Research Policy 44 (2015) 1844–1855

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

The impact of R&D subsidies during the crisis

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ARTICLE INFO

Article history:
Received 13 April 2014
Received in revised form 8 June 2015
Accepted 8 June 2015

JEL:
C14
C21
G01
H50
O38

Keywords:
R&D
Subsidies
Policy evaluation
Economic crisis
Treatment effects

ABSTRACT

This study investigates the impact of public R&D subsidies on R&D investment of small and medium-sized enterprises (SMEs) in Germany during the most recent economic crisis. Our analysis is based on firm-level data of the Mannheim Innovation Panel (MIP) covering the period 2006–2010. While we find an overall positive effect of R&D subsidies on SMEs' R&D investment behavior, there is evidence for a crowding out effect for the crisis year 2009. In 2010, when the German economy started to recover, the subsidy effect is smaller than in the pre-crisis years, but positive and significant. Additional tests indicate that the temporary crowding out effect was caused by reluctant innovation investment behavior of the subsidy recipients rather than by Germany's countercyclical innovation policy during the crisis.

1. Introduction

The global economic crisis of 2008/2009 has severely affected the OECD economies. The unemployment rate has reached a post-war height of 8.5% in October 2009, the GDP declined by 4% in 2009 as compared to 2008 (OECD, 2012a), and long-term investments like innovation expenditures decreased significantly in a range of countries including Canada, Sweden and the UK (OECD, 2012b; Filipetti and Archibugi, 2011).

Private sector innovation and research and development (R&D) activities substantially contribute to sustainable growth (Griliches, 1979; Grossman and Helpman, 1994; Aghion and Howitt, 2009; Doraszelski and Jaumandreu, 2013). Even a short-term decline or stagnation of these activities can have detrimental consequences in the long run. Policymakers are well aware of the importance of private sector R&D and also of the fact that private R&D spending is lower than socially desirable, even in boom periods. For that reason, public support for R&D activities is particularly important in times of an economic downturn.

R&D investment is risky and the returns are uncertain and long-term. During recessions, not only firms facing financial constraints are likely to reduce their investment in R&D (Schumpeter, 1939; Freeman et al., 1982). R&D investments might also be cut in response to a decreased demand in recession periods (Stiglitz, 1993; Aghion and Saint-Paul, 1998). Furthermore, it has been shown that the responsiveness of companies to policy initiatives is weaker in times of economic uncertainty (Bloom et al., 2007; Bloom, 2008). Uncertainty raises the real option value of investments, which makes firms more cautious concerning their R&D investment decisions during recessions.

In order to prevent firms from reducing their R&D expenses and to maintain the national R&D capacities, policymakers in many industrialized countries, including Austria, Denmark and Sweden, reacted immediately to the most recent crisis and increased the public R&D budgets (OECD, 2012b). In Germany, the private sector reduced R&D expenses by 2.9% (Fig. 1), while the German Federal Ministry for Education and Research (BMBF) reacted to the crisis by increasing its budget by 9% in 2009 as compared to 2008.

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http://dx.doi.org/10.1016/j.respol.2015.06.003
0048-7333/

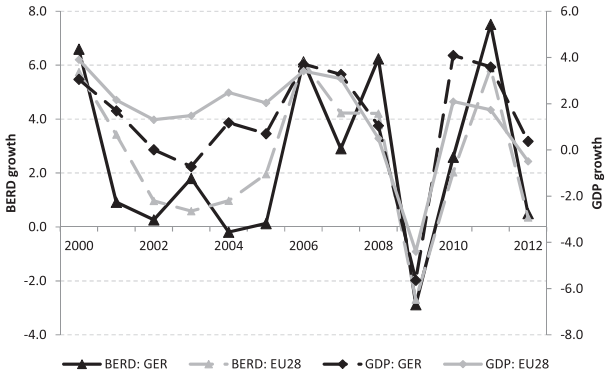

Fig. 1. Annual real GDP growth and real Business Enterprise Expenditure on R&D (BERD) growth in Germany and EU28 between 2000 and 2012, in %.

Source: OECD and OECD (2013). Own calculations. Real GDP and BERD growth rates are calculated based on GDP and BERD at constant 2005 USD.

This paper empirically examines the effects of the BMBF's public R&D subsidy program on firms' R&D investment during the most recent crisis. Our analysis is based on firm-level data of the Mannheim Innovation Panel (MIP) and on public R&D subsidy data provided by the BMBF. We focus on small and medium-sized enterprises (SMEs) because these firms are expected to be more vulnerable during an economic downturn as compared to large enterprises. Our sample covers the period of 2006–2010, with 2009 marking the peak of the crisis period in Germany (and the EU) as revealed in Fig. 1.[1]

Our empirical strategy consists of several steps. We rely upon propensity score matching in order to assess whether R&D subsidies stimulate additional R&D investment over the sample period. The matching estimator accounts for the fact that subsidies are not randomly distributed among SMEs, but that companies self-select themselves into the funding scheme. This procedure provides us with an estimate of the average effect of subsidies on the subsidized companies' R&D investment. In the next step, we compare the effectiveness of the treatment of the crisis period to the pre-crisis (2006–2008) and post-crisis (2010) periods. In the final step, we test whether SMEs subsidized during the crisis are less promising innovators than SMEs subsidized before the crisis or whether the investment behavior of subsidy recipients changed during the crisis. The former could be a consequence of an expanded subsidy program during the crisis that could have lowered the average "quality" of the pool of subsidy recipients.

Our results show that R&D subsidies lead to an additionality effect for the overall period. Only for the crisis year, we find evidence for a crowding out effect from which SMEs are already recovering again in the first post-crisis year. The crowding out effect of the crisis year can be indicative of reluctant R&D investment behavior of the subsidy recipients or of the countercyclical innovation policy that may have changed the average "quality" of the pool of subsidy recipients during the crisis. Our further empirical tests suggest that the crowding out effect is caused by SMEs' reluctance to invest in R&D during a crisis period. We do not find support for the hypothesis that the crowding out effect is related to a lower average "quality" of subsidized firms in the crisis and post-crisis years due the expanded subsidy program.

Although our main finding is that the average additionality effect is negative for the crisis year 2009, the countercyclical innovation policy is likely to have had a stabilizing effect on the economy. It may have helped SMEs to keep their R&D personnel and to maintain national innovation capacities.[2]

The remainder of the paper is organized as follows. The next section surveys related literature. Section 3 presents the empirical strategy. The data set is described in Section 4. The results are discussed in Section 5. The last section concludes.

2. Literature review

2.1. The rationale for public R&D subsidies

The economic rationale for R&D subsidies to the private sector is that the level of privately financed R&D in the economy is lower than socially desirable. This is because R&D has the characteristics of a public good as it generates positive external effects, which cannot be internalized by the innovating companies (Arrow, 1962). In the absence of public subsidies, projects that would generate positive benefits for society but do not cover the private costs, would hence not be carried out. This type of market failure is the main reason for governments to subsidize private R&D projects. Public funding reduces the price for private investors so that the otherwise too expensive innovation projects are carried out. The policymakers' objective is twofold regarding R&D subsidies. On the one hand, the aim is to maintain national innovation capabilities, the national R&D and employment level, especially in recession periods, where typically subsidies to the private sector are preferred over public procurement because of the potential of additionality effects. On the other hand, the government's interest is to generate more innovation outcome. Public subsidies can help the economy recovering from a crisis by fostering the creation of new innovations leading to economic growth.

The positive effect of R&D subsidies on firms' R&D activities, however, cannot be taken for granted. In practice, firms always have an incentive to apply for public R&D support due to relatively low application costs, even if the expected net return of the project is positive and although the R&D projects could be conducted with own financial means. Once the application was successful, firms can use the public grant to replace private with public investment. This is called a "crowding out" effect (e.g., David et al., 2000). If the majority of firms acted this way, public R&D subsidies would lead the economy to a lower growth path in the long-term. The likelihood of crowding out may be particularly high during recession periods as firms face declining sales and financial markets that hamper the financing of R&D. Firms may use the additional risk-free money to service short-term debt or to maintain their production capacities.

A vast empirical literature has investigated the question whether R&D subsidy programs lead to a crowding out effect or stimulate R&D activities in the private sector. The majority of the studies find that R&D subsidies lead to an additionality effect (see Zúñiga-Vicente et al., 2014, for a recent survey). The early literature up to the year 2000 – as surveyed by David et al. (2000) and Klette et al. (2000) – is criticized for disregarding a potential selection bias of firms into R&D subsidy programs. On the one hand, companies with larger R&D capacity are more likely to apply for R&D subsidies. On the other hand, these companies may be more likely to receive the public funds if the government wants to maximize the returns to the subsidy program. A simple comparison of subsidized and non-subsidized firms hence leads to biased results.

The more recent literature with focus on the firm level as surveyed by Cerulli and Poti (2010) and Zúñiga-Vicente et al. (2014)

[1] Germany was already severely affected by the crisis in the last quarter of 2008 reaching the peak in 2009. This does not show up in the aggregate annual data though. We therefore refer to 2009 as the crisis year in the remainder of the paper.

[2] According to the German R&D statistics, R&D personnel is the largest cost unit in a firm's R&D process (Stifterverband, 2013).