Transmission of Knowledge and Innovation into Poland: Role of Trade and Foreign Investment

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Non-technical summary

Technology diffusion can occur through a variety of channels transmitting ideas and knowledge. Possible important paths for such transmission are among others: imports of high-tech products, foreign direct investments by multinational corporations and acquisition of human capital. This research aims to assess the relative importance of the first two factors of technology transmission into Poland, namely the high-technology imports and FDI inflows for the total factor productivity of Polish manufacturing industry.

Poland is a country where industries did not manage to accumulate substantial stock of knowledge and technology. Domestic spending on R&D was severely cut-off at the beginning of the transformation process (the first half of the 1990s). Even now, R&D expenditures in relative terms are lower than in other countries in the region (*e.g.* Hungary, Slovenia), and as far as government policy is concerned, it lacks efficiently enforced, clearly defined objectives. Still, the existence of some stock of technology and the perceived relatively high quality of human capital suggests that there is some absorptive capacity within the Polish industry.

The country has opened up, and re-orientated its trade flows towards more developed economies. This gave rise to high-technology imports from the West, as well as encouraged one of the biggest FDI inflows in the region. Assuming that trade and foreign investment determine a country's access to foreign technologies embodied in advanced intermediate goods, one can expect that that there has been a transfer of innovation and that this transfer has helped in productivity improvement. This research examines the effect of R&D activities of domestic and foreign firms, and high-tech imports on the productivity of Polish manufacturing industries during the period of 1995-1999. It examines the technology content of trade coming to Poland from eight OECD economies which are the source of about 90% of the world's R&D: Germany, Italy, France, the Netherlands, Sweden, the UK, Japan, and the US.

The most important and robust finding of this research is that inflow of foreign technology matters for the productivity of domestic industries. The results of econometric testing suggest that there exist intra-industry spillovers deriving from imports of more technologically-advanced commodities to the same industry. The receiving industry benefits from foreign industries' technology, due to the trade in embodied technology. Technology, or know-how, created by foreign R&D investment is transmitted into domestic manufacturing industries, and enhances growth of domestic industries.

It is difficult to assess the influence of domestic technology stock on improvement of productivity of domestic industries. If something has an effect, then these are rather spillovers from R&D embedded in intermediates from other industries used in the production of a given

industry. It can be interpreted that domestic investment in R&D has not started to be productive yet, and we still have to wait to see its effects. But it is also possible that business intramural R&D expenditures in Poland were targeted at other factors, not necessarily at productivity improvements.

The effects of FDI-related R&D stock are difficult to model. First of all, few foreign firms decide to conduct R&D in Poland, so the sample used for the estimations – and of course accumulated knowledge stocks – is small. Secondly, the results presented here, plus research on the subject, suggest that the relationship between the activities of multinationals and productivity growth is more complex, and the empirical evidence in economic literature on this issue is mixed.

It is possible, that given the productivity-increasing foreign technology inflows, Poland can benefit from further productivity improvements by the development of its low-tech sector. Starting from lower level of human capital than technological leaders, the economy can adapt through the use of know-how initially developed in the high-tech sector, along the lines of endogenous growth models with trade. In this view, imported technology helps to adapt and to develop the production of commodities that require a lower level of embodied technology, are labor-intensive, and relatively easy to produce. Broadly defined, lower-technology export of this type accounts for the significant part of Polish exports and has been growing continuously during the last years.

The paper is organised as follows: issues of technology transmission and the model of technology transmission are discussed first, then follows a discussion on R&D intensity, technology stock and the productivity of Polish manufacturing industries, and a description of estimation techniques and results. The paper concludes with a section examining prospects for specialisation in low-tech, easily-imitable exports. A description of variables is in the appendix.