



# R&D offshoring and the productivity growth of European regions

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## ABSTRACT

The recent increase in R&D offshoring has raised fears that knowledge and competitiveness in advanced countries may be at risk of 'hollowing out'. At the same time, economic research has stressed that this process is also likely to allow some reverse technology transfer and foster growth at home. This paper addresses this issue by investigating the extent to which R&D offshoring is associated with productivity dynamics of European regions.

We find that offshoring regions have higher productivity growth, but this positive effect fades with the number of investment projects carried out abroad. A large and positive correlation emerges between the extent of R&D offshoring and the home region productivity growth, supporting the idea that carrying out R&D abroad strengthens European competitiveness.

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## 1. Introduction

Research and Development (R&D), together with other core business activities, is usually centralized at the firms' headquarters in the home country (Patel and Pavitt, 1991; Narula, 2002; Belderbos et al., 2011), but recent decades have documented an increase in the internationalization of R&D and inventive activities (Guellec and van Pottelsberghe de la Potterie, 2001; Picci, 2010). This was at first mainly motivated by the need to better exploit existing home-based advantages (i.e. by adapting existing products to foreign markets needs), while more recently the need to source complementary assets, talents and competences abroad has also become an important motive.<sup>1</sup>

The trend towards offshoring R&D activities<sup>2</sup> has raised concerns that the knowledge base of advanced countries may be 'hollowed out', worsening their relative international competitiveness.<sup>3</sup> At the same time, economic research has highlighted the potential benefits of offshoring R&D in terms of reverse technology transfer and increased competitiveness at home. However, while there are works investigating the impact of R&D offshoring both on the innovative and productive performance at the level of the firm, evidence of the overall impact of this phenomenon on the home economy is still scarce and inconclusive. This lack of evidence is particularly unfortunate from the policy perspective, since an informed policy intervention needs to

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<sup>1</sup> See for example, Cantwell (1995), Kuemmerle (1999), Patel and Vega (1999), von Zedtwitz and Gassmann (2002), Le Bas and Sierra (2002), Narula and Zanfei (2005), Manning et al. (2008), Dunning and Lundan (2009), Ambos and Ambos (2011).

<sup>2</sup> [R&D] Offshoring is defined as the location or transfer of [R&D] activities abroad. It can be done internally by moving services from a parent company to its foreign affiliates – sometimes referred to as 'captive' or 'in-house' offshoring – or to third (unrelated) parties – referred to as international outsourcing – (UNCTAD, 2006). The empirical analysis carried out in this work will refer to 'captive' R&D offshoring only. This offshoring of R&D activities is related to the emerging phenomenon of Global Innovation Networks (GINs) (Ernst, 2002, 2012; Chaminade, 2009).

<sup>3</sup> See, for example, Lieberman (2004) for the US, and Kirkegaard (2005) or Pro Inno Europe (2007) for Europe.

evaluate both the firm-level effects and their interactions at a more aggregate level.

This work contributes to filling this gap by assessing to what extent the productivity growth of 262 regions in Europe is associated with offshoring of R&D activities by domestic multinational enterprises (MNEs) based in the same regions. The focus on regional productivity allows us to capture not only the direct effect of R&D offshoring on firms' competitiveness, but also the effect through the growth in size of offshoring firms (i.e. through market shares reallocation) and the indirect effect via increase/decrease in local firms' productivity and propensity to enter/exit the market ('spillover' effect).<sup>4</sup> The relationship between R&D offshoring and regional productivity is particularly relevant in the European Union (EU) where regional competitiveness and social and economic cohesion have been crucial concerns for policy makers.<sup>5</sup>

In order to investigate to what extent offshoring of R&D is associated with regional productivity growth, we gather data on international investment projects and we use these to build unique measures of outward investments in R&D at the regional level for the countries of the European Union. We then estimate regressions of productivity growth as a function of the lagged number of international R&D investments, controlling for a measure of incoming multinational activity, as well as other regional characteristics and country fixed effects. We find that offshoring regions have higher productivity growth, and a positive correlation emerges between the extent of R&D offshoring and the home region productivity growth.

The contribution of this work is threefold. First, to the best of our knowledge, it is the first large sample empirical investigation into the role of R&D offshoring on home region performance, and, thus is a first attempt to provide robust empirical evidence to the broad question of whether R&D offshoring is ultimately positively or negatively associated with the growth prospects of territories within advanced economies. Second, given the availability of measures of outgoing and incoming international investments, we are able to look at the effect of R&D offshoring taking into account the extent to which each region is also attracting incoming multinational activity, thus overcoming another major gap in the literature, which has mainly looked either at the outward or at the inward internationalisation separately. Third, combining the information on the sector and destination country in which the R&D offshoring has taken place, we are able to uncover interesting insights on the possible mechanisms through which R&D offshoring affects productivity at home.

The rest of the paper is organized as follows: [Section 2](#) presents the theoretical and empirical background of this paper; [Section 3](#) provides details on the characteristics of the data and focuses on how the main variables of interest have been measured and built; [Section 4](#) illustrates the econometric specification and results. [Section 5](#) concludes the paper.

## 2. R&D offshoring and regional productivity growth: theoretical and empirical framework

The increasing propensity towards geographical fragmentation of firm activities, especially of high-value added tasks, raises concerns on the impact that offshoring activities may have on competitiveness and employment at home. Despite a widespread fear,

especially among policy makers, that offshoring may cause loss of jobs and 'hollowing-out' of local competences (Lieberman, 2004), economic research has not reached a consensus (Bardhan, 2006). As a matter of fact, several studies find a positive relationship between the internationalization of high-value added activities and the degree of innovation and productivity at home. For example, Criscuolo et al. (2005) and Criscuolo (2009), using data on patent citations, show the existence of a reverse technology transfer to European firms, while Piscitello and Santangelo (2010) and D'Agostino et al. (2012) support the hypothesis that the patenting activity of OECD countries and regions benefitted from offshored R&D activities in emerging economies (BRICKST). Using firm-level data, from the Spanish Technological Innovation Panel, Nieto and Rodriguez (2011) find a positive relationship between offshoring and innovation, with a greater effect on product than process innovations, and through captive offshoring than offshore outsourcing.<sup>6</sup>

Our study relates to these empirical works, and assesses the relationship between R&D offshoring of EU firms and the productivity growth of their home region. But why (and how) does offshoring of R&D affect regional productivity? As noted (among others) by Bartelsman and Doms (2000), aggregate productivity dynamics can be decomposed into changes in productivity at the level of the firm (the within-component of productivity growth) and reallocation of resources across incumbents and through entry and exit (the between-component). In this perspective, our theory should explain both the effect of R&D offshoring on individual firms' productivity, and on their relative size and probability to entry/exit. This makes it very difficult to offer clear-cut predictions, and even harder to test the precise underlying mechanisms, especially given the lack of micro data on individual firm productivity and size within each region. Nonetheless, it is important to lay out the various channels through which R&D offshoring may contribute to the home regions' productivity growth, before assessing its net effect by means of an econometric exercise.

The economics and management literature on R&D offshoring has mainly focused on the effects at the level of the firm (i.e., the within-component), highlighting the positive role that R&D offshoring may have on firms' productivity through different channels. For example, R&D labs abroad are required to be able to quickly and effectively adapt products to the needs and specificities of new markets.<sup>7</sup> Also, the need for enhancing innovation capability leads firms to engage in competence-creating activities (Cantwell and Mudambi, 2005) and interaction with different and geographically dispersed actors (Hitt et al., 1997; Narula and Zanfei, 2005). Moreover, R&D offshoring is necessary to gain access to strategic complementary assets (Teece, 1986), as well as highly qualified and/or lower cost R&D personnel (Manning et al., 2008; Chung and Yeaple, 2008; Puga and Trefler, 2010).

However, R&D offshoring is not a sufficient condition for the increase of knowledge and productivity at home. First, offshored labs need to be able to extract knowledge from foreign locations, thus it may need time and investments to establish relationships with actors in the host innovation system (Narula and Michel, 2009). Second, the firm must be able to manage reverse knowledge transfers (from the offshored labs back to the headquarters

<sup>4</sup> Unfortunately, due to the lack of disaggregated data we cannot evaluate the relative contribution of these different channels, but we can measure the overall net effect on the aggregate productivity.

<sup>5</sup> As documented by Fiaschi et al. (2009), 35% of the EU budget for the period 2007–2013 has been allocated to promote social and economic cohesion among the regions of its member states.

<sup>6</sup> Similar results can be found in the Pro Inno Europe (2007) report, which is based on a survey conducted on a sample of 158 EU companies. According to the answers provided by the R&D managers, the benefits from R&D offshoring were magnified by the co-occurrence of other factors, such as the ability to choose successful R&D projects, the length of time it took to commercialize the innovative idea, the cost efficiency of innovation processes and, finally, the ability to learn from the R&D conducted by other firms.

<sup>7</sup> Eventually, innovation developed for the local markets may be decontextualized, becoming part of the knowledge base of the multinational firms, subsequently exploited elsewhere (Zanfei, 2000; Castellani and Zanfei, 2006).

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