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## Research paper

# The role of collaborative networks in supporting the innovation performances of lagging-behind European regions

Ivan De Noni<sup>c</sup>, Luigi Orsi<sup>a,\*</sup>, Fiorenza Belussi<sup>b</sup><sup>a</sup> University of Milan, Department of Environmental Science and Policy, Via Celoria 2, 20133 Milano, Italy<sup>b</sup> University of Padua, Department of Economics and Management, Via del Santo 33, 35123 Padova, Italy<sup>c</sup> University of Milan, Department of Economics, Management and Quantitative Methods, Via Conservatorio 7, 20122 Milano, Italy

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## ABSTRACT

In rapidly changing regional economies, less innovative European regions (henceforth referred to as lagging-behind regions) must actively work to reduce the gap between them and knowledge-intensive regions. Recent literature has stressed that the lack of efficient institutional settings reduces the opportunities of local knowledge spillover and increases the need for local organisations to exploit collaborative networks to better support their innovation performance. In this light, since increasing attention has recently been directed at the role of inter-regional collaborations, we have measured the capacity of local innovative organisations embedded in lagging-behind European regions to develop internal and external regional inventors' networks by exploring their collaborative patenting processes. Then, a seven-year panel dataset (2002–2008) was organised using patents data at a regional level to validate the research hypothesis that collaborations, and specifically with highly innovative (knowledge-intensive) regions, positively affect the innovation performances of lagging-behind regions. Finally, the implications of EU policies for supporting lagging-behind regions are discussed.

## 1. Introduction

Over the last decade, many European Union (EU) cohesion programmes have pursued ambitious research and development (R&D) policies with the aim of fostering innovation growth in the peripheral regions of Europe. Traditionally, the European Commission distinguishes core and peripheral regions focusing on productivity performance (Schürmann and Talaat, 2000) in order to identify the regions needing support (Morgan, 2007; Puga, 2002). However, a number of studies apply different classifications (Tödtling and Trippl, 2005; Trippl et al., 2016). According to several studies looking at innovation performance and disparities to capture the diversity of regional innovation systems (Crescenzi et al., 2007; Navarro et al., 2009), we firstly identify lagging-behind and knowledge-intensive regions as based on innovation and patenting activities (Hajek et al., 2014). Then, we specifically investigate the role that collaborative inventors' networks, promoted by local innovative organisations, play in improving the innovation performance of less innovative regions. According to Asheim et al. (2011), in fact, the participation in collaborative networks not only enables organisations to enhance firm-internal knowledge creation processes, but influences the innovation capacity of the entire region by providing fast access to specific knowledge components, supplying localised

actors, and increasing the opportunities of knowledge spillovers. However, the literature extensively claims that knowledge spillover tends to be spatially bounded (Bottazzi and Peri, 2003) and depends on the region-specific institutional framework in which the organisations are embedded (Asheim and Gertler, 2005; Cooke, 2001; Tödtling et al., 2013). This suggests that the knowledge-intensive regions are inclined to better support local knowledge spillovers than lagging-behind regions, thanks to the larger availability of resources and services supporting innovation processes and information exchanges (Tödtling and Trippl, 2005). Moreover, when regional capacity to sustain local knowledge spillovers is limited, organisations need to promote knowledge exchange and access external knowledge by collaborations, international partnerships and alliances, or other forms of global networking (Grillitsch and Nilsson, 2015). Thus, in order to compensate for the lack of local knowledge spillovers (Grillitsch and Nilsson, 2015), collaboration networks in lagging-behind regions are expected to enable the exchange and transfer of knowledge, foster the interactive learning process, create organisational proximity, and increase the opportunities to complement and combine knowledge available regionally with knowledge acquired from extra-regional sources (Asheim and Coenen, 2006; Cantner et al., 2010; Fitjar and Rodríguez-Pose, 2011; Tödtling et al., 2012; Trippl, 2011).

\* Corresponding author.

E-mail addresses: [ivan.denoni@unimi.it](mailto:ivan.denoni@unimi.it) (I. De Noni), [luigi.orsi@unimi.it](mailto:luigi.orsi@unimi.it) (L. Orsi), [fiorenza.belussi@unipd.it](mailto:fiorenza.belussi@unipd.it) (F. Belussi).<http://dx.doi.org/10.1016/j.respol.2017.09.006>Received 9 August 2016; Received in revised form 13 September 2017; Accepted 14 September 2017  
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Based on such a framework, this study aims to explore to what extent the innovation performance of lagging-behind regions positively depends on the capacity of innovative organisations embedded in lagging-behind regions (OELRs) and engaged in knowledge-production processes to activate collaborative inventors' networks with external and knowledge-intensive regions. Therefore, the paper contributes to an enriched understanding of the interplay between collaboration networks, inter-regional knowledge flows, and regional innovation performance.

In order to investigate this issue, we apply a fixed effects regression model on a 7-year longitudinal dataset of 205 European regions. The OECD RegPat database is used for measuring both the networking capacity of OELRs as co-patenting activities from 2002 to 2008, and the innovation performance of lagging-behind regions as the 3-year lagged cumulative number of patents. Data from Eurostat are further collected to define the control variables more widely assumed by the literature on innovation.

Our findings are threefold. First, the innovation performance of the less innovative regions does not depend on the average size of inventors' networks (internal and external to the region) developed by local organisations. Second, the more the OELRs' collaborative networks are extended outside the region, the higher the level of regional innovation. Third, the more the OELRs' collaborative networks involve inventors from knowledge-intensive regions, the more innovative the lagging-behind region. This suggests that the quality and openness of collaborative networking are likely to be more important than network size.

The structure of the paper is as follows. The next section is devoted to the background literature and hypotheses building. We define and justify the main hypotheses linking regional innovation performance and collaboration networks in lagging-behind regions. In section 3, we address the methodology and, in the successive section, the main results are presented. Section 5 is devoted to discussing the results and implications for European regional innovation and cooperation policies. The last section is devoted to summarising the main conclusions, including some limitations.

## 2. Theory and hypotheses

The literature shows considerable evidence that the production of scientific and technological knowledge is increasingly considered a collective knowledge-driven process (Crescenzi et al., 2016), wherein knowledge is shared among a community of inventors who are often employed by organisations with competing intellectual property interests (Powell and Giannella, 2010), and wherein actors collaborate to combine organisation-internal and organisation-external knowledge.

The literature on inter-organisational knowledge transfer and knowledge spillovers has identified various formal and informal mechanisms for stimulating knowledge exchange and flows across organisations and regions. The former mainly involves joint research, licensing, acquisition of patents and consulting, the latter differently refers to social networks and non-contractual interactions (Cantner et al., 2010; Grimpe and Hussinger, 2013). The mixed mechanisms of knowledge spillover are labour mobility (Breschi and Lissoni, 2009) and spin-offs (Ponds et al., 2010), which could be both spontaneously developed or strategically encouraged. Each of these mechanisms enables organisations to access various external knowledge sources, increasing the opportunities for knowledge exchange, transfer and sharing, fostering knowledge spillovers and enhancing innovation performance at the organisational and regional levels (Asheim et al., 2011; Huggins and Thompson, 2014).

In addition, even though some studies have recently shown the complementary effect of the technological, social and organisational proximity to the geographical one (Paci et al., 2014), these mechanisms tend to stress the importance of the spatial proximity and the unequal level of innovativeness across regions (Chaminade and Plechero, 2015).

Following these considerations, knowledge spillovers are often related to the structuring of regional innovation systems (Fritsch, 2000; Isaksen, 2001; Tödtling and Grillitsch, 2014; Tödtling and Trippel, 2005) and on the extent of the regional knowledge base (Asheim et al., 2011). The knowledge-intensive regions, in fact, are typically characterised by higher local public or private research and innovation-supporting services, investments and institutes/universities (Breschi and Lissoni, 2009) that facilitate and stimulate the local flows or exchanges of knowledge, resources and human capital, in order to promote the knowledge transfer, sharing, creation or recombination processes. Therefore, such an environment encourages organisations embedded in these elite regional innovation systems to network among themselves (Hoekman et al., 2009; Ter Wal and Boschma, 2009) and to benefit from local knowledge spillovers as undirected and spontaneous 'buzz' (Storper and Venables, 2004).

Conversely, lagging-behind regions are typically characterised by a lack of dynamic firms, organisational thinness, lowly specialised organisations, weak educational institutions, brain drain, loss of highly qualified personnel and weakly developed local networks (Tödtling et al., 2013). Here, spontaneous knowledge spillovers are limited. As a result, in lagging-behind regions where institutional systems are unable to foster local knowledge spillovers, OELRs must increase their collaboration processes in order to provide extra-organisational knowledge sources and better support the innovation processes of local firms. According to Wanzenböck et al. (2014), in fact, the knowledge creation success of regions depends not only on internal conditions but on the ability of local organisations to identify and access a diverse set of external knowledge sources, and on their ability to participate and position themselves in inter-organisational knowledge networks. Based on this issue, we can formulate the following wide hypothesis:

**Hyp.1.** The larger the collaborative inventors' network (number of nodes/inventors of the network) of organisations located in a lagging-behind region, the higher the number of innovations of that specific region

In the last decade, several studies argued that both intra- and inter-regional extra-muros collaborations, as well as their balance (De Noni et al., 2017), enable organisations to exchange and combine knowledge across organisational and technological boundaries, and support organisations to improve innovation performance (Tsai, 2009). The effect of local networks has specifically been considered, for a long time, as being strongly related to spatial proximity because of the opportunity to better support interactive learning and innovation processes by providing actors with a shared base of collaborative links (Boschma, 2005). However, other types of proximity, such as cultural, cognitive, social or organisational proximity (Crescenzi et al., 2016), have recently been shown to be even more effective than geographical ones. Despite this consideration, local collaborations have still been expected to enable and boost network embeddedness and to strengthen social capital, stimulating the creation and development of a solid canvas of organisations and institutions (Fitjar and Rodríguez-Pose, 2013). Moreover, local ties are inclined to produce stronger and trusting relationships (Capaldo, 2007), which may decrease the cost of opportunism associated with the transmission and sharing of knowledge and inter-connections for local organisations. Organisational and control criteria make it likely to be convenient for OELRs to support, in the short time, the development of intra-regional collaborations. Thus, we formulate the following hypothesis:

**Hyp. 2.** The higher the capacity of organisations located in a lagging-behind region to extend their collaborative networks to inventors of the same region, the higher the number of innovations of that specific region

Moreover, collaborative relationships with inventors embedded in other regional systems may foster access to a number of more diversified region-external knowledge sources, preventing firms and

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