R&D Content in the Global Value Chain Trade*

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Abstract

The relationship between R&D and productivity has been of interest among economists already for many years. In recent years, the contribution of global value chain trade to the technology diffusion has become of a major focus. Generally, we take it as given that any form of R&D activities potentially contributes not just to the growth of output but to the shift of technology frontier. Due to its non-rivalry, products of research sooner or later become available not only to the inventor but to the society as a whole. Therefore, social returns to R&D are considered to be significantly higher than private returns to R&D. At the same time, there is still a lot be done to provide exact measurements of those returns (Griliches, 1998).

Many recent academic studies tried to quantify spillovers from R&D activities either at a firm or industry level. Namely, researchers pursued the following question: are there any gains in productivity in those sectors (firms) that do not engage in R&D stemming from R&D intensive sectors (firms)? Findings are usually quite mixed and this paper contributes to the discussion in several ways. First, we study the international dimension of R&D spillovers. In our paper we try to provide the information about relative importance of the global value chain trade channel for technology transmission using data from recent periods (1999-2011) and many countries.

Another strand of the literature we are contributing to is connected with the use of input-output analysis in R&D studies. The methodology has been originally applied in Terleckyj (1974) and extended later in Griliches (1979). This paper adds to the literature in a way that we focus on more detailed data available in world input-output tables. Namely, we compute bilateral flows of domestic R&D value added across countries and industries instead of introducing proxies for R&D flows in the form of expenditures or patent stocks. Data comes mainly from the World Input-Output Database (WIOD). In line with Timmer et al. (2018) it allows us to disentangle domestic value added from export flows. Next, we split it into a capital and a labor component, whereas labor can be represented by broad occupation categories: Research and Development (R&D), Marketing...

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and Management (M&M), Fabrication. Thus, we assume that value is added either from capital usage or from labor employment distinguished according to major groups of tasks performed by workers.

Data on trade in R&D value added allows us to study product-embodied technology diffusion that has been underrepresented in the literature before. Most papers usually focus on patents or licenses which are actually products of innovative activity (see Keller, 2004). Moreover, the purchase of a patent is not necessarily associated with a purchase of equipment incorporating new technology. Another important argument in favor of more product-embodied technology diffusion studies is that there are not so many firms buying or selling patents on average while many of them do buy technologically sophisticated inputs. Do those purchases always contribute to the productivity growth? There has been no clear answer presented in the literature yet. Current study uses information on domestic R&D capital and R&D labor contributions in order to get a better estimate of TFP as a residual in the production function. Then, we analyse data on product-embodied R&D value added trade flows to confirm existence and identify the magnitude (if any) of R&D spillovers originating from abroad. Since patents are products of innovative activity, we believe that our data on actual inputs of innovative activity helps to better control for endogeneity in the production function estimation and measure R&D spillovers with a greater precision.

Overall, this paper investigates presence and significance of product-embodied R&D spillovers originating from the global value chain trade. The research proceeds in two stages: (1) estimation of TFP at a country-industry level and (2) identification of spillover effects. On the first stage we contribute to the academic agenda by incorporating data on actual inputs of the technology function: R&D labor and R&D capital. We believe that it allows us to better control for endogeneity and estimate spillovers at a later stage with a higher precision. On the second stage we contribute by identifying heterogeneity in spillover effects across participants and industries excluded from intensive R&D activities. We also present an evidence of competition effects at play associated with product-embodied technology diffusion. Our results suggest that there are spillovers to productivity in the vicinity of 2% per point increase in foreign R&D intensity of a country-industry. Further, negative R&D spillovers are reported to those countries whose industries are involved into trade in technologically sophisticated inputs to a lesser extent relative to the world average. The effect arises due to competition effects on global markets.

It has to be emphasized that the relationship between R&D and productivity is still far from being perfectly investigated. New detailed datasets allow to answer questions and identify effects that have not been studied before. Moreover, it provides a lot of resources to finally quantify R&D spillovers and returns to R&D activities. Current study aims to apply new data to already well-established questions. We hope that our findings will contribute to the growth of interest to the field. In particular, one of the avenues of future research is devoted to detailed industry-level studies of product-embodied technology diffusion through the global value chain trade.
References

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