
Technology spillovers: myth or reality?

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In CPB Report 1998/4, Jacobs, Nahuis and Tang (see also Jacobs et al., 1999) use Dutch data to investigate one of the more lively aspects of the current economics debate: what is the effect of R&D activity on economic performance (including macroeconomic growth and the competitive strength of industry), and what is the size and role of technological spillovers (if they exist) in this process? The authors find that domestic R&D tends to be more important for Dutch productivity than does foreign R&D. Furthermore, R&D speeds up the assimilation of technologies.

The current literature maintains that the role of R&D in the economic process is important. A steady flow of new ideas, products, and processes seems to have become the magic fluid that can be applied by policy makers to cure all economic woes. And indeed, on theoretical grounds the case for R&D in the economic process can readily be made; product innovation increases the variety and quality of products on offer, while process innovation increases the efficiency of production. In both cases more of the potential surplus available in the market is captured. Moreover, the process of carrying out R&D is thought to generate positive external effects: the technological spillover. If the effect of R&D on the functioning of markets would not be enough to draw the attention of policymakers towards this rather erratic activity, then this technological spillover surely will. Indeed, the spillovers make a strong case for claiming that market forces do not direct enough resources towards innovative activities.

The above points are all theoretical considerations. Fortunately, there are also researchers who try to give these theoretical notions some empirical grounding (including Coe and Helpman (1995), Bartelsman et al. (1996), Coe, Helpman and Hoffmeister (1997), and Jones and Williams (1998); see also Keller (1998)). But, as so often is the case in the international economics literature, most of these researchers use non-Dutch data. The study of Jacobs et al. (1999) is therefore a more-than-welcome addition to the empirical knowledge we have to date on the Dutch economy, notwithstanding the comments I have.

First of all, I would not be inclined to agree with the authors' statement that "A general concern is that investment in innovative products and production methods is too low in the Netherlands." Of course, based on the theoretical considerations mentioned above this can be said for any country. The authors, however, refer specifically to the

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Dutch case. But what do we see if we consider the international context? In 1996 some 2.09% of Dutch GDP was spent on R&D, which is well above the EU average (1.84%).¹ The issue here is, I think, that a relatively large share of R&D in the Netherlands is financed with public funds (about 50%, Ministry of Economic Affairs (1997)). This would imply that we are doing relatively much fundamental research (no need for the government to sit on the entrepreneur's chair), which indeed is the case (Ministry of Economic Affairs (1997)). The real concern is then not so much the level of R&D investment, but the connection between public (fundamental) and private (applied) research. An important objective in this respect, as also alluded to by Jacobs et al. (1999), would be to increase the dissemination of fundamental research results.

Next, I am less afraid of international spillovers (as opposed to national ones). Free riding by other countries on Dutch research results is of less importance than our free ride on the international research community. Indeed, technological spillovers are a two-way phenomenon, especially for a small open economy like that of the Netherlands. I am therefore surprised to learn from Jacobs et al. that the elasticity of total factor productivity with respect to the stock of foreign R&D is 0.015. Not only is this much smaller than the domestic spillover (the same elasticity with respect to domestic R&D is 0.53), it is also well below the international technological spillover reported for other countries (Coe and Helpman (1995), for instance, find it to be between 0.06 and 0.09).² This finding of Jacobs et al. could be due to the way they model spillovers. Although theoretically they distinguish knowledge spillovers from rent spillovers, empirically they do not. All spillovers are treated as emanating from intermediate goods to final goods only (rent spillovers). But, as mentioned by the authors, the flow of domestic inputs is much larger than the flow of international inputs. Indeed, ignoring knowledge spillovers could induce a downward bias of the international spillover estimate (this is especially true for the service sector, which almost exclusively relies on domestic supplies). In addition, for the international information flows no distinction is made between those going between the same sector, and those going between different sectors. For domestic spillovers this distinction is shown to matter a lot (the elasticity of total factor productivity with respect to the stock of knowledge is 0.35 within a sector and 0.18 between sectors). Ignoring this difference is likely to add to the downward bias of the estimated international spillover.

Although I would have liked the technological spillover to be modelled in a bit more detail (distinguishing empirically knowledge spillovers from rent spillovers and considering international spillovers within sectors and between sectors), this study does reveal that knowledge spillovers exist in the Netherlands and that they are important for economic growth. One puzzle remains; according to Jacobs

et al. manufacturing industries are much less able to absorb technological spillovers than are service industries. But aren't the latter full of bureaucrats obstructing any form of technological progress?

References

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Notes

- ¹ CBS (1998). It is below the OECD average though (2.18%).
- ² Considering manufacturing separately, Jacobs et al. (1999) report an elasticity of domestic foreign R&D to total factor productivity of 0.075.

In reply

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"The R&D expenditures by firms in the Netherlands fall behind considerably." wrote the Minister of Economic Affairs to the parliament in 1995.¹ R&D expenditures have since then increased and returned to their 1990 level -- and perhaps they no longer warrant such concern. However, the largest employer organisation has concluded in a very recent publication that the Netherlands is still lagging internationally (behind, for example, Germany and France). The government is therefore implored to improve the "R&D-investment climate".² The concern of under-investment is perhaps not shared by everyone at every point in time, but it seems to be an ever-recurring theme in discussions about public policy towards R&D. In any case, it has been one of the motivations behind our recent study.

Jeroen Hinloopen touches upon two other issues. One of them concerns the research method. Hinloopen suggests that a limitation is that we only measure rent spillovers. However, we only cannot distinguish between rent and knowledge spillovers (see page 15 in Jacobs, Nahuis and Tang). We fully agree that more work should be done to unravel the vehicles for and types of spillovers.

The other issue concerns the significance of foreign R&D for Dutch productivity. Hinloopen seems surprised by our results, which are, however, not strikingly different from those of other studies. It might be useful to emphasise that the estimated coefficients of Coe and Helpman (1995), for example, are not directly comparable to ours. The interpretation of the estimated coefficients depends on the construction of explanatory variables. We want our explanatory variables -- weighted R&D stocks -- to do two things. First, we are concerned with the effect of a sector's composition of suppliers. We want to know, all else being equal, does a sector that uses inputs from R&D-intensive sectors see its productivity rise? Second, the explanatory variables measure the "openness" of a sector (to other domestic sectors and foreign sectors). That is, we want to know, with a given composition of intermediate use, whether or not the level of openness matters. In order to interpret our coefficients as elasticities with respect to R&D in sectors/countries, we have to correct for the latter. Therefore we argue that in our preferred comparison: "Coe and Helpman find an elasticity of TFP to foreign R&D of 6-9%. The magnitude is in line with our finding of 7.5%." (page 26). Alternatively, we can compare our study with very recent work by Keller (1999). He also finds that spillovers from domestic R&D

are more important than those from foreign countries. This only strengthens our feeling that spillovers from R&D activity also depend on geography.

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Notes

- ¹ See p.16 in Minister of Economic Affairs et al. (1995), translation JNT.
- ² See VNO-NCW (1999), for example on page 9.