The Identification of Technology Spillovers: Keller Revisited

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Abstract

From early works by Terleckyj (1974) and Scherer (1982) onwards, the empirical estimation of the productivity effects of intersectoral technology spillovers has gained much attention. The bottomline of the studies is that this class of spillovers do have a significant positive impact on productivity growth (see Nadiri, 1993, for a survey of empirical results). This conclusion is not only interesting from an academic point of view, but has also implications for technology policy: firms in sectors that generate important spillovers should be stimulated to increase their R&D investments, because it is quite likely that the social returns to these investments are much higher than the private returns. A major problem, however, is that it has so far been impossible to discern the productivity effects of specific spillovers-generating industries for a sector considered.

The most straightforward way to estimate the productivity effects of technology generated by R&D processes in other sectors was followed by Bernstein (1989). His regression equations contained R&D expenditures for each sector as regressors, which lead to multicollinearity problems. To circumvent these, other authors included a single "R&D spillover variable", constructed as a weighted sum of R&D sectoral expenditures by other sectors. Many weighting systems have been proposed, differences often implied by theoretical considerations, such as an emphasis on "rent spillovers" or "knowledge spillovers" (see Los and Verspagen, 2006, for an overview). As was stressed by Keller (1998) in an influential critique of Coe and Helpman (1995), and a satellite paper (Keller, 1997) for the case of intersectoral spillovers, many of these R&D spillover variables yield very similar productivity effect estimates, which do not differ from those obtained if the sectoral R&D outlays would not have been weighted at all.

This paper chooses a different approach to identifying the main drivers (through spillovers) of productivity growth. It returns to the specification of Bernstein (1989) separate regressors for each sector's R&D expenditures, but avoids the multicollinearity problem by using non-classical econometrics based on the maximum entropy (ME) principle, advocated by Golan *et al.* (1996). The starting point (the "prior") is that all sectors contribute equally strongly. Loosely speaking, the estimation procedure amounts to extracting information from observations which is at odds with this "prior", after which "posterior" estimates are obtained. This method is well-known to yield unbiased point estimators from data that are "badly behaved" from the perspective of classical econometrics, such as high degrees of multicollinearity. We have such data at hand. By applying ME econometrics on sectoral productivity and R&D data obtained from OECD databases for developed countries, we hope to come up with new insights into the sectors that generate the most important productivity–enhancing spillovers. These might also inform us about the class of spillovers ("rent spillovers" or "knowledge spillovers") that is empirically most important.