Imports and Estimates of Industry Growth and Productivity

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February 2013

Abstract

Increased offshoring by U.S. companies has put international trade measurement issues on the front burner for growth and trade economists, and national accountants. Using an industry production account for the U.S. economy covering 1998-2011 to assess the impact on the industry sources of growth and productivity, we investigate two concerns raised in the literature on offshoring bias: 1) the allocation of imported goods between intermediates and final demand, and 2) the prices paid by U.S. producers for imports. First, we construct a set of Import "Use" tables using a concordance of harmonized trade data to end-use categories and compare this approach to methods currently used by the BEA. Second, we document the role of import prices in the accounts and compare the industry sources of growth under prices that reflect somewhat different underlying assumptions. We detail the impact of these treatments of imports on the measured growth of the Computer and electronics manufacturing industry–an important driver of U.S productivity growth over the period–but also an industry where concerns have been raised about measurement biases. Finally, we compare growth and productivity estimates for broad sectors in the economy, including industries that use information technology relatively intensively.

[1] The views expressed in this paper are solely those of the authors and not necessarily those of the U.S. Bureau of Economic Analysis or the U.S. Department of Commerce. We are grateful to Peter Kuhbach, Amanda Lyndaker, and Sarah Osborne for their help constructing the labor data, Greg Linder for his help with the trade data, and Gabriel Medeiros for his help assembling the alternative intermediate input estimates. We thank Jiemin Guo, Peter Kuhbach, Wendy Li, Carol Moylan, Sarah Osborne, Rachel Soloveichik, and Sally Thompson for their very helpful comments and suggestions.

1 Introduction

The increased role of international trade in U.S. economic activity is evident in the headline gross domestic product statistics. Between 1948 and 1965, the value of imports of goods and services relative to gross domestic product held steady at about 4%. By the end of the 1970's the ratio had grown to close to 10%, and remained at about that level through the end of the 1980's. Between 1990 and 2000, imports relative to GDP increased from about 10% to nearly 15%, and peaked at 17.9% of GDP in 2008. During the financial crisis events of 2009 and 2010, imports fell relative to GDP, but the value of imports of goods and services relative to GDP bounced back to 17.6% of GDP in 2011.

While the trend of increased reliance on imports within the U.S. economy is clear, the uses of these imports within the economy are subsumed in the aggregate data. Given the published level of detail in the National Income and Product accounts (NIPAs), which measure gross domestic product from the expenditure side, it is difficult to analyze major questions about the economic impact of increased imports on the economy. Most importantly, it is not possible to quantify how imports are used by industries in their production processes, and how these substitutions affect the economy as a whole. The most often studied economic impacts are the effects of increased globalization on U.S. labor markets and industry competitiveness.

The economic impact of imports depends on how the imports are used. For example, a particular import could be made for direct consumption by households, for a select group of industries as an intermediate input, or for a broad set of industries as a substitute for goods that are already produced domestically. While each of these scenarios has ramifications for the production and labor market decisions of U.S. producers, and for U.S. industry competitiveness, the implications across the economy may be significantly different. In one case, an import may be a close substitute for a good that is used in only one industry. In this case, the suppliers of the substitute domestic good, and the suppliers to the domestic good industry are impacted by the import. In another case, an import may be a substitute for a good that is produced by only one industry. In this case, the production of the industry is impacted, as are all of the suppliers that sell to the producing industry, and all of the industries that consider the import a substitute good. Analyzing the impact of imports on the overall U.S. economy requires a set of transaction data that accounts for inter-industry linkages.

Empirical research on the effects of increasing imports on the U.S. economy has focused both on the broad economic impact of increased trade and the industry-specific effects. A large body of research has examined the impact of increased trade on wages in the U.S. For example, Feenstra & Hanson (1999) argues that, depending on the specification, outsourcing accounted for between 15 and 40 percent of the increase in the non-production to production relative wage rate between 1979 and 1990. Lawrence & Slaughter (1993) argues that international trade did not play a major role in the slow real hourly compensation growth in the U.S. between 1973 and 1991, but Haskel, Lawrence, Leamer, & Slaughter (2012) concludes that the effects of globalization on the labor market became more important in the early 1990's. Eldridge & Harper (2012) econometrically estimates the impact of imports on production

processes in the manufacturing sector, while Yuskavage & Strassner (2008) and Kurz & Lengermann (2008) analyze the contribution of off-shoring to economic growth in the U.S.

Analyzing the effects of imports across industries in the economy requires data on the use of imports by industry and by type of import. Houseman, Kurz, Lengermann, & Mandel (2011) argues that measurement issues related to imports result in an overstatement of growth in the official statistics on value added and productivity growth in the manufacturing sector, a conclusion which may also have implications for economic research that relies on this type of data.

The two major issues related to assembling the data necessary to analyze the effects of increasing imports on the U.S. economy are that 1) imports used by industry by detailed type of import are not available at the necessary level of detail in the source data, and 2) Houseman, Kurz, Lengermann, & Mandel (2011) argues that shifts to lower cost suppliers of imports are not captured in the import price data.

These two data issues are directly related to a primary objective of the Industry Directorate at the Bureau of Economic Analysis (BEA). A major function of the Directorate is the production of estimates of value added growth by industry and industry value added contributions to aggregate growth, along with price and quantity estimates of inputs used by industry. When imports cannot be treated as perfect substitutes for domestically produced goods, either because of lower prices for the same good, or quality or compositional differences, the estimation of real value added requires estimates of the value of imports used by industry by type of import, and each import's respective price.

As the body of research on the economic impact of globalization grows, these measurement issues have come to the forefront. Feenstra & Romalis (2012) constructs a trade model that incorporates product quality and produces a quality-adjusted set of import and export prices to be used in the next generation of the Penn World Table. Bridgman (2012) analyzes how to adjust import prices for quality differences in the presence of fixed market entry costs.

In this paper, we document current measurement practices at BEA in constructing estimates of value added growth by industry. We compare these baseline growth accounting results to alternative estimates that differ in their treatment of imports purchased by industry. We also examine the import price data and analyze a country-bias adjusted import price. We frame the analysis in the context of an industry production account that provides the sources of U.S. economic growth across industries, factors of production, and multifactor productivity. This approach supplements research that has focused mainly on the manufacturing sector. Using broad economic categories (BEC), we use a two-step approach to produce an alternative import-use matrix that underlies the estimates of the quantity index of intermediate inputs used across industries in the U.S. economy between 1998 and 2011. We also consider an alternative set of import prices to those currently used in the BEA Industry Accounts. Using these alternatives, we use the industry production account and growth accounting techniques to compare the baseline case of current practice to five alternatives: 1) an alternative import-

use matrix, 2) an alternative set of import prices, 3) both the alternative import-use matrix, and the alternative set of import prices, 4) a country-bias adjusted import price, and 5) a country-bias adjusted import price and alternative import allocation.

Our major findings are:

- Compared to the standard import proportionality assumption, the use of broad economic categories to allocate imports to intermediate inputs produces noticeably different distributions for many commodities, but this does not translate to significantly different import shares of intermediate inputs across most industries.

- The alternative assumptions we consider on import use and import prices have only a small impact on measures of aggregate real value added and multifactor productivity growth: over the period 1998-2011, aggregate value added increased 1.87% per year in the baseline compared with a range of 1.87% to 1.84% under the alternatives. Multifactor productivity (MFP) increased 0.49% per year in the baseline compared with a range of 0.49% to 0.45% per year under the alternatives.

- The impact on real value added and MFP for the manufacturing sector is also small: over the 1998-2011 period, manufacturing contributed 0.25 percentage points per year to aggregate value added growth in the baseline, compared with a range of 0.25 to 0.23 percentage points per year under the alternatives.

- The Computer and electronic products manufacturing industry value added increased at an average annual rate of 17.51% per year over the 1998-2011 period, compared to a range of 17.47%–18.45% per year under the alternatives.

The paper proceeds along the following outline. In Section 2, we provide an overview of the current measurement practices in the BEA industry accounts, including the approach to accounting for imports across industries and their prices. In Section 3, we discuss our alternative import-use matrix, while in section 4, we discuss the alternative set of import prices. Section 5 gives our results for the sources of U.S. economic growth under the baseline and alternative assumptions. Section 6 concludes that the alternative approaches to import measurement do not produce markedly different estimates of value added and MFP growth over the 1998-2011 period.

2 The BEA Industry Accounts

A major objective of the Industry Directorate at the Bureau of Economic Analysis is the production of estimates of gross domestic product by industry and contributions of industry

GDP to aggregate GDP growth.[2] These measures of value added by industry, which are published at the 65-sector level, require nominal values, prices, and quantities of industry output and intermediate input over time that are consistent with GDP measured from the expenditure side as part of the NIPAs. Real value added is calculated using the double deflation method, so that real value added growth is the difference between the growth rate of industry output, deflated by the appropriate output deflator, and industry input, deflated by an industry input deflator that reflects the heterogeneity of the input use of the industry. Mayerhauser & Strassner (2010) provides the most complete description of the methodology used to construct the time series of industry accounts.

2.1 Overview of the BEA Accounts

The starting point for the published time series of industry accounts is the benchmark input-output account produced approximately every 5 years. The most recent published version covers the year 2002 and is described by Stewart, Brede Stone, & Streitwieser (2007). This account, while published at about the 550-industry level, is constructed at about the 900 industry and 5,000 "item", or product, level, and relies heavily on data tabulated by the Census Bureau from the quinquenniel Economic Census. Two key components in the compilation of the benchmark account (and that of the annual time series) is the construction of the make table and the calculation of domestic supply.

The make table shows the dollar amount of primary and secondary production produced by each industry. Table A in Stewart, Brede Stone, & Streitwieser (2007) provides the principal sources of data used to construct gross output by industry and commodity in a benchmark year; appendix B provides a list of the publication level industries and commodities in the benchmark account for 2002. Wherever possible, the time series of industry and commodity gross output in the annual industry accounts uses source data at the same level of detail. However, if data at this level of detail are not available, then an appropriate higher-level indicator is used to extrapolate these more detailed components of output. Table F in Washington, Bellone, Jacobson, and Lee (2012) provides the principal sources of data used to estimate nominal gross output by industry on an annual basis.

Domestic supply provides an estimate of the total value of the supply for each commodity that is available for domestic consumption as an intermediate input or as final use. Domestic supply is equal to domestic output plus imports and sales from final uses minus exports and changes in private inventories.[3] Consequently, imports and exports play an important role in the calculation of domestic supply.[4] Import and export data are incorporated from the International

[2] The latest data are updated here: http://www.bea.gov/industry/index.htm

[3] Sales from final uses include sales of used goods from one final-use sector to another and sales of scrap from final uses to intermediate inputs.

[4] Reexports and reimports are not included in the calculation of domestic supply because these goods are not available for domestic consumption. Reexports are goods produced outside the United States that were previously imported into the United States and subsequently exported in substantially the same condition. Reimports are

Transactions Accounts (ITAs). Goods data are tabulated by the Census Bureau according to the international harmonized tariff schedule (HTS) for over 15,000 products, and services data are based on survey data tabulated by the BEA. Yuskavage, Strassner, & Medeiros (2009) provides a description of source data on international trade that are available for use in the industry accounts, and include a translation of this data to a NAICS-based commodity basis. Chapter 7 of Horowitz & Planting (2006) provides detailed examples of the reconciliation of international trade data among the ITAs, NIPAs, and industry accounts.

The allocation of domestic supply by commodity to final uses and to intermediate inputs differs for the benchmark I-O accounts and for the time series of annual industry accounts. In a benchmark year, the commodity-flow method is used to allocate a portion of the total domestic supply for each item to final versus intermediate use. In some cases, the detailed product description from the Economic Census allows the total supply to be assigned directly to intermediate inputs, consumption expenditures, or investment. When a detailed assignment cannot be made, the commodity-flow method is used to allocate a percentage of domestic supply to the appropriate purchaser based on class-of-customer data from the economic census. When percentage distributions are unavailable, a modified commodity-flow method is used to allocate a residual amount of supply to personal consumption expenditures or investment after intermediate inputs and government consumption and investment are accounted for. Intermediate input data for broad categories of expenses come from the Economic Census and (for 2002) the business expenses supplement at the four-to-six-digit level of NAICS detail.[5] Chapter 6 and 10 of Horowitz & Planting (2006) provides a complete description of the methodology used to estimate final uses and intermediate inputs in a benchmark year.

On an annual basis, the final allocation of domestic supply that is available for final use versus intermediate use is established as part of the balancing process. The allocation takes into account business expenses data from the Census's Annual Survey of Manufacturing and Services annual survey to estimate initial intermediate inputs by industry before the annual use table is balanced to a set of pre-determined controls, which include industry and commodity gross output from the make table, more than 350 final expenditure categories from the NIPAs, and compensation and taxes on production and imports, less subsidies, by industry and the control totals for consumption, investment, and net exports from expenditure-side GDP. As previously noted, Mayerhauser & Strassner (2010) provides details on the construction of the industry accounts time series, including the use of NIPA data in the process of finalizing industry value added.[6]

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domestically produced goods that were previously exported to other countries for processing and/or assembly, and then returned to the United States for further processing or for sale. Reexports are available by HTS code and can be matched against imports by HTS code. Reimports are available only by the total value of reimports.

[5] In a benchmark year, intermediate inputs materials consumed data are available for the mining and manufacturing sectors.

[6] It is important to note that the time series of annual industry accounts are not designed to provide an independent measure of the expenditure or production approach to measuring GDP, but rather, to augment the

The estimation of value added by industry also differs when preparing a benchmark account versus that of the time series of annual industry accounts. In a benchmark year, value added is established through a reconciliation process that quality-weights an initial estimate of gross operating surplus measured residually and a direct measure of gross operating surplus measured using data on gross domestic income that is adjusted to an establishment basis. Residual gross operating surplus is estimated as gross output less intermediate inputs, compensation, and taxes on production and imports, less subsidies, by industry. Compensation and taxes on production and imports, less subsidies, are available on an establishment basis in the NIPAs. This reconciliation was first introduced in the 2004 comprehensive revision of the annual industry accounts Moyer, Planting, Fahim-Nader, & Lum (2004), Lawson, Moyer, Okubo, & Planting (2006). The reconciliation model currently used in a benchmark year is described by Rassier, Howells III, Morgan, Empey, & Roesch (2007). On an annual basis, an initial distribution of value added by industry is prepared by extrapolating reconciled estimates of value added from a benchmark year using an establishment-based distribution of gross domestic income. Value added by industry is finalized as part of balancing the use table.

2.2 Import Measurement in the BEA Industry Accounts

With growing imports into the U.S. economy, the treatment of import measurement in the GDP by Industry accounts has garnered attention. For example, Houseman, Kurz, Lengermann, & Mandel (2011) argues that the current treatment of import prices may lead to an offshoring bias in estimates of industry value added, especially concentrated in the manufacturing sector. In this section, we review the treatment of imports in the BEA Industry Accounts for the purpose of comparing this approach to the alternative approaches that we consider in subsequent sections.

Conceptually, imports are treated as heterogeneous items and distinct from domestically produced items in order to allow for price differences between foreign and domestically produced goods that are purchased as intermediate inputs. That is, at the item level, the import and domestic commodity are treated as differentiated goods, either due to cost of the item, the quality of the item, or the composition of goods within the item category; thus imports are allowed to have prices that differ from the domestically produced item. An important measurement difficulty is that the value of imports by item by industry is not measured directly.

BEA uses the import proportionality, or comparability, assumption to allocate the value of imports by item by industry. This allocation is discussed in Moyer, Reinsdorf, & Yuskavage (2006), Yuskavage, Strassner, & Medeiros (2009), Yuskavage, Strassner, & Medeiros (2008), Strassner, Yuskavage, & Lee (2010), and Mayerhauser & Strassner (2010). The proportionality method assumes that each industry that purchases an item for intermediate use, purchases an

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expenditure measure of GDP by providing an industry breakout while making full use of the high quality source data that is available on an annual basis within the U.S. federal economic statistical system.

amount from a foreign supplier that is in the same proportion as the ratio of imports to domestic supply for that item. In other words, the imported portion of intermediate inputs by industry is homogenous at the item level for each industry that purchases the particular item. This homogeneity is imposed only at the 900 industry by 5,000 item level, not at higher levels of aggregation.

It is worth noting a couple aspects of the treatment of imports in calculating GDP by industry. First, the import proportionality assumption does not affect the estimates of nominal value added by industry. This is because the import proportionality assumption does not determine the level of use of items by an industry; it only determines the share of an item used by an industry that belongs to imported intermediate use for the purposes of deflating intermediate use by the appropriate price index in constructing real value added. Second, if at the item level domestically produced and imported goods are assumed to be homogeneous, or perfect substitutes, import and domestic prices change at the same rate and there is no need for a separate treatment of imports in calculating real value added growth.

The allocation of intermediate inputs to domestic versus foreign sources allows the BEA to incorporate the full suite of price statistics available within the U.S. economic statistical system. The Bureau of Labor Statistics' (BLS) producer price indexes are the primary source used to deflate the domestic portion of intermediate inputs. These prices are the same as those used to deflate the commodity composition of gross output by industry. In other words, each industry that purchases a domestic item pays the same price for that item. Table F in Washington, Bellone, Jacobson, & Lee (2012) provides the principal sources of data used to deflate gross output by industry and the domestic portion of intermediate inputs by item. BLS import (MPI) price indexes are used to deflate the imported portion of intermediate inputs by item, also with the assumption that each industry that purchases imported inputs pays the same price for the imported intermediate input. Both the PPIs and the MPIs are used at their most detailed levels available: PPIs range mostly from four-to-seven digit detail; NAICS MPIs are more aggregated—typically these indexes are available only for two-to-four digit detail. To deflate some imports by item, BEA uses prices prepared by the National Income and Wealth division at BEA. The components deflated by these prices are given in Table A.

Because BLS import price indexes are applied at the item level, implicit import prices paid by industry by aggregated commodity will differ from published aggregates produced by the BLS. The implicit price paid for imports at the industry and commodity level reflects the BEA weights that are consistent with the annual GDP by Industry accounts.

3 Alternative Import Allocation using Broad Economic Categories

Our alternative approach to allocating commodity imports across industries is motivated by the World Input-Output Database (WIOD) approach of Timmer (2012). The WIOD approach deviates from the import proportionality assumption by first assigning imports to three Broad Economic Categories (BECs) (intermediates, final consumption, or investment). The second step

is to proportionally allocate imported intermediate inputs across industries after this initial split has been applied. It is worth noting that this approach is purely an alternative allocation, and no new data are used to give additional detail on actual use of different types of imports by industry.[7]

For the first step in this exercise, our objective is to construct shares for each imported item in the BEA industry accounts that reflect allocation information in the harmonization code to BEC concordance. Specifically, for each imported item in the BEA industry accounts and each year, we estimate the share of the item that is sold to intermediates, consumption, and investment based on a harmonization code to BEC concordance. Our objective is not to construct new estimates of trade flows, but to reallocate current estimates of trade flows. This preserves consistency with the NIPA trade data. Once we have item-level shares, we apply these shares to estimate the value of each item sold to intermediate input. The second step is to allocate this total value of intermediate input across industries.

We use the concordance between the harmonized trade data and broad economic categories that is published by the United Nations to do the initial allocation of imports to the three broad groups.[8] The harmonized trade data are at the 10-digit level, while the harm code to BEC concordance is at the 6-digit level. Because of the different levels of detail, we first assume that for each of the 6-digit commodities in the Harm Code to BEC mapping, the 10-digit components have the same broad economic category.[9] This gives us the value of imported good by broad economic classification at the 10-digit level for all of the components of the harmonized trade data.[10] To go from the 10-digit harmonized data by broad economic classification to BEA's item level detail, we apply the Industry Directorate's mapping between harm codes and items to get the value of items by broad economic classification based on the harmonized trade data.[11] We use these import values by item and broad economic category to construct the share, by BEA-item, that was sold to intermediate input. We apply this value share to the current estimates of imports by item in the BEA industry accounts to derive an alternative value of imports that were sold to intermediate use. Finally, we allocate this total imported intermediate

[7] Strassner, Yuskavage, & Lee (2010) uses data from multinational companies (MNC) and compares reported use of imports by broad type to the import proportionality assumption. They find broadly consistent results between current practice and the MNC data and attribute some of the differences to the difference between establishment and company concepts.

[8] Because our analysis covers 1998-2011, we use 1996 concordance for 1998-2001, the 2002 concordance for 2002-2006, and the 2007 concordance for 2007-2011. Concordances available here: http://unstats.un.org/unsd/trade/conversions/HS%20Correlation%20and%20Conversion%20tables.htm

[9] There are limited cases where the BEC code for a given 6-digit commodity is ambiguous in the published concordance. For example the 6-digit harm code can be listed multiple times and assigned to BEC codes that do not give a unique map to intermediate input, consumption, or investment. In these cases, we default to the import proportionality assumption for the proportion of this item included in this 6-digit harm code.

[10] In constructing the GDP by Industry accounts, typically reexports are netted out from the value of imports, but in constructing the value to be used to allocate imports across broad economic categories, we do not net out reexports.

[11] The foundation for this mapping is the Census guidelines on appropriate NAICS codes for each harm code (when this information is available).

proportionally by item across industries to yield the import-use matrix. Because the harmonized trade data covers mostly goods, we exclude any adjustments to non-goods items. We apply the above methodology for years 1998-2011, so that the results are consistent with the GDP by Industry estimates published in November 2012.

For clarity, the following table enumerates the steps we use to construct our alternative import-use table.

Step 1	Compile concordances between 6-digit harm code trade data and U.N.-based broad economic categories covering 1998-2011.
Step 2	Construct map from 10-digit harm data to 6-digit harm codes.
Step 3	Aggregate 10-digit harm trade data on imports to the 6-digit level.
Step 4	Apply the 6-digit harm code to BEC concordance to get estimates at the 6-digit level of the values sold to intermediate, final consumption, investment, or undetermined.[12]
Step 5	Assume that the allocation for the 10-digit components of the harm code data is the same as the 6-digit allocation to obtain values sold to intermediate, final consumption, investment, or undetermined at the 10-digit harm level.
Step 6	Allocate the 10-digit values to BEA item codes using the existing internal BEA mapping. Note that a 10-digit code may go to multiple items, and a single item may be made up of multiple 10-digit coded data.
Step 7	Based on the results from Step 6, construct the share of each BEA item that was sold to intermediate input.
Step 8	Use the baseline item level import data as a control and distribute the value that was sold to intermediate input using the values shares calculated in Step 7.
Step 9a	For items that have a portion that goes to intermediate input according to UNcomtrade, allocate items across industries using the proportionality assumption. This is the two step approach of Timmer (2012).
Step 9b	For items that have an undetermined allocation, revert to the standard proportionality assumption.
Step 9c	For items that have a BEC coding of capital good, revert to the standard proportionality assumption.[13]

The impact of the BEC allocation of imports on estimates of GDP by industry depends on three basic elements. The first is the value of trade by item that belongs to intermediate input based on the BEC allocation must be different than that based on the baseline import proportionality assumption. A different allocation of imports translates to a different nominal value of

[12] An import is assigned to "undetermined" if the 6-digit harm code to BEC map is ambiguous.

[13] An alternative is to assume that capital goods get sold only to final demand, but this leads to all of the capital goods that typically get embedded in other goods being allocated to final demand.

imported goods used by industries that buy a particular item. Second, the price of imported items must differ from prices paid for domestic goods, and third, the value share of imports used in production within an industry must be significantly different under the BEC-allocation. The third condition is important because while the BEC allocation may produce a different allocation of inputs for a particular item, if the value share of total imports in a particular industry's production is relatively unchanged as a result of the new allocation across all commodities used by the industry, the BEC-based allocation will have very little impact on estimates of value added growth by industry.

Table 1 compares the share of imports allocated to intermediate input by commodity based on the alternative import allocation to the baseline approach of applying the import proportionality assumption. The level of aggregation corresponds to that published in the annual input-output accounts, although as described above, the import allocations are estimated at the item level. Differences in estimated allocations have the potential to impact estimates of value added growth for any industry that purchases that particular commodity. The difference in allocations between the baseline and BEC-based allocation reflects the binary assignment of an import to either an intermediate or final demand in the BEC mapping, and the item-level component allocations from the import proportionality assumption. For example, within the Forestry, fishing, and related activities commodity, the BEC-based approach allocated 98% of commercial fishing to final demand, while the baseline allocated 20%.

The largest differences in import allocation are for the Forestry, fishing, and related activities commodity and Utilities where the share of imports allocated to intermediate inputs for each of these differs by more than fifty percentage points. The next largest difference is for Food and beverage products where the item level import proportionality assumption allocated 48% to intermediate purchases, while the BEC approach allocated only 13%, a difference of 35%. Next, there are differences in allocations between 10 and 16 percentage points for Textiles, Publishing (including software), Chemical products, Petroleum and coal products, Miscellaneous manufacturing, Plastics and rubber, and Printing and related support activities. Farms, Apparel and leather products, Electrical equipment, and Machinery have allocation differences between 5% and 10%. The remainder of the commodities shows minor, or no difference in import allocation. Recall that we restrict our alternative import data to only goods.

While there are some large differences in import allocations across intermediate and final use, the impact of the alternative allocations depends on the particular imports by an industry and the value of imported goods relative to the use of goods produced domestically. For example, if an industry relies heavily on chemical products relative to all other inputs, a change in the estimated share of imported goods used in production has the potential to have a significant impact on estimates of the growth of that industry's intermediate input, thus that industry's value added growth. Table 2 gives the share of imported intermediate inputs relative to total intermediate inputs based on the baseline and the BEC allocation. Based on the baseline allocation, 15% of the inputs in Miscellaneous manufacturing are imported, while 26% were imported according to the BEC mapping. Food services and drinking places differed by 4 percentage points across allocations, as did Ambulatory services, and Nonmetallic mineral

products. The alternative allocation made very little or no difference for the remainder of the industries at the 63-sector level.

As mentioned above, for the allocation of imports based on BEC to produce different estimates of value added by industry, the price of imported goods must be different than the prices used to deflate purchases from domestic suppliers. Table 3 compares price growth of domestically produced goods relative to imports between 1998 and 2011 at the 63-commodity level. While the table provides price comparisons for all imported goods and services, only the differences between imported and domestic goods prices are relevant because our alternative mapping considers goods only. At this level of detail, Oil and gas, and Primary metals have price growth that differs on average of about 4 percentage points per year. Imports of Forestry and fishing, Mining and Petroleum also show substantial difference in import price growth. Wood products, Computer and electronic products, Farms, Paper, and Chemical products price growth is different across domestic and foreign supplies, by between 1 and 2 percentage points per year on average. Price differences reflect different baskets of underlying items, so price differences at the 63-commodity level reflect both different prices for the same item and the compositional difference in the import baskets. In order for import measurement to have a significant effect on measures of value added growth, imports must be a non-negligible portion of domestic supply. Table 3 shows that for many commodities, imports are a very small share of domestic intermediate use.

Tables 1 and 2 indicate that the allocation of imports between final demand and intermediate input is noticeably different based on the BEC coding, but the import share of inputs is not significantly different for most industries. To estimate the effect of the BEC allocation on measured value added growth at the industry level requires taking into account these effects, in addition to the price differences between domestic and foreign goods. We do this analysis below in the context of an industry production account covering 1998-2011.

4 Import Prices

As discussed above, when prices paid for imports differ from prices paid for domestically produced goods, data on import prices are necessary to construct measures of intermediate input. Figure 7 plots item-level price growth of imported versus domestically produced goods, excluding Mining and Petroleum and coal, weighted by the import values of the individual items relative to other items in the same aggregated commodity. The figure indicates that, in general, there are item-level price differences between imported and domestic goods, thus reinforces the importance of incorporating imports into measures of intermediate input. Comparing import and domestic prices at the item-level limits compositional effects at higher levels of aggregation. For example, the price indexes for total imported intermediate materials and total domestic intermediate materials reflects the compositional differences in types of materials that are imported versus purchased from domestic sources. At the item level, skewness above the forty five degree line would indicate a disproportionate number of cases where import prices increased relative to domestic prices. The data indicate that, at the item level, about 62%

of the items have import prices that fell relative to their domestic counterparts over the 1998-2011 period.

4.1 Industry-Specific Import Prices and the Import Proportionality Assumption

While the import proportionality assumption yields estimates of the value of imports used by items across industries, quantity estimates of real value added require deflators for these purchased imports. As described in Section 2.2, import prices are applied at the item level to deflate industry purchases of imports.[14]

The import proportionality assumption potentially impacts the deflation of intermediate purchases of imports, and thus estimates of real value added by industry. The impact of the import proportionality assumption on prices paid by industry can be seen in the following stylized example. Suppose that there are two industries that import two types of paper. The subset of the use table for the two industries and the two types of paper can be represented as:

	Industry 1	Industry 2	Total Commodity Use	Imports
Paper A	Paper A used by Ind 1	Paper A used by Ind 2	Total Use of Paper A	Imports Paper A
Paper B	Paper B used by Ind 1	Paper B used by Ind 2	Total Use of Paper B	Imports Paper B

The role of the import proportionality assumption in deflation can be seen by considering the construction of an input price index for total imported paper (Paper A + Paper B) purchased by Industry 1 and Industry 2. Suppose that there is an import price deflator available for both types of paper. The import proportionality assumption yields estimates of the nominal value of each type of paper imports used by industry. Consider an extreme case when Industry 1 uses only Paper A and Industry 2 uses only Paper B. The subset of the use matrix would be:

	Industry 1	Industry 2	Total Commodity Use	Imports
Paper A	Paper A used by Ind 1	0	Total Use of Paper A	Imports Paper A
Paper B	0	Paper B used by Ind 2	Total Use of Paper B	Imports Paper B

and the import use matrix would be:

[14] Note that in most cases the BLS import price covers multiple items, i.e. the import prices are only available at a higher level of aggregation.

	Industry 1	Industry 2	Total Commodity Use	Imports
Paper A	Imports Paper A	0	Total Use of Paper A	Imports Paper A
Paper B	0	Imports Paper B	Total Use of Paper B	Imports Paper B

In this example, under the import proportionality assumption, the input price index for total imported paper in industry 1 is just the deflator for imported type-A paper, while the input price index for total imported paper in industry 2 is the deflator for imported type-B paper, even though there is no actual data on imports by type of paper by industry. In general, the import proportionality assumption determines the weights used in constructing input price indexes for the imports use in production across industries. Now suppose that the only import price index available is a price for total paper, not differentiated by type. With only a price index for total imported paper, each industry's purchases of imported paper would be deflated by the same price index, and thus would not be affected by the import proportionality assumption.

In general, whether the import proportionality assumption plays a role in deflating industry imports depends on the level of detail available in the nominal use table and the import prices data. If the imported commodity appears in the use table row at a finer level of detail than in the import price data, the same import price is applied to each component commodity and the import proportionality assumption does not have an effect on the deflation of imports by industry. If the level of detail in the import price data is as fine as that in the use table, the import proportionality assumption will determine the allocation of imports by type across industries. In the latter case, applying the detailed import price deflator to the detailed estimates of the value of imports by industry will result in estimates of deflated imports that reflects the industry heterogeneity of different types of purchased imports.

An alternative assumption, in the above example, that does not rely on the import proportionality assumption is that both industries pay the aggregated price of imported paper. If there is not data on the actual distribution of types of paper across industries, but there is data on total imports of paper by type, an alternative is to assume that all industries buy the same bundle of imported paper. As an exercise, we analyze the effect of this second assumption on estimates of GDP by industry by considering an alternative set of import prices that does not reflect the distribution of commodities by industry. Specifically, we incorporate an alternative set of import prices provided by Dale Jorgenson and his coauthors that is based on a combination of aggregated prices from the BLS International Price Program (IPP) and the NIPAs.

Since much of the underlying import price data are the same, differences in the two approaches reflect differences in the weights applied to the disaggregated prices. There are (at least) two thoughts on the resulting differences due to weighting schemes. The first is that BEA weights reflect item level estimates of the value of imports across industries that bring in industry level

information. The internally consistent industry accounting requires consistent weights, so BEA uses these item level weights by industry. A counter argument is that because these weights are due to the proportionality assumption, the differences in prices paid for imports across industries at the aggregated level are driven solely by this assumption.

Table 4 compares these alternative prices at the 63-commodity level to the import prices used in the baseline estimates of GDP by industry. The largest difference is in the import price of Information and data processing services. The baseline import price reflects import weights by detailed item in the BEA import use table, while the alternative's source is the implicit import price deflator for imports in the BLS's nominal and real input-output accounts.[15] The baseline price for Motion picture and sound reporting industries reflects the declining price of imported reproducible media. The other price differences are smaller in magnitude, but potentially important for estimates of real value added.

4.2 Import Prices and Country-Specific Index Number Bias

Recent literature has argued that the import prices used in estimating GDP by Industry may exhibit index number bias. Specifically, Houseman, Kurz, Lengermann, & Mandel (2011) argues that switches to low cost providers are excluded from the index number estimate of the import price at the time of the switch, leading to an overstatement of the growth in value added quantity indexes in manufacturing industries. Inklaar (2012) argues that a portion of the bias can be analyzed by assuming that imports across countries are perfect substitutes.

We follow the approach in Inklaar (2012) to construct country-bias adjusted import prices. We use data from U.N. Comtrade that includes the value (V_{ic}) and quantity (Q_{ic}) of imports of type i into the U.S. from country c, and 6-digit harmonization codes from 1998-2011.[16] We map imports by country to BEA's item categories and construct two alternative price indexes for item i. The first is:

$$\Delta \ln pf_i = \sum_c \overline{w_{ic}} \Delta \ln pf_{ic}$$

where pf_i is the item-specific import price, c indexes country, and $\overline{w_{ic}}$ is the average value share of imports of type i from country c in periods t and t-1, so that pf_i is a tornqvist price index. Assuming that items are prefect substitutes across countries yields an alternative price for item i:

[15] Produced by the BLS Office of Employment Projections.

[16] We consider only imports for which data are given on value and quantity in kilograms. We use the value and quantity to define the implicit price.

$$\Delta \ln pf_{alt,i} = \Delta \ln \left(\frac{\sum_c V_{ic}}{\sum_c Q_{ic}} \right)$$

The bias, which we refer to as country-substitution bias, is defined as $\Delta \ln B_i = \Delta \ln pf_i - \Delta \ln pf_{alt,i}$ for each imported item, and captures the difference in item level prices under the two alternative assumptions. We apply this bias adjustment to the baseline import prices used in the construction of GDP by Industry at the item level, many of which are constructed to hold quality constant, unlike the implicit prices from the Comtrade data. The approach of adding the bias to the baseline prices used in the construction of GDP by Industry allows for the import prices to maintain the existing adjustments to hold quality fixed. This is particularly important for information technology goods which exhibit rapidly changing product characteristics.

5 Value Added and Productivity under Alternative Import Assumptions

In this section, we analyze how the alternative approaches to imports affect measured value added and productivity growth at the industry and aggregate level using an industry production account. The industry production account includes nominal values, and prices and quantities for industry output and inputs. The industry production account used here covers 1998-2011, and is an updated version of Fleck, Rosenthal, Russell, Strassner, & Usher (2012) which covers the 63 industries that are published in the BEA Gross Domestic Product by Industry data.[17] This section covers the pertinent accounting details, but we refer the reader to Fleck, Rosenthal, Russell, Strassner, & Usher (2012) for detail on the data sources and methods.

5.1 Industry Production Account

The starting point for the industry production account is that under zero profits in time t, the nominal value (V) of output (Y) in industry j equals the nominal value paid to inputs, divided between payments to capital (K), labor (L), and intermediate inputs (X)[18] [19]:

[17] Industry output and intermediate input for the baseline case is taken from the 1998-2011 Annual revision of the GDP-by-Industry data (http://www.bea.gov/industry/gdpbyind_data.htm). Capital and labor services are extrapolated through 2011 using internal estimates and include a labor and capital composition adjustment based on the approach of Jorgenson, Ho, & Samuels (2011).

[18] Often times, intermediate inputs are subdivided into Energy (E), Materials (M), and Services (S) to form a KLEMS-type database.

[19] This accounting identity holds at every period, but we omit the time subscript t for notational convenience.

$$V_{Yj} = V_{Kj} + V_{Lj} + V_{Xj} \tag{1}$$

The nominal values can be decomposed into prices (P) and quantities (Q):

$$P_{Yj}Q_{Yj} = P_{Kj}Q_{Kj} + P_{Lj}Q_{Lj} + P_{Xj}Q_{Xj} \tag{2}$$

A key feature of the accounts is that inputs of capital and labor are treated symmetrically with the quantity index of output and intermediate input. Analogous to the quantity index of output and intermediate input, which includes heterogeneous types of output and intermediate input, capital and labor services are constructed as a quantity index over different types of capital and labor services. Specifically, in the industry production account at the 63 sector level Q_Y is defined as a weighted aggregate over subcomponents of industry j output where the weights reflect the changing nominal value shares of the components within industry j. Similarly, Q_X is a weighted aggregate of different types of materials purchased by industry j in producing output Q_{Yj}. Mathematically:

$$\begin{aligned}
\Delta \ln Q_{Lj} &= \sum_i \bar{w}_{Lij} \Delta \ln Q_{Lij} \\
\bar{w}_{Lij} &= \frac{1}{2}\left(\frac{P_{Lijt}Q_{Lijt}}{\sum_i P_{Lijt}Q_{Lijt}} + \frac{P_{Lijt-1}Q_{Lijt-1}}{\sum_i P_{Lijt-1}Q_{Lijt-1}} \right) \\
\Delta \ln Q_{Kj} &= \sum_i \bar{w}_{Kij} \Delta \ln Q_{Kij} \\
\bar{w}_{Kij} &= \frac{1}{2}\left(\frac{P_{Kijt}Q_{Kijt}}{\sum_i P_{Kijt}Q_{Kijt}} + \frac{P_{Kijt-1}Q_{Kijt-1}}{\sum_i P_{Kijt-1}Q_{Kijt-1}} \right)
\end{aligned} \tag{3}$$

so that $\Delta \ln Q_{Lj}$ and $\Delta \ln Q_{Kj}$ are tornqvist indexes of labor and capital, respectively. For the labor index, hours worked by worker Q_{Lij} are cross classified across i demographic groups: {(male, female),(employee, self-employed), seven age groups, and six levels of educational attainment} for a total of 168 different types of workers by industry, while the price of labor input P_{Lij} is the workers compensation per hour. For capital, Q_{Kij} is assumed to be proportional to the net capital stock, and P_{Kij} is the Jorgensonian user cost of capital for the i capital types described in Fleck, Rosenthal, Russell, Strassner, & Usher (2012).

By differentiating (2) with respect to time, and grouping quantities, we define multifactor productivity growth (MFP):

$$\Delta \ln MFP_j \equiv \Delta \ln Q_j - \overline{w_{Kj}} \Delta \ln Q_{Kj} - \overline{w_{Lj}} \Delta \ln Q_{Lj} - \overline{w_{Xj}} \Delta \ln Q_{Xj} \tag{4}$$

where the weights are the average of period t and $t-1$ value shares of each of the inputs in the value of output, which is the typically used tornqvist index of MFP.

To analyze the industry contributions to aggregate value added growth we appeal to the translog production possibility frontier analyzed in Jorgenson, Ho, Samuels, & Stiroh (2007):

$$\Delta \ln V = \sum_j \overline{w_j} \Delta \ln V_j \tag{5}$$

so that aggregate value added growth $\Delta \ln V$ is a translog index over industry value added growth rates $\Delta \ln V_j$. Because the quantity index of industry value added $\Delta \ln V_j$ is not directly observable, we appeal to the nominal accounting identity that the value of gross output equals nominal value added plus nominal intermediate input. Differentiating this accounting identity with respect to time and taking a discrete time approximation yields a tornqvist index for the growth rate of industry gross output:

$$\Delta \ln Q_j = \overline{w_{Vj}} \Delta \ln V_j + \overline{w_{Xj}} \Delta \ln Q_{Xj} \tag{6}$$

which, solving for $\Delta \ln V_j$, yields an estimate of industry value added growth. This approach to estimating value added growth is typically referred to as the double deflation method because it allows for separate price deflators for output and intermediate input.

To analyze the industry sources of growth at the aggregate level, we combine equations(4), (5), and (6) to yield a decomposition of aggregate value added growth:

$$\Delta \ln V = \sum_j \overline{w_j} \frac{\overline{w}_{K,j}}{\overline{w}_{V,j}} \Delta \ln Q_{Kj} + \overline{w_j} \frac{\overline{w}_{L,j}}{\overline{w}_{V,j}} \Delta \ln Q_{Lj} + \overline{w_j} \frac{1}{\overline{w}_{V,j}} \Delta \ln MFP_j \tag{7}$$

which gives aggregate economy value added growth as the weighted industry contributions of capital, labor, and MFP to industry output growth. We define:

$$\Delta \ln MFP_{Agg} \equiv \sum_j \overline{w_j} \frac{1}{\overline{w}_{V,j}} \Delta \ln MFP_j \tag{8}$$

and refer to this as aggregate MFP growth. [20] We call $\overline{w_j} \frac{1}{\overline{w}_{V,j}} \Delta \ln MFP_j$ the industry contribution to aggregate MFP, or Domar-weighted MFP growth.[21]

The industry production account framework allows us to analyze contributions of industries and sectors to aggregate growth and productivity. For aggregate sector J, we define the sector's contribution to aggregate value added growth as:

[20] This decomposition is the direct aggregation across industries approach of Jorgenson, Ho, Samuels, & Stiroh (2007).

[21] Note that this differs from the concept of aggregate TFP used in Jorgenson, Ho, Samuels, & Stiroh (2007) by their reallocation terms.

$$CT_{Vagg,J} = \sum_{j \in J} \overline{w_j} \Delta \ln V_j \tag{9}$$

and contribution to aggregate MFP growth as:

$$CT_{MFPagg,J} = \sum_{j \in J} \overline{w_j} \frac{1}{\overline{w}_{V,j}} \Delta \ln MFP_j \tag{10}$$

In our analysis below, we consider two versions of J . Table B divides industries into aggregated sectors. The first, based on the IT-Intensity index of Jorgenson, Ho, & Samuels (2011) divides industries into IT-Producing, IT-Using, and Non-IT industries, a classification that is used to analyze the impact of alternative assumptions on measurements of the role of Information Technology in the economy. The second, which is based on the classification scheme in Jorgenson & Schreyer (2013, forthcoming), gives a broader picture of the sources of growth across aggregated sectors.

5.2 Imports and Growth Accounting

Our analysis of the treatment of imports in the Industry Accounts reduces to alternative estimates of Q_{Xj}, the quantity index of intermediate inputs used by industry. Intuitively, the reasons why Q_{Xj} differs under the alternatives are: 1) with an alternative allocation of imports by broad economic category, the share of intermediate use by industry by item that is imported now reflects the information available in the BEC mapping; this division of use by industry by item across domestically produced and imported items then is deflated by either the domestic or the import price. In other words, under the alternative, the share of imports is different, and this new share is deflated by the import price index; 2) the value of imports is deflated by an alternative price index, thus yields a different quantity; 3) both an alternative estimate of the value of imports by item by industry, and an alternative price index; 4) an alternative country-bias adjusted price index results in a different intermediate quantity index; 5) the country-bias adjusted import prices and the BEC-based import allocation incorporates both alternative import shares and bias-adjusted prices.

The five treatments of imports lead us to define alternative estimates of Q_{Xj} that feed through our exercise via equation (4).

$Q_{Xj,Base}$	Baseline treatment.
$Q_{Xj,Alt1}$	Uses BEC-based allocation.
$Q_{Xj,Alt2}$	Uses alternative import price.

$Q_{Xj,Alt3}$	Uses both BEC-based allocation and alternative import price.
$Q_{Xj,Alt4}$	Uses country-bias-adjusted import prices.
$Q_{Xj,Alt5}$	Uses both BEC-based allocation and country-bias adjusted import prices.

Based on equations (4)-(7), we define the alternative estimates of value added growth and its sources. Equation (6) yields five alternative estimates of value added growth by industry: $\Delta \ln V_{j,Alt1} \ldots \Delta \ln V_{j,Alt5}$. Equation (4) gives alternative estimates of MFP growth by industry: $\Delta \ln MFP_{j,Alt1} \ldots \Delta \ln MFP_{j,Alt5}$. Based on equation(5), there are alternative estimates of aggregate value added growth: $\Delta \ln V_{Alt1} \ldots \Delta \ln V_{Alt5}$.

It is straightforward to verify:

$$\Delta \ln MFP_{j,Alt} - \Delta \ln MFP_{j,Base} = \overline{w_{Xj}}(\Delta \ln Q_{Xj,Base} - \Delta \ln Q_{Xj,Alt}) \tag{11}$$

and

$$\Delta \ln V_{j,Alt} - \Delta \ln V_{j,Base} = \overline{w_{Xj}} / \overline{w_{Vj}}(\Delta \ln Q_{Xj,Base} - \Delta \ln Q_{Xj,Alt}) \tag{12}$$

so that the difference between MFP growth at the industry level measured under the alternative is equal to the difference in the growth rates of the alternative estimates of intermediate input weighted by the value share of intermediate input in the value of industry output. Because MFP growth is estimated as a residual, faster growth in an alternative estimate of intermediate input growth would imply slower growth in the industry's estimated MFP growth relative to the baseline. Also, the difference between the baseline and alternative estimates of industry value added growth is due to the difference of estimates of intermediate growth by industry, weighted by the ratio of the value of intermediate input to nominal industry value added. Similarly,

$$\Delta \ln MFP_{Agg,Alt} - \Delta \ln MFP_{Agg,Base} = \sum_j \overline{w_j} \frac{1}{\overline{w}_{V,j}} \overline{w_{Xj}}(\Delta \ln Q_{Xj,Base} - \Delta \ln Q_{Xj,Alt}) \tag{13}$$

implying that differences in aggregate measured MFP are due to differences in measured intermediate input growth, weighted by the Domar weight times the share of intermediate in the value of output. Finally, using equation (7) and (8):

$$\Delta \ln V_{Agg,Alt} - \Delta \ln V_{Agg,Base} = \Delta \ln MFP_{Agg,Alt} - \Delta \ln MFP_{Agg,Base} \tag{14}$$

so that all of the differences in estimated value added at the aggregate level are due to alternative estimates of MFP.

5.3 Import Treatment and Value Added Growth Estimates

In this section, we compare the baseline estimates of industry value added growth in the U.S between 1998 and 2011 to estimates based on the alternative treatments of imports.[22]

Table 5 gives the differences in the growth of the quantity index of value added at the 63-industry level for each of the alternative treatments of imports. Figure 1 shows that the BEC allocation of imports produces minor differences in the estimates of value added growth by industry. As discussed above, the difference between the baseline estimate of value added growth and the alternatives is due to alternative estimates of the growth of intermediate inputs by industry, weighted by the ratio of the value of intermediate inputs to nominal value added. This difference takes into account the alternative value of imported commodities within an industry and the price difference between domestic and foreign purchases. Between 1998 and 2011, Miscellaneous manufacturing would have grown 0.3 percentage point per year faster (3.22% per year versus 2.89% per year) if estimated with the BEC allocation, while Food and beverages would have grown about 0.2 percentage points per year slower (0.85% per year versus 1.06%). Nonmetallic minerals would have shown a difference of -3.04% per year versus 3.15% per year, while Motor vehicles would have grown at 0.17% per year versus 0.28%. The other of the 63 industries all exhibited percentage point differences of less than 0.1 percentage points per year.

To understand the impact of the BEC-allocations, which are summarized in Table 1, on the value added growth estimates in Table 5, we trace through the effect of the BEC-based distribution of Forestry, fishing and related activities. Table 1 indicates that a significantly smaller share of imported Forestry, fishing, and related activities was purchased as an intermediate input under the BEC mapping. The implication of this alternative allocation on value added growth depends on which industries purchase Forestry, fishing, and related activities items, and the value of the imported items relative to the value of other intermediate inputs used by the industries. Furthermore, the impact depends on the item-level allocations within each commodity. For example, as discussed above, the major difference between the BEC-based and baseline treatment of Forestry, fishing and related activities is the treatment of commercial fishing. Because the commercial fishing item is sold mainly to a subset of the industries that purchases forestry and fishing items, the BEC-based allocation impacts only this set of industries. In particular, the largest purchaser of Forestry, fishing and related activities is the Wood products industry, yet the BEC-based and baseline estimates of imports of Forestry, fishing and related activities purchased by the Wood products industry are equivalent because the wood industry does not purchase commercial fishing.[23] On the other hand, there is a large impact on the estimates of imports purchased by the Food services and drinking places industry. In the Food services industry, however, purchases of forestry and fishing items were about 2% of total intermediate purchases, while the difference between prices growth of domestic versus imported was about 8%. The implies a value added growth rate for the Food services industry

[22] Due to differences in index number methodology, there are small differences between published estimates and estimates given here.

[23] This excludes the purchases by the Forestry, fishing and related activities industry itself. Based on the 2007 annual input-output table.

that differs by about 0.1 percentage points in 2007, and no difference in value added growth in the Wood products industry. Over the 1998-2011 period, value added estimates for the Food services industry differed by 0.02 percentage points, comparing the baseline and BEC-based import allocation, reflecting the treatment of commercial fishing, other items in the Forestry, fishing and related activities commodity, and the effects on value added growth for the other years in the sample.

Figure 2 shows that estimates of value added by industry based on the aggregated import prices differ from the baseline by more than those based on the BEC classification. The estimates for each of the 63 industries are given in Table 5. Based on this aggregated set of import prices, Water transportation, Petroleum and coal products, and Primary metals would have grown about 3 percentage point per year slower. The only other industries to have a value added growth rate differ by more than 1 percentage point per year were Textile mills and Plastic and rubber products.

Table 5, column Alt3, compares value added growth by industry using both the BEC import allocation and the aggregated import prices. The results, roughly, combine the effects of the Alt1 and Alt2 approaches. Under these methods, the largest differences between the baseline and the alternative estimates were for the Water transportation, Petroleum and coal products, and Primary metals industries which would have had growth rates that differed by over 3 percentage points per year for the period. Textile mills and Plastic and rubber products were the only other industries where estimated value added growth differed by more than 1 percentage point per year from the baseline estimates.

The value added by industry estimates that incorporate the country-bias adjusted import prices are given in the Alt4 column of Table 5 and differences from the baseline are given in Figure 3. The differences are similar in order of magnitude to the differences between the baseline and the BEC-based import allocation. The largest difference (in absolute value) was for Other transportation equipment, which would have been estimated to grow about 0.4 percentage points per year more slowly with the country-bias adjusted import price. Wood products, Motor vehicles, Primary metals and Textile mills were the only other industries where value added growth differed by more than 0.2 percentage points per year.

5.4 Import Treatment and MFP Growth Estimates by Industry

Because MFP growth accounts for about 30 percent of growth in aggregate value added between 1998-2010, according to Fleck, Rosenthal, Russell, Strassner, & Usher (2012), small changes in estimates of MFP growth at the industry level may have important ramifications for the sources of aggregate MFP growth. Equation (11) shows that the difference between the baseline and alternative estimate of MFP growth equals the difference in the growth rates of intermediate input, weighted by the value share of intermediate inputs in output.

Table 6 compares MFP growth rates across the baseline and different treatments for imports. Figure 4 shows that the BEC-based import allocation produces both marginally faster and slower MFP growth rates across industries. The largest difference was for Miscellaneous manufacturing where MFP would have grown about 0.17 percentage points per year faster under the BEC mapping (1.63% versus 1.46%) a difference of a little over 10%. Food and beverages and tobacco MFP grew 0.05 percentage points per year slower based on the BEC, while all of the other industries' MFP growth differed by less than 0.05 percentage points per year.

Figure 5 shows that the MFP estimates based on the alternative import prices (Alt2) differ more compared to the baseline than those based on the BEC allocation. Measured MFP growth in Water transportation would differ by over 1 percentage point per year compared to the baseline, as would that for Petroleum and coal. While the difference in MFP growth for Primary metals is relatively large, -0.86% per year versus -0.12%, the difference is about 0.7 percentage points per year over the period. Electrical equipment would have had slower MFP growth by about 0.2 percentage points per year, Plastics and rubber products, Textile mills, and Computers and Electronic products all would have exhibited faster MFP growth by about 0.4 percentage points per year.

Like value added growth rates, the country-bias adjusted import prices would result in only marginally different MFP growth rates across industries. Figure 6 compares measured MFP growth under the baseline prices to MFP growth measured after incorporating the country-bias adjusted import prices (Alt4). The largest differences in absolute value were for Other transportation equipment, Wood products, and Nonmetallic mineral products; each would show differences of about 0.1 percentage points per year.

Table 12 presents the effects of the alternative import assumptions on estimated value added and MFP in the aggregated sector Manufacturing excluding computers and electronic products, a portion of the economy that Houseman, Kurz, Lengermann, & Mandel (2011) argues is particularly affected by measurement bias. Across the alternative import assumptions that we analyze, between 1998 and 2011, value added growth in this portion of the economy ranged from -0.13% per year under the baseline to -0.32% per year under the alternative import allocation and country-bias adjusted import prices. MFP growth estimates ranged from 0.37% per year to 0.30% per year. The range of estimated contributions of this sector to aggregate value added and MFP growth reflects the share of this sector relative to aggregate value added (about 11 percent over the period); in the baseline, Manufacturing excluding computers and electronic products contributed 0.00 percentage points per year to aggregate value added growth, and -0.03 percentage points per year under Alt5. The contribution of this sector to aggregate MFP growth was 0.11 percentage points per year under the baseline, and 0.09 percentage points per year under the Alt5 treatment of imports.

5.5 The Sources of Growth under the Alternatives

In this section, we compare the sources of aggregate value added and MFP growth by industry across the alternative treatment of imports using the equations specified in section 5.2.

Table 7, which presents estimates of aggregate value added and MFP growth based on equations (5) and (8), shows that there are very few significant differences based on the alternative import measurement approaches. For the period as a whole, the estimates of value added growth ranged from 1.87% per year for the baseline to 1.84% per year based on the country-bias adjusted import prices with BEC-based import allocation (Alt5), a 1.8% difference in percentage terms. Most of this difference occurs during the 2006-2011 period; the MFP growth estimate based on the country-bias adjusted import prices (0.27% per year) is about 25% lower than the baseline of 0.36% per year.

Across each of the treatments of imports that we analyze, MFP growth accounts for between 25%-30% of aggregate value added growth between 1998 and 2011. While this is also true over the 1998-2006 period, MFP growth estimates for the 2006-2011 period differ somewhat based on the treatment of imports. As a share of aggregate value added growth, the baseline method attributes about 30% to MFP, while the alternative (Alt5) allocation with the BEC import allocation with country-bias adjusted import prices attributes less than 10% of aggregate growth to MFP growth.

Table 8, which is based on equation (9), shows that the sources of aggregate value added growth decomposed across IT-Producing Industries, IT-Using Industries, and Non-IT industries are very similar across methodologies. For the 1998-2011 period, each of the methods estimates that about 22% of aggregate value added growth was due to IT-Producing industries, 62% to IT-Using industries, and 16% to Non-IT industries. For the 2006-2011 period, the distribution of value added growth attributed to these three broad sectors under the BEC-allocation and country-bias adjusted import prices reflects the slower estimates of value added growth for the IT-Using and Non-IT sectors. Specifically, IT-Producing industries accounted for about 93% of aggregate value added growth, IT-Using industries about 84%, and Non-IT industries -76%.

For the broad economic sectors shown in Table 9, the sources of value added growth are similar across approaches. For the period as a whole, there are very few discernible differences in the sources of growth across methodologies. Agriculture accounted for about 1% of aggregate value added growth, Transportation, Warehousing, and Utilities 5%, Construction -5%, Durable manufacturing 14%, Nondurable 0%, Trade 12%, Information 11%, Finance, insurance, real estate 27%, Other services 29%, and Government 6%. For the 2006-2011 period, the basic sources of growth story is similar across methods, but there are some differences in the shares of growth attributed to some of the broad sectors. For example, under the baseline treatment of imports, Transportation, warehousing, and utilities accounted for 15% of aggregate growth and 20% under the country-bias adjusted import prices and BEC-allocated import use matrix.

Similarly, Durable manufacturing accounted for 11% of the growth under the baseline, but approximately 0% under the Alt5 treatment.

Table 10 shows that the sources of aggregate MFP growth exhibit a similar pattern across the treatments of imports that we analyze. For the 1998-2011 period, the results indicate that IT-Producing industries accounted for 65%-70% of aggregate MFP growth, IT-Using industries about 31-33%, and Non-IT industries about -3% to 2%. For the 2006-2011 sub period, the allocation of MFP growth across sectors shows minor sensitivity to the treatment of imports because MFP originating from IT-Producing sectors is similar across treatments, while aggregate MFP exhibits some differences. While there is some sensitivity of the shares of aggregate MFP due to these sectors, the fundamental sources of MFP growth are little changed across treatments of imports.

Under each of the treatments of imports, the sources of MFP growth across broad sector are in agreement. Table 11 shows that for the period as a whole, the contributions of broad sectors to aggregate MFP growth are almost identical. For the 2006-2011 period, there are some minor differences. For example, applying the country-bias to import prices and the BEC-based import use matrix leads to a lower contribution from Durable goods manufacturing (0.13% per year) compared to the baseline of 0.17% per year. Nondurable goods under this same alternative contributed -0.10% per year versus -0.08% per year. Taking into account the differences in each of the sectors produces an aggregate MFP contribution estimate of 0.02% per year against 0.11% per year in the baseline. Again, the fundamental sources of aggregate MFP are very similar across the different treatments of imports.

6 Conclusions

Estimated GDP from the expenditure side demonstrates the increasing role of imports in U.S. economic activity. In this paper, we have examined the role of import measurement on estimates of the sources of GDP growth from an industry perspective. Between 1998 and 2011, the value of imports relative to GDP increased from 12.7% to 17.7%. Over the same period based on the value added approach to measuring GDP, the share of imported intermediates used in domestic production increased from about 9% to 13% for the economy as a whole, and from 16% to 25% in Manufacturing. Due to interest in how these imports are treated in the measurement of GDP by industry, we have documented the current approach to capturing the role of imports on measures of growth and productivity at the industry level, and how import measurement issues translate to aggregate measures of growth and productivity. The industry production account that we analyze in this paper is an important element of quantifying the impact of imports on the U.S. economy.

Because a basic requirement in assembling industry estimates of real value added and MFP growth is the value of imports by type that are used by different industries in the economy, we have detailed the application of the import proportionality assumption in the BEA industry accounts, and compared this to an approach that relies on the broad economic classifications

published by the U.N. We find that estimates of GDP and MFP growth by industry show no major differences based on the BEC allocation. We attribute this to the level of detail at which BEA applies the import comparability assumption, which is much finer than the 63-sector level at which the annual accounts are published.

Another component of the accounts that affects measures of GDP and MFP by industry is the prices used to deflate imports used in production across industries. We compare the current practice, which relies heavily on published BLS import price indexes at the detailed level to a set of prices at the more aggregated level, and an import price that incorporates a country-bias adjustment. Again, we do not find a significant impact on the sources of growth across industries, or on the fundamental growth decomposition at the aggregate level.

The industry production account approach that we make use of in our analysis reinforces the notion that the economy-wide impact of increasing imports depends on industry measures of import use. While there is some evidence that methodology applied to estimate imports at the industry level has some minor industry specific measurement effects, across industries these effects often cancel out so that at higher levels of aggregation there are very few observable differences due to the treatment of imports among the import treatments that we analyze. It is worth recalling that our analysis focuses solely on different treatments of the imports of goods in the accounts.

Surely, measurement issues related to the growth in globalization will not dissipate. This study was based on the 2002 benchmark input-output table that forms the basis of the annual industry accounts. The 2007 benchmark input-output table, available in December 2013, will incorporate updated information on the structure of inter-industry purchases and the annual industry accounts will be revised to reflect this new information. Looking further ahead, the treatment of factoryless goods production is a measurement area that is gaining attention. The GDP by Industry account's methodologists are actively involved in discussing methods to treat factoryless goods and how to incorporate these concepts into their estimates.

7 Bibliography

Bridgman, B. (2012). *Adjusting Import Prices for Quality Differences in the Presence of Fixed Market Entry Costs.*

Eldridge, L., & Harper, M. (2012). *Substitution of Imports for Domestic Labor, Capital and Materials in U.S. Manufacturing.*

Feenstra, R., & Hanson, G. (1999). The Impact of Outsourcing and High-Technology Capital on Wages: Estimates For The United States, 1979–1990 . *The Quarterly Journal of Economics*, pp. 907-940.

Feenstra, R., & Romalis, J. (2012). *International Prices and Endogenous Quality.*

Fleck, S., Rosenthal, S., Russell, M., Strassner, E., & Usher, L. (2012). *A Prototype BEA/BLS Industry-Level Production Account for the United States.*

Haskel, J., Lawrence, R., Leamer, E., & Slaughter, M. (2012). Globalization and U.S. Wages: Modifying Classic Theory to Explain Recent Facts. *Journal of Economic Perspectives*, 119–140.

Horowitz, K. J., & Planting, M. A. (2006). *Concepts and Methods of the U.S. Input-Output Accounts.* U.S. Department of Commerce.

Houseman, S., Kurz, C., Lengermann, P., & Mandel, B. (2011). Offshoring Bias in U.S. Manufacturing. *Journal of Economic Perspectives, 25*(2), 111–132.

Inklaar, R. (2012). *Offshoring bias in manufacturing growth across advanced and emerging economies.*

Jorgenson, D., & Schreyer, P. (2013, forthcoming). Industry-level Productivity Measurement and 2008 System of National Accounts. *Review of Income and Wealth*.

Jorgenson, D., Ho, M., & Samuels, J. (2011). Information Technology and U.S. Productivity Growth Evidence from a Prototype Industry Production Account.

Jorgenson, D., Ho, M., Samuels, J., & Stiroh, K. (2007). The Industry Origins of the American Productivity Resurgence. *Economic System Research, 19*(3), 229-252.

Kurz, C., & Lengermann, P. (2008). *Outsourcing and U.S. Economic Growth: The Role of Imported Intermediate Inputs.*

Lawrence, R., & Slaughter, M. (1993). International Trade and American Wages in the 1980s: Giant Sucking Sound or Small Hiccup? *Brookings Papers on Economic Activity, 1993*(2), pp. 161-226.

Lawson, A. M., Moyer, B. C., Okubo, S., & Planting, M. A. (2006). Integrating Industry and National Economic Accounts: First Steps and Future Improvements. In D. Jorgenson, J. S. Landefeld, & W. Nordhaus, *A New Architecture for the U.S. National Accounts.* University of Chicago Press.

Mayerhauser, N. M., & Strassner, E. H. (2010). Preview of the Comprehensive Revision of the Annual Industry Accounts: Changes in Definitions, Classification, and Statistical Methods. *Survery of Current Business 90 (March)*, 21-34.

Moyer, B. C., Planting, M. A., Fahim-Nader, M., & Lum, S. K. (2004). Preview of the Comprehensive Revision of the Annual Industry Accounts: Integrating the Annual Input-Output Accounts and the Gross Domestic Product by Industry Accounts. *Suvery of Current Business 84 (March)*, 38-51.

Moyer, B. C., Reinsdorf, M., & Yuskavage, R. E. (2006). Aggregation Issues in Integrating and Accelerating the BEA's Accounts: Improved Methods for Calculating GDP by Industry. In D. Jorgenson, J. S. Landefeld, & W. Nordhaus, *A New Architecture for the U.S. National Accounts.* University of Chicago Press.

Moylan, C. (2002). Titel.

Rassier, D. G., Howells III, T. F., Morgan, E. T., Empey, N. R., & Roesch, C. E. (2007). Integrating the 2002 Benchmark Input-Output Accounts and the 2002 Annual Industry Accounts. *Survery of Current Business 84 (December)*, 14-22.

Stewart, R. L., Brede Stone, J., & Streitwieser, M. L. (2007). U.S. Benchmark Input-Output Accounts, 2002. *Survery of Current Business 87 (October)*, 19-48.

Strassner, E. H., Yuskavage, R. E., & Lee, J. (2010). Imported Inputs and Industry Contributions to Economic Growth: An Assessment of Alternative Approaches. In S. N. Houseman, & K. F. Ryder, *Measurement Issues Arising from the Growth of Globalization.*

Timmer, M. (2012). *The World Input-Output Database (WIOD).*

Washington, P. A., Bellone, J. M., Jacobson, A. M., & Lee, J. (2012). Annual Industry Accounts: Revised Statistics for 2009-2011. *Survey of Current Business 92 (December)*.

Yuskavage, R. E., Strassner, E. H., & Medeiros, G. W. (2008). *Domestic Outsourcing and Imported Inputs in the U.S. Economy: Insights from Integrated Economic Accounts.*

Yuskavage, R. E., Strassner, E. H., & Medeiros, G. W. (2009). Outsourcing and Imported Services in BEA's Industry Accounts. In M. Reinsdorf, & M. J. Slaughter, *International Trade in Services and Intangibles in the Era of Globalization.* University of Chicago Press.

Yuskavage, R., & Strassner, E. M. (2008). *Domestic Outsourcing and Imported Inputs in the U.S. Economy: Insights from Integrated Economic Accounts.*

Table 1: Share of Imports Allocated to Intermediate Inputs by Commodity 2007

	Baseline	BEC-based Allocation	Difference (Absolute Value)
Forestry, fishing, and related activities	0.85	0.24	0.61
Utilities	0.45	1.00	0.55
Food and beverage and tobacco products	0.48	0.13	0.35
Textile mills and textile product mills	0.53	0.37	0.16
Publishing industries (includes software)	0.15	0.02	0.14
Chemical products	0.51	0.64	0.14
Miscellaneous manufacturing	0.16	0.28	0.12
Plastics and rubber products	0.72	0.83	0.11
Printing and related support activities	0.82	0.72	0.11
Farms	0.56	0.48	0.08
Apparel and leather and allied products	0.10	0.02	0.08
Electrical equipment, appliances, and components	0.55	0.61	0.06
Machinery	0.42	0.48	0.06
Furniture and related products	0.15	0.10	0.04
Computer and electronic products	0.36	0.39	0.03
Fabricated metal products	0.82	0.84	0.03
Motor vehicles, bodies and trailers, and parts	0.31	0.33	0.02
Other transportation equipment	0.51	0.52	0.01
Paper products	0.93	0.92	0.01
Mining, except oil and gas	0.99	1.00	0.01
Wood products	0.92	0.93	0.01
Nonmetallic mineral products	0.84	0.84	0.00
Primary metals	1.00	1.00	0.00
Motion picture and sound recording industries	0.55	0.55	0.00
Petroleum and coal products	0.87	0.87	0.00
Information and data processing services	0.83	0.83	0.00
Computer systems design and related services	0.46	0.46	0.00
Oil and gas extraction	1.00	1.00	0.00
Air transportation	0.22	0.22	0.00
Rail transportation	1.00	1.00	0.00
Water transportation	0.11	0.11	0.00
Truck transportation	1.00	1.00	0.00
Federal Reserve banks, credit intermediation, and related activities	0.41	0.41	0.00
Insurance carriers and related activities	0.62	0.62	0.00
Rental and leasing services and lessors of intangible assets	0.54	0.54	0.00
Legal services	0.61	0.61	0.00
Miscellaneous professional, scientific, and technical services	0.98	0.98	0.00
Administrative and support services	0.96	0.96	0.00
Waste management and remediation services	1.00	1.00	0.00
Educational services	0.44	0.44	0.00
Performing arts, spectator sports, museums, and related activities	0.19	0.19	0.00
Other services, except government	0.59	0.59	0.00

Table 2: Share of Imports in Total Industry Intermediate Use 2007

	Baseline	BEC-based Allocation	Difference (Absolute Value)
Miscellaneous manufacturing	0.15	0.26	0.11
Food services and drinking places	0.09	0.04	0.05
Ambulatory health care services	0.08	0.12	0.04
Food and beverage and tobacco products	0.10	0.06	0.04
Nonmetallic mineral products	0.10	0.14	0.04
Computer and electronic products	0.23	0.26	0.03
Furniture and related products	0.19	0.17	0.03
Social assistance	0.06	0.04	0.02
Printing and related support activities	0.12	0.10	0.02
Other transportation equipment	0.19	0.21	0.02
Motor vehicles, bodies and trailers, and parts	0.23	0.25	0.02
Mining, except oil and gas	0.09	0.11	0.02
Federal general government	0.14	0.15	0.01
Amusements, gambling, and recreation industries	0.06	0.05	0.01
Wholesale trade	0.08	0.09	0.01
Accommodation	0.06	0.05	0.01
Textile mills and textile product mills	0.17	0.16	0.01
Machinery	0.19	0.19	0.01
State and local general government	0.08	0.08	0.01
Educational services	0.05	0.04	0.01
Electrical equipment, appliances, and components	0.20	0.21	0.01
Forestry, fishing, and related activities	0.12	0.13	0.01
State and local government enterprises	0.07	0.08	0.01
Chemical products	0.15	0.16	0.01
Hospitals and nursing and residential care facilities	0.06	0.07	0.01
Transit and ground passenger transportation	0.12	0.13	0.00
Truck transportation	0.08	0.09	0.00
Primary metals	0.25	0.26	0.00
Miscellaneous professional, scientific, and technical services	0.05	0.06	0.00
Oil and gas extraction	0.17	0.17	0.00
Other transportation and support activities	0.12	0.13	0.00
Fabricated metal products	0.12	0.12	0.00
Retail trade	0.07	0.07	0.00
Construction	0.09	0.09	0.00
Apparel and leather and allied products	0.13	0.13	0.00
Support activities for mining	0.09	0.09	0.00
Performing arts, spectator sports, museums, and related activities	0.02	0.02	0.00
Utilities	0.19	0.20	0.00
Other services, except government	0.05	0.04	0.00
Warehousing and storage	0.04	0.04	0.00
Wood products	0.12	0.12	0.00
Federal government enterprises	0.11	0.11	0.00
Insurance carriers and related activities	0.09	0.09	0.00
Water transportation	0.33	0.33	0.00
Rental and leasing services and lessors of intangible assets	0.05	0.05	0.00
Plastics and rubber products	0.16	0.16	0.00
Rail transportation	0.07	0.07	0.00
Farms	0.10	0.10	0.00
Paper products	0.17	0.17	0.00
Management of companies and enterprises	0.06	0.06	0.00
Publishing industries (includes software)	0.05	0.05	0.00
Waste management and remediation services	0.07	0.07	0.00
Real estate	0.01	0.01	0.00
Air transportation	0.24	0.24	0.00
Legal services	0.03	0.03	0.00
Computer systems design and related services	0.09	0.09	0.00
Administrative and support services	0.06	0.06	0.00
Broadcasting and telecommunications	0.10	0.10	0.00
Pipeline transportation	0.21	0.21	0.00
Motion picture and sound recording industries	0.03	0.03	0.00
Securities, commodity contracts, and investments	0.08	0.08	0.00
Federal Reserve banks, credit intermediation, and related activities	0.02	0.02	0.00
Information and data processing services	0.11	0.11	0.00
Petroleum and coal products	0.60	0.60	0.00
Funds, trusts, and other financial vehicles	0.00	0.00	0.00

Table 3: Price Growth: Domestic versus Foreign 1998-2011

	Domestic	Imported	Difference (Absolute Value)	Import Share in Total Intermediate Use
Information and data processing services	0.68	-15.72	16.40	0.00
Motion picture and sound recording industries	2.68	-4.28	6.97	0.05
Oil and gas extraction	11.22	15.89	4.66	0.58
Primary metals	4.54	8.66	4.11	0.27
Federal Reserve banks, credit intermediation, and related activities	2.49	-1.60	4.09	0.00
Forestry, fishing, and related activities	1.11	4.81	3.71	0.23
Mining, except oil and gas	4.63	8.11	3.48	0.09
Petroleum and coal products	12.88	16.03	3.14	0.18
Computer systems design and related services	-1.66	1.38	3.04	0.04
Air transportation	2.13	5.00	2.87	0.16
Water transportation	0.79	3.53	2.73	0.05
Legal services	3.91	1.38	2.53	0.01
Other services, except government	3.71	1.38	2.33	0.01
Electrical equipment, appliances, and components	3.05	0.89	2.16	0.39
Wood products	0.50	2.51	2.01	0.17
Performing arts, spectator sports, museums, and related activities	3.38	1.38	2.00	0.00
Insurance carriers and related activities	2.29	4.10	1.81	0.12
Computer and electronic products	-5.74	-3.96	1.78	0.45
Farms	4.36	6.06	1.70	0.06
Paper products	2.91	1.22	1.69	0.15
Waste management and remediation services	3.09	1.41	1.68	0.00
Rental and leasing services and lessors of intangible assets	2.25	3.73	1.48	0.00
Miscellaneous manufacturing	2.26	0.91	1.35	0.25
Chemical products	5.02	3.90	1.13	0.17
Administrative and support services	2.42	1.38	1.04	0.00
Miscellaneous professional, scientific, and technical services	2.42	1.38	1.04	0.04
Furniture and related products	1.68	0.73	0.95	0.15
Food and beverage and tobacco products	3.67	4.47	0.80	0.10
Educational services	3.88	3.12	0.77	0.02
Publishing industries (includes software)	1.67	1.05	0.62	0.01
Printing and related support activities	0.97	1.56	0.59	0.03
Motor vehicles, bodies and trailers, and parts	0.57	1.11	0.55	0.32
Fabricated metal products	2.62	2.18	0.44	0.13
Textile mills and textile product mills	1.47	1.76	0.28	0.31
Plastics and rubber products	2.65	2.91	0.26	0.13
Rail transportation	3.16	2.93	0.24	0.05
Utilities	3.68	3.90	0.22	0.01
Other transportation equipment	1.96	1.84	0.12	0.24
Nonmetallic mineral products	2.41	2.31	0.10	0.15
Machinery	2.08	2.00	0.08	0.37
Apparel and leather and allied products	0.83	0.75	0.07	0.61
Truck transportation	2.96	2.93	0.03	0.07

Notes: Average annual percentage log growth. Share is the ratio in dollar values.

Table 4: Import Price Growth: Baseline versus Alternative 1998-2011

	Baseline	Alternative	Difference (Absolute Value)
Information and data processing services	-15.72	1.01	16.73
Motion picture and sound recording industries	-4.28	2.92	7.21
Truck transportation	2.93	0.20	2.73
Oil and gas extraction	15.89	13.57	2.31
Federal Reserve banks, credit intermediation, and related activities	-1.60	0.58	2.18
Other services, except government	1.38	3.43	2.05
Petroleum and coal products	16.03	14.34	1.69
Insurance carriers and related activities	4.10	2.55	1.55
Legal services	1.38	2.75	1.37
Educational services	3.12	1.89	1.23
Publishing industries (includes software)	1.05	2.16	1.11
Computer and electronic products	-3.96	-2.88	1.08
Chemical products	3.90	2.83	1.07
Performing arts, spectator sports, museums, and related activities	1.38	2.41	1.03
Plastics and rubber products	2.91	1.93	0.98
Utilities	3.90	3.01	0.89
Rental and leasing services and lessors of intangible assets	3.73	2.94	0.79
Food and beverage and tobacco products	4.47	3.71	0.76
Administrative and support services	1.38	0.70	0.67
Printing and related support activities	1.56	2.22	0.66
Primary metals	8.66	8.01	0.64
Farms	6.06	6.65	0.59
Water transportation	3.53	2.94	0.59
Wood products	2.51	1.95	0.57
Textile mills and textile product mills	1.76	1.19	0.57
Machinery	2.00	1.52	0.48
Air transportation	5.00	4.56	0.44
Nonmetallic mineral products	2.31	1.90	0.40
Mining, except oil and gas	8.11	8.44	0.32
Rail transportation	2.93	2.62	0.31
Computer systems design and related services	1.38	1.08	0.30
Apparel and leather and allied products	0.75	0.57	0.18
Waste management and remediation services	1.41	1.23	0.17
Other transportation equipment	1.84	1.74	0.11
Miscellaneous manufacturing	0.91	1.01	0.10
Motor vehicles, bodies and trailers, and parts	1.11	1.02	0.09
Furniture and related products	0.73	0.67	0.06
Miscellaneous professional, scientific, and technical services	1.38	1.32	0.06
Electrical equipment, appliances, and components	0.89	0.84	0.05
Forestry, fishing, and related activities	4.81	4.85	0.04
Fabricated metal products	2.18	2.21	0.03
Paper products	1.22	1.22	0.00

Notes: Average annual percentage log growth.

Table 5: Growth in Industry Value Added under Alternatives 1998-2011

	Baseline	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Farms	2.12	2.12	2.12	2.12	2.12	2.12
Forestry fishing and related activities	3.34	3.33	3.35	3.30	3.34	3.32
Oil and gas extraction	-3.74	-3.75	-3.67	-3.67	-3.75	-3.75
Mining except oil and gas	-2.92	-2.93	-2.98	-2.98	-2.93	-2.94
Support activities for mining	6.31	6.30	6.16	6.13	6.34	6.33
Utilities	1.36	1.36	1.41	1.41	1.36	1.36
Construction	-2.24	-2.24	-2.27	-2.26	-2.28	-2.29
Wood products	0.22	0.22	0.58	0.59	-0.10	-0.11
Nonmetallic mineral products	-3.15	-3.04	-2.99	-2.95	-2.95	-3.52
Primary metals	-3.13	-3.13	-6.29	-6.29	-3.39	-3.38
Fabricated metal products	-1.18	-1.18	-1.47	-1.46	-1.23	-1.23
Machinery	0.22	0.21	0.16	0.16	0.14	0.13
Computer and electronic products	17.51	17.47	18.43	18.45	17.52	17.48
Electrical equipment appliances and components	0.80	0.79	0.04	0.02	0.73	0.73
Motor vehicles bodies and trailers and parts	0.28	0.17	0.59	0.59	0.02	-0.09
Other transportation equipment	0.95	0.92	0.99	0.95	0.57	0.53
Furniture and related products	-2.76	-2.74	-2.54	-2.55	-2.89	-2.88
Miscellaneous manufacturing	2.89	3.22	2.80	2.79	2.83	2.30
Food and beverage and tobacco products	1.06	0.85	0.84	0.86	1.07	0.80
Textile mills and textile product mills	-4.26	-4.26	-2.90	-2.92	-4.48	-4.50
Apparel and leather and allied products	-4.83	-4.77	-4.63	-4.56	-4.91	-4.85
Paper products	-2.87	-2.87	-2.75	-2.75	-2.93	-2.93
Printing and related support activities	-0.96	-0.98	-0.78	-0.83	-0.92	-0.98
Petroleum and coal products	1.44	1.44	-2.10	-2.10	1.34	1.34
Chemical products	1.03	1.00	1.74	1.84	0.94	0.90
Plastics and rubber products	-0.68	-0.69	0.60	0.59	-0.77	-0.77
Wholesale Trade	2.19	2.20	2.19	2.19	2.19	2.17
Retail Trade	1.41	1.42	1.42	1.41	1.41	1.40
Air transportation	3.03	3.03	2.57	2.57	3.00	3.00
Rail transportation	0.10	0.10	-0.06	-0.05	0.05	0.05
Water transportation	9.00	9.00	5.21	5.20	8.98	8.98
Truck transportation	1.74	1.74	1.44	1.43	1.73	1.73
Transit and ground passenger transportation	1.25	1.25	1.20	1.21	1.24	1.24
Pipeline transportation	6.62	6.63	6.82	6.82	6.62	6.62
Other transportation and support activities	1.77	1.77	1.61	1.61	1.76	1.76
Warehousing and storage	3.69	3.69	3.68	3.68	3.69	3.69
Publishing industries (includes software)	2.62	2.62	2.69	2.68	2.62	2.62
Motion picture and sound recording industries	1.18	1.18	1.20	1.19	1.17	1.17
Broadcasting and telecommunications	5.79	5.79	5.93	5.92	5.79	5.79
Information and data processing services	7.16	7.16	7.30	7.30	7.17	7.17
Federal Reserve banks credit intermediation and related activities	2.99	2.99	3.03	3.03	2.99	2.99
Securities commodity contracts and investments	5.59	5.59	5.59	5.59	5.59	5.59
Insurance carriers and related activities	1.41	1.41	1.33	1.33	1.41	1.41
Funds trusts and other financial vehicles	4.48	4.48	4.49	4.49	4.48	4.48
Real estate	2.28	2.28	2.29	2.29	2.28	2.28
Rental and leasing services and lessors of intangible assets	1.89	1.89	1.89	1.89	1.89	1.89
Legal services	-0.35	-0.35	-0.33	-0.33	-0.35	-0.35
Computer systems design and related services	6.91	6.91	6.99	6.99	6.91	6.91
Miscellaneous professional scientific and technical services	3.11	3.11	3.14	3.14	3.11	3.11
Management of companies and enterprises	0.27	0.26	0.37	0.35	0.25	0.26
Administrative and support services	3.06	3.06	3.00	3.00	3.05	3.05
Waste management and remediation services	2.56	2.56	2.54	2.55	2.55	2.55
Educational services	1.15	1.15	1.20	1.20	1.15	1.15
Ambulatory health care services	3.52	3.47	3.72	3.89	3.51	3.40
Hospitals Nursing and residential care facilities	1.89	1.85	2.01	2.12	1.89	1.82
Social assistance	2.99	2.99	2.99	2.99	2.99	2.99
Performing arts spectator sports museums and related activities	2.28	2.28	2.27	2.27	2.28	2.28
Amusements gambling and recreation industries	1.25	1.26	1.25	1.27	1.25	1.25
Accommodation	1.77	1.76	1.81	1.80	1.78	1.76
Food services and drinking places	2.04	2.02	2.02	2.02	2.09	2.02
Other services except government	-1.00	-0.99	-0.98	-0.99	-1.00	-1.00
Federal Government	1.03	1.03	1.02	1.02	1.03	1.03
State and Local Government	0.85	0.85	0.84	0.84	0.85	0.85

Note: Alt1 uses the alternative import allocation based on the BEC. Alt2 uses the alternative set of import prices. Alt3 uses both the alternative allocation and the alternative import prices. Alt4 uses the bias adjusted import prices, and Alt5 uses bias adjusted import prices and the alternative import use matrix.

Table 6: MFP Growth under Alternatives 1998-2011

	MFP Growth	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Farms	0.95	0.95	0.95	0.95	0.95	0.95
Forestry fishing and related activities	2.05	2.03	2.04	2.01	2.05	2.02
Oil and gas extraction	-2.84	-2.84	-2.79	-2.79	-2.84	-2.84
Mining except oil and gas	-1.38	-1.38	-1.40	-1.41	-1.38	-1.38
Support activities for mining	1.81	1.81	1.76	1.74	1.82	1.82
Utilities	0.28	0.28	0.31	0.31	0.28	0.28
Construction	-1.15	-1.15	-1.16	-1.16	-1.17	-1.17
Wood products	1.21	1.20	1.30	1.30	1.11	1.11
Nonmetallic mineral products	-0.73	-0.69	-0.66	-0.65	-0.64	-0.86
Primary metals	-0.12	-0.12	-0.86	-0.86	-0.19	-0.19
Fabricated metal products	-0.06	-0.06	-0.18	-0.17	-0.08	-0.08
Machinery	0.64	0.64	0.62	0.62	0.61	0.61
Computer and electronic products	8.15	8.13	8.54	8.55	8.15	8.13
Electrical equipment appliances and components	0.96	0.95	0.66	0.65	0.93	0.93
Motor vehicles bodies and trailers and parts	0.70	0.68	0.76	0.76	0.65	0.63
Other transportation equipment	0.57	0.56	0.58	0.57	0.43	0.42
Furniture and related products	0.08	0.09	0.18	0.17	0.02	0.03
Miscellaneous manufacturing	1.46	1.63	1.41	1.41	1.43	1.16
Food and beverage and tobacco products	0.19	0.14	0.13	0.14	0.19	0.12
Textile mills and textile product mills	1.33	1.33	1.77	1.77	1.26	1.25
Apparel and leather and allied products	3.37	3.39	3.44	3.47	3.32	3.34
Paper products	-0.09	-0.09	-0.05	-0.05	-0.11	-0.11
Printing and related support activities	1.11	1.11	1.18	1.16	1.13	1.11
Petroleum and coal products	0.20	0.20	-0.87	-0.87	0.18	0.18
Chemical products	0.42	0.41	0.68	0.72	0.39	0.38
Plastics and rubber products	0.24	0.23	0.69	0.69	0.20	0.20
Wholesale Trade	0.67	0.68	0.67	0.67	0.67	0.66
Retail Trade	0.15	0.15	0.15	0.15	0.15	0.14
Air transportation	2.18	2.18	1.98	1.98	2.17	2.17
Rail transportation	0.54	0.54	0.47	0.48	0.52	0.52
Water transportation	2.73	2.73	1.59	1.59	2.71	2.71
Truck transportation	0.68	0.68	0.54	0.54	0.68	0.68
Transit and ground passenger transportation	-0.71	-0.71	-0.74	-0.74	-0.71	-0.71
Pipeline transportation	2.20	2.20	2.28	2.28	2.19	2.20
Other transportation and support activities	1.39	1.39	1.29	1.29	1.39	1.39
Warehousing and storage	0.76	0.76	0.76	0.76	0.76	0.76
Publishing industries (includes software)	0.28	0.28	0.32	0.31	0.28	0.28
Motion picture and sound recording industries	0.59	0.59	0.60	0.60	0.59	0.59
Broadcasting and telecommunications	1.85	1.85	1.92	1.92	1.85	1.85
Information and data processing services	-0.17	-0.17	-0.10	-0.10	-0.17	-0.17
Federal Reserve banks credit intermediation and related activities	0.45	0.45	0.48	0.48	0.46	0.45
Securities commodity contracts and investments	1.02	1.02	1.02	1.02	1.02	1.02
Insurance carriers and related activities	-0.51	-0.51	-0.56	-0.56	-0.51	-0.51
Funds trusts and other financial vehicles	0.04	0.04	0.05	0.05	0.04	0.04
Real estate	0.25	0.25	0.25	0.25	0.25	0.25
Rental and leasing services and lessors of intangible assets	-1.08	-1.08	-1.08	-1.08	-1.08	-1.08
Legal services	-2.28	-2.28	-2.27	-2.27	-2.28	-2.28
Computer systems design and related services	2.02	2.02	2.08	2.08	2.02	2.02
Miscellaneous professional scientific and technical services	0.13	0.13	0.15	0.15	0.13	0.13
Management of companies and enterprises	-2.28	-2.29	-2.22	-2.23	-2.29	-2.29
Administrative and support services	1.23	1.23	1.19	1.19	1.22	1.23
Waste management and remediation services	0.90	0.90	0.90	0.90	0.90	0.90
Educational services	-1.26	-1.25	-1.22	-1.22	-1.25	-1.25
Ambulatory health care services	0.36	0.32	0.49	0.60	0.35	0.28
Hospitals Nursing and residential care facilities	-0.17	-0.19	-0.10	-0.03	-0.17	-0.21
Social assistance	0.62	0.61	0.62	0.62	0.62	0.61
Performing arts spectator sports museums and related activities	0.27	0.27	0.27	0.27	0.27	0.27
Amusements gambling and recreation industries	0.10	0.11	0.10	0.12	0.10	0.10
Accommodation	0.19	0.19	0.21	0.21	0.20	0.19
Food services and drinking places	0.64	0.63	0.62	0.62	0.66	0.63
Other services except government	-1.15	-1.14	-1.14	-1.14	-1.15	-1.15
Federal Government	0.20	0.20	0.20	0.20	0.20	0.20
State and Local Government	-0.38	-0.38	-0.39	-0.39	-0.38	-0.39

Note: Alt1 uses the alternative import allocation based on the BEC. Alt2 uses the alternative set of import prices. Alt3 uses both the alternative allocation and the alternative import prices. Alt4 uses the bias adjusted import prices, and Alt5 uses bias adjusted import prices and the alternative import use matrix.

Table 7: Growth in Aggregate Value Added and MFP

	1998-2011	1998-2006	2006-2011
Baseline			
Value Added	1.87	2.82	0.36
MFP	0.49	0.72	0.11
Alternative Import Allocation			
Value Added	1.87	2.82	0.34
MFP	0.48	0.72	0.10
Alternative Import Prices			
Value Added	1.87	2.82	0.34
MFP	0.48	0.72	0.10
Alternative Import Allocation and Import Prices			
Value Added	1.88	2.84	0.34
MFP	0.49	0.74	0.10
Bias-Adjusted Import Prices			
Value Added	1.86	2.82	0.32
MFP	0.47	0.72	0.07
Alternative Import Allocation and Bias-Adjusted Import Prices			
Value Added	1.84	2.82	0.27
MFP	0.45	0.72	0.02

Notes: All figures are average annual percentages.

Table 8: Sector Contributions to Aggregate Value Added Growth

	1998-2011	1998-2006	2006-2011
Baseline			
Value Added	1.87	2.82	0.36
IT-Producing Industries	0.40	0.49	0.25
IT-Using Industries	1.16	1.71	0.28
Non-IT Industries	0.31	0.62	-0.17
Alternative Import Allocation			
Value Added	1.87	2.82	0.34
IT-Producing Industries	0.40	0.49	0.25
IT-Using Industries	1.16	1.71	0.27
Non-IT Industries	0.31	0.62	-0.18
Alternative Import Prices			
Value Added	1.87	2.82	0.34
IT-Producing Industries	0.41	0.51	0.27
IT-Using Industries	1.17	1.72	0.28
Non-IT Industries	0.29	0.59	-0.20
Alternative Import Allocation and Import Prices			
Value Added	1.88	2.84	0.34
IT-Producing Industries	0.41	0.51	0.27
IT-Using Industries	1.17	1.73	0.28
Non-IT Industries	0.29	0.60	-0.20
Bias Adjusted Import Prices			
Value Added	1.86	2.82	0.32
IT-Producing Industries	0.40	0.49	0.25
IT-Using Industries	1.16	1.72	0.26
Non-IT Industries	0.31	0.61	-0.19
Alternative Import Allocation and Bias Adjusted Import Prices			
Value Added	1.84	2.82	0.27
IT-Producing Industries	0.40	0.49	0.25
IT-Using Industries	1.14	1.72	0.23
Non-IT Industries	0.30	0.61	-0.21

Notes: All figures are average annual percentages. The contribution of an output or input is the growth rate multiplied by the average value share. Sector aggregation is discussed in the text.

Table 9: Sector Contributions to Aggregate Value Added Growth

	1998-2011	1998-2006	2006-2011
Baseline			
Value Added	1.87	2.82	0.36
Agriculture, Forestry, Fishing, Hunting, and Mining	0.02	0.01	0.03
Transportation, Warehousing, Utilities	0.10	0.12	0.06
Construction	-0.10	-0.01	-0.24
Manufacturing	0.25	0.46	-0.07
Durable Goods	0.25	0.39	0.04
Nondurable Goods	0.00	0.07	-0.11
Trade	0.23	0.41	-0.06
Information	0.21	0.28	0.11
Finance, Insurance, Real Estate, Rental and leasing	0.51	0.77	0.09
Other Services	0.54	0.66	0.35
Government	0.11	0.13	0.09
Alternative Import Allocation			
Value Added	1.87	2.82	0.34
Agriculture, Forestry, Fishing, Hunting, and Mining	0.02	0.01	0.03
Transportation, Warehousing, Utilities	0.10	0.12	0.06
Construction	-0.10	-0.01	-0.24
Manufacturing	0.25	0.46	-0.08
Durable Goods	0.25	0.39	0.04
Nondurable Goods	0.00	0.07	-0.12
Trade	0.23	0.41	-0.06
Information	0.21	0.28	0.11
Finance, Insurance, Real Estate, Rental and leasing	0.51	0.77	0.09
Other Services	0.54	0.65	0.35
Government	0.11	0.13	0.09
Alternative Import Prices			
Value Added	1.87	2.82	0.34
Agriculture, Forestry, Fishing, Hunting, and Mining	0.02	0.01	0.03
Transportation, Warehousing, Utilities	0.09	0.11	0.05
Construction	-0.10	-0.01	-0.24
Manufacturing	0.24	0.44	-0.08
Durable Goods	0.25	0.39	0.03
Nondurable Goods	-0.01	0.05	-0.12
Trade	0.23	0.41	-0.06
Information	0.22	0.28	0.11
Finance, Insurance, Real Estate, Rental and leasing	0.51	0.77	0.09
Other Services	0.55	0.67	0.36
Government	0.11	0.13	0.09
Alternative Import Allocation and Import Prices			
Value Added	1.88	2.84	0.34
Agriculture, Forestry, Fishing, Hunting, and Mining	0.02	0.01	0.03
Transportation, Warehousing, Utilities	0.09	0.11	0.05
Construction	-0.10	-0.01	-0.24
Manufacturing	0.24	0.45	-0.08
Durable Goods	0.25	0.39	0.04
Nondurable Goods	-0.01	0.06	-0.12
Trade	0.23	0.41	-0.06
Information	0.22	0.28	0.11
Finance, Insurance, Real Estate, Rental and leasing	0.51	0.77	0.09
Other Services	0.56	0.68	0.36
Government	0.11	0.13	0.09
Bias Adjusted Import Prices			
Value Added	1.86	2.82	0.32
Agriculture, Forestry, Fishing, Hunting, and Mining	0.02	0.01	0.03
Transportation, Warehousing, Utilities	0.10	0.12	0.05
Construction	-0.10	-0.01	-0.24
Manufacturing	0.24	0.46	-0.10
Durable Goods	0.25	0.39	0.02
Nondurable Goods	0.00	0.07	-0.12
Trade	0.23	0.41	-0.06
Information	0.21	0.28	0.11
Finance, Insurance, Real Estate, Rental and leasing	0.51	0.77	0.09
Other Services	0.54	0.66	0.35
Government	0.11	0.13	0.09
Alternative Import Allocation and Bias Adjusted Import Prices			
Value Added	1.84	2.82	0.27
Agriculture, Forestry, Fishing, Hunting, and Mining	0.02	0.01	0.03
Transportation, Warehousing, Utilities	0.10	0.12	0.05
Construction	-0.10	-0.01	-0.24
Manufacturing	0.23	0.46	-0.13
Durable Goods	0.24	0.39	0.00
Nondurable Goods	-0.01	0.06	-0.13
Trade	0.23	0.41	-0.07
Information	0.21	0.28	0.11
Finance, Insurance, Real Estate, Rental and leasing	0.51	0.77	0.09
Other Services	0.53	0.65	0.34
Government	0.11	0.13	0.09

Notes: All figures are average annual percentages. The contribution of an output or input is the growth rate multiplied by the average value share. Sector aggregation is discussed in the text.

Table 10: Sector Contributions to Aggregate MFP Growth

	1998-2011	1998-2006	2006-2011
Baseline			
MFP Growth	0.49	0.72	0.11
IT-Producing Industries	0.32	0.38	0.22
IT-Using Industries	0.16	0.29	-0.05
Non-IT Industries	0.01	0.05	-0.05
Alternative Import Allocation			
MFP Growth	0.48	0.72	0.10
IT-Producing Industries	0.32	0.38	0.21
IT-Using Industries	0.16	0.29	-0.06
Non-IT Industries	0.00	0.05	-0.06
Alternative Import Prices			
MFP Growth	0.48	0.72	0.10
IT-Producing Industries	0.34	0.40	0.23
IT-Using Industries	0.16	0.30	-0.05
Non-IT Industries	-0.02	0.02	-0.08
Alternative Import Allocation and Import Prices			
MFP Growth	0.49	0.74	0.10
IT-Producing Industries	0.34	0.40	0.23
IT-Using Industries	0.17	0.31	-0.05
Non-IT Industries	-0.01	0.03	-0.08
Bias Adjusted Import Prices			
MFP Growth	0.47	0.72	0.07
IT-Producing Industries	0.32	0.39	0.21
IT-Using Industries	0.15	0.29	-0.08
Non-IT Industries	0.00	0.04	-0.07
Alternative Import Allocation and Bias Adjusted Import Prices			
MFP Growth	0.45	0.72	0.02
IT-Producing Industries	0.32	0.39	0.21
IT-Using Industries	0.14	0.29	-0.11
Non-IT Industries	-0.01	0.04	-0.09

Notes: All figures are average annual percentages. The contribution of an output or input is the growth rate multiplied by the average value share. Sector aggregation is discussed in the text.

Table 11: Sector Contributions to Aggregate MFP Growth

	1998-2011	1998-2006	2006-2011
Baseline			
MFP Growth	0.49	0.72	0.11
Agriculture, Forestry, Fishing, Hunting, and Mining	-0.01	0.00	-0.03
Transportation, Warehousing, Utilities	0.07	0.09	0.03
Construction	-0.11	-0.16	-0.04
Manufacturing	0.39	0.58	0.09
Durable Goods	0.35	0.46	0.17
Nondurable Goods	0.04	0.11	-0.08
Trade	0.07	0.13	-0.02
Information	0.09	0.11	0.07
Finance, Insurance, Real Estate, Rental and leasing	0.06	0.06	0.05
Other Services	-0.03	-0.04	-0.02
Government	-0.04	-0.05	-0.02
Alternative Import Allocation			
MFP Growth	0.48	0.72	0.10
Agriculture, Forestry, Fishing, Hunting, and Mining	-0.01	0.00	-0.03
Transportation, Warehousing, Utilities	0.07	0.09	0.03
Construction	-0.11	-0.16	-0.04
Manufacturing	0.39	0.58	0.08
Durable Goods	0.35	0.46	0.17
Nondurable Goods	0.04	0.11	-0.09
Trade	0.07	0.13	-0.02
Information	0.09	0.11	0.07
Finance, Insurance, Real Estate, Rental and leasing	0.06	0.06	0.05
Other Services	-0.04	-0.04	-0.03
Government	-0.04	-0.05	-0.02
Alternative Import Prices			
MFP Growth	0.48	0.72	0.10
Agriculture, Forestry, Fishing, Hunting, and Mining	-0.01	0.00	-0.03
Transportation, Warehousing, Utilities	0.06	0.09	0.02
Construction	-0.11	-0.16	-0.04
Manufacturing	0.38	0.57	0.08
Durable Goods	0.35	0.47	0.16
Nondurable Goods	0.03	0.10	-0.09
Trade	0.07	0.13	-0.02
Information	0.10	0.11	0.08
Finance, Insurance, Real Estate, Rental and leasing	0.06	0.06	0.05
Other Services	-0.02	-0.02	-0.01
Government	-0.04	-0.05	-0.03
Alternative Import Allocation and Import Prices			
MFP Growth	0.49	0.74	0.10
Agriculture, Forestry, Fishing, Hunting, and Mining	-0.01	0.00	-0.03
Transportation, Warehousing, Utilities	0.06	0.09	0.02
Construction	-0.11	-0.16	-0.04
Manufacturing	0.38	0.57	0.08
Durable Goods	0.35	0.47	0.17
Nondurable Goods	0.03	0.10	-0.09
Trade	0.07	0.13	-0.02
Information	0.10	0.11	0.08
Finance, Insurance, Real Estate, Rental and leasing	0.06	0.06	0.05
Other Services	-0.01	-0.01	-0.01
Government	-0.04	-0.05	-0.03
Bias Adjusted Import Prices			
MFP Growth	0.47	0.72	0.07
Agriculture, Forestry, Fishing, Hunting, and Mining	-0.01	0.00	-0.03
Transportation, Warehousing, Utilities	0.07	0.09	0.03
Construction	-0.11	-0.16	-0.04
Manufacturing	0.38	0.58	0.06
Durable Goods	0.34	0.47	0.15
Nondurable Goods	0.04	0.11	-0.09
Trade	0.07	0.13	-0.02
Information	0.10	0.11	0.07
Finance, Insurance, Real Estate, Rental and leasing	0.06	0.06	0.05
Other Services	-0.03	-0.04	-0.02
Government	-0.04	-0.05	-0.02
Alternative Import Allocation and Bias Adjusted Import Prices			
MFP Growth	0.45	0.72	0.02
Agriculture, Forestry, Fishing, Hunting, and Mining	-0.01	0.00	-0.03
Transportation, Warehousing, Utilities	0.07	0.09	0.03
Construction	-0.11	-0.16	-0.04
Manufacturing	0.37	0.58	0.03
Durable Goods	0.34	0.47	0.13
Nondurable Goods	0.03	0.11	-0.10
Trade	0.07	0.13	-0.03
Information	0.10	0.11	0.07
Finance, Insurance, Real Estate, Rental and leasing	0.06	0.06	0.05
Other Services	-0.04	-0.04	-0.04
Government	-0.04	-0.05	-0.02

Notes: All figures are average annual percentages. The contribution of an output or input is the growth rate multiplied by the average value share. Sector aggregation is discussed in the text.

Table 12: Value Added and MFP: Manufactruing excluding Computer and electronic products

	1998-2011	1998-2006	2006-2011
Baseline			
Value Added Growth	-0.13	1.19	-2.23
Contribution to Aggregate VA Growth	0.00	0.13	-0.21
MFP Growth	0.37	0.72	-0.20
Contribution to Aggregate MFP Growth	0.11	0.23	-0.08
Alternative Import Allocation			
Value Added Growth	-0.15	1.19	-2.30
Contribution to Aggregate VA Growth	-0.01	0.13	-0.22
MFP Growth	0.36	0.72	-0.22
Contribution to Aggregate MFP Growth	0.11	0.23	-0.09
Alternative Import Prices			
Value Added Growth	-0.34	0.96	-2.42
Contribution to Aggregate VA Growth	-0.03	0.10	-0.23
MFP Growth	0.30	0.65	-0.26
Contribution to Aggregate MFP Growth	0.08	0.20	-0.10
Alternative Import Allocation and Import Prices			
Value Added Growth	-0.33	1.00	-2.45
Contribution to Aggregate VA Growth	-0.03	0.10	-0.24
MFP Growth	0.30	0.66	-0.27
Contribution to Aggregate MFP Growth	0.09	0.20	-0.10
Bias Adjusted Import Prices			
Value Added Growth	-0.22	1.19	-2.47
Contribution to Aggregate VA Growth	-0.01	0.13	-0.24
MFP Growth	0.34	0.72	-0.28
Contribution to Aggregate MFP Growth	0.10	0.23	-0.11
Alternative Import Allocation and Bias Adjusted Import Prices			
Value Added Growth	-0.32	1.18	-2.72
Contribution to Aggregate VA Growth	-0.03	0.13	-0.27
MFP Growth	0.30	0.72	-0.36
Contribution to Aggregate MFP Growth	0.09	0.23	-0.13

Notes: All figures are average annual percentages. Value Added and MFP growth for Manufacturing excluding Computer and electronic products is constructed by aggregating the component industries output and inputs and defining VA and MFP growth as described in the text.

Table A. Detailed Components Deflated using a NIPA supplied Price

NAICS Commodity	Component Deflated Detail using NIPA supplied Price
211	Crude petroleum, incl. lease condens. (vols. corrected to 60 deg. F) shipped, Natural gas, Natural gas liquids
221	Electric power transmission and control
324	Motor gasoline, inc. finished base stocks & blending agents, Jet fuel, Heavy fuel oils, inc. grades no. 5,6, heavy diesel-type, Lubricating oils (including hydraulic fluids, quenching & cutting oils, etc.)
331	Cast carbon steel railroad car wheels and railway specialties
333	Projectors, except rear screen viewers, Photocopying equipment, including diffusion transfer, dye transfer, electrostatic, light and heat sensitive types, etc. , Motion picture equipment (all sizes 8 mm and greater), excluding projection screens and processing equipment.
334	Data Communications Equipment (including routers, gateways, bridges, terminal servers, and concentrators), Cellular System Equipment, Amateur Radio Station Communications Systems and Equipment, Personal Computers, Laptops (AC/DC), Parts, Attachments, and Accessories for Computer Storage Devices, Display Terminals, Keyboards, Memory Cards, Readers, Keying Equipment, Mice, Digitizers, Light Pen Tablets, Input/Output Dev., Perip. Share, Optical Scanning Devices (bar code, flat bed, etc), Plotters, COM Equipment, Media Copying and/or Conversion Equipment,Impact Computer Printers, including Line and Serial Type.
336	Civilian Aircraft, Complete space vehicles (excluding propulsion systems) for other customers, Complete missile or space vehicle engines - US nonmilitary
481	Air Transportation, Passenger Transport-International, Express Air Freight-nonmargin
482	Railroads, freight- nonmargin
483	Water passenger transportation, deep sea, Water freight, non-margin
484	Other truck transportation services; nonmargin
492	Air courier services
514	Internet access fees, Data Processing, Hosting, and Related Services
521CI	Service Charges on Deposit Accounts and Cash Management Services of Commercial Banks
524	Medical Malpractice Insurance (Property and Causality), Fidelity, Ocean Marine Insurance, Aircraft Insurance
532RL	Passenger Car, Truck, Airplane Leasing (including vans and SUVs) , Royalty Income
5411	Offices of Lawyers (taxable)
5412OP	Payroll Services,Other Accounting Services,Architectural Services,Landscape Architectural Services,Engineering Services
5415	Custom Computer Programming,Computer Systems Integrators
561	Temporary Help Services, Photocopying and Duplicating Services, Collection Agencies
562	Hazardous Waste Treatment and Disposal, Nonhazardous Waste Treatment and Disposal, Remediation Services
611	Expenses (net of sales) of Colleges, Univ., Prof. Schools, JoCo incidental to education activities (tax exempt)
622HO	Expenses (net of sales) of Psychiatric and Substance Abuse Hospitals Private, (tax exempt)
711AS	Entertainment services provided by theater companies and dinner theaters EXCLUDING contract fees (taxable)
81	Other repair & related services

Table B: Industry Sectors

		Classification 1	Classification 2
1	Farms	Non-IT Industries	Agriculture, Forestry, Fishing, Hunting, and Mining
2	Forestry fishing and related activities	Non-IT Industries	Agriculture, Forestry, Fishing, Hunting, and Mining
3	Oil and gas extraction	Non-IT Industries	Agriculture, Forestry, Fishing, Hunting, and Mining
4	Mining except oil and gas	Non-IT Industries	Agriculture, Forestry, Fishing, Hunting, and Mining
5	Support activities for mining	Non-IT Industries	Agriculture, Forestry, Fishing, Hunting, and Mining
6	Utilities	Non-IT Industries	Transportation, Warehousing, Utilities
7	Construction	Non-IT Industries	Construction
8	Wood products	Non-IT Industries	Manufacturing
9	Nonmetallic mineral products	Non-IT Industries	Manufacturing
10	Primary metals	Non-IT Industries	Manufacturing
11	Fabricated metal products	Non-IT Industries	Manufacturing
12	Machinery	IT-Using Industries	Manufacturing
13	Computer and electronic products	IT-Producing Industries	Manufacturing
14	Electrical equipment appliances and components	Non-IT Industries	Manufacturing
15	Motor vehicles bodies and trailers and parts	Non-IT Industries	Manufacturing
16	Other transportation equipment	IT-Using Industries	Manufacturing
17	Furniture and related products	IT-Using Industries	Manufacturing
18	Miscellaneous manufacturing	IT-Using Industries	Manufacturing
19	Food and beverage and tobacco products	Non-IT Industries	Manufacturing
20	Textile mills and textile product mills	Non-IT Industries	Manufacturing
21	Apparel and leather and allied products	Non-IT Industries	Manufacturing
22	Paper products	Non-IT Industries	Manufacturing
23	Printing and related support activities	IT-Using Industries	Manufacturing
24	Petroleum and coal products	Non-IT Industries	Manufacturing
25	Chemical products	Non-IT Industries	Manufacturing
26	Plastics and rubber products	Non-IT Industries	Manufacturing
27	Wholesale Trade	IT-Using Industries	Trade
28	Retail Trade	IT-Using Industries	Trade
29	Air transportation	IT-Using Industries	Transportation, Warehousing, Utilities
30	Rail transportation	Non-IT Industries	Transportation, Warehousing, Utilities
31	Water transportation	IT-Using Industries	Transportation, Warehousing, Utilities
32	Truck transportation	IT-Using Industries	Transportation, Warehousing, Utilities
33	Transit and ground passenger transportation	Non-IT Industries	Transportation, Warehousing, Utilities
34	Pipeline transportation	IT-Using Industries	Transportation, Warehousing, Utilities
35	Other transportation and support activities	Non-IT Industries	Transportation, Warehousing, Utilities
36	Warehousing and storage	Non-IT Industries	Transportation, Warehousing, Utilities
37	Publishing industries (includes software)	IT-Producing Industries	Information
38	Motion picture and sound recording industries	IT-Using Industries	Information
39	Broadcasting and telecommunications	IT-Using Industries	Information
40	Information and data processing services	IT-Producing Industries	Information
41	Federal Reserve banks credit intermediation and related activities	IT-Using Industries	Finance, Insurance, Real Estate, Rental and leasing
42	Securities commodity contracts and investments	IT-Using Industries	Finance, Insurance, Real Estate, Rental and leasing
43	Insurance carriers and related activities	IT-Using Industries	Finance, Insurance, Real Estate, Rental and leasing
44	Funds trusts and other financial vehicles	Non-IT Industries	Finance, Insurance, Real Estate, Rental and leasing
45	Real estate	Non-IT Industries	Finance, Insurance, Real Estate, Rental and leasing
46	Rental and leasing services and lessors of intangible assets	Non-IT Industries	Finance, Insurance, Real Estate, Rental and leasing
47	Legal services	IT-Using Industries	Other Services
48	Computer systems design and related services	IT-Producing Industries	Other Services
49	Miscellaneous professional scientific and technical services	IT-Using Industries	Other Services
50	Management of companies and enterprises	IT-Using Industries	Other Services
51	Administrative and support services	IT-Using Industries	Other Services
52	Waste management and remediation services	Non-IT Industries	Other Services
53	Educational services	IT-Using Industries	Other Services
54	Ambulatory health care services	IT-Using Industries	Other Services
55	Hospitals Nursing and residential care facilities	IT-Using Industries	Other Services
56	Social assistance	IT-Using Industries	Other Services
57	Performing arts spectator sports museums and related activities	IT-Using Industries	Other Services
58	Amusements gambling and recreation industries	Non-IT Industries	Other Services
59	Accommodation	Non-IT Industries	Other Services
60	Food services and drinking places	Non-IT Industries	Other Services
61	Other services except government	IT-Using Industries	Other Services
62	Federal Government	IT-Using Industries	Government
63	State and Local Government	IT-Using Industries	Government

Figure 1: Measured VA Growth 1998-2011: Alt1 less Baseline

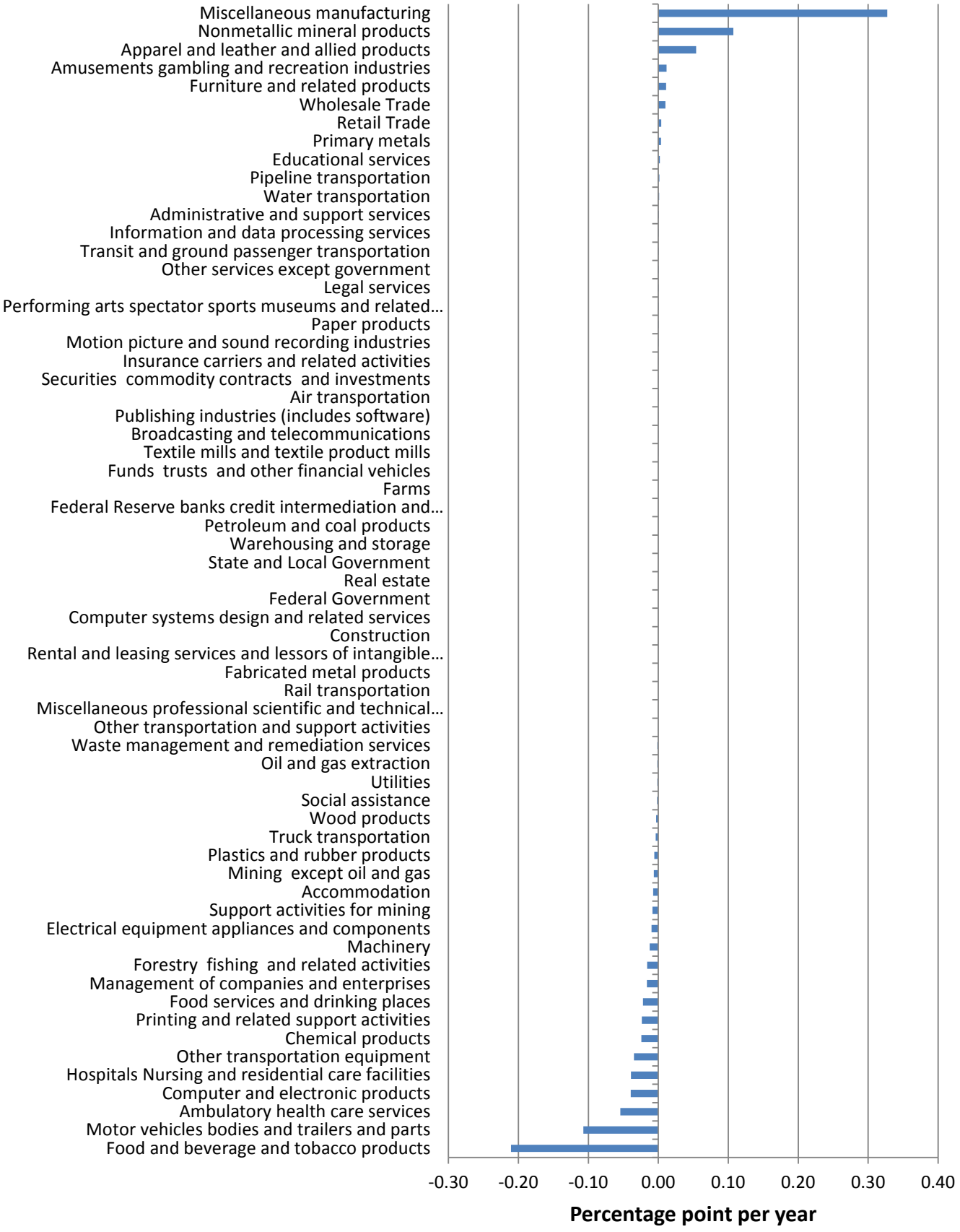


Figure 2: Measured VA Growth 1998-2011: Alt2 less Baseline

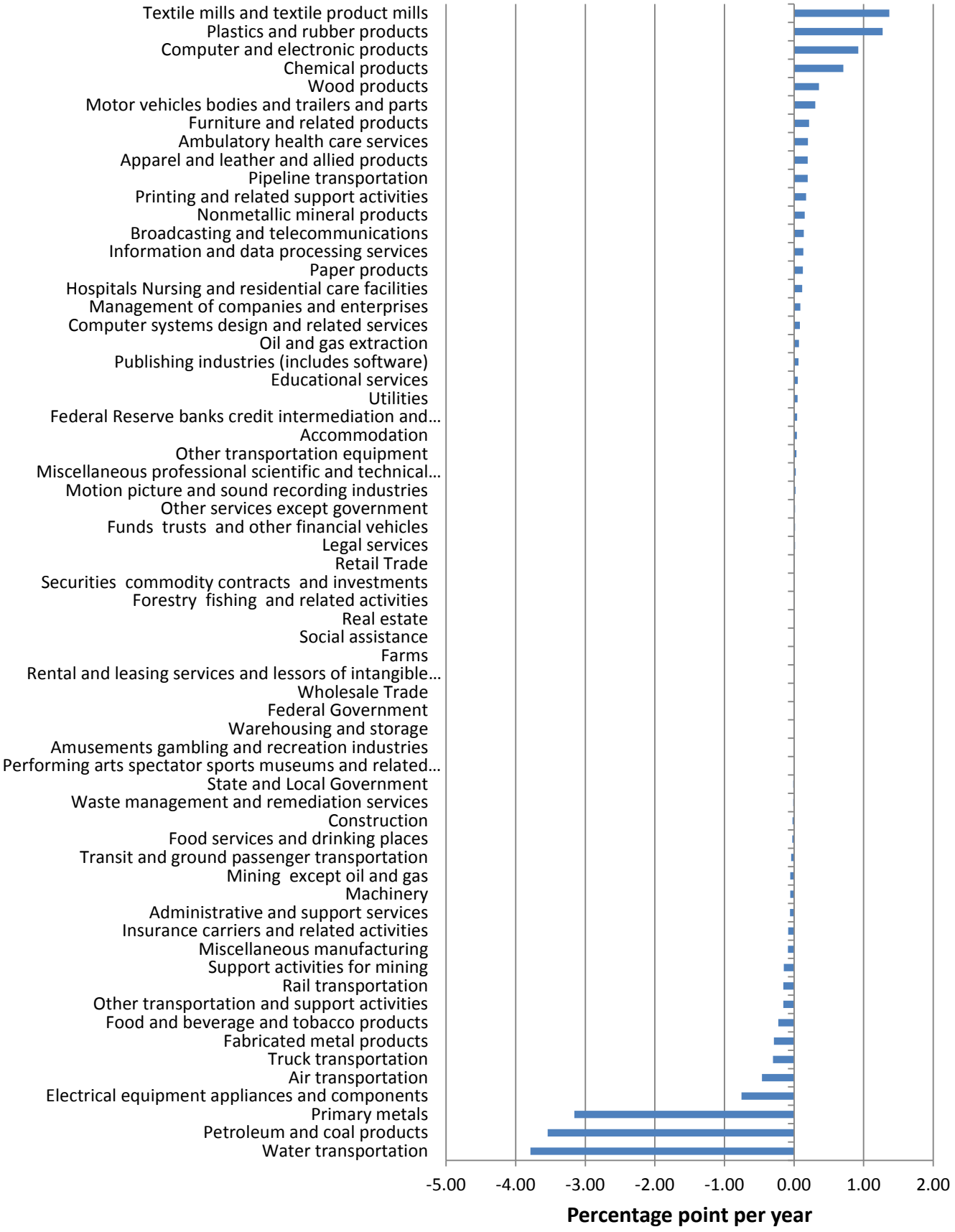


Figure 3: Measured VA Growth 1998-2011: Alt4 less Baseline

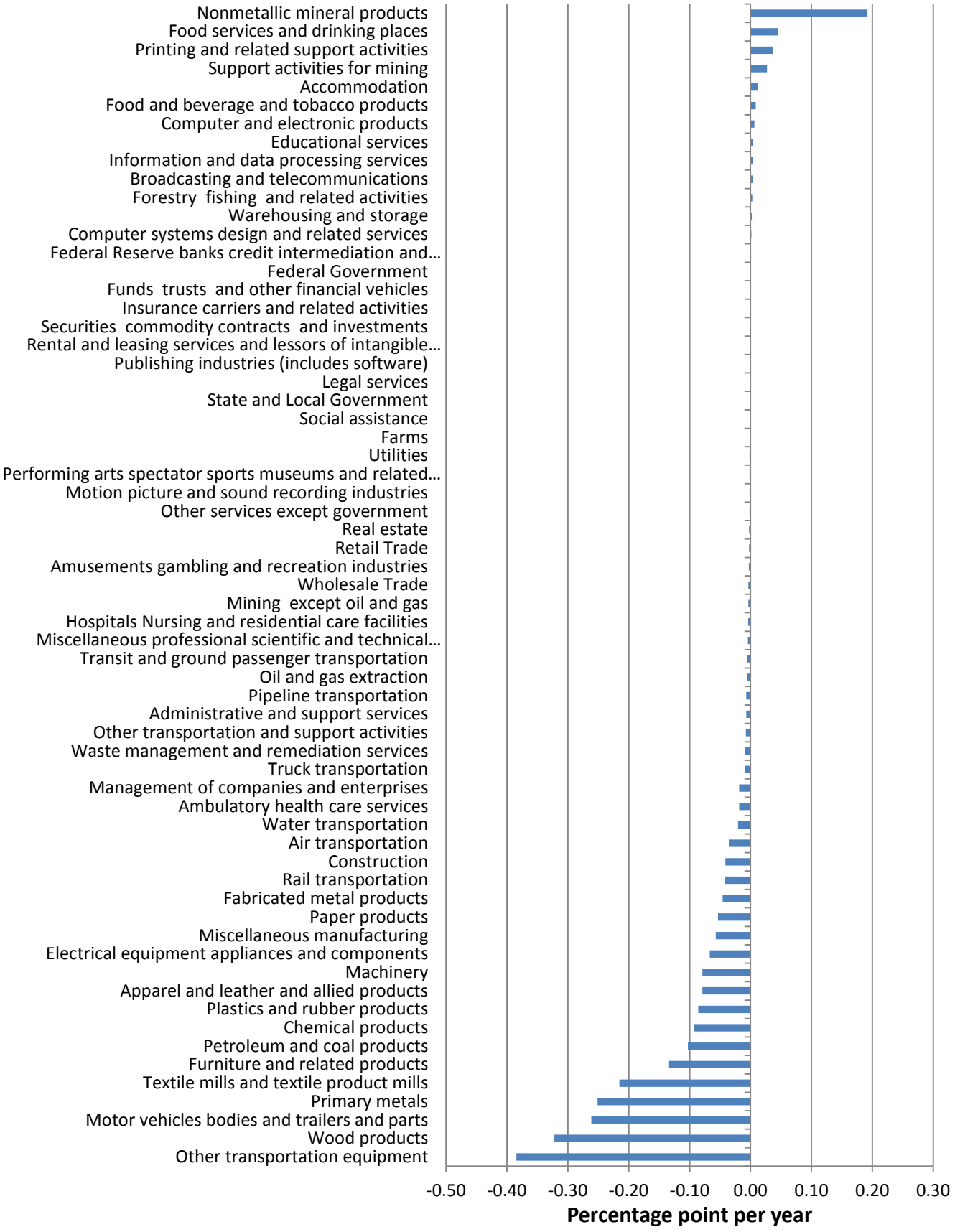


Figure 4: Measured MFP Growth 1998-2011: Alt1 less Baseline

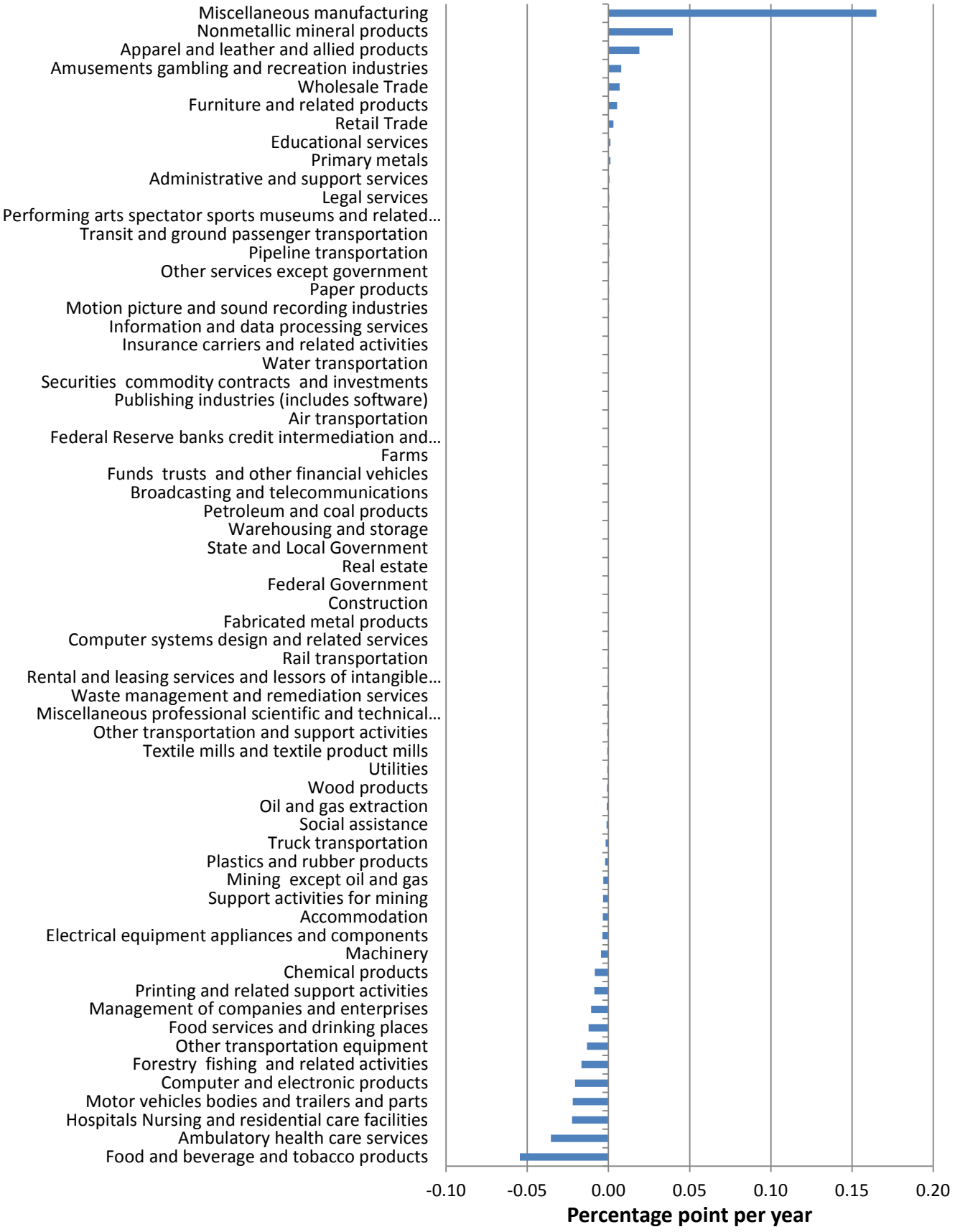


Figure 5: Measured MFP Growth 1998-2011: Alt2 less Baseline

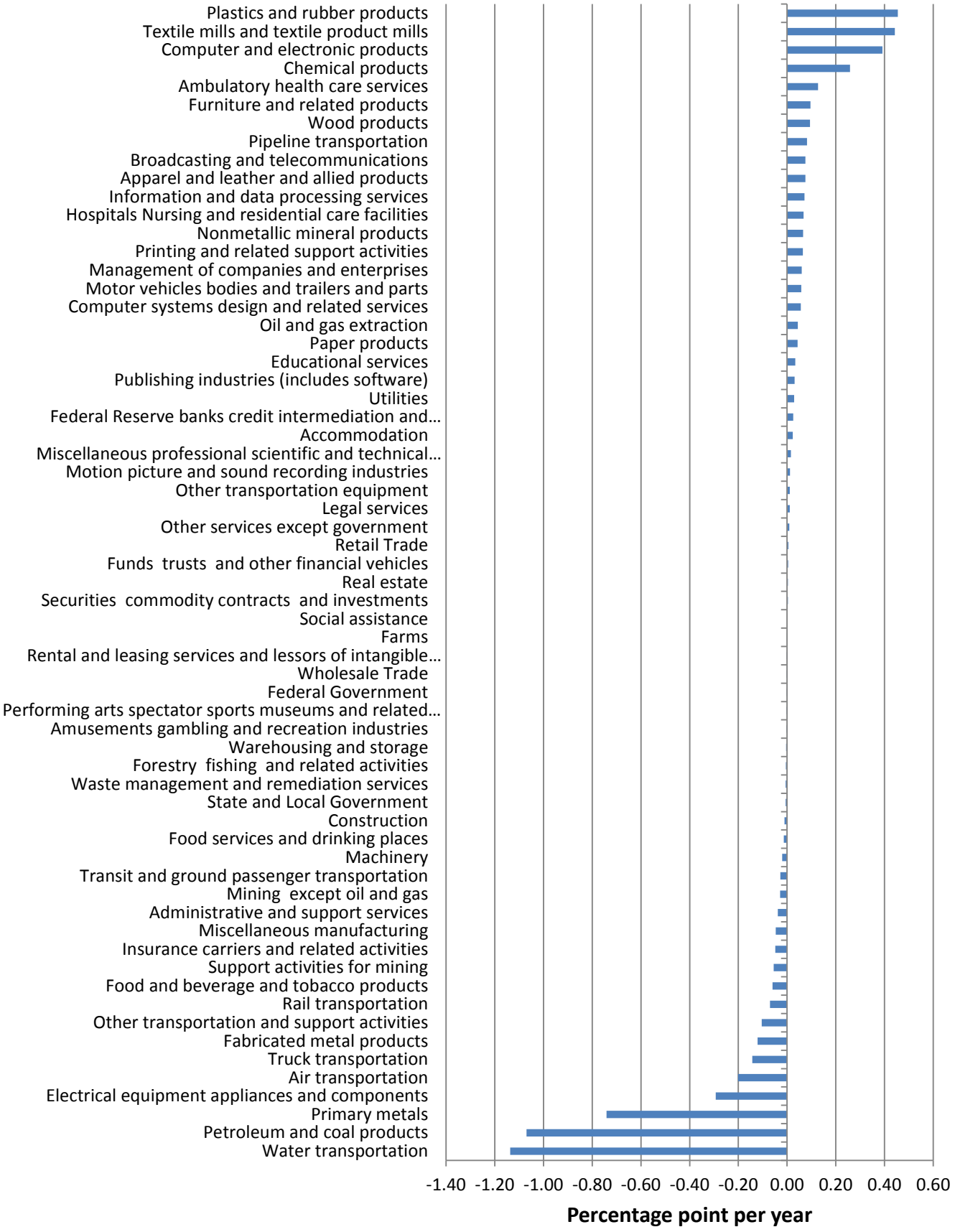


Figure 6: Measured MFP Growth 1998-2011: Alt4 less Baseline

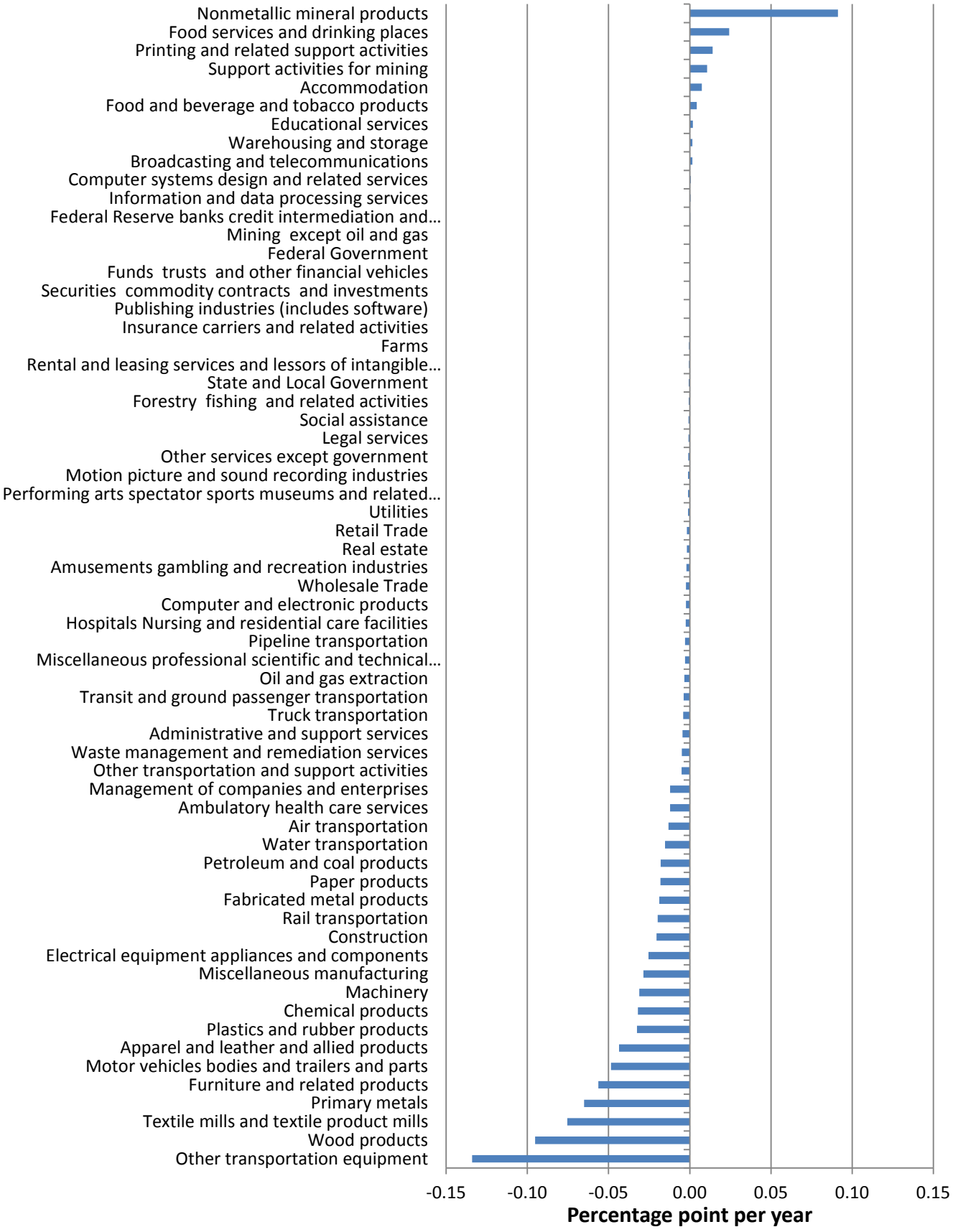
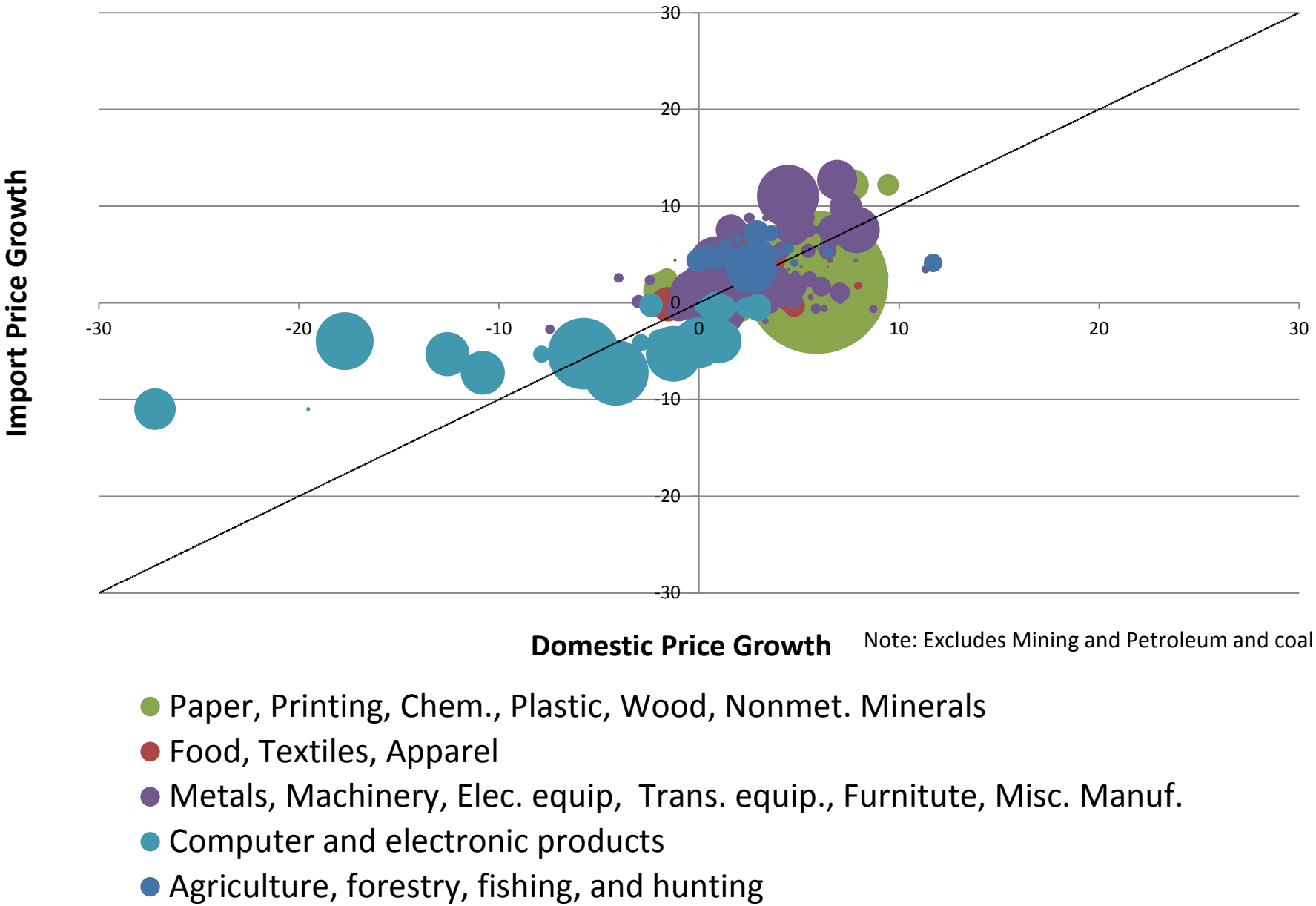


Figure 7: Item-level Price Gowth 1998-2011: Imported versus Domestic Goods



Note: Excludes Mining and Petroleum and coal