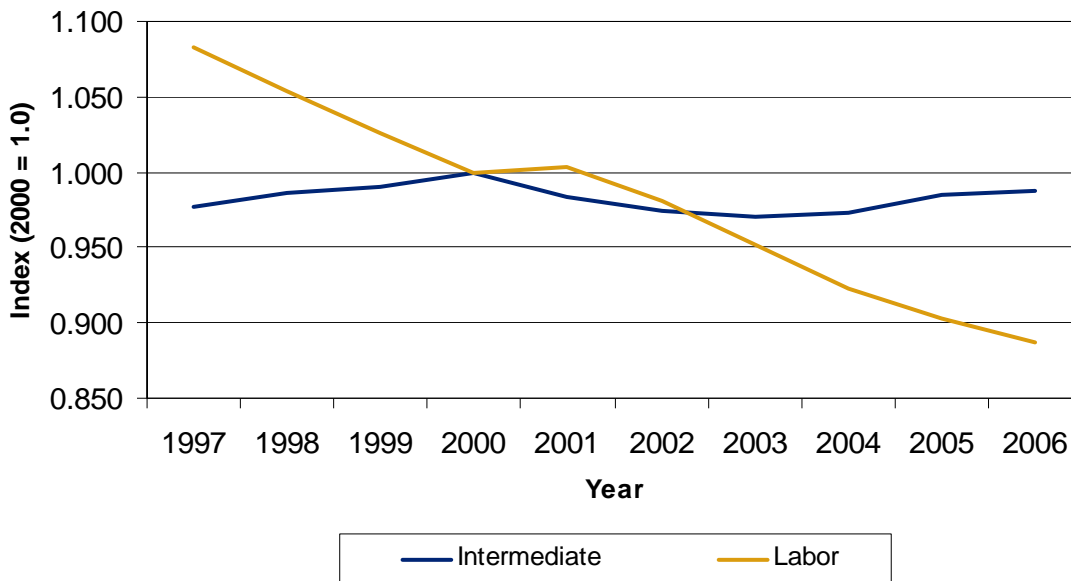
The import share of outsourcing can be interpreted as an indicator of offshore outsourcing. For all private industries, imports accounted for relatively small shares of both purchased services inputs (3.2 percent in 2006) and outsourcing-related inputs (2.3 percent in 2006). While low, the import share of outsourcing steadily increased from 1.7 percent in 1997 to 2.3 percent in 2006. The increase in the share for private goods-producing industries was larger than for private services-producing industries. Outsourcing import shares were highest in manufacturing durable goods (4.8 percent) and in transportation and warehousing (4.1 percent).

Despite the interest in services, imports are much more significant for materials inputs and energy inputs than for purchased services. Among all private industries, imports accounted for 8.0 percent of energy inputs and 20.9 percent of materials inputs in 2006 (table 4). Import shares for both energy and materials have increased sharply since 1997, reflecting both relative price increases and substitution of imports for domestic production. Import shares of energy imports increased rapidly after 2002 due to the surge in prices. Import shares of materials also increased faster after 2002 for both the goods-producing and services-producing sectors.

#### **D. Intermediate Input Intensity**

In this subsection, growth in intermediate inputs after 1997 is explored by examining the contributions of outsourcing and imported inputs to growth in the use of real inputs. Growth in these types of inputs is important because of the implications for the output and employment of domestic industries. Intermediate input intensity is defined as real intermediate inputs per unit of real gross output. Input intensities, which are calculated as a ratio of quantity indexes, show the relative growth of real measures over time. Intensity measures are better than nominal cost shares for identifying the relative importance of real inputs because changes in nominal shares reflect changes in both relative quantities and relative prices. This paper examines the published categories of energy, materials, and purchased services and the unpublished categories of imported and domestic inputs. Domestic and imported input intensities are examined separately.

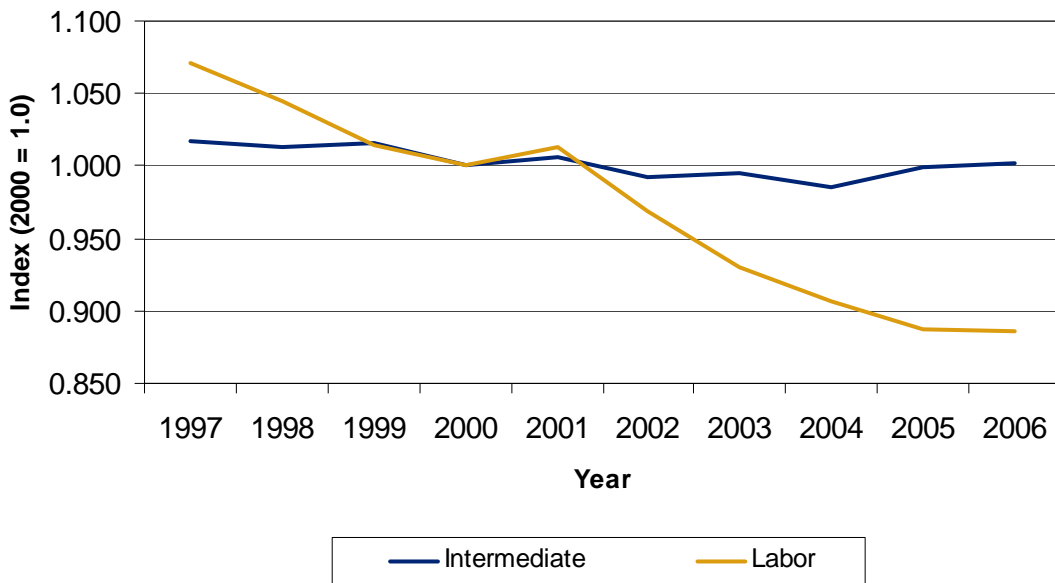
**Chart A.-- Real Input per Unit of Real Gross Output  
All Private Industries**



Growth in an industry's intermediate input intensity may indicate the substitution of energy, materials, and purchased services inputs for labor and capital (value added) inputs in the production process or it may indicate a decline in MFP that results in less real output per unit of all combined inputs.<sup>9</sup> Chart A shows trends in the input intensities of intermediate inputs and labor input for all private industries over the period 1997-2006. Labor input is measured using BEA's estimates of full-time equivalent employment by industry. Intermediate input intensity increased at an average annual rate of 0.1 percent, while the labor intensity of gross output declined at an average annual rate of 2.1 percent. Intermediate input intensity increased from 1997-2000, declined by about the same magnitude during the downturn and the initial stages of the recovery, and then increased sharply after 2003.

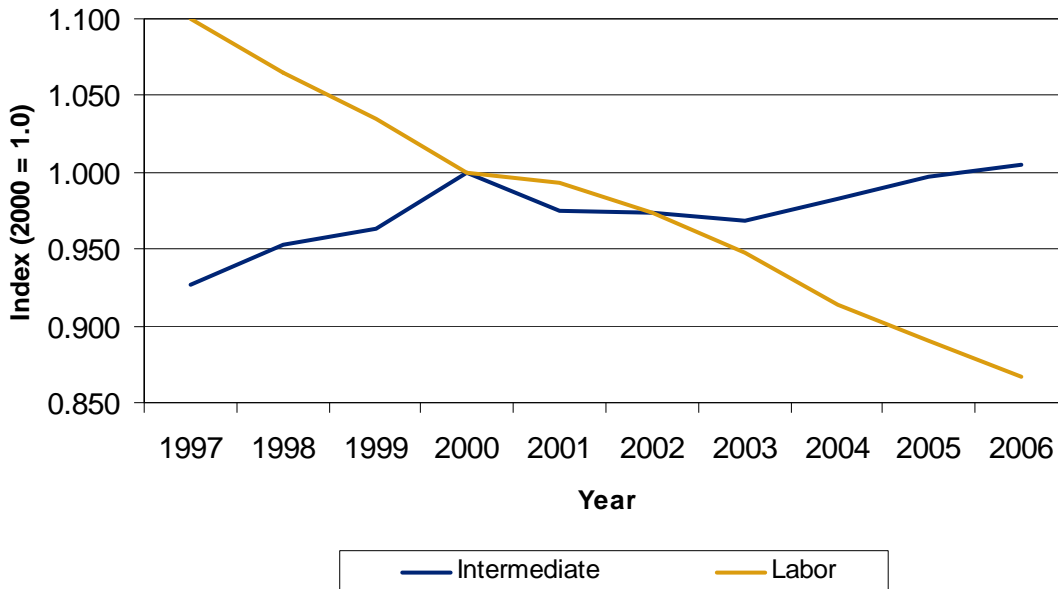
<sup>9</sup> Substitution among inputs is better addressed by the concept of input deepening, usually measured as the growth of one input relative to another input, such as materials per employee. BEA's industry accounts do not provide separate measures of capital services so the data cannot be used to calculate input deepening measures for all possible input combinations.

**Chart B.-- Real Input per Unit of Real Gross Output  
Private Goods Industries**



The patterns of change differed for the private goods-producing and private services-producing sectors of the economy. For the private goods sector, which consists mostly of manufacturing and accounts for about 20 percent of GDP, intermediate input intensity declined at a 0.2 percent annual rate over the entire period, but it increased noticeably in 2005 and 2006 (chart B). For manufacturing alone, the intermediate input intensity declined 0.6 percent, partly reflecting growth in capital services and MFP. For the private services sector, which accounts for about 70 percent of GDP, the intermediate input intensity increased sharply at an average annual rate of 0.9 percent over the period (chart C). Strong growth from 1997 through 2000 was followed by a decline through 2003 and then by strong growth again after 2003.

**Chart C.-- Real Input per Unit of Real Gross Output  
Private Services Industries**



For all private industries, the increase in intermediate input intensity was more than accounted for by the growth in real purchased services per unit of real gross output. Within purchased services, outsourcing-related services made an important contribution, but not as much as services that are not outsourcing-related. Purchased services intensity increased at an average annual rate of 1.8 percent (table 5). The input intensity of broadly defined outsourcing increased at an average annual rate of 0.8 percent, less than half the rate of purchased services. This implies that the intensity for services not outsourcing related, such as utilities, communications, and finance, increased even faster. The outsourcing intensity of services increased faster than that for goods. Input intensities for energy and materials both declined over the entire period for both the goods and services-producing sectors (table 6).

Even though imports accounted for only 10.6 percent of intermediate inputs, the slight increase in intermediate input intensity for all private industries was nearly entirely due to imported intermediate inputs. The import intensity of intermediate inputs relative to domestic intermediate inputs is calculated as real imported inputs per unit of real domestic input. This intensity measure increased at an average annual rate of 2.0 percent over the entire period, accelerating to 2.4 percent after 2002 (table 7). The increase for

all intermediate inputs and for each category of inputs suggests substantial substitution of imported inputs for domestic inputs in the production of both goods and services.

The import intensity of purchased services increased 1.7 percent for all private industries, but outsourcing's import intensity increased much faster (6.2 percent). The import intensity of outsourcing in the goods-producing sector increased a robust 9.4 percent over the same period. Import intensities of outsourcing increased strongly for all of the private industry groups in both periods. Import intensities also increased strongly for both energy and materials inputs. For all private industries, the import intensity for materials inputs increased 3.9 percent and for energy inputs it increased 6.4 percent (table 8). The strong growth in the materials input intensity was uniform among private industry groups, suggesting widespread substitution over the period of imported for domestic materials. The strong growth in the import intensity of energy inputs primarily occurred after 2002 in both the goods and services sectors, despite an increase in the relative price of imported energy imports during this period.

## **V. Summary and Conclusion**

Economists often turn first to aggregate data from the national accounts to understand new developments in the economy, and for most developed countries national accounts data are timely enough and have sufficient detail to allow researchers to address the most salient features of emerging events. Yet unless the national accounts data are integrated with industry-level production-oriented data, researchers will find it difficult to determine whether new developments are simply short-term fluctuations around an existing trend or represent the initial stages of more fundamental structural change.

For example, the acceleration of labor productivity growth in the mid-1990s spurred discussion among economists about the emergence of a "new economy" propelled by investment in information and communications technology. This development was first studied using aggregate data from the national accounts on business investment and employment. Later studies focused on the role of specific industries to better understand the sources of faster growth. Studies of offshore outsourcing have followed a similar path. Initial studies using national accounts data looked at imported services and its implications for aggregate economic growth. Later



studies, though, tried to understand outsourcing in the broader context of structural change at the industry level.

Offshore outsourcing has received considerable attention during the past ten years, mostly because of concerns about its effects on the output and employment of domestic industries. Much anxiety has been expressed about the potential loss of high-paying professional jobs to foreign competitors. While the impact of import substitution on jobs is not a new concern, the affected industries and occupations are now different. Offshore outsourcing, however, should be studied in the broader context of domestic outsourcing, which is considerably larger and may be a pre-cursor to offshore outsourcing. Domestic outsourcing does not have the same job-loss implications as offshore outsourcing, but it is an important and interesting development that requires further study.

Empirical evidence for studying and assessing the impact of domestic outsourcing has been quite limited. A recent NAPA report on off-shoring identified gaps and limitations in the federal statistical system that have stymied attempts to better understand the magnitude and impact of offshore outsourcing. Many of those data limitations are specific to foreign trade and are related to difficulties obtaining reliable data on international transactions. Some of the limitations, however, relate to domestic data and directly affect the measurement of outsourcing. One possible reason for the limited empirical evidence is the lack of consensus in the economics profession about what constitutes outsourcing and how it manifests itself in the economy. Another reason is a lack of direction from international guidelines on how to measure outsourcing.

This paper highlights results based on a combination of published and unpublished data from BEA's integrated annual industry accounts that shed light on domestic outsourcing and imported inputs. For this purpose, the paper adopts a specific concept of outsourcing that is based on changes over time in the mix of industry inputs used in production. We find that the intermediate input intensity of gross output has increased since 1997 as the labor intensity has declined, that outsourcing-related services have experienced strong growth in both the goods and services sectors, that other types of purchased services have grown even faster than outsourcing, and that the import

intensity of intermediate inputs has increased sharply due to imports of outsourcing-related services and materials inputs.

This paper has also identified some limitations in the data for studying outsourcing that may affect the reliability of the estimates. BEA's annual industry accounts require the use of several assumptions to provide updated estimates and these accounts also do not provide data on occupation by industry or on capital services by industry. Although these data are separately available from BLS, they are not easily integrated with the BEA industry data. The additional data are necessary for understanding the process of substitution among all inputs--labor, capital, and intermediate--and the effects of outsourcing on industry output and employment. Data enhancements are also needed that would allow direct measurement of imported intermediate inputs by industry and that would improve price indexes for services and for imports. BEA plans to make several improvements for the next comprehensive revision that should improve the accuracy of the outsourcing estimates.

Guidance would be very welcome from the research community and from international standards for how statistical agencies should go about developing industry-level time series data that are suitable for studying outsourcing. This would include assistance with the appropriate concepts and definitions, including identifying activities subject to outsourcing, how they differ from other types of purchases services, and how to distinguish outsourcing from technological change and the overall growth of services. Other related issues not directly addressed in this paper include the treatment of leased assets, capitalized outsourced services such software, and own-account capital formation. The recommendation in the revised SNA for multifactor productivity measurement at the industry level in a KLEMS framework is an important step forward, but additional guidance aimed directly at improving the measurement of outsourcing is also needed.

## **Attachment A.--The ABC Toaster Company in the Economic Census and the Benchmark Input-Output Accounts**

The evolution of the hypothetical ABC Toaster Company illustrates how changes in a company's organizational structure and the ways it acquires its inputs and markets its output would be reflected in the data available for measuring outsourcing. In less than 15 years, ABC transforms itself from a single-establishment manufacturing enterprise to a multi-establishment wholesale trade enterprise that imports the products it sells. Along the way, it also makes changes in how it acquires material inputs used in production and inputs of administrative support and professional services.

### **ABC from 1988 to the Early 1990's**

ABC started as a single-establishment manufacturing firm in eastern Pennsylvania in 1988. It did not report in the 1987 economic census and, as a result, was not eligible to be selected for the Annual Survey of Manufactures. At the time, ABC employed production workers at its manufacturing plant and accountants, clerical staff, and sales staff in offices located next to the plant. It did not purchase services from outside the company and all of its material inputs were acquired from U.S. producers. Most of its output was sold directly to retailers in eastern states but some of it was also sold to independent merchant wholesalers serving markets in western Pennsylvania and some mid-eastern states.

Transport costs for shipping its toasters to its western markets became quite expensive in the early 1990's due to the spike in energy prices, so ABC opened another manufacturing plant in western Pennsylvania, with the same mix of employees as the eastern location. During the recession of 1990-91, ABC decided, in a cost-cutting move, to consolidate its administrative staff in a separate office building located near the eastern plant. As a result, the administrative staff from both plants relocated to the company's new central administrative office (CAO). That same year, ABC also consolidated its sales and marketing activities in a single location. This manufacturer's sales branch (MSB) was located at a new office building in central Pennsylvania. All of the sales staff moved from offices at the plants to the new location.

In the Census Bureau's 1992 Enterprise Statistics, ABC was classified as a manufacturing enterprise with employment and payroll in manufacturing (SIC 3634), in

wholesale trade, and in auxiliaries. Because the company was classified in manufacturing, tabulations of any of its data items would be reported in SIC 36. Its establishment-based sales, payroll, operating expenses, and employment, however, appeared in the Census of Manufactures, the Census of Wholesale Trade (due to the MSB), and in a separate report for CAOs and other auxiliaries. The latter program also provided information on the establishment-based industries served by the auxiliaries.

In BEA's 1992 benchmark input-output (I-O) accounts, the gross output of SIC 3634 included ABC's product shipments and the value of its inventory change. No output was recorded in any industry for the activities of the CAO, but its operating expenses (mostly payroll) were combined with the operating expenses of the manufacturing establishments that it served in SIC 3634. In contrast, the gross output of the wholesale trade industry included the operating expenses of the MSB, due to I-O convention. Although sales data for the MSB were available from the Census of Wholesale Trade, BEA measured the gross output of MSBs by their operating expenses, which is a measure of the wholesale trade margin on the toasters. Because ABC did not purchase services from outside the company, intermediate inputs from the Census of Manufactures included only materials and energy. Some of ABC's material inputs were now imported, but the data did not identify the source of the materials.

### **ABC After 1992**

During the next few years, demand for ABC's toasters increased on the west coast and labor costs became cheaper in the Sun Belt, so ABC closed its western Pennsylvania plant and opened a new plant in Arizona. That plant sold toasters directly to independent wholesalers in the west but the eastern plant continued to arrange its sales through the Pennsylvania MSB. The Pennsylvania CAO still provided administrative and professional services to both plants, but it became increasingly difficult to serve the Arizona plant. As a result, ABC authorized that plant to acquire professional services directly from independent west coast firms. Unfortunately, because of this change some professional staff in eastern Pennsylvania had to leave the company. A few employees, however, relocated to the west coast to work for professional services firms, including one firm that acquired ABC as a client.

In the 1997 economic census, the company's structure was the same as in 1992 but it now had one establishment in Arizona and one less in Pennsylvania. ABC was still classified as a manufacturing enterprise in the Enterprise Statistics program.<sup>10</sup> Its product shipments were classified in NAICS industry 335211. As a result of NAICS, however, the CAO was now separately classified in a new industry for the management of companies (NAICS 551114), and its payroll and other operating expenses were collected in the economic census. BEA's I-O accounts measured the gross output of the CAO by its operating expenses, and this output was allocated to the manufacturing industry as an intermediate input (purchased service). The I-O accounts also included as intermediate inputs professional services purchased by the Arizona plant directly from others firms.

After 1997, labor costs became even cheaper in Asia than in Arizona, so ABC closed both of its U.S. plants and opened a new, large plant in China. Most of the plant's U.S. sales were arranged through its company-owned wholesaler in central Pennsylvania, but some sales were still made through independent wholesalers in various parts of the country.<sup>11</sup> As a result of these changes, ABC was no longer classified as a manufacturing enterprise in the 2002 economic census but rather as a wholesale trade enterprise. Data for domestic manufacturing shipments no longer included ABC's toasters, which were now classified as merchandise imports in the I-O accounts and were included in the total supply of toasters. The output of both the company-owned wholesaler and the independent wholesalers included the gross margin on the imported toasters. This gross margin was treated in the I-O accounts as part of the purchasers' price of toasters.

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<sup>10</sup> The Census Bureau did not publish Enterprise Statistics data after 1992.

<sup>11</sup> In the 1997 economic census, the Census Bureau introduced a new merchant wholesale trade category with the description "own brand importer-marketers." These wholesalers were defined as establishments that deal primarily or exclusively in the parent company's own branded products manufactured outside of the U.S. Prior to 1997, these establishments were classified as manufacturers' sales branches or offices.

**Attachment B. -- Commodities Included in BEA's Broad Measure of Outsourcing-Related Services**

<u>Commodity Code</u>	<u>Commodity Description</u>
2337	Maintenance and repair construction
4840	Truck transportation
4921	Couriers
4930	Warehousing and storage
5112	Software Publishers
5141	Information Services
5142	Data Processing Services
5411	Legal Services
5412	Accounting, Tax Preparation, Bookkeeping, and Payroll Services
5413	Architectural, Engineering, and Related Services
5414	Specialized Design Services
5415	Computer Systems Design and Related Services
5416	Management, Scientific, and Technical Consulting Services
5417	Scientific Research and Development Services
5418	Advertising and Related Services
5419	Other Professional, Scientific, and Technical Services
5511	Management of Companies and Enterprises
5611	Office Administrative Services
5612	Facilities Support Services
5613	Employment Services
5614	Business Support Services
5615	Travel Arrangement and Reservation Services
5616	Investigation and Security Services
5617	Services to Buildings and Dwellings
5619	Other Support Services
8110	Repair and maintenance
8111	Automotive Repair and Maintenance
8112	Electronic and Precision Equipment Repair and Maintenance
8113	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
9N00 (pt.)	Other private services payments to affiliated foreigners

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**Table 1.-- Purchased Services and Outsourcing Shares of Nominal Gross Output by Industry Group, Selected Years  
(Percent)**

Industry Group	Purchased Services Share of Gross Output			Outsourcing Share of Gross Output			Outsourcing Share of Purchased Services		
	1997	2002	2006	1997	2002	2006	1997	2002	2006
All industries	22.5	24.9	26.0	10.2	11.7	11.8	45.4	46.9	45.3
Private industries	22.6	24.9	26.0	10.2	11.5	11.5	45.0	46.2	44.1
Agriculture, forestry, fishing, and hunting	18.1	18.9	18.2	3.0	3.9	3.5	16.8	20.9	19.4
Mining	18.5	21.7	15.7	8.2	9.8	7.4	44.1	45.3	47.2
Utilities	8.6	6.8	3.6	4.6	4.0	2.2	53.5	59.1	60.1
Construction	14.4	13.6	14.0	9.2	8.8	8.8	64.0	64.6	62.7
Manufacturing	14.9	17.0	16.2	8.8	10.4	9.7	59.0	61.0	60.1
Durable goods	15.0	16.5	16.1	8.8	10.2	9.8	59.0	61.9	60.8
Nondurable goods	14.7	17.6	16.3	8.7	10.5	9.7	59.0	60.0	59.3
Wholesale trade	22.6	22.9	26.1	12.5	12.6	13.7	55.2	55.2	52.4
Retail trade	23.0	25.3	28.9	13.4	15.1	16.2	58.3	59.8	56.0
Transportation and warehousing	34.2	32.9	31.0	16.1	16.1	14.5	47.2	49.1	46.7
Information	37.5	43.3	44.3	12.3	15.1	15.4	32.8	34.8	34.8
Finance, insurance, real estate, rental, and leasing	29.4	28.7	32.6	8.6	8.6	9.7	29.1	30.0	29.7
Professional and business services	26.1	31.3	31.6	14.7	18.2	17.6	56.5	58.1	55.7
Educational services, health care, and social assistance	26.2	27.3	28.5	10.3	10.9	10.7	39.2	40.0	37.8
Arts, entertainment, recreation, accommodation, and food services	22.0	23.7	25.8	8.2	8.7	8.7	37.3	36.9	33.6
Other services, except government	24.2	26.0	28.0	9.9	11.1	11.3	40.7	42.8	40.4
Government	22.0	24.8	26.4	10.7	12.9	14.3	48.8	52.1	54.0
Addenda:									
Private goods producing industries <sup>1</sup>	15.1	16.7	15.9	8.5	9.8	9.1	56.2	58.5	57.5
Private services-producing industries <sup>2</sup>	26.9	28.7	30.6	11.1	12.3	12.5	41.5	43.0	40.9

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 2.-- Energy and Materials Shares of Nominal Gross Output by Industry Group, Selected Years  
(Percent)**

Industry Group	Energy Share of Gross Output			Materials Share of Gross Output			Energy Share of Energy plus Materials		
	1997	2002	2006	1997	2002	2006	1997	2002	2006
All industries	2.0	1.9	2.4	20.6	17.5	18.2	8.7	9.7	11.4
Private industries	1.9	1.7	2.1	21.9	18.5	19.3	7.9	8.6	10.0
Agriculture, forestry, fishing, and hunting	3.6	4.3	4.3	37.4	38.6	38.2	8.8	10.0	10.2
Mining	4.2	3.7	4.7	22.7	21.4	19.8	15.7	14.9	19.2
Utilities	11.2	11.5	10.6	18.3	18.5	22.4	38.0	38.2	32.2
Construction	1.2	1.0	1.5	34.4	32.2	34.5	3.5	2.9	4.2
Manufacturing	1.7	1.5	1.7	49.5	46.4	50.7	3.4	3.2	3.3
Durable goods	1.3	1.0	1.1	48.0	45.3	47.8	2.5	2.2	2.3
Nondurable goods	2.3	2.1	2.3	51.4	47.6	53.7	4.4	4.2	4.1
Wholesale trade	1.1	0.9	1.3	7.1	5.7	6.8	13.1	14.2	16.3
Retail trade	1.7	1.6	2.1	6.1	6.5	6.3	22.2	20.2	24.5
Transportation and warehousing	7.9	7.6	12.0	7.6	6.7	6.1	51.0	53.3	66.2
Information	0.4	0.3	0.3	10.2	8.6	8.4	3.7	3.8	3.8
Finance, insurance, real estate, rental, and leasing	1.0	1.2	1.5	4.0	3.2	3.4	19.6	26.6	30.0
Professional and business services	1.2	1.2	1.4	5.5	5.5	5.3	17.9	17.5	21.4
Educational services, health care, and social assistance	1.0	1.0	1.1	11.0	10.1	9.8	8.4	8.9	10.1
Arts, entertainment, recreation, accommodation, and food services	2.2	2.1	2.2	21.5	18.5	17.0	9.5	10.2	11.5
Other services, except government	1.5	1.4	1.6	17.6	17.8	17.2	7.7	7.4	8.7
Government	2.7	3.0	4.1	10.4	10.2	9.6	20.3	22.5	29.8
Addenda:									
Private goods producing industries <sup>1</sup>	1.9	1.6	2.0	45.8	42.6	45.2	3.9	3.7	4.2
Private services-producing industries <sup>2</sup>	1.9	1.8	2.2	8.3	7.5	7.4	18.7	19.3	23.1

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 3.— Import Shares of Total Intermediate, Purchased Services, and Outsourcing Inputs by Industry Group, Selected Years (Percent)**

Industry Group	Import Share of Intermediate Inputs			Import Share of Purchased Services Inputs			Import Share of Outsourcing Inputs		
	1997	2002	2006	1997	2002	2006	1997	2002	2006
All industries	8.1	8.3	10.4	2.6	3.0	3.1	1.5	1.9	2.1
Private industries	8.3	8.5	10.6	2.7	3.0	3.2	1.7	2.0	2.3
Agriculture, forestry, fishing, and hunting	5.0	5.6	7.3	0.2	0.3	0.4	0.5	0.6	0.9
Mining	9.5	9.2	14.0	2.4	2.5	2.2	2.1	2.8	2.6
Utilities	6.1	9.0	13.8	0.6	0.7	1.1	0.5	0.6	1.0
Construction	5.0	5.9	7.3	0.9	0.9	0.9	0.7	0.7	0.8
Manufacturing	13.5	15.0	20.0	3.3	4.7	5.3	1.8	2.7	3.4
Durable goods	14.6	15.6	18.9	3.4	4.9	5.7	2.4	3.7	4.8
Nondurable goods	12.1	14.3	20.9	3.2	4.5	4.9	1.1	1.5	1.9
Wholesale trade	6.1	7.3	7.5	3.8	5.5	4.8	2.3	3.7	3.6
Retail trade	3.1	3.7	4.1	0.5	0.5	0.5	0.5	0.5	0.5
Transportation and warehousing	9.2	9.7	12.2	9.6	9.9	12.1	3.1	3.5	4.1
Information	7.0	5.1	5.5	4.6	2.4	2.3	2.3	2.4	2.7
Finance, insurance, real estate, rental, and leasing	3.3	4.8	4.9	2.5	4.3	4.2	2.4	3.2	3.1
Professional and business services	3.8	3.7	4.3	1.6	1.5	1.7	1.5	1.5	1.8
Educational services, health care, and social assistance	3.9	4.2	4.8	0.3	0.3	0.5	0.4	0.4	0.4
Arts, entertainment, recreation, accommodation, and food services	4.2	4.7	5.3	0.5	0.5	0.6	0.6	0.6	0.7
Other services, except government	5.9	6.3	7.6	0.4	0.5	0.5	0.6	0.6	0.7
Government	5.7	6.3	8.0	2.4	2.6	2.8	0.6	0.6	0.9
Addenda:									
Private goods producing industries <sup>1</sup>	12.0	13.2	17.3	2.8	3.8	4.1	1.7	2.3	2.9
Private services-producing industries <sup>2</sup>	4.7	5.1	5.8	2.6	2.8	2.9	1.7	1.9	2.1

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 4.-- Import Shares of Total Intermediate, Energy, and Materials Inputs by Industry Group, Selected Years  
(Percent)**

Industry Group	Import Share of Intermediate Inputs			Import Share of Energy Inputs			Import Share of Materials Inputs		
	1997	2002	2006	1997	2002	2006	1997	2002	2006
All industries	8.1	8.3	10.4	3.6	5.0	9.8	14.5	16.2	20.8
Private industries	8.3	8.5	10.6	2.9	3.6	8.0	14.6	16.4	20.9
Agriculture, forestry, fishing, and hunting	5.0	5.6	7.3	2.6	3.7	3.4	7.6	8.3	11.0
Mining	9.5	9.2	14.0	7.2	11.6	22.5	15.8	15.6	21.4
Utilities	6.1	9.0	13.8	5.8	8.0	13.3	8.9	12.7	16.0
Construction	5.0	5.9	7.3	3.3	4.7	5.9	6.8	8.1	10.0
Manufacturing	13.5	15.0	20.0	2.3	2.5	8.1	16.9	19.2	25.1
Durable goods	14.6	15.6	18.9	1.1	1.3	4.4	18.5	19.9	23.7
Nondurable goods	12.1	14.3	20.9	3.2	3.2	10.0	15.0	18.4	26.3
Wholesale trade	6.1	7.3	7.5	1.4	1.9	5.9	14.2	15.3	18.4
Retail trade	3.1	3.7	4.1	0.9	1.5	4.3	13.5	16.8	20.3
Transportation and warehousing	9.2	9.7	12.2	4.4	4.9	10.0	12.2	13.9	17.5
Information	7.0	5.1	5.5	0.6	1.0	3.2	15.8	19.1	22.2
Finance, insurance, real estate, rental, and leasing	3.3	4.8	4.9	0.5	0.5	1.1	9.7	11.0	12.9
Professional and business services	3.8	3.7	4.3	3.7	5.4	12.2	14.2	15.4	18.0
Educational services, health care, and social assistance	3.9	4.2	4.8	1.2	1.7	5.1	12.6	15.0	17.3
Arts, entertainment, recreation, accommodation, and food services	4.2	4.7	5.3	0.4	0.7	2.4	8.4	10.5	12.7
Other services, except government	5.9	6.3	7.6	0.9	1.3	3.5	13.9	15.2	19.5
Government	5.7	6.3	8.0	8.0	10.9	17.6	12.1	14.1	18.3
Addenda:									
Private goods producing industries <sup>1</sup>	12.0	13.2	17.3	2.8	3.7	9.5	15.4	17.2	22.3
Private services-producing industries <sup>2</sup>	4.7	5.1	5.8	2.9	3.6	7.3	12.0	14.3	17.0

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 5.-- Real Intermediate Inputs, Purchased Services Inputs, and Outsourcing Inputs per Unit of Real Gross Output  
(Average Annual Growth Rates, Selected Periods)**

Industry Group	Intermediate Inputs per Unit of Real Gross Output			Purchased Services Inputs per Unit of Real Gross Output			Outsourcing Inputs per Unit of Real Gross Output		
	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006
All industries	0.3	0.3	0.4	1.9	1.9	2.0	1.2	1.5	0.8
Private industries	0.1	0.0	0.3	1.8	1.7	1.9	0.8	1.2	0.4
Agriculture, forestry, fishing, and hunting	-0.7	-0.3	-1.3	-0.8	-1.7	0.4	-0.2	1.2	-1.8
Mining	2.3	2.3	2.2	2.1	4.0	-0.1	5.9	5.8	6.0
Utilities	-2.7	-1.5	-4.2	-7.8	-5.3	-10.9	-6.7	-3.4	-10.7
Construction	2.4	1.3	3.9	2.2	0.4	4.6	1.5	-0.1	3.4
Manufacturing	-0.6	-0.9	-0.4	0.3	0.4	0.1	-0.3	0.2	-0.8
Durable goods	-1.4	-1.6	-1.1	-1.3	-1.4	-1.2	-1.9	-1.6	-2.3
Nondurable goods	0.3	0.1	0.4	2.2	2.8	1.6	1.8	2.5	0.8
Wholesale trade	0.6	-2.2	4.3	0.8	-2.0	4.3	-0.4	-2.6	2.6
Retail trade	0.5	0.4	0.6	0.8	0.1	1.6	0.0	0.4	-0.6
Transportation and warehousing	-1.5	-1.2	-1.8	-1.0	-1.0	-1.1	-1.1	-0.6	-1.8
Information	0.0	1.2	-1.5	0.5	1.8	-1.2	0.3	2.1	-1.8
Finance, insurance, real estate, rental, and leasing	1.6	0.4	3.0	1.9	0.7	3.5	0.8	-0.8	2.9
Professional and business services	2.6	4.2	0.6	2.9	4.5	1.0	2.5	4.7	-0.3
Educational services, health care, and social assistance	1.3	2.0	0.4	1.9	2.6	1.1	0.9	1.9	-0.4
Arts, entertainment, recreation, accommodation, and food services	0.3	0.3	0.3	2.1	1.7	2.5	0.7	1.4	-0.1
Other services, except government	2.6	3.3	1.8	2.7	2.9	2.5	2.4	3.4	1.1
Government	2.3	3.2	1.1	3.3	3.8	2.7	4.1	4.2	3.9
Addenda:									
Private goods producing industries <sup>1</sup>	-0.2	-0.5	0.2	0.6	0.4	0.8	0.3	0.4	0.2
Private services-producing industries <sup>2</sup>	0.9	1.0	0.8	1.7	1.5	1.8	0.8	1.3	0.3

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 6.-- Real Intermediate Inputs, Energy Inputs, and Materials Inputs per Unit of Real Gross Output  
(Average Annual Growth Rates, Selected Periods)**

Industry Group	Intermediate Inputs per Unit of Real Gross Output			Energy Inputs per Unit of Real Gross Output			Materials Inputs per Unit of Real Gross Output		
	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006
All industries	0.3	0.3	0.4	-2.5	-1.4	-3.7	-1.4	-1.6	-1.2
Private industries	0.1	0.0	0.3	-2.8	-2.3	-3.4	-1.6	-1.9	-1.3
Agriculture, forestry, fishing, and hunting	-0.7	-0.3	-1.3	-4.3	-0.2	-9.2	-0.3	0.5	-1.3
Mining	2.3	2.3	2.2	2.8	-0.3	6.9	2.3	1.4	3.4
Utilities	-2.7	-1.5	-4.2	-1.8	0.4	-4.5	-1.6	-0.9	-2.5
Construction	2.4	1.3	3.9	-1.9	-3.7	0.5	2.7	1.8	3.7
Manufacturing	-0.6	-0.9	-0.4	-3.9	-4.9	-2.7	-0.8	-1.1	-0.4
Durable goods	-1.4	-1.6	-1.1	-6.0	-7.1	-4.5	-1.3	-1.6	-0.9
Nondurable goods	0.3	0.1	0.4	-2.1	-2.8	-1.3	-0.2	-0.6	0.2
Wholesale trade	0.6	-2.2	4.3	-2.6	-4.8	0.2	0.7	-2.6	5.1
Retail trade	0.5	0.4	0.6	-2.6	-2.0	-3.3	0.2	2.0	-2.1
Transportation and warehousing	-1.5	-1.2	-1.8	-2.4	-1.6	-3.4	-2.2	-1.7	-2.9
Information	0.0	1.2	-1.5	-6.5	-4.0	-9.4	-2.1	-1.3	-3.0
Finance, insurance, real estate, rental, and leasing	1.6	0.4	3.0	2.0	3.5	0.2	-1.7	-3.4	0.4
Professional and business services	2.6	4.2	0.6	-1.9	-0.3	-3.9	1.9	3.8	-0.5
Educational services, health care, and social assistance	1.3	2.0	0.4	-1.2	1.1	-3.9	-0.2	0.5	-0.9
Arts, entertainment, recreation, accommodation, and food services	0.3	0.3	0.3	-1.9	-0.3	-3.9	-1.5	-1.1	-2.0
Other services, except government	2.6	3.3	1.8	-0.8	1.2	-3.2	2.7	4.0	1.1
Government	2.3	3.2	1.1	-0.2	3.6	-4.7	0.8	1.9	-0.6
Addenda:									
Private goods producing industries <sup>1</sup>	-0.2	-0.5	0.2	-3.1	-4.1	-2.0	-0.3	-0.7	0.1
Private services-producing industries <sup>2</sup>	0.9	1.0	0.8	-2.7	-1.6	-4.1	-1.0	-0.5	-1.6

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 7.— Real Imported Inputs per Unit of Real Domestic Input: Intermediate, Purchased Services, and Outsourcing Inputs by Industry Group  
(Average Annual Growth Rates, Selected Periods)**

Industry Group	Intermediate Inputs per Unit of Domestic Input			Purchased Services Inputs per Unit of Domestic Input			Outsourcing Inputs per Unit of Domestic Input		
	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006
All industries	2.1	1.8	2.4	1.6	2.8	0.0	5.9	5.9	5.9
Private industries	2.0	1.7	2.4	1.7	2.6	0.4	6.2	6.4	5.9
Agriculture, forestry, fishing, and hunting	2.3	2.2	2.4	7.0	9.5	3.9	10.5	6.5	15.7
Mining	5.0	0.6	10.7	4.6	5.8	3.2	5.7	8.1	2.8
Utilities	6.4	7.2	5.3	8.1	4.7	12.5	9.2	2.6	18.0
Construction	5.2	5.6	4.7	0.5	0.9	0.0	3.1	2.5	3.8
Manufacturing	3.5	3.0	4.2	6.6	8.7	4.0	10.4	10.7	10.0
Durable goods	4.3	3.0	6.0	7.0	8.7	4.8	11.5	12.0	10.9
Nondurable goods	2.7	2.8	2.6	6.2	8.9	3.0	9.0	9.0	9.1
Wholesale trade	3.7	5.9	1.1	3.2	9.1	-3.7	7.8	12.5	2.2
Retail trade	4.9	6.8	2.6	0.9	2.3	-0.8	3.5	3.3	3.8
Transportation and warehousing	1.8	0.7	3.1	-0.1	-0.1	-0.1	3.7	2.5	5.3
Information	-0.3	-3.3	3.7	-7.0	-12.4	0.1	3.4	2.0	5.1
Finance, insurance, real estate, rental, and leasing	3.8	7.1	-0.2	4.4	9.1	-1.1	5.9	8.7	2.3
Professional and business services	3.5	3.0	4.2	1.2	0.3	2.3	4.2	2.6	6.3
Educational services, health care, and social assistance	4.2	3.6	4.9	4.7	-0.4	11.5	4.5	3.0	6.4
Arts, entertainment, recreation, accommodation, and food services	4.0	5.1	2.6	3.6	1.0	6.9	4.1	3.1	5.3
Other services, except government	5.5	4.0	7.4	2.2	1.5	3.2	4.8	4.1	5.8
Government	3.8	4.5	3.0	1.5	5.6	-3.3	4.0	-0.4	9.9
Addenda:									
Private goods producing industries <sup>1</sup>	3.3	2.8	3.9	5.9	8.3	3.1	9.4	10.0	8.8
Private services-producing industries <sup>2</sup>	2.6	3.0	2.1	0.5	1.0	-0.2	5.0	5.1	4.8

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.

**Table 8.-- Real Imported Inputs per Unit of Real Domestic Input: Intermediate, Energy, and Materials Inputs by Industry Group  
(Average Annual Growth Rates, Selected Periods)**

Industry Group	Intermediate Inputs			Energy Inputs			Materials Inputs		
	per Unit of Domestic Input			per Unit of Domestic Input			per Unit of Domestic Input		
	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006	1997-2006	1997-2002	2002-2006
All industries	2.1	1.8	2.4	6.9	4.0	10.6	4.0	3.4	4.8
Private industries	2.0	1.7	2.4	6.4	2.1	11.9	3.9	3.3	4.6
Agriculture, forestry, fishing, and hunting	2.3	2.2	2.4	0.1	5.4	-6.2	2.1	1.2	3.1
Mining	5.0	0.6	10.7	11.7	8.3	16.0	4.3	0.2	9.6
Utilities	6.4	7.2	5.3	4.4	4.3	4.5	5.7	7.4	3.7
Construction	5.2	5.6	4.7	3.8	6.0	1.0	5.4	5.5	5.4
Manufacturing	3.5	3.0	4.2	8.5	-1.7	22.9	3.6	2.9	4.4
Durable goods	4.3	3.0	6.0	9.0	0.4	20.7	4.1	2.5	6.2
Nondurable goods	2.7	2.8	2.6	8.0	-2.8	23.2	2.9	3.1	2.7
Wholesale trade	3.7	5.9	1.1	9.7	3.4	18.2	4.5	2.9	6.5
Retail trade	4.9	6.8	2.6	10.9	6.4	16.8	6.5	6.5	6.5
Transportation and warehousing	1.8	0.7	3.1	6.8	1.3	14.0	5.4	3.9	7.3
Information	-0.3	-3.3	3.7	10.3	4.0	18.7	8.5	8.3	8.8
Finance, insurance, real estate, rental, and leasing	3.8	7.1	-0.2	0.7	-5.7	9.3	5.1	5.6	4.4
Professional and business services	3.5	3.0	4.2	9.3	5.2	14.6	6.0	5.5	6.6
Educational services, health care, and social assistance	4.2	3.6	4.9	12.8	4.6	24.0	6.1	6.0	6.3
Arts, entertainment, recreation, accommodation, and food services	4.0	5.1	2.6	11.7	3.0	23.6	6.2	7.3	4.9
Other services, except government	5.5	4.0	7.4	8.3	3.4	14.7	6.2	3.8	9.4
Government	3.8	4.5	3.0	7.1	4.6	10.4	6.9	5.6	8.6
Addenda:									
Private goods producing industries <sup>1</sup>	3.3	2.8	3.9	9.2	2.4	18.5	3.3	2.6	4.1
Private services-producing industries <sup>2</sup>	2.6	3.0	2.1	5.0	2.0	8.9	6.5	6.5	6.4

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

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Source: Authors' calculations using published and unpublished data from BEA's Annual Industry Accounts.