

Counting borders in global value chains

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Author: Kirill MURADOV

It is widely recognised that the growing fragmentation of production across borders may have important implications for trade and investment policies. When value chains are global, intermediate inputs cross national borders multiple times as their value is carried forward from one production stage to another. Multiple border crossings involve multiple trade barriers and associated costs.

Although the measurements of global value chains are available and the analysis of their impact on trade, environment and jobs is now well established, little has been done to quantify the number of border crossings. A likely reason is that the existing accounting techniques have been developed to discover value added in gross trade flows. However, it is a product not value added that physically crosses the border.

Specifically, the “global” Leontief inverse (or its Ghosh counterpart) is not suitable for the analysis of border crossings because it treats foreign intermediate inputs in the same way as domestic inputs. This paper addresses the said technical difficulty by introducing another “global” inverse that is capable of consistently delimiting domestic and international trade transactions. The new inverse is a key element in a gross exports accounting framework that traces the destination of direct exports to their eventual users through multi-stage production. The result is a measure of cumulative exports, delivered to the final users by mode of direct or indirect exports.

The power series of this multiplier matrix model a “melting” part of the initial exports until it is entirely consumed (used) at an infinitely remote tier. An indicator of the weighted average number of border crossings builds on the power series of the new “global” inverse where each term corresponds to a border crossing. It utilizes the logic of the average propagation length (proposed by Dietzenbacher, Romero Luna and Bosma in 2005) and the value added propagation length (explored by Ye, Meng and Wei in 2015). The proposed measure sums the number of border crossings weighted by the share of indirect exports at each successive tier (border crossing) in the cumulative exports at all tiers. Its lowest value is 1 when a sector only exports final products. This is in line with the conventional wisdom: exported products cross borders at least once.

For a numerical test of the proposed measure, the paper uses the inter-country input-output tables from the World Input-Output Database (WIOD) for 2001, 2005 and 2010. From the perspective of an exporting country (after sector-wise aggregation), the weighted average number of border crossings across all partners ranged in 2010 from 1.68 for India to 2.31 for Russia. The change in the number of total border crossings has not been uniform. For 20 exporting countries in WIOD, this number increased both in 2001-2005 and 2005-2010. For 19 countries, it increased in 2001-2005 but descended in 2005-2010. One country experienced a decline of this measure in both periods.

From the perspective of an exporting sector (after country-wise aggregation) in 2010, the products of the “Mining and Quarrying” industry had to cross more borders than any other product “ 2.33, while the products of “Leather and Footwear” only crossed borders 1.24 times which was the lowest number (apart from the “Private Households with Employed Persons”).

Now, it is of significant analytical interest to check whether more border crossings have led to higher costs that accumulate along the value chain. For this exercise, the average number of border crossings is paired with the cumulative imports tariff, drawing on a combination of the WIOD and UN TRAINS data. It is confirmed that the indirect cumulative tariff rises with the average number of

borders crossed. However, the continuous reduction of direct import tariffs neutralised the effect of the heightened number of border crossings in value chains in 2001-2010.

The measure of the average number of border crossings is thought to be useful for the studies of trade policies in the global value chain environment.