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Do subsidies to commercial R&D reduce market failures? Microeconometric evaluation studies [1]

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Abstract

A number of market failures have been associated with R&D investments and significant amounts of public money have been spent on programs to stimulate innovative activities. In this paper, we review some recent microeconometric studies evaluating effects of government-sponsored commercial R&D. We pay particular attention to the conceptual problems involved. Neither the firms receiving support, nor those not applying, constitute random samples. Furthermore, those not receiving support may be affected by the programs due to spillover effects which often are the main justification for R&D subsidies. Constructing a valid control group under these circumstances is challenging, and we relate our discussion to recent advances in econometric methods for evaluation studies based on non-experimental data. We also discuss some analytical questions, beyond these estimation problems, that need to be addressed in order to assess whether R&D support schemes can be justified. For instance, what are the implications of firms' R&D investments being complementary to each other, and to what extent are potential R&D spillovers internalized in the market?

JEL classification: O30; O40; L10
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1. Introduction

The theoretical literature on market failures associated with R&D and technological innovations is vast, and there is also a steadily growing empirical literature verifying the importance of spillovers in R&D and innovative activities. There is consequently little controversy among economists about the desirability of governmental support to these activities [2], and all OECD countries have over sev-

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[2] See, however, the heated and wide-ranging debate on this issue in *Research Policy*, starting with the review by David (1997) of Kealey's book on economic issues of scientific research (Kealey, 1997). See also the exchange between Friedman (1994) and Griliches (1994).

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eral decades spent significant amounts of public money on programs intended to stimulate innovative activities. However, compared to the size of the programs and the emphasis put on technology policy by politicians, the effort to evaluate in quantitative terms the economic benefits and costs of R&D subsidies has been rather modest.

In this paper, we review some recent contributions to this evaluation literature that use econometric techniques based on microdata, in particular firm-level data. More specifically, we review the microeconometric literature evaluating the effects of government sponsored commercial R&D. This kind of government support to commercial R&D projects is supposed to target projects with large expected social benefits, but with inadequate expected returns to private investors. An important question is whether the government agencies are able to choose projects with high social returns that the private sector would not undertake on its own. [3]

Evaluating the effects of government sponsored projects, one has to face the question of what would have taken place without the subsidies, and it is important to realize that evaluating large scale subsidy programs is an exercise in counter factual analysis. Neither the firms receiving support, nor those not applying, can be considered random draws. Constructing a valid control group in this setting is quite challenging and we relate our discussion to the recent advances in econometric methods for evaluation studies based on non-experimental data.

Most of the available evaluation studies of R&D programs have not been based on microeconometric techniques, but instead on case studies and interviews with program and project managers. [4] These key persons are typically asked to report the payoff from the projects, and similar questions might be asked also to downstream users of innovations emerging from the R&D program in question. [5] It is easy to conceive an upward bias in the payoff reported by project managers, not least because a high estimate typically increases the chances that the R&D program will be considered successful and continued or replaced by a similar program. Also, one should not underestimate the problems for the project managers in constructing an estimate of the payoff from individual projects, since such estimates are based on counter factual questions similar to those faced by the econometrician. [6] Another disadvantage of the case studies is that they have high costs per case (project) considered, and case studies consequently tend to be quite selective and suffer from the objection that they may not be representative. Finally, evaluation studies not based on 'objective data' may more easily be biased, e.g., by prior beliefs, which is a problem because evaluation studies typically are done by 'professional evaluators' who are part of the political process that formulates the programs, and who ''are dependent on those commissioning the evaluation studies for further projects and studies, and risk losing future clients if they voice strong criticism'' (Luukkonen, 1998).

It is outside the scope of this paper to discuss in detail evaluation studies based on interviews and case studies. Our study focuses on microeconometric studies of firm level data or similar data sources, as we pointed out above. It is also narrowly focused on the impact on manufacturing performance of direct government support to commercial R&D-projects, and it largely ignores closely related issues such as the impact of research in governmental labs, defense related R&D-contracts, support to basic research in universities and tax-breaks for R&D. [7] Furthermore, we do not review the literature that exclusively considers to what extent R&D subsidies crowd out privately financed R&D investments [8], but our discussion addresses this issue in the context of the more wide-ranging studies that we consider.

[3] See, e.g., Yager and Schmidt (1997) for a detailed and skeptical discussion of the government's ability to reduce market failures in R&D activities.

[4] Mansfield (1996) surveys this methodology and gives references to the previous literature.

[5] Cf., e.g., Link (1996) and Link et al. (1996). The 1996 book by Link is reviewed by Averch (1997).

[6] Notice that the project manager might have less information than the econometrician about economic results of competing projects or firms.

[7] See the survey by Hall and van Reenen (1999) on taxes and R&D, and Mowery and Rosenberg (1998) for a wide ranging discussion of the other issues and further references.

[8] See David et al. (1999) for a survey.