BRQ Business Research Quarterly (2014) 17, 22–30

BUSINESS RESEARCH QUARTERLY

www.elsevier.es/brq

ARTICLE

Public funding of R&D and its effect on the composition of business R&D expenditure☆

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Received 1 December 2011; accepted 9 January 2013
Available online 23 July 2013

JEL CLASSIFICATION
D04;
O32;
H25

KEYWORDS
Innovation strategy;
Technology policy evaluation;
R&D subsidies;
Selection models;
Internal–external R&D

Abstract This paper discusses the potential effects of R&D public subsidies on a strategic issue for companies, the decision to combine internal and external R&D expenditure. Analyzing some arguments discussed in the management literature, it is assessed whether public intervention by granting R&D subsidies influences the composition of R&D expenditure. To do this, we analyze the data from the Survey on Business Strategies for the period 1991–2008. Results confirm that the public funding of R&D expenditure through subsidies have a positive impact on internal R&D and especially in the decision to conduct R&D internally and externally simultaneously.

1. Introduction

Public subsidies are, together with tax incentives, one of the most used tools for technology policy to stimulate R&D private expenditure. Its theoretical justification is based on the logic of market failures which argues that in the absence of Government intervention, incomplete appropriability of innovation benefits and difficulties in financing R&D generate a level of expenditure on R&D below the social optimum (Hall, 2002).

In order to confirm the effectiveness of this policy, the literature that evaluates the impact of R&D subsidies has grown steadily in recent years by providing a broad base of documentation to assess the impact of R&D public subsidies (Almus & Czarnitzki, 2003; Blanes & Busom, 2004; Busom, 2000; Czarnitzki, 2006; Czarnitzki & Licht, 2006; Duguet, 2004; García Quevedo & Afcha,

☆ Please cite this article as: Afcha S, León López G. Financiación pública de la I+D y composición del gasto empresarial en I+D. Cuad Econ Dir Empresa. 2013. http://dx.doi.org/10.1016/j.cede.2013.01.001.

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http://dx.doi.org/10.1016/j.cede.2013.01.001

2009; González & Pazó, 2008; Herrera & Heijs, 2007; Lach, 2002).

Traditionally, one of the criteria used in the technology policy evaluation to assess additionality of subsidies, has been increasing private R&D expenditure. However, consideration of this variable as an indicator of innovative efforts made by the company ignores the composition of R&D expenditure which, far from being homogeneous, includes elements enforced by different factors. This expenditure presents a heterogeneous composition widely recognized in the management literature (Arora & Gambardella, 1990; Teece, 1986; Granstrand & Pavitt, 1997; Narula, 2001; Pisano, 1990), which has not received enough attention from the evaluation point of view of technology policy, although it may reveal information that could help to improve the design of it.

Expenditure decisions on internal and external R&D are conditioned by a variety of economic, technological and organizational factors as well as their interaction with various agents in the innovation system. As a central part of this system, public sector can create through subsidies, soft loans or tax incentives, mechanisms to influence directly over decisions of companies to improve their innovation processes.

This paper addresses the effect of direct subsidies analyzing their impact on the decision of R&D expenditure in terms of its internal and external composition. The leading hypothesis argues that public subsidies affect the composition, implicitly favoring the combination of internal and external R&D expenditure. Therefore, it influences the innovative performance of the company. This is based on several reasons.

On the one hand, some of the recent empirical literature analyzes the impact of subsidies on the cooperation agreements in companies. For the specific case of Spain, this literature suggests that the percentage of subsidized companies involved in this type of agreement is higher than unsubsidized companies (Afcha, 2011; Busom & Fernández-Ribas, 2008). Furthermore, the receiving of public support enables companies somehow to prove financial viability, and quality of scientific and technical R&D activities of the companies. It reduces uncertainty and helps to correct information asymmetries that hinder the company access to external financing and marketing of its products in the technology market (Hall & Lerner, 2010).

Its main contribution lies, therefore, in complementing existing evaluation studies regarding additional financial R&D subsidies, with relevant information on R&D type generated from the grant receiving. Thus, the analysis of the composition of R&D expenditure presented in this article, involves a more qualitative examination. It allows an advance in the understanding of mechanisms that underlie the improvements of innovative results of subsidized companies.

To analyze this effect, we propose the use of a Multinomial Logit Model that allows exploring the decisions made by the company in accordance with the allocation of R&D resources. This model will allow assessing the influence of different types of public funding on decisions regarding internal – external R&D expenditure. Also, it will allow assessing both types: R&D expenditure as well as not expenditure at all on R&D.

2. Literature review

Economic literature identifies several arguments to explain why companies conduct internal and external R&D activities. At the theoretical level, the theory of transaction costs (Coase, 1937; Williamson, 1989) argues that outsourcing R&D activities makes sense, if and only if, the assumption of such activities minimizes the number of transactions necessary to reach R&D investment planned by the company. This condition implies that the acquisition of external knowledge will only take place if there is a complementary resource base and a high level of specificity between the contracting company and the contractor in order to facilitate the transfer of knowledge.

Supported by this theoretical perspective, Audretsch et al. (1996) analyzed the choice between domestic and foreign R&D investment in the Manufacturing sector. Their results indicate that external knowledge acquisition is more likely in those companies that have a higher level of specific assets for the acquisition and assimilation of foreign technology (measured by the level of human capital formation). Additionally, their findings highlight the importance of technological opportunities in the acquisition of external knowledge, finding that both types of R&D (internal and external) are complementary in the case of industrial sectors with high-technology intensity and, they also tend to be substitutes in low-technology sectors.

The findings of Arora and Gambardella (1990, 1994) for the biotechnology sector, coincide with those in Audretsch et al. (1996) and with other empirical studies (Watkins & Paff, 2009) when pointing out that the complement of internal and external R&D activities occurs especially in sectors characterized by complexity and rapid technological change and shows that in such sectors, the learning effect generated by conducting internal R&D plays a decisive role in the assimilation of information provided by outside sources.

In the same approach, Martín de Castro et al. (2009) analyzed for the case of the biotechnology industry in Spain, the importance of reputation in the formation of strategic alliances. Their results confirm, in a way, the importance of internal capacity of the company to absorb external knowledge that involves the creation of alliances with other companies. Specifically, the authors include variables such as innovation and the ability to keep talented staff, as key elements to establish successful cooperation agreements with other companies.

The absorptive capacity hypothesis raised by Cohen and Levinthal (1989) has been accepted frequently to explain how the effort or intensity of internal R&D expenditure positively influences the use of external knowledge sources. This influence appears to be conditioned to the type of partner when establishing external relations, in the case of cooperation agreements (Belderbos et al., 2004; Fritsch & Lukas, 2001) as well as the number of external relations established by companies and the type of external relations (outsourcing or partnership). Dhont-Peltrault and Pfister (2011) conclude that companies that highly support R&D are increasingly turning to outsourcing, as a way to reduce transaction costs. And those external relations are more frequent when the company uses more generic or standardized technology in its production process.