Indicators of Bilateral Trade Dependence in Global Production Networks

Bart Los and Marcel P. Timmer
Groningen Growth and Development Centre, Faculty of Economics and Business,
University of Groningen

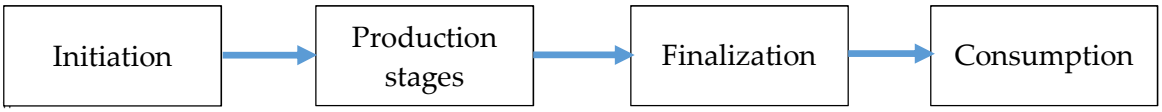
(Abstract submitted to the Conference on Research in Income and Wealth 2018)

Recently, trade dependencies between countries have gained center stage in economic debates, as a consequence of political developments. In the present world, gross exports statistics are no longer a reliable guidance on assessing such dependencies: the export value contains a lot of value that has been added in more upstream production processes in other countries (see, e.g. Koopman et al., 2014).

With the availability of global input-output tables like the World Input-Output Database (WIOD, Timmer et al., 2015) and the OECD Trade in Value Added database (OECD-TiVA) new measures have been proposed. They showed that early proxies to bilateral trade dependence which were based on single country input-output tables (like in Hummels et al., 2001) could be replaced by more accurate measures. A "dominant design" of these new set of measures has not emerged yet as several different measures were proposed. While related, these alternatives have different and specific interpretations, which initially led to confusion which is still lingering. This paper aims to provide a systematic discussion of the similarities and differences between three types of bilateral trade dependencies and proposes indicators for each of these.

To argue why three types of bilateral dependence indicators are needed, we start from the notion that the global economy consists of a network of value chains that can be considered as (often complex) extensions of the simple linear process depicted in Figure 1.

Figure 1: Simplified chain from Scratch to Consumption



"Initiation" relates to the most upstream activities, like agricultural and mining activities. "Production stages" act as a label for the production of intermediate inputs. This does not only refer to the production of parts and components, but also to the supply of business and financial services. In many real-world GVCs, several production stages can be observed, since

components themselves often contain subcomponents. "Finalization" refers to the activities needed to the activities required to make products ready for final use (e.g. assembly activities). "Consumption" relates not only to consumption by households, but to all types of final use. Most countries are simultaneously active in all parts of the chain (although the mix of activities varies across countries).

The first type of bilateral dependence between countries A and B considered by us is the value added of A that is induced by B as the country where the consumption activities take place (B as the *country-of-consumption*), irrespective of the location of production activities that are more downstream than those executed by A and the country where the finalization takes place. Quantifications of this type of bilateral dependence can e.g. shed light on questions about the extent to which the GDP of a country is affected by increasing demand in emerging countries. The approach has been pioneered by Johnson and Noguera (2012).

The second type of bilateral dependence measures the value added of A that is induced by B as the *country-of-finalization*. Indicators like these would give insights into, for example, the consequences for Western European economies of the fact that China has managed to perform larger subsets of the activities in the GVCs for its final products within China itself (see Kee and Tang, 2016). The value of such a measure is not dependent on whether the final product is sold to B's consumers or exported. The first paper adopting this approach was Timmer et al. (2013).

The third type of measure looks at A's value added in its exports sold directly to B. This measure is not affected by what happens in more downstream stages than those performed by A. In this approach, B is considered to be the *country-of-purchase*. This approach (pioneered by Wang et al., 2013, Koopman et al., 2014, and refined by Los et al., 2016) is relevant for research questions related to the effects of barriers to trade. It could, for example, be used to get insights into the potential effects of the introduction of bilateral tariff barriers by the US on value added generation in Mexico.

In this paper, the concepts will be carefully introduced and their proper interpretation will be discussed. Furthermore, a common framework for computing indicators for the three types of bilateral trade dependence is presented. It is based on "hypothetical extraction", a popular technique in input-output analysis (see Miller and Blair, 2009). Finally, bilateral dependencies of the three types are quantified for a number of interesting pairs of (groups of) countries, using WIOD and the OECD TiVA database. We will also discuss and outline how newly developed data (such as extended supply-and use tables) will improve the accuracy of the indicators.

References:

Hummels, David, Jun Ishii and Kei-Mu Yi (2001), "The Nature and Growth of Vertical Specialization in World Trade", *Journal of International Economics*, 54(1), 75-96.

Johnson, Robert C., and Guillermo Noguera (2012), "Accounting for Intermediates: Production Sharing and Trade in Value Added", *Journal of International Economics*, 86(2), 224-236.

Kee, Hiau Looi, and Heiwai Tang (2016**),** "Domestic Value Added in Exports: Theory and Firm Evidence from China", *American Economic Review*, 106(6), 1402-1436.

Koopman, Robert, Zhi Wang and Shang-Jin Wei (2014), "Tracing Value-Added and Double Counting in Gross Exports", *American Economic Review*, 104(2), 459-494.

Los, Bart, Marcel P. Timmer and Gaaitzen J. de Vries (2016), "Tracing Value-Added and Double Counting in Gross Exports: Comment", *American Economic Review*, 106(7), 1958-1966.

Miller, Ronald E., and Peter D. Blair (2009), *Input-Output Analysis; Foundations and Extensions* (2nd ed.), Cambridge: Cambridge University Press.

Timmer, Marcel P., Bart Los, Robert Stehrer and Gaaitzen J. de Vries (2013), "Fragmentation, Incomes and Jobs: An Analysis of European Competitiveness", *Economic Policy*, 28(3), 613-661.

Timmer, Marcel P., Erik Dietzenbacher, Bart Los, Robert Stehrer and Gaaitzen J. de Vries (2015), "An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production", *Review of International Economics*, 23(3), 575-605.

Wang, Zhi, Shang-Jin Wei and Kunfu Zhu (2013), "Quantifying International Production Sharing at the Bilateral and Sector Levels", NBER Working Paper 19677, Cambridge MA.