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Comment

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The international statistical community's embrace of trade in value added (TiVA) statistics is a response to globalization, which has been characterized by international fragmentation of production and the rapid development of global supply chains. In the new global economy, traditional international trade statistics can be misleading. First, measures of exports and imports double count content that is part of a global supply chain as it crosses borders multiple times, inflating the level of trade and, as global production chains expand, its growth. Second, while the gross flows approach to measuring international trade still provides an accurate estimate of a county's overall trade balance, it does not provide accurate estimates of bilateral trade balances because it does not account for the imported content of exports. China's exports, for example, often come from factories engaged in final processing and use inputs produced in other countries. Consequently, exported consumer goods from China embed much value added from other countries. One study finds that trade statistics inflated the US trade deficit with China in the early 2000s by 40 percent (Johnson and Noguera 2012).

In principle, statistics that measure trade in value added resolve these problems. By isolating value added contributed by each country in the production chain, they also can provide better indicators of a country's international competitiveness in various industries. While the national statistical agencies now widely acknowledge the benefits of using a TiVA concept, at least in the short term, it is impractical to directly measure trade in value added. TiVA statistics, therefore, are estimated from existing data collected by national statistical organizations. International efforts, such as those led by OECD, estimate TiVA statistics from intercountry input-output tables that are based on country-level national accounts data and detailed international trade statistics.

The fundamental question addressed in this chapter is whether data already collected as part of the US statistical system can be utilized to generate more accurate TiVA statistics. The work for this chapter is part of an

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ongoing collaboration between the US Bureau of Economic Analysis (BEA) and the Census Bureau to develop better supply and use tables—input-output tables for the US economy—that, with SUTs from other countries, are the basic building blocks in the development of intercountry input-output tables. The chapter provides insights into the challenges in constructing world IO tables and the progress being made in the United States. The exercise also provides some interesting insights into the structure of imports and exports in the United States.

The chapter reports on two technical contributions in the improvement of SUTs for the United States. The first involves breaking out purchasers' prices (the prices purchasers pay for goods and services) into basic prices for domestic inputs and into costs, insurance, and freight (CIF) prices for imported inputs. In so doing, trade margins, transportation costs, taxes, import duties, and subsidies are separately reported.

The second contribution, and the focus of my remarks, involves the introduction of firm heterogeneity into the estimation of SUTs. The underlying issue is that the United States, like other countries, does not track the destination of imports as intermediate inputs or for final use in the economy. Although business surveys collect information on expenditures on intermediates by type of good or service, businesses are not asked to break out these purchases by whether they are sourced domestically or internationally, let alone by the country from which they were sourced. Indeed, particularly if purchased from a wholesaler, businesses may not be able to answer this question. In constructing input-output tables for the US economy, the BEA must estimate imported intermediate inputs used by each industry. To do so, as Fetzer and coauthors explain, the BEA uses the import proportionality assumption: an industry uses imported intermediates in proportion to its overall use of the product in the economy. If, for instance, an industry accounts for 10 percent of the consumption of a product, it is assumed to account for 10 percent of imports of that product. This method implicitly assumes that exporters are no more likely than firms producing solely for domestic consumption to use imported intermediates.

Owing to the growth of globally integrated supply chains, however, it is reasonable to suppose that exporting firms, which at least for merchandise exports are disproportionately multinational enterprises (MNEs), are more likely to also use imported intermediates compared to firms that produce solely for their domestic market. Findings from studies for China and other countries indeed have found this to be the case. To better account for firm heterogeneity, the authors exploit data from the BEA survey on Activities of Multinational Enterprises (AMNE) linked with microdata from BEA trade in services surveys to separately estimate the import content of exports from US-based MNEs, foreign MNEs, and non-MNEs.

Notably, these data only show what is directly imported by MNEs. Fetzer et al. essentially make the conservative assumption that these direct imports

account for all imports used by MNEs and that industry import use is fixed at the level given by the import proportionality assumption. After allocating the MNE imports to each of its establishments using census data establishment employment, they compute import use by non-MNEs as a residual—industry-level estimates from the SUT less the estimates of MNE imports based on the AMNE and services import surveys.

Findings and Their Implications for TiVA Statistics

The authors acknowledge that their assumptions bias downward the estimates of import content for MNEs. For industries in which the import values of MNEs based on the AMNE and services import surveys exceed the total estimated import use in the SUT, they reallocate the excess to other industries. These cases, as would be expected, primarily involve industries in the wholesale sector. Such reallocation, the authors point out, helps but does not fully mitigate the downward bias to MNE imports. Nevertheless, their findings indicate, as expected, that on average the import content of exports is higher among MNEs, especially foreign-owned MNEs, than among non-MNEs, though estimates vary across industries and over time (figures 9.3–5). Preliminary estimates from a detailed analysis of the semiconductor industry also show considerable heterogeneity across firm types.

The chapter's analysis yields other interesting insights into the relative importance of MNEs and non-MNEs in accounting for the value of goods and services exports. While their estimates suggest that most of the value of US goods exports comes from the value added of MNEs, particularly the value added of US-based MNEs, about two-thirds of the estimated value of services exports comes from the value added of non-MNEs.

The finding that MNEs on average use relatively more imported inputs than non-MNEs and account for most of the value of goods exports naturally raises the question, Does accounting for heterogeneity between MNEs and non-MNEs in SUTs lead to substantially higher estimates of the imported value of exports? The chapter does not directly answer this question. The authors do report that that their estimates of the imported content of exports across all industries is somewhat *lower* than OECD estimates of foreign imported content for both 2005 and 2012. Because of differences in the way the TiVA statistics were computed, the two sets are not fully comparable, however. The OECD uses intercountry IO tables, whereas Fetzer et al. use the US IO table to compute TiVA, though this method should, all else the same, result in a higher estimate of import content than the OECD's estimate of foreign content. Although they do not discuss the factors underlying this somewhat surprising finding, it may reflect the fact that they report an average for all industries and non-MNEs, which use below average imported intermediates, account for most of exports in the services sector. In addition,

the chapter's estimates of import content are to some degree understated for MNEs, which purchase at least some imports from wholesalers.

To directly show the effect of firm heterogeneity on TiVA statistics, it would be helpful in future work to generate comparisons using the same method—first based on the US SUT table and then based on the extended US SUT table that allows for firm heterogeneity. Because the degree to which MNEs account for exports varies considerably across industries, researchers also should show the effect of accounting for firm heterogeneity by sector and industry. Additionally, researchers should test the sensitivity of the effects of firm heterogeneity on TiVA measures under different assumptions about MNE purchases from wholesalers. Currently, they make the very conservative assumption that MNEs import all foreign goods themselves and allocate the residual to non-MNEs (estimated total industry imports based on the import proportionality assumption less MNE direct imports). Instead, they could allocate the residual to both MNEs and non-MNEs under various assumptions about the division, possibly informed by census establishment microdata on expenditures for intermediates. The purpose of such an exercise would be to bound the potential effects of firm heterogeneity on estimates of the imported content of exports.

In other words, it is important to bear in mind that utilizing data on MNE imported intermediates still requires assumptions about how imported intermediates are allocated between different types of firms. If estimates of the imported content of exports are highly sensitive to those assumptions, it would indicate that there are limits to the use of data already collected in the US statistical system to improve TiVA estimates. In this case, new data collection, as discussed by Nadim Ahmad (this volume), would be necessary.

Implications for Labor Productivity

Although not the chapter's focus, Fetzer et al. also use their estimates to compare labor productivity between MNEs and non-MNE establishments. They report that labor productivity among MNEs is nearly double that among non-MNEs when measured as gross output per employee. When measured as value added per employee, MNE labor productivity is only about 25 percent higher, and when the petroleum industry is dropped, labor productivity of MNEs is on average lower than that of non-MNEs. They argue that one source of higher productivity for MNEs is their better ability to source inputs from domestic and foreign firms and that this, in turn, argues for using the gross output concept in computing labor productivity.

The authors should be extremely cautious in making and interpreting such comparisons, however. Cross-establishment labor productivity comparisons implicitly assume that the production functions are homogeneous. Even if they were to control for detailed industry, this assumption would almost certainly be violated. Just as MNEs and non-MNEs systematically

differ in their use of imported inputs, they also may systematically differ in the stages of production done within establishments. MNEs have been behind the "slicing up of the value chain" that characterizes globalization. Thus, the greater use of imported inputs by MNEs likely reflects not simply the substitution of imported for domestic inputs but also offshoring—the outsourcing of functions to overseas producers or affiliates. In a case study of the US home furniture industry, Holmes (2011) illustrates the offshoring of processes, which led to wide variation in stages of production performed in domestic factories. In the early 2000s, for instance, some upholstery manufacturers began outsourcing the most labor-intensive stage of the process, the cutting and sewing of the upholstery material, to China; one even outsourced all furniture production to China, retaining only final assembly in the United States.

Such outsourcing will mechanically increase measured labor productivity when labor productivity is measured as gross output per employee; the denominator, employment, will be lower, but the numerator, gross output, all else the same will be unchanged by outsourcing. Because outsourcing lowers both the numerator and the denominator when labor productivity is computed as value added per employee, in general, value added labor productivity measures are less susceptible than gross output labor productivity measures to mechanical changes associated with outsourcing (Dey, Houseman, and Polivka 2012). While firms may reap true productivity gains when they outsource—i.e., the same quantity of output can be produced with fewer inputs—a change in what is produced within the boundary of the firm does not, per se, increase productivity, and labor productivity measures based on gross output measures can be highly misleading.

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