Measuring High-Tech Competitiveness in a World with International Production Fragmentation

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ABSTRACT

Conventional indicators of high-tech competitiveness of countries rely on gross export statistics. Countries that increase their shares in world markets for advanced products are considered to have gained in high-tech competitiveness. Such indicators based on gross exports sketched a reasonable picture in an era in which all stages of production (from scratch till assembly) took place within countries. This is no longer the case: many production processes have become geographically fragmented. Exporting telecommunications equipment does not necessarily imply high-tech activities, because the high-tech components and specifications may have been developed and produced elsewhere (as shown e.g. in the already classical study of the Ipod by Dedrick et al., 2010). The assembly activities required to export electronics might actually not be more skill- or technology-intensive than the manufacturing of apparel. New indicators of competitiveness are called for which are based on an analysis of activities carried out in production, rather than an analysis of the product content of exports (Houseman and Mandel, 2015; Koopman, R., Z. Wang, and S.-J. Wei 2014).

In this paper, we merge data from the World Input-Output Database (see Timmer et al., 2015) and harmonized data on occupations by industry (mainly derived from Labor Force Surveys) to develop a new approach to measuring high-tech competitiveness of countries in a "Factory World". In the first part of the paper, we define and identify Global Value Chains (GVCs) as the set of activities anywhere in the world (and in any industry) required to produce a specific type of final product, using the methods outlined in Timmer et al. (2014). To characterize production activities in GVCs we link these results to occupational data and quantify the numbers of R&D workers, engineers, and other knowledge workers (also employed in services industries) active in specific GVCs. This includes not only workers in manufacturing but also those in services sectors delivering intermediate inputs (Baldwin and Venables, 2013). Using annual data for 1995-2014, we can track the technology-intensity of goods produced in globally fragmented production processes.

In the second part of the paper we propose to use modified measures of Revealed Comparative Advantage to analyse a country's competitiveness based on activities within GVCs rather than on products exported. We define high-tech activities roughly as those carried out by knowledge workers and track which country-industries (and countries as a whole) have become more specialized in high-tech activities and which less.

References

Baldwin, Richard E. and Anthony J. Venables (2013), "Spiders and Snakes: Offshoring and Agglomeration in the Global Economy", *Journal of International Economics*, 90, 245-254.

Dedrick, Jason, Kenneth L. Kraemer and Greg Linden (2010), "Who Profits from Innovation in Global Value Chains?: A Study of the iPod and Notebook PCs", *Industrial and Corporate Change*, 19, 81-116.

Houseman, S.N. and M. Mandel (eds. 2015), Measuring Globalization . Better Trade Statistics for Better Policy, Volumes 1 and 2, W.E. Upjohn Institute: Kalamazoo, Michigan.

Koopman, R., Z. Wang, and S.-J. Wei (2014), "Tracing Value-Added and Double Counting in Gross Exports", *American Economic Review*, 104(2), pp. 459-94.

Los, B., M. P. Timmer and G. J. de Vries (2016), "Tracing Value-Added and Double Counting in Gross Exports: Comment", *American Economic Review*, forthcoming.

Los, Bart, Marcel P. Timmer and Gaaitzen J. de Vries (2015), "How Global Are Global Value Chains? A New Approach to Measure International Fragmentation", *Journal of Regional Science*, 55, 66-92;

Timmer, Marcel P., Abdul Azeez Erumban, Bart Los, Robert Stehrer and Gaaitzen J. de Vries (2014), "Slicing Up Global Value Chains", *Journal of Economic Perspectives*, 28, 99-118.

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