Research Policy 39 (2010) 549–563

Contents lists available at ScienceDirect

Research Policy

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

Public selection and financing of R&D cooperative projects: Credit versus subsidy funding

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ARTICLE INFO

Article history:
Received 15 November 2007
Received in revised form
15 December 2009
Accepted 20 January 2010
Available online 12 February 2010

JEL classification:
H23
H43
H53

Keywords:
Public Funding
R&D Cooperation
Project selection
Credit
Subsidy

ABSTRACT

In this article we develop an analytical model of the selection process for R&D cooperative projects, to study the factors that motivate public project selection and corresponding funding, using two different financial instruments: subsidies and credits. For this purpose, we propose a three stage empirical strategy to analyse the differential individual effects of several factors on the decisions taken by the public agency. This analysis is based on project level data from cooperative R&D project calls under the Spanish PROFIT initiative, for the period 2000-2003. The main results show that the public agency uses the two financial instruments to address different objectives. First, some projects close to the market are well supported through credits, while basic research projects receive only selective support in the form of subsidies. Second, there is significant diversity in the selection and funding of technological areas. Third, regarding the explicit goal of fostering cooperation, the public agency selectively favours partnerships with universities and technology institutes through the award of subsidies. However, there seems to be less incentive for large consortia. Fourth, there are significant regional differences among financed projects and, also, our data show sharp yearly fluctuations.

1. Introduction

The importance of research and development (R&D) as one of the main contributors to sustainable growth in highly industrialized economies is undisputed among economists, and especially in the context of the modern knowledge based economies. This means that government support for R&D activities is widely accepted, in contrast to public support in the areas of investment, production or commercial protection (García-Quevedo, 2004; Giebe et al., 2006; Heijs, 2003). The broad consensus on the value of public support for R&D is rooted in the existence of market failures (Arrow, 1962), which create a gap between the private and social benefits deriving from R&D activities. This gap implies that private resources dedicated to R&D activities will always be below the social optimum (Klette et al., 2000). As consequence, since the mid 1980s, public expenditure oriented to supporting industrial R&D accounts for some 30 per cent of total R&D expenditure in the OECD area (OECD, 2001), and as much as 36 per cent in the European Union (EU) countries. In the case of Spain the share of public funding of R&D activities in the private sector is close to 40 per cent (OECD, 2001).

Technological agreements can be another solution to some of the failures in technology markets, especially in the case of appropriability (Cassiman, 2000) and uncertainty (Smith, 1991). Some general trends (i.e. new scientific challenges more capital-intensive or shorter life cycles of products) make the individual actions of firms difficult, and increase the relevance of cooperation in the innovation process (Heijs, 2005a). Cooperative agreements boost firm innovativeness by their effective combining of partners' resources and exploitation of complementarities (Kogut, 1988; Das and Teng, 2000; Hagedoorn et al., 2000). Moreover, cooperation generates externalities for society as a whole conceptualized in the notion of collective learning (Heijs, 2005a).

In spite of the above mentioned benefits, there are several barriers and transaction costs, especially those related to coordinating, managing and controlling the activities of the different parties involved, which could inhibit organizations' engagement in tech-

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doi:10.1016/j.respol.2010.01.011

nological cooperation (Becker and Dietz, 2004). Thus, considering the impact of cooperation on private profits and social benefits, the greatest challenge for public policy is to find mechanisms that promote cooperation, usually the provision of funding (Bozeman, 2000). To this end, various support programmes have been implemented in the US, Japan and the EU to encourage private R&D efforts and research partnerships between private firms and public research organizations (PROs). Some examples are the Advanced Technology Program in the US and the successive European Framework Programmes.

Many questions of political interest are suggested by the previous arguments and are a good motivation for this paper. According to Fölster (1995), public funding for cooperative R&D is an effective tool for encouraging private research and increasing cooperation in line with social incentives. However, it should be remembered that research funding is an uncertain business, and the outputs of R&D are not only equally uncertain, but also skewed (Molas-Gallart and Salter, 2002). Under these conditions, one of the main problems for research policy is how to distribute research funds to satisfy multiple objectives.

According to Bozeman and Rogers (2001), public R&D management tends to be discrete and *ad hoc*, focusing on generating maximum output through individual projects. In some cases, public agencies use public funding mechanisms to attract firms to a particular location (country or region), or to encourage technological upgrading in firms of particular importance (in terms of employment, for instance) to the country or region. In this case, the supply and distribution of funds among selected R&D projects and firms is trying to fulfil a variety of goals (Blanes and Busom, 2004). However, if the selection criteria are not well defined, many public programmes will fail to reach their targeted populations (Blanes and Busom, 2004; Heijs, 2005b). This highlights the importance of clearly setting out the public sector evaluation criteria and procedures for selecting and funding R&D projects.

The main contribution of this paper is in providing an analysis of the selection process for cooperative R&D projects by studying some of the factors that jointly influence project selection and funding amounts, and by showing how different financial instruments are used. Although there is a large tradition in the study of public support schemes for R&D activities,[3] to our knowledge, this is one of the few attempts to analyse the effects of simultaneous utilization by public agencies of subsidies and credits[4] for funding projects. We look particularly at the selection process adopted by a Spanish public agency in charge of funding cooperative R&D projects using these two financial mechanisms: subsidies and credits. In doing so, the purpose of the study is threefold: a) to identify some of the factors influencing project selection and resources allocation; b) to analyse the extent to which the results of the public agency's decisions comply with the main goals established by the funding programme; and c) to show how the two financial instruments–subsidies and credits - are used. To carry out this work we use project level data from a Spanish innovation support initiative, the PROFIT[5] Programme, for 2000-2003. The sample consists of 2,790 project proposals, with an acceptance rate of about 45%.

PROFIT is the Spanish government's main technical innovation support programme, designed to foster innovation in all sectors (industry, government and research) and technological areas. It should be noted that the period 2000-2003 was the first period when financial support was awarded explicitly to both individual and cooperative projects, implementing measures designed to encourage the participation of one specific type of research organization, the technology institute (TI). The PROFIT data base contains information on project inputs, expected outputs, research partners, technological area or programme, geographical area of applicant organizations and the year of call, which allows us to explore some factors underlying the public selection of R&D cooperative projects and the application of subsidies and credits. In this sense, this study could be considered as complementing studies focused on the factors that lead a firm to participate in R&D subsidy programmes (Acosta and Modrego, 2001; Blanes and Busom, 2004).

The paper is organized as follows. In Section 2, we review the existing literature, describe the PROFIT programme and, based on this, develop arguments and conjectures about the public selection of R&D cooperative projects. We describe the data, the variables and the empirical strategy in Section 3, and discuss the results in Section 4. Section 5 presents the conclusions.

2. Public selection and funding of cooperative R&D projects

The main trend in innovation policies during the last two decades is characterized by what is termed the 'cooperative paradigm', or the fostering of cooperation among sectors - industry, government and research - and among rival or vertically related firms (Bozeman, 2000). Public support for cooperation would seem to be justified if we take account of Von Hippel's (1988) arguments about the relevance of technological alliances and networks as the main sources of innovation. In addition, according to Duysters et al. (1999), alliances have shifted from being a somewhat peripheral aspect to become a cornerstone of the firm's technological strategy. Therefore, public administrations, conscious of the potential of technological agreements, do not hesitate to give financial support to the setting up of R&D collaborations, through a range of R&D funding programmes, many explicitly focused on fostering R&D cooperation (Geroski, 1992; Martin, 1996).

2.1. Public selection of R&D projects

Several studies have focused on evaluating the effectiveness of R&D programmes (Meyer-Krahmer and Montigny, 1989; Ormala, 1989; Roessner, 1989) and their influence on private R&D efforts (David et al., 2000; Klette et al., 2000). However, few works have examined the criteria used by government evaluators to select projects (Hsu et al., 2003; Lee and Om, 1996, 1997). Knowledge of these criteria is crucial for two reasons: first they reflect the real objectives of policy makers and, second they determine the characteristics of those projects that are actually implemented or developed and, consequently, the results obtained. Also, they can affect not only responses to future calls, but also the definition and content of project proposals.

In the context of R&D project selection in a private firm, top management is obliged to resolve the crucial problem of adopting a proper selection method to identify those projects that fit with organizational goals (Lee and Om, 1997). This has led to the hundreds of methods and techniques available in the literature for R&D project selection (Hsu et al., 2003). These approaches tend to be either qualitative or quantitative, and range from unstructured peer review to sophisticated mathematical programming (Henriksen and Traynor, 1999; Hsu et al., 2003). In the process of R&D project selection, whatever method is used, one of the most important steps is to calculate technical and market risks (Taggart and Blaxter, 1992), a rather infrequent practice in the public sector (Bozeman and Rogers, 2001, p. 414). So why is it so difficult for the

[3] This is particularly important in Spain. See, e.g. Molero and Buesa, 1995; Acosta and Modrego, 2001; Heijs, 2001, 2003, 2005b; Blanes and Busom, 2004; Herrera and Heijs, 2007.

[4] Huergo and Trenado (2008) analyse Spanish public aid for R&D projects from the public agency point of view, although they were not able simultaneously to study subsidies and credits: the programme they analyse is focused on credits.

[5] PROFIT: *'Programa de Fomento de la Innovación Tecnológica'* (Programme of Promotion of Technological Innovation).