

## Research Spotlight

# Identifying Firm Heterogeneity in Value Added and Trade for U.S. Businesses

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*This article discusses a new economic accounting framework for the United States that describes the production and sourcing patterns for different types of firms in an industry. The estimates show that domestic value added by an industry as a share of output is lower for globally engaged firms, compared with domestically oriented firms, and that exports and imports of goods as a share of output are larger for globally engaged firms.*

THE GROWTH OF COMPLEX and increasingly fragmented supply chains in the global economy has increased trade in intermediate goods and services, some of which return to the sending country for final sale or for further processing. These changes have increased the interest in measuring the degree to which gross trade values reflect value added from the trading partner or from intermediate inputs sourced from other countries, including the home country. For example, Johnson and Noguera (2012) estimate that as much as two-thirds of gross trade is comprised of intermediate goods that pass a given customs frontier multiple times before becoming final goods and reaching their ultimate consumer. They also estimate that when bilateral trade flows are adjusted to include only trade in value added (TiVA), the United States-China bilateral trade deficit for goods and services is about 30 percent to 40 percent smaller and the United States-Japan deficit is about 33 percent larger.

However, national statistical agencies have found that directly measuring the degree to which trade flows contain value added from the immediate partner country, as opposed to intermediate inputs from other countries, is very difficult. The most popular approach to estimating TiVA is by using input-output (I-O) coefficients for the home country and for its major trading partners. The coefficients measure, for a given industry, the amount of each industry's output that is required as an intermediate input to produce one unit of output in that industry. These coefficients come from a global supply-use table (SUT), which decom-

poses total output for an industry into value added by firms in that industry and intermediate inputs that are sourced domestically or imported. There are multiple international efforts to develop the statistical infrastructure to develop TiVA estimates, including efforts by the Organisation for Economic Co-operation and Development, the Asia Pacific Economic Cooperation, the World Trade Organization, and the United Nations Statistics Division.<sup>1</sup>

The underlying economic accounting framework in these efforts is the extended SUT. The key feature of this type of table that distinguishes it from a traditional SUT is the explicit accounting for firm-level heterogeneity. In a traditional SUT, firm heterogeneity is captured only by the disaggregation by industry. The extended SUT recognizes that even within an industry, there can be important firm heterogeneity. A consensus has not yet emerged in the literature on the most relevant firm characteristics to capture firm heterogeneity, but the Bureau of Economic Analysis (BEA) has chosen to focus on the degree of a firm's global engagement.<sup>2</sup> Researchers such as Melitz (2003) have demonstrated that globally engaged firms are more productive than their domestically oriented peers and have production functions that are significantly more reliant on exports and imports. In this research, globally engaged firms are U.S. businesses that are part of a U.S.-based or foreign-based multinational enterprise (MNE). Roughly 90 percent of trade in goods (Bernard, Jensen, and Schott (2009)) and more than 80 percent of trade in services (Barefoot and Koncz-Bruner (2012)) involve multinational enterprises. Accounting for firm-level heterogeneity will yield more informative TiVA and global value chain measures, as the aggregate production functions of industries in

1. For more information, see [the papers presented at the International Conference on Measurement of Trade and Economic Globalization](#).

2. For details about this research, see "Identifying Heterogeneity in the Production Components of Globally Engaged Business Enterprises in the United States."

national economy SUTs are decomposed into relevant sets of firm characteristics and as differences in TiVA are ascribed to these characteristics.

This Research Spotlight presents preliminary estimates that compare components of total output by industry and by firms' level of global engagement. The estimates show heterogeneity in the composition of output among different types of firms. They allow us to answer some important questions about the effects of globalization on the U.S. economy, such as the following:

- Which industries are more involved in global value chains?
- How much do MNEs contribute to the domestic economy by purchasing intermediate goods and services from other U.S. businesses?
- How much value do MNEs add to U.S. production?
- What types of firms are more likely to import and export?

Similar to this study for the United States, research that has analyzed the components of value added for other countries within a SUT framework has shown evidence of firm heterogeneity (for a broad group of countries, see Piacentini and Fortanier (2015), for Turkey, see Ahmad, Araújo, Lo Turco, and Maggioni (2013), and for China, see Ma, Wang, and Zhu (2015)). These studies found that value added by foreign-owned MNEs is a smaller share of output or sales than value added by domestic-owned firms in many, but not all, of the countries studied. Exceptions include only a few countries, such as Finland, Turkey, and for production of processing exports, China.<sup>3</sup> Exports and imports as a share of output or turnover are typically larger on average for foreign-owned MNEs than for domestic-owned firms.

The estimates presented for the United States rely on source data from BEA and from other sources for 2011. Internal Revenue Service Statistics of Income (SOI) data are used to account for all firms with operations in the United States. All data for MNEs are based on comprehensive data on U.S. direct investment abroad and foreign direct investment in the United States that are collected from mandatory surveys conducted by BEA.<sup>4</sup> These data cover both the operations

3. Processing exports are part of China's processing trade regime, which exempts materials imported for further processing and reexported from import duties. Value added is a larger share of output for processing exports produced by foreign-owned firms than processing exports produced by Chinese-owned firms because foreign-owned processing exports rely much less on Chinese produced inputs. See table 3 in Ma, Wang, and Zhu (2015).

4. See Scott (2015) and Ismaylov and Limes (2015) for recent descriptions of these data for 2013.

of MNEs with headquarters in the United States (domestic-owned MNEs) and U.S. affiliates of MNEs with headquarters abroad (foreign-owned MNEs). Results for domestic-owned non-MNEs are computed as the difference between the SOI data for all U.S. firms less the results for domestic-owned and foreign-owned MNEs. SOI data are used instead of data from BEA I-O tables because the SOI data are collected and published by industry at the enterprise level, similar to the BEA MNE data.

## Results

The components of total output show heterogeneity in value added, imports, and exports as a share of output between the three types of firms: domestic-owned MNEs, foreign-owned MNEs, and non-MNEs. The patterns of the heterogeneity are consistent with other research.

In most broad industry groups, value added as a share of output is smallest for foreign-owned MNEs and largest for non-MNEs (tables 1 and 2 and chart 1). In particular, domestic value added as a share of output is

- Smaller for foreign-owned MNEs than for both domestic-owned MNEs and non-MNEs.
- About 10 percentage points larger on average for domestic-owned MNEs than for foreign-owned MNEs.
- Larger for domestic-owned MNEs, compared with foreign-owned MNEs in almost all industries, although the share varies across industries.

**Table 1. Use Table for All Private Industries by Type of Firm, 2011**  
[Percentage of total output]

	Domestic-owned MNEs	Foreign-owned MNEs	Non-MNEs	Exports of goods	Other uses
Domestic-owned MNEs.....	n.a.	n.a.	n.a.	6	94
Foreign-owned MNEs.....	n.a.	n.a.	n.a.	9	91
Non-MNEs.....	n.a.	n.a.	n.a.	3	97
Total domestic intermediate consumption and imports of services .....	63	61	48	.....	.....
Total imports of goods .....	7	18	5	.....	.....
Total intermediate consumption .....	69	79	53	.....	.....
Value added .....	31	21	47	.....	.....
<i>of which:</i>					
Compensation of employees .....	17	12	22	.....	.....
Gross operating surplus.....	12	7	22	.....	.....
<i>of which:</i>					
Consumption of fixed capital .....	4	3	5	.....	.....
Taxes on production and imports .....	2	2	4	.....	.....
Total output.....	100	100	100	.....	.....

n.a. Not available  
MNEs Multinational enterprises

NOTE: The preliminary estimates presented in this table are provisional and are intended only for discussion and to illustrate the types of analysis that can be performed with this framework.

- At least 50 percent larger on average for non-MNEs than for MNEs.
  - Larger in labor-intensive industries such as health care and social assistance.
  - About 6–7 percentage points smaller on average for MNEs that export goods than those that do not, although this varies by industry.
  - Smaller for foreign-owned firms, compared with domestic-owned firms.
- Consistent with earlier BEA studies, such as Zeile

(1998), imports and exports as a share of output are larger on average for the foreign-owned MNEs, compared with domestic-owned firms, though these shares vary by industry (chart 2). In particular,

- Imports and exports as a share of output are larger for foreign-owned firms than domestic-owned firms.
- Imports as a share of output are 2–3 times larger on average for foreign-owned MNEs.
- Exports as a share of output are largest for foreign-

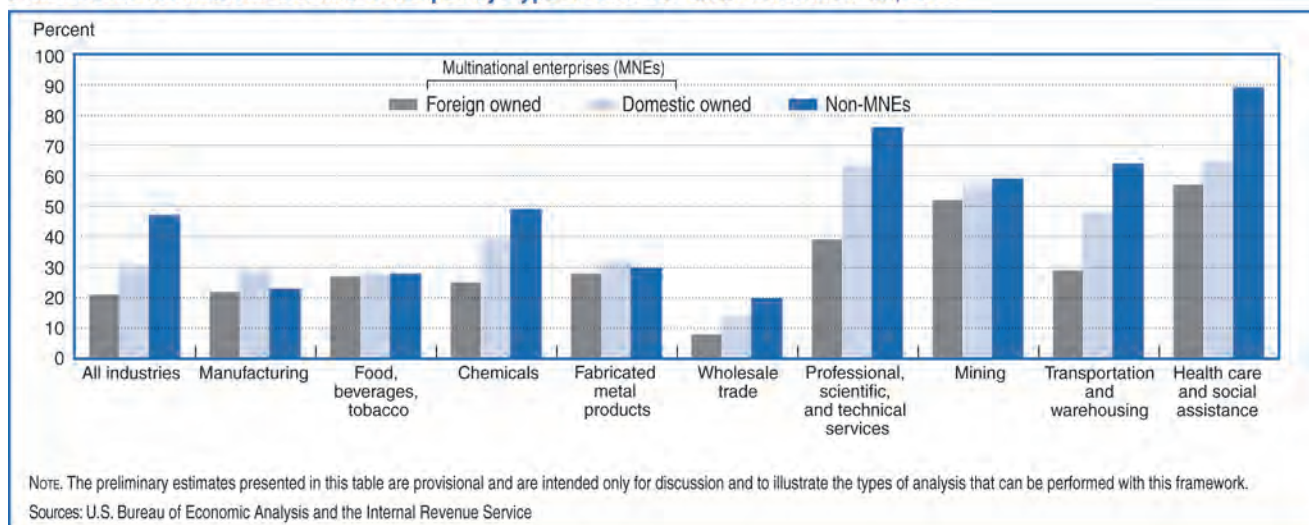
**Table 2. Share of Output Accounted for by Value Added, Employee Compensation, and Gross Operating Surplus by Type of Firm for Selected Industries, 2011**  
[Percentage of total output]

	Value added's share of output			Employee compensation's share of output			Gross operating surplus's share of output		
	Domestic-owned MNEs	Foreign-owned MNEs	Non-MNEs	Domestic-owned MNEs	Foreign-owned MNEs	Non-MNEs	Domestic-owned MNEs	Foreign-owned MNEs	Non-MNEs
All industries .....	31	21	47	17	12	22	12	7	22
Manufacturing .....	29	22	23	14	12	5	13	8	14
Food, beverages, and tobacco products.....	28	27	28	11	12	35	14	12	-13
Chemicals.....	39	25	49	17	12	-7	21	13	47
Fabricated metal products .....	32	28	30	21	19	28	10	8	-1
Wholesale trade.....	14	8	20	7	5	10	6	2	8
Finance and insurance .....	23	23	102	19	18	19	3	4	77
Insurance carriers and related activities.....	9	16	63	11	11	11	-3	3	48
Professional, scientific, and technical services.....	63	39	76	39	30	42	22	8	31
Mining.....	57	52	59	13	18	10	38	30	45
Transportation and warehousing .....	48	29	64	27	19	24	18	9	38
Health care and social assistance.....	65	57	89	46	38	87	17	18	-1

MNEs Multinational enterprises

NOTES. The preliminary estimates presented in this table are provisional and are intended only for discussion and to illustrate the types of analysis that can be performed with this framework. Some values for employee compensation and gross operating surplus for non-MNE firms are negative because of differences in the data sources used to calculate the values for non-MNE firms.

**Chart 1. Value Added as a Share of Output by Type of Firm for Selected Industries, 2011**



owned MNEs (9 percent) and smallest for non-MNEs (3 percent).

- Imports as a share of intermediates are larger on average (23 percent) for foreign-owned MNEs than for domestic-owned MNEs and non-MNEs (9 percent each).<sup>5</sup>

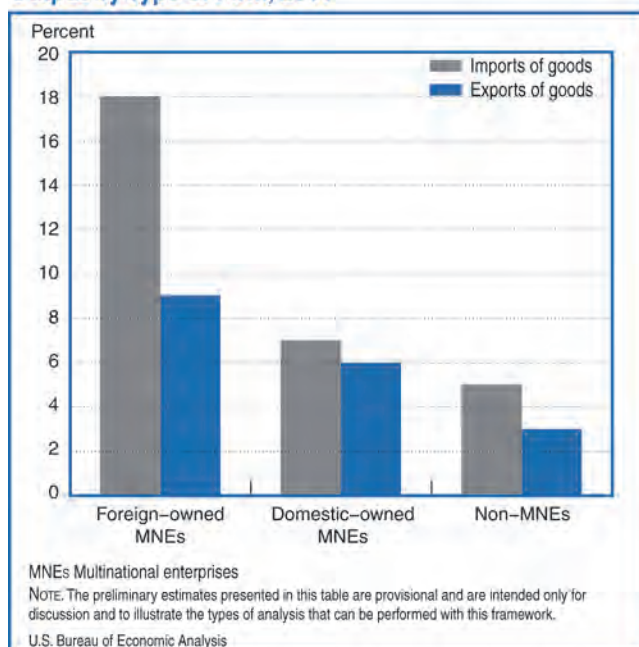
These preliminary results raise a number of interesting research questions, such as the following:

- Why is value added as a share of output for foreign-owned MNEs typically smaller than that for domestic-owned MNEs?
- Why is value added as a share of output larger for domestic-owned MNEs in manufacturing than for non-MNEs?
- What are the differences in the structure of production by different types of firms?
- How do different types of firms engage in global value chains?

Future research will lead to refinements in the measurement of extended SUTs and new insights about the role of MNEs in the U.S. economy. BEA and the U.S. International Trade Commission are currently collaborating to produce more detailed estimates that are disaggregated by firm type using the methodology in this paper. Looking ahead, BEA and the Census Bureau will

5. The MNE data on imports do not provide information on whether the imports are used as intermediate inputs or sold as final demand in the economy. The assumption made that total imports are consumed as intermediate goods is most plausible for manufacturing in which imports make up 25 percent of intermediate inputs for foreign-owned MNEs, compared with 18 percent for domestic-owned MNEs and 1 percent for non-MNEs.

**Chart 2. Imports and Exports of Goods as a Share of Output by Type of Firm, 2011**



undertake research at the Census Bureau Center for Economic Studies with the eventual goal of developing official extended SUTs and other statistics that more fully measure the impact of global value chains on the U.S. economy.

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