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A comparative evaluation of regional subsidies for collaborative and individual R&D in small and medium-sized enterprises

Annalisa Caloffi^{a,e,*}, Marco Mariani^b, Federica Rossi^{c,e}, Margherita Russo^{d,e}

^a Department of Economics and Management, University of Florence, Italy

^b Regional Institute for Economic Planning of Tuscany, IRPET, Italy

^c School of Business, Economics and Informatics, Birkbeck, University of London, United Kingdom

^d Department of Economics, University of Modena and Reggio Emilia, Italy

^e Centre for the Analysis of Public Policies – CAPP, University of Modena and Reggio Emilia, Italy

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ABSTRACT

We analyse whether public subsidies supporting collaborative research and development (R&D) projects in small and medium-sized enterprises (SMEs) are able to encourage persistent R&D investment and interorganisational networking more than subsidies supporting individual R&D projects. Adopting a counterfactual approach to policy evaluation, we compare subsidies for collaborative R&D and for individual R&D implemented in the same Italian region in the same period. Our findings suggest that, once public support is no longer available, the two subsidies have different effects on different types of SMEs. If the policymakers' objective is to increase the number of R&D-performing SMEs over time, they should provide subsidies for collaborative R&D to firms with modest R&D experience. If their objective is to increase the amount of spontaneous R&D investment over time, they should target SMEs with some prior R&D experience, using either subsidy. Finally, if their objective is to induce SMEs to network with external organisations, subsidies for collaborative R&D projects should be preferred to subsidies for individual R&D projects.

1. Introduction

Innovation policies often target small and medium-sized enterprises (SMEs), many of which lack adequate financial or human resources to undertake research and development (R&D) activities (Vossen, 1998; Peneder, 2008; Ortega-Argilés et al., 2009). In countries with multi-level policy frameworks, such policies are more likely to be implemented at the regional level (Blanes and Busom, 2004), where interventions often pursue local development objectives. As a consequence, many regional innovation policies aim not only to support the R&D efforts of the most dynamic SMEs, but also to expand the range of SMEs that perform some amount of R&D. This dual objective is typical of lagging economies as well as of more advanced ones: even in the latter, in fact, many SMEs do not innovate at all and, among those that do, many engage in forms of innovation that are not necessarily based on R&D (Som 2012).

Policymakers can pursue the dual objective to support dynamic SMEs' R&D efforts and encourage more SMEs to take up R&D activities through different policy instruments, including subsidies, tax-credits, loans or consultancies. We focus on subsidies and, in particular, on two distinct approaches to delivering them. On the one hand, policymakers

can provide SMEs with subsidies for individual R&D projects, in order to overcome the financial hurdles that prevent them from engaging in R&D activities or limit the amount of their R&D investment. Until recently, this is by far the most common approach. On the other hand, policymakers can grant subsidies to SMEs that perform collaborative R&D projects with external organisations (such as universities, public bodies, other firms or others), a more complex form of support that mixes financial and behavioural incentives. Besides providing financial support, these policies stimulate SMEs to internalise spillovers, pool resources and share costs (Hagedoorn et al., 2000). By encouraging collaboration, policymakers aim to address network failures that can occur whenever firms' lack of linkages with other organisations leads to an insufficient development of complementarities, learning processes, and creation of new ideas, or when firms are trapped in relational and knowledge lock-ins (Carlsson and Jacobsson, 1997; Hagedoorn et al., 2000; Hekkert and Negro, 2009). This can be particularly important for SMEs, which are often constrained by limited internal resources (Nooteboom, 1994).

R&D collaboration policies have gained popularity in recent years (Metcalfé and Georghiou, 1997; Rahm et al., 2000). However, despite their growing international diffusion, there is still little empirical

* Corresponding author at: Department of Economics and Management, University of Florence, via delle Pandette, 32, 50127 Florence, Italy.

E-mail addresses: annalisa.caloffi@unipd.it (A. Caloffi), marco.mariani@irpet.it (M. Mariani), f.rossi@bbk.ac.uk (F. Rossi), margherita.russo@unimore.it (M. Russo).

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evidence regarding their ability to support R&D and networking both in absolute terms and compared with other more established approaches, such as subsidies to individual R&D.

Several recent studies comparing the effects of different R&D policies have either contrasted policies implemented at different government levels (Marzucchi and Montresor, 2015; Huergo and Moreno, 2017), or compared R&D subsidies and R&D tax-credits (Hægeland and Møen, 2007; Busom et al., 2014; Garza et al., 2015). To the best of our knowledge, a comparative evaluation of subsidies for individual and collaborative R&D projects has not yet been performed.

Focusing on SME innovation policy, our contribution aims to address this gap and to stimulate further debate on the topic. In particular, we analyse whether subsidies for SMEs to perform collaborative R&D projects are more or less able than subsidies for SMEs' individual R&D projects to stimulate R&D and networking effects after the subsidised project is completed. The term 'R&D effects' refers to the increase in R&D investment induced by the receipt of public aid (David and Hall, 2000). From a social viewpoint, this can be achieved both through an increase in R&D investment by all firms, including those that were already R&D performers, and through an increase in the number of R&D performers (González et al., 2005; Arqué-Castells and Mohnen, 2015; Garza et al., 2015). In what follows we will consider both aspects. The network effects – which is part of the broader notion of behavioural additionality (Buisseret et al., 1995; Autio et al., 2008) – refers to the increase in collaborations with external organisations induced by the receipt of public aid (Georghiu and Clarysse, 2006; Falk, 2007; Busom and Fernández-Ribas, 2008).

A striking result emerging from the previous literature is that individual R&D subsidies can support networking (Busom and Fernández-Ribas, 2008; Antonioli et al., 2014). Therefore, one might wonder whether subsidies for collaborative R&D are really needed to boost firms' networking propensity, or whether individual R&D subsidies may be sufficient for this purpose. Our study can potentially contribute to improving policy design besides advancing general knowledge of comparative policy effects.

The paper is organised as follows. In Section 2 we put forward an interpretative framework to guide us in the analysis of the comparative effects of the two policies. Section 3 describes in some detail the empirical object of the analysis: two different policy interventions – one being a subsidy for collaborative R&D projects and the other a subsidy for individual R&D projects. Both interventions were implemented in the same region (Tuscany, Italy), in the same programming period (2000–2006), by the same public authority (the regional government), and targeted the same types of beneficiaries (SMEs). Section 4 presents data and variables, and Section 5 explains our empirical strategy, which uses a matching approach applied to the case of multiple treatments, as proposed by Lechner (2002a, 2002b). So far, this approach has not been adopted in relation to enterprise and innovation policies. Sections 6 and 7 present and discuss the results. Finally, Section 8 concludes with policy implications and proposed avenues for further research.

2. Interpretative framework and resulting hypotheses

It has been argued that R&D subsidies can increase aggregate R&D in two (non mutually exclusive) ways: they can increase the number of firms performing R&D (extensive margin) or the R&D investment made by any firm (intensive margin) (González et al., 2005; Arqué-Castells and Mohnen, 2015; Garza et al., 2015). Arqué-Castells and Mohnen (2015) suggest that R&D subsidies can stimulate the increase in R&D over one or the other margin depending on their size. Subsidies that are large enough to cover the cost of initiating R&D activities (i.e. the entry threshold, which is rather high due to the presence of sunk costs) can affect the extensive margin, while subsidies above the continuation threshold – which is lower than the entry threshold – can affect the intensive margin.

Other contributions suggest that different types of policy instruments have different effects on R&D increases over the intensive or the extensive margin. Comparisons between R&D tax-credits and individual subsidies (Busom et al., 2014; Garza et al., 2015) find that, because of their greater simplicity and flexibility, tax-credits are better able to increase R&D investment on the part of R&D-performing firms that do not suffer from serious financing constraints and, therefore, would not need to receive the aid in advance. Instead, subsidies are more attractive for financially-constrained firms such as SMEs and suited to encourage both R&D entry and higher R&D investment.

What type of subsidy – to individual or collaborative R&D projects – works better remains an open question, especially if we are interested in assessing the effectiveness of such subsidies with respect to their legacy effects (Roper and Hewitt-Dundas, 2014). In our study, we investigate the effects of the programmes on firms' later R&D behaviour, in a time where public aid is no longer available. At this time, the main effect that can be investigated is R&D persistence: the extent to which firms that received the subsidy continue to perform R&D. In this context, the definition of extensive and intensive margin put forward by the previous literature needs to be adjusted: one might view persistence effects as a matter of higher probability of performing R&D (extensive margin), or as a matter of higher R&D investment (intensive margin) during the unsubsidised follow-up period. As we will explain in what follows, this distinction is relevant because we argue that the two policies we focus on can have different effects on the different margins.

There are a number of reasons for focusing on R&D persistence, particularly when analysing SMEs. It is known that SMEs tend to carry out, if any, informal R&D activities (Kleinknecht and Reijnen, 1991), often in an intermittent and semi-structured way (Rammer et al., 2009). This approach limits the accumulation of internal R&D skills over time, increasing SMEs' dependence on the inflows of external knowledge and know-how, which are subject to search, screening and other transaction costs (Fontana et al., 2006), and may ultimately result in discontinuous R&D practice (Rammer et al., 2009). The presence of persistence effects suggests that a policy has been able to encourage SMEs to engage in R&D more continuously, independently from future subsidisation programmes. As argued by Klette and Møen (2012), positive effects may be expected to arise after a time lag has passed due to the fact that the implementation of the subsidised project can induce learning-by-doing in R&D activities, and thus change the firms' future profit opportunities in favour of more R&D-intensive products.

2.1. Effects on R&D

Both in the case of policies supporting collaborative R&D projects and of those supporting individual R&D projects, the subsidy may help SMEs carry out R&D activities and learn from the project. Thanks to experiential learning processes, employees and managers can develop new or improved skills and increase their capacity to interpret different aspects of the creative process, which can drive change in company routines (Cyert and March, 1963; Clarysse et al., 2009). Moreover, during the project's development, the firm can build or acquire some innovation infrastructures or equipment, which can be used in future innovation projects. Once the subsidised project is over, new and improved knowledge, skills, capabilities, routines, and, possibly, equipment and infrastructures, improve the value of the firm's future innovation projects and therefore can increase the probability that it will continue to invest in R&D with its own funds (Clarysse et al., 2009; Roper and Hewitt-Dundas, 2014). The increase in absorptive capacity that results from new and improved skills can strengthen this effect (Cohen and Levinthal, 1989). As investing in R&D has become less costly, the SME can even decide to increase the amount invested. However, the effect on the amount invested is more uncertain because, for example, there could be an "optimal" project dimension that the SME, even for organizational or cognitive reasons, can manage (Bocci and Mariani, 2015).

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