



# The effect of public R&D subsidies on firms' competitiveness: Regional and sectoral specifics in emerging innovation systems

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## ABSTRACT

This article examines regional and sectoral impacts of R&D subsidies on firms in Czechia during the period 2007–2014. Driven by still-developing innovation policies where regional innovation systems are emerging, R&D support plays an important role for activating regional potential. To explore this we employed a geographical perspective and a combination of two counterfactual approaches. Our results revealed that R&D support has a higher net effect on companies operating in regions with lower R&D intensity. In the most advanced regions, the differences in effects between supported and unsupported entities are very small and targeted support no longer plays such a significant role. In contrast, indirect tax support associated with innovation activity is applied much more often. Furthermore, our case study in the South Moravian Region revealed that the impact of R&D support is changing over time and reflects from economic cycles. It has been confirmed that direct R&D support in this advanced regional innovation system is associated negatively with firms' competitiveness.

## 1. Introduction

Public support to R&D collaborative projects belongs among standard policy tools to enhance firm-university or firm-firm linkages and spur innovativeness and competitiveness. In traditional economic literature, the normative reason for direct R&D support is a market failure (Hall & Lerner, 2010). A more geographical perspective, and particularly a 'regional innovation system' approach, goes beyond the traditional notion of market failure and emphasizes a 'system failure' approach (Tödtling & Trippl, 2005).

Although there are many partial empirical results in the literature on the effects and impact of R&D support in firms, the results are not unambiguous. Attention is often focused on the effects of R&D investment (David, Hall, & Toole, 2000; Acemoglu, Akcigit, Bloom, & Kerr, 2013), the growth of firms or their potential to obtain external resources (Lerner, 2000). The bulk of studies shows the positive and stimulating effects of R&D on the performance and competitiveness of firms (Brander, Egan, & Hellmann, 2008; Branstetter & Sakakibara, 1998; Klette & Møen, 1999). Sometimes effects are analyzed specifically in times of crisis (Hud & Hussinger 2014), but generally, effects are observed in the context of the whole economy. The diversity of results is influenced by various methodological approaches and data availability, but most studies have a purely economic and econometric character. The geographic perspective is neglected (except for geographic work such as Broekel, 2012, 2015a, 2015b) and we would like to fill this gap.

Since "one size does not fit all" (Tödtling & Trippl, 2005) and regions have a different economic structure that is more or less transformed, we may assume different regional impacts within R&D effects. In other words, we may expect that the real possibilities and the personnel and knowledge capacities of the regions are differently limited and therefore the R&D support effects will be regionally differentiated. The purpose of this article is therefore to highlight the regional policy implications of the R&D policy, which are still largely unspecified. For this purpose, we worked with individual sets of corporate microdata for the period 2007–2014. This allowed us to monitor the impact of support over time to contribute to existing scholarly work.

The paper has aims to systematically analyze the support of R&D in a dynamically transforming economy in Central Europe, in which innovation policies and regional innovation systems are being formed. There are several reasons for trying to do so. First, similar in-depth analyses of Central European countries are still lacking, although these are very dynamically developing countries in which the specifics of R&D support play an important role for activating innovation potential. Second, high dependency on foreign capital, geographically differentiated changes in the structure of regional economies, and a gradually increasing number of firms with their own research and development offer a unique opportunity for research. A number of companies have been integrated into the global economy in a very disadvantageous position within global production chains/networks (GPN) (Pavlínek & Ženka, 2011), but future competitiveness will not rely on low-cost labor

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production and the role of R&D support is increasing. Significant challenges are associated with the potential shifts in GPN and the upgrading effect, which can be supported by R&D subsidies, particularly functional and intersectoral upgrading (for more see [Humphrey & Schmitz, 2004](#)). This is a policy that undoubtedly has regionally uneven effects, and no work has been done to our knowledge to evaluate companies' microdata from a regional point of view, and the econometric work to date remains largely at the national level.

Therefore, this paper aims to evaluate the regional and sectoral impacts and effects of targeted R&D support on firms in Czechia during the period 2007–2014. The article will reveal the answers to the following research questions:

- To what extent can regularities be found between effects of R&D subsidies and the innovative maturity of regions?
- For which sectors does R&D support give the highest effect?
- How do the effects of R&D support differ over time in supported firms compared to a control group?

We employ a geographical perspective and a combination of two modern counterfactual approaches to address the above-mentioned research questions. More specifically we employ 'difference in differences' (DiD) and 'propensity score matching' (PSM) approaches, which bring representative results and reveal spatially uneven effects of R&D subsidies on firm performance and competitiveness.

The paper is structured as follows. Firstly, conceptual starting points and discussion of existing empirical work on effects and impacts of R&D support from different perspectives are presented. Next, the formulation of innovative policies and regional innovation systems in Czechia is specifically described, since this provides an important contextual framework in which it is necessary to implement the results of this analysis. The empirical part first focuses on the regional differentiation of R&D support from the point of view of corporate performance and competitiveness; then, the results of sectoral analyses are presented; and in the last part, the focus is specifically on the South Moravian Region, whose regional innovation system is most developed in Czechia. Finally, since the results of the regional impacts revealed a different effect of support in the region, necessitating an in-depth analysis of the region, that analysis is presented.

### 1.1. Importance of R&D subsidy for firm and regional competitiveness

Publicly supported R&D projects represent an important type of incentive for innovation and economic growth ([Romer, 1990](#)). Although R&D objectives and projects may vary, the main and common feature is the effort to strengthen corporate competitiveness and thereby to increase regional and national competitiveness indirectly, including associated spillover effects ([Czarnitzki, Ebersberger, & Fier, 2007](#)).

The national innovation system frames and creates an institutional context and tools to support innovation activities ([Freeman, 1995](#); [Lundvall, 1992](#)). The innovation performance of firms is conditioned by a number of mechanisms and factors that can vary from country to country ([Lorenz & Lundvall, 2006](#)). R&D support is mostly coordinated at the national level but has strong regional impacts. In general, there are many forms of R&D support and the degree of their intensity varies from country to country ([European Commission, 2014](#)). Economist J. Stiglitz (1986), the European Economic and Social Committee and others define the occurrences of market failure as being due to the following 'macroeconomic' reasons: (1) Imperfect competition (2) Imperfect information (3) Externalities (4) Public goods. The non-macro-economic reasons could be named as (5) Private dis-motivation to conduct R&D and (6) High-risk investment profile ([Akerlof, 1970](#); [Arrow & Debreu, 1954](#)).

It is also necessary to mention the latest solution to market failure: indirect R&D support in the form of tax forgiveness based on R&D

projects reported by companies. In current discourse, it has been mostly [Tödting and Trippel \(2005\)](#) who offered convincing arguments justifying such a policy of intervention beyond the traditional notion of market failure. The substance of policy according to these distinguished authors should be to promote the functioning of the system (Regional Innovation System) and strengthen knowledge exchanges between actors in the economy.

### 1.2. Assessment of R&D activities

With the evolution of innovation systems and an increasing amount of public funding that directly or indirectly support R&D activities, there is also increasing interest in assessing the effects and effectiveness of such instruments. R&D effects are most often measured in relation to corporate R&D investments and specifically crowding out effects ([Audretsch, Link, & Scott, 2002](#); [Görg & Strobl, 2007](#); [Zúñiga-Vicente, Alonso-Borrego, Forcadell, & Galan, 2014](#)), patent activities ([Czarnitzki & Hussinger, 2004](#); [Czarnitzki et al., 2007](#)), corporate competitiveness ([Branstetter & Sakakibara, 1998](#)), or access to other external resources ([Hall & Lerner, 2010](#); [Meuleman & De Maeseneire, 2012](#)). Another influence on R&D subsidies of corporate and regional competitiveness has been research subject, which were described by [Hud & Hussinger, 2014](#). The crisis years were investigated regarding the crowding out of R&D subsidies. They suggested that "the counter-cyclical innovation policy of the German government is likely to have a stabilizing effect on innovation investment behavior" ([Hud & Hussinger, 2014](#), p. 1848). A major problem in terms of R&D investment was the economic crisis for SMEs, which had to face ups and downs in finances ([Archibugi & Filippetti, 2011](#); [Czarnitzki & Hottenrott, 2011](#); [Paunov, 2012](#)).

The results of scholarly works can not be considered final as a number of contradictory findings can be identified. Not only does this lead us to believe that R&D policy and support effects should be evaluated at the regional level, but, at the same time, it seems inappropriate to compare regional results to national, as national and regional innovation systems are affected differently by a number of specific factors and mechanisms in the regions at different stages of development and by the effects of R&D support.

### 1.3. The regional dimension of R&D activities

The innovation process at the company level is influenced, among other things, by regional specifics and the developmental level of the regional innovation system ([Cooke, Uranga, & Etzebarria, 1997](#)). The assessment of the regional dimension of R&D activities and support is less frequent in the literature than overall economic analyses assessing the effects of the whole innovation system. When the regional dimension is considered, most attention is focused on regional cooperation and various aspects of innovation performance in the regions, and the results of qualitative and quantitative evaluations are inconclusive ([Fritsch, 2004](#); [Ibrahim, Fallah, & Reilly, 2009](#)). For example, [Broekel \(2015a\)](#) focused on the regional perspective of R&D in the example of Germany when he evaluated the subsidies for R&D cooperation and its effects in regions with different innovation capacities, and explored various effects on the innovation efficiency of regions. [Broekel \(2015b\)](#) further revealed an inverted u-shape regarding regional innovation performance and the intensity of cooperation. In other words, it seems that "regional and inter-regional biased cooperation" will be negative for innovation performance ([Broekel, 2012, 2015b](#)). Regional R&D activities of foreign-invested enterprises in China identified [Wei, Zhou, Sun, and Lin \(2012\)](#) and emphasized limited local embeddedness with technological, institutional, spatial, and structural mismatches.

Furthermore, [Czarnitzki and Hottenrott \(2009\)](#) assessed the local milieu/regional characteristics' and its/their influence on innovation success in firms (firm performance). Patent activity has been a frequently pursued result in regional analyses. This is important in developed countries, but in the case of regions with a less developed

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