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Comment Wolfgang Keller

High per capita output is primarily achieved by using a given bundle of factors more efficiently—not by changing the bundle (Hall and Jones 1999). What is the source of these efficiency gains? They are driven by firms' technology investment and adoption decisions. Moreover, investments in technology lead to complementary capital accumulation, further increasing per capita output (Howitt 2000). In his chapter, Francisco Moris describes recent efforts to get a better grasp on technology investments and diffusion in the era of globalization by focusing on international trade in R&D services. Does this significantly improve the ability of economists to explain these activities? There are good reasons to believe that, no, it does not, but there are even better reasons to believe that yes, it does. Why? In my comments, I will start with the former before turning to the latter.

Not Even Close!

The case that this is an exercise in futility can be made by noting, first, that many technology investments are not showing up in R&D tables according to the standard conventions. For example, financial service firms derive most of their profit flows from financial products and types of transactions that did not exist fifteen years ago. Financial firms hold patents codifying and protecting their products and methodologies, but finance firms spend nothing on R&D, according to the usual accounting conventions. Or take Southwest Airlines as another example. It is widely regarded as having introduced many frontier innovations, such as boarding passengers by broad group without assigned seats. One will not find an R&D figure that led to this strategy in Southwest's books, but it still has driven Southwest's success. Thus, formal R&D figures, according to the Organization for Economic Cooperation and Development (OECD's) *Frascati* definition, grossly underestimate technology investments.

Second, even if most of technology investments were captured in R&D figures, R&D service trade would still capture only a small fraction of technology flows between countries. This is because the majority of international technology transfers are not market transactions, but externalities, or spillovers. Such spillovers are often unintentional and hence no contract where buyer and seller agree on the price of the transaction exists. According to McNeil's (2006) estimate, I compute that U.S. R&D and Testing Service exports in 2001 of $40.7 billion are less than 5 percent of the technology spillovers the United States has provided in that year.[1]

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Then what can we learn from these R&D service trade figures? This is where the case for this agenda begins.

Way to Go!

First, consider the possibility that technology investments are nothing but a proximate cause for growth—the fundamental drivers are differences in institutions across countries (Acemoglu, Johnson, and Robinson 2005). If so, then surely differences in economic and political institutions should have a strong effect on firms' technology investment and adoption decisions. Or consider the influential view that productivity differences across countries are in large part due to barriers to technology adoption (Parente and Prescott 2000). In both cases, research in support of the argument using observable counterparts of technology investment and adoption is extremely scarce.

At a less aggregate level, research often includes specific technology variables. Griffith, Harrison, and van Reenen (2006), for example, provide evidence on technology flows from the United States to the United Kingdom: high technology growth in the U.S. is associated with relatively high U.K. firm productivity growth if the U.K. firms locate a relatively high share of their innovative activity in the United States. Similarly, Keller (2002) shows that the productivity benefits from R&D spending in the largest industrialized countries are smaller, the more geographically distant a recipient country is from these countries. At the same time, these studies are typical in that they rely on indirect or proxy variables—they do not employ direct information on the monetary value of technology transfers.

The information on trade in R&D services that Moris describes in this chapter is a big step forward in this respect. While clearly only a part of all international technology transfer, in principle these data have the information that is of interest. In particular, the R&D service trade figures capture the value, not the cost, of international technology flows. Moreover, the technology sender and recipient are identifiable as the buyer and seller. Therefore, this information provides an important angle to tackle the issue.

Multinational enterprises (MNEs) play the key role in international R&D service trade (see table 5.1). This is not surprising given that MNEs account for most of the R&D conducted in the world. In the United States, for example, U.S. multinational parents, together with U.S. affiliates of foreign-owned multinationals, account for more than 90 percent of R&D in the United States. The breakdown is about 83 percent for U.S. multinational parents and about 9 percent for U.S. affiliates of foreign-owned

1. McNeil's (2006) figures are based on the framework of Coe and Helpman (1995), Keller (1998), and Xu and Wang (1999).

multinationals.[2] The technological "footprint" of MNEs is indeed very large. This is a major reason of why it is promising to start studying technology transfer by looking at MNEs.

A second reason for a focus on MNEs, at least initially, is the fact that much of the observable part of international technology transfer today consists of transfers within the parent and affiliates of the same multinational enterprise. United States statistics at the Bureau of Economic Analysis (BEA) paint a rich picture of parent and affiliate activity, as well as their relationships in terms of trade in goods and services. Recent efforts to link the (BEA) MNE data to detailed company-level R&D data from U.S. surveys has the potential of greatly improving our understanding of international technology flows (see NSF 2005). For example, we need to learn more about the headquarter services provided by MNE parents for their affiliates: what exactly is their nature, and how do the services provided vary by industry and by MNE host country?

One important question is how similar the within-MNE trade patterns are to trade at arm's length between unaffiliated parties. For example, how important are transfer pricing issues? Second, how representative international R&D transfers are for all international knowledge flows. Extending the analysis to include patent royalty and licensing payments of MNEs should help in this respect. While royalties are only observed whenever a firm has patented, which is a strategic choice, R&D trade and royalty flows together will provide a better picture of international technology flows than either by itself. It will also be useful to combine the analysis of R&D with results from surveys that define innovation more broadly, such as the Community Innovation Surveys of the European Union; see Criscuolo, Haskel, and Slaughter (2005) for a recent analysis that relies on this survey.

To sum up, information on international R&D service trade begins to open up new avenues for quantitative work on international technology flows. This should yield important insights for productivity growth and convergence versus divergence in the world. A better understanding of domestic and international dimensions of technological activity will also inform the policy debate on whether international technological transfers should be encouraged or rather reduced: what is the impact of a relatively open versus closed technological knowledge regime? Getting this right has major implications for economic welfare.

References

Acemoglu, D., S. Johnson, and J. Robinson. 2005. Institutions as the fundamental cause of long-run growth. In *Handbook of economic growth,* ed. S. Durlauf and P. Aghion, 385–472. North-Holland: Elsevier.

2. See NSF (2005, appendix table 1). This figure is for the manufacturing sector around the year 1998. If one looks at all industrial R&D, not only manufacturing, MNEs still account for more than 80 percent of R&D inside the United States (NSF 2005).

Coe, D., and E. Helpman. 1995. International R&D spillovers. *European Economic Review* 39 (5): 859–87.

Criscuolo, C., J. E. Haskel, and M. J. Slaughter. 2005. Global engagement and the innovation activities of firms. NBER Working Paper no. 11479. Cambridge, MA: National Bureau of Economic Research, July.

Griffith, R., R. Harrison, and J. Van Reenen. 2006. How special is the special relationship? Using the impact of U.S. R&D spillovers on UK firms as a test of technology sourcing. *American Economic Review* 96 (5): 1859–79.

Hall, R., and C. Jones. 1999. Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics* 114 (1): 83–116.

Howitt, P. 2000. Endogenous growth and cross-country income differences. *American Economic Review* 90 (4): 829–46.

Keller, W. 1998. Are international R&D spillovers trade-related? Analyzing spillovers among randomly matched trade partners. *European Economic Review* 42 (8): 1469–81.

———. 2002. Geographic localization of international technology diffusion. *American Economic Review* 92 (1): 120–42.

McNeil, L. 2006. International trade and economic growth: A methodology for estimating cross-border R&D spillovers. U.S. Bureau of Economic Analysis, April.

National Science Foundation (NSF). 2005. Research and development data link project. Final report. Census Bureau, Bureau of Economic Analysis, and National Science Foundation. Washington, D.C., June.

Parente, S. L., and E. C. Prescott. 2000. *Barriers to riches.* Cambridge, MA: MIT Press.

Xu, B., and J. Wang. 1999. Capital goods trade and R&D spillovers in the OECD. *Canadian Journal of Economics* 32 (5): 1258–74.