Technological Forecasting & Social Change xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

The impact of public support on firm propensity to engage in R&D: Spanish experience

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ARTICLE INFO

Article history:
Received 21 July 2014
Received in revised form 18 March 2015
Accepted 12 May 2015
Available online xxxx

JEL classification:
H81
L20
O38

Keywords:
Public support
R&D projects
Impact analysis
R&D extensive margin

ABSTRACT

Our objective is to estimate the effect of public low-interest loans for R&D projects on the probability of performing R&D by Spanish firms. The estimations provide evidence of the effectiveness of public low-interest loans, being the stimulus effect larger for SMEs than for large firms and also higher for manufacturing than for services. Supported firms are approximately 25 percentage points more likely to self-finance their R&D investments than non-supported firms. The effect is quite relevant if we consider that the probability of self-financing R&D activities is 53.2 percentage points higher when the firm has invested in R&D activities in the previous year. This result suggests that firms can be induced persistently to perform R&D activities by means of loans.

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1. Introduction

It is commonly accepted that innovation companies are subject to financial constraints associated with the presence of information asymmetry and moral hazard problems, which provoke a higher cost of financing research and development (R&D) activities with respect to ordinary investment and a lower level of funding by private external financers, who are reluctant to lend when the investment is concentrated essentially on intangible assets (Himmelberg and Petersen, 1994; Hall, 2002; Hall and Lerner, 2010). Also because knowledge is characterized by increasing returns to scale and because of the uncertainty and the incomplete appropriability of R&D returns due to knowledge spillovers, private investment in R&D is expected to be below the optimum social level (Arrow, 1962).

In this context, it is not surprising that the main justification for public intervention is the correction of these market failures (Czarnitzki and Lopes-Bento, 2013), although public agencies may also have other goals when supporting business R&D. Among these objectives, we can emphasize the promotion of national champions, the technological upgrading of firms that are of particular importance in declining or traditional industries, or the funding of R&D projects that would not be otherwise carried out (Blanes and Busom, 2004; Clausen, 2007).

Obviously, public intervention can result in a negative effect on aggregate business R&D if awarded firms reduce their own R&D investment, displacing or crowding out private investment. With this in mind, many empirical articles which try to

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http://dx.doi.org/10.1016/j.techfore.2015.05.011
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Please cite this article as: Huergo, E., et al., The impact of public support on firm propensity to engage in R&D: Spanish experience, Technol. Forecast. Soc. Change (2015), http://dx.doi.org/10.1016/j.techfore.2015.05.011

measure the impact of public aid on private R&D have been published, with several countries studied and many methodologies applied (see Zúñiga-Vicente et al., 2014, and Becker, 2014, for a review). And, from a policy point of view, many of these papers conclude that R&D subsidies generate larger additionality at the extensive margin (share of R&D performers) than at the intensive margin (R&D intensity of actual performers).

This article tries to go more deeply into the knowledge of the actual relationship between public and private R&D expenditures. More in detail, our aim is to analyze the effect of being awarded aid by the Center for the Development of Industrial Technology (CDTI) on the firm's decision to self-finance R&D. The CDTI is the main public agency providing funding for firms' R&D projects in Spain. Among the typology of funding programs managed by the CDTI between 2003 and 2005, we focus on the following: Technological Development Projects, Technological Innovation Projects and Joint Industrial Research Projects. By means of these, the CDTI funded firms to conduct R&D projects with low-interest loans (that is, with an interest rate lower than normal rates for the current market) that could reach 60% of the total budget.

Although there are many references which deal with the impact of subsidies on R&D projects, few of them focus on programs based on low-interest loans. Despite the fact that low-interest credits include a hidden subsidy (equivalent to the saving in financial costs), their effects on the firm's decisions are not expected to be the same for at least three reasons: i) low-interest loans are fully compatible with tax benefits; ii) the percentage of the financed budget is usually higher, simultaneously increasing the firm's chances to get private financing; iii) as the firm must pay back the loan, it imposes self-discipline on it, something not present with other types of aid. In that sense, low-interest loans should be expected to generate higher additionality than the equivalent subsidy or limit the crowding out effect.

Notice that the factors that determine participation in the public system of low-interest loans may be the same as those which affect the firm's R&D decision. This fact could have biased the estimates of the impact upward if the CDTI had selected firms with a higher likelihood of self-financing R&D projects. Among the existing methodologies which deal with this bias, in this paper a two-stage procedure is presented. Firstly, we estimate the determinants of participation in CDTI programs (selection equation), trying to assess the characteristics of projects awarded the aid. Then, in a second stage, we estimate the factors affecting the firm's decision to allocate its own resources to R&D activities (impact equation). When dealing with this second equation, the predicted value for the probability of participation obtained from the first one is used as an explanatory variable.

Additionally, the R&D expenditure decision may well show some persistence that should be considered. The presence of sunk costs or learning-by-doing associated with these activities could make, among other reasons, that firms with R&D expenditures one year were more likely to continue investing the next period.

The main contribution of this study to the literature on impact assessment of public support for R&D is that our analysis takes into consideration both the selection problem and potential persistence in the decision to undertake R&D activities. Only a few papers have analyzed the effect of public aid in the presence of persistence in the R&D decision,[1] but to our knowledge none of them focus on the impact of low-interest loans. We use the method proposed by Wooldridge (2005) to control for this possibility of persistence. Our results confirm the existence of a positive impact of CDTI low-interest loans on self-financed R&D, even once persistence effects are considered, showing the effectiveness of CDTI programs.

The rest of the paper is divided into four parts. After this introduction, in Section 2 we review empirical evidence. In Section 3, we describe the empirical methodology along with the main variables included in the database, trying to obtain a guide of supported firm-related variables that will be used later on as explanatory factors in the econometric analysis. Section 4 shows the estimates of both the selection and the impact equations, stressing the differences in these decisions between small and medium-sized firms (SMEs) and large firms and between manufacturing and services firms. Finally, we present key conclusions in Section 5.

2. Public support and the decision to invest in R&D

From a theoretical point of view, the main channel through which public funding can impact business R&D investment is the reduction of the cost of R&D (Bloom et al., 2002). This is especially obvious in the case of firms deciding to start R&D projects in the presence of financial constraints.[2] Given the higher level of uncertainty surrounding innovative projects and the public good character of knowledge, innovative firms usually face a higher cost of external financing, and can even be credit rationed. Therefore, they mainly rely on their own resources to finance R&D projects. In this context, the decision to engage in R&D is quite sensitive to the availability of internal liquidity, and access to external sources of financing could induce firms to undertake R&D projects that would not otherwise be started (Czarnitzki et al., 2011).

Consistent with this interpretation, González et al. (2005) model the relationship between R&D subsidy effectiveness and the existence of barriers to R&D in terms of set-up costs. In their model, the decision of whether or not to spend on R&D arises from the comparison of optimal non-zero effort with the effort needed to reach some profitability (threshold effort). Below this threshold, R&D costs cannot be completely recovered and firms will decide not to undertake innovative activities, but this decision can be modified if expected subsidies reduce the cost of R&D.

Also considering the existence of fixed R&D costs and a cost of external finance, Takalo et al. (2013a) develop a structural model of strategic interaction among subsidy applicants and public and private sector R&D financiers to analyze the effects of R&D subsidies. From this model, they conclude that higher costs of external finance provide a reason to increase R&D subsidies at the extensive margin, where firms decide whether or not to invest in R&D.

[1] See, for example, the papers by Arqué-Castells and Mohnen (2012) and Arqué-Castells (2013).

[2] As Mancusi and Vezzulli (2014) point out for a large representative sample of manufacturing SMEs, credit rationing has a negative impact on both the probability of setting up R&D activities and the level of R&D expenditure (conditioned on the R&D decision), and the global estimated reduction in R&D expenditure is mostly associated with the first impact.

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