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The innovative performance of firms in heterogeneous environments: The interplay between external knowledge and internal absorptive capacities

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ABSTRACT

This paper investigates the link between firm-level innovative performance and innovation prone external environments where knowledgeable individuals tend to cluster. Organizational ambidexterity and absorptive capacities (potential and realized) make it possible for firms to leverage the availability of external knowledge and boost their innovation performance. The empirical analysis focuses on England and is based on a novel combination of Community Innovation Survey (CIS) firm-level data and patent data. The results show that only firms complementing potential and realized absorptive capacities are able to take advantage of favorable external environments by actively combining internal and external sources of knowledge.

1. Introduction

The geographical mobility of skilled individuals as a channel of knowledge accumulation and diffusion has received remarkable attention in the existing literature (e.g. Feldman, 1994; Audretsch and Feldman, 2004; Carlino et al., 2007; Oettl and Agrawal, 2008; Breschi and Lissoni, 2009; Trippl and Maier, 2010; Gagliardi, 2015). Areas experiencing inflows of highly qualified individuals benefit from the development of an enabling environment for innovation and growth (Carlino et al., 2007; Glaeser et al., 2010; Kerr, 2010). Firms located in these innovation prone environments may take advantage of knowledge flows localized within the recipient spatial units (e.g. Marshall, 1920).

However, local firms have often been treated as passive recipients of local knowledge inflows rather than as active nodes that may (or may not) search for external knowledge by leveraging connections with their external environment (e.g. Feldman, 2003; Barnard and Cantwell, 2006). To overcome this limitation and investigate the conditions that allow firms to take advantage of favorable external environments and knowledge sources, this paper brings firms (and their strategies) back at the very center of the conceptualization of the link between mobility and innovation.

In order to shed new light on the response of firm-level innovative performance to the concentration of knowledgeable individuals in their external environment, we cross-fertilize the geography of innovation literature with insights from strategic management. In so doing, we aim at contributing to both strands of research that have been rarely combined to address similar questions. On the one hand, strategic management has devoted a significant attention to inter-organizational mobility of personnel as a way to achieve better innovative outcomes (e.g. Rao and Drazin, 2002;, Song et al., 2003; Rosenkopf and Almeida, 2003; Corredoira and Rosenkopf, 2010; Palomeras and Melero, 2010; Singh and Agrawal, 2011; Mawdsley and Somaya, 2016), while overlooking the complementary role of geographic mobility. On the other hand, the geography of innovation literature has traditionally focused on how contextual conditions shape firms' innovative performance (e.g. Dahl and Pedersen, 2004; Audretsch and Feldman, 2004; Boschma et al., 2008; Beugelsdijk, 2007; Crescenzi et al., 2013), but has often adopted an aggregate approach overlooking the role of firm-level heterogeneity in its interaction with the external environment.

The conceptual framework relies on the notion of organizational ambidexterity as the ability of firms to simultaneously explore and exploit (e.g. Tushman and O'Reilly, 2007; Gibson and Birkinshaw, 2004; Rothaermel and Alexandre, 2009), and applies this concept to firms' knowledge acquisition behavior. The knowledge acquisition behavior of firms is the result of the exploration and exploitation of internal and external sources; firms benefit from the combination of both. In this context absorptive capacities are the key enabling factor for the emergence of ambidexterity benefits. In particular, we rely on the distinction between potential and realized absorptive capacities (e.g. Zahra and George, 2002). The former being the actual capability of the firm to understand and process knowledge (Cohen and Levinthal, 1990) while the latter reflects differences in knowledge management

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strategies in terms of ability to "leverage the knowledge that is absorbed" (Zahra and George, 2002, p.190), and exploit it within the internal process of knowledge generation. Firms complementing potential and realized absorptive capacities are in the best position to take advantage of favorable external environments through the combination of internal and external knowledge.

This central hypothesis derived from our conceptual framework is empirically tested by means of a novel database that combines data on English firms from the United Kingdom (Community) Innovation Survey (UKIS)[1] with information on the mobility of inventors from patents records provided by the European Patents Office (EPO). We focus on firms that are sampled in two consecutive waves of the CIS – CIS4 and CIS5–thus exploiting the panel dimension of the data. In addition, we make use of information on the location behavior of multi-patenting inventors to identify those locations in England that were exposed to inflows of highly knowledgeable individuals (e.g. Song et al., 2003; Agrawal et al., 2006). While inventors' mobility offers an imprecise measure of the magnitude of the actual inflows (e.g. Ge et al., 2016), it allows a clear identification of locations that act as centers of attraction for talent. In areas that manage to develop themselves into knowledge hubs, productivity gains emerge from the clustering of talented people (Florida, 2002). Where the two datasets are merged on the basis of geographical locations we can compare the innovative performance of firms located in areas that experienced inflows of inventors in the previous period against areas which did not, testing whether – after controlling for firm-specific observable and unobservable characteristics – different contextual conditions affect innovative outcomes. In order to investigate how firms leverage realized absorptive capacities in their learning and knowledge acquisition behaviors, we distinguish between firms that make use of external resources to develop their innovations and firms that rely mainly on internal assets. We test the robustness of our results against endogeneity concerns due to reverse causality – via instrumental variable techniques – and alternative explanations for variations in firms' innovative outcomes as a consequence of their external environment.

The empirical results suggest that firms' innovative performance strongly depends on their internal assets and potential absorptive capacities. Instead, no effect is associated with their location in areas that were exposed to knowledgeable inflows in the previous period when we control for time invariant firm-specific characteristics. This result diverges from the traditional findings in the economic geography literature where the mobility of talents is associated with a boost in innovative performance via agglomeration externalities (e.g. Faggian and McCann, 2006 and Gagliardi, 2015 for the UK; Peri, 2007 and Hunt and Gauthier-Loiselle, 2010 for the US; Miguélez and Moreno, 2013 for Europe). It also supports the existence of an overestimation bias potentially affecting exiting studies that do not fully control for firm-level observable and unobservable characteristics when investigating the role of innovation prone environments. Coherently with this latter claim, we find that the innovation benefit from the location in a contextually enabling environment is highly heterogeneous and depends on the level and scope of firms' realized absorptive capacities. Only firms that successfully complement internal and external knowledge sources can take full advantage of the positive spatial externalities generated by innovation prone environments. This result links back to early innovation studies focusing on the pay-off of complementarity strategies that combine internal and external sources of knowledge (e.g. Arora and Gambardella, 1990; Cassiman and Veugelers, 2006; Love and Roper, 2009), and to more recent contributions addressing the topic in a dynamic context, by looking at the variation in innovation outcomes at the firm level as the result of the switch towards complementary strategies (e.g. Love et al., 2014). It also emphasizes – with reference to the link between mobility and innovation – that firms' outcomes can neither be fully explained by firms' internal inputs nor by their external environment in isolation, but they are rather the result of the interaction between the latter and firms' heterogeneous internal assets, technological capabilities and knowledge management strategies (e.g. Maré et al., 2014; Gagliardi, 2015).

The following section details the conceptual framework of our study. Section three describes the data used for the empirical investigation with a focus on key variables, while section four discusses the estimation and identification approach. Section five presents the main results and robustness checks and section six concludes.

2. Conceptual framework and hypothesis

The conceptual framework of this analysis aims to cross-fertilize the strategic management view on firms' knowledge acquisition behavior, and the economic geography literature, which has looked at the location behavior of individuals and firms in space in the formation of agglomeration economies.

In the Marshallian theory of agglomeration economies firms cluster in specific locations to take advantage of (i) inter-firm linkages, (ii) labor pooling effects and (iii) localized knowledge spillovers. In this context, geographical mobility (and in particular the mobility of highly skilled individuals) contributes to the creation of an enabling environment for innovation (Feldman 1994; Audretsch and Feldman, 2004; Carlino et al., 2007; Glaeser et al., 2010; Kerr, 2010). This 'enabling' environment supports the localized diffusion of knowledge and has often been evoked by both urban economists (Glaeser et al., 2010; Kerr, 2010) as well as by the more institutional approaches in the regional systems of innovation (RSI) tradition (e.g. Lundvall, 1992; Nelson, 1993; Edquist, 1997). In the former case, firms' advantages are associated to the location in places where 'knowledge is in the air' (Marshall, 1920). In the latter, benefits arise from "regionally embedded, institutionally supported, networks of actors" (Uyarra, 2011, p. 125). In these contexts, firms benefit from supportive local innovation ecosystems (Roper et al., 2017), which in turn links back to the notion of innovation prone regions as regional systems that are "capable of transforming a larger share of their own R&D into innovation and economic activity" (Rodríguez-Pose, 1999, p.82). Existing empirical studies employing this rationale have almost exclusively adopted a spatial approach (Borjas, 1999, 2006; Dustmann et al., 2005; Rodríguez-Pose and Crescenzi, 2008; Glitz, 2012) that looks at the spatial correlation between innovative outcomes and environmental attributes within self-contained, functional geographical units of analysis. They generally converge in suggesting a positive state/regional/city-level effect of geographic mobility on innovation: agglomeration dynamics taking place within recipient spatial units result in an innovation-enhancing effect.

Yet, within this framework, firms are often treated as passive recipients of knowledge with limited attention to differences in their capacity to take advantage of localized sources of knowledge. In a resource-based perspective firms are heterogeneous with respect to their resources, capabilities and organizational capacities to develop new competencies (Teece et al., 1997). This heterogeneity plays a key role in terms of (i) internal resources and capabilities that mediate the acquisition of individually embodied human and relational capital (e.g. Adler and Kwon, 2002; Hatch and Dyer, 2004; Groysberg and Lee, 2009; Mayer et al., 2012), and (ii) firms' strategic behavior in the way in which they achieve the optimal matching between alternative sets of resources for the development of their knowledge outcomes (Grigoriou and Rothaermel, 2014). In this perspective, the conditions under which firms are able to take advantage of being located in knowledge hubs are of two types. First, both financial and human resources are needed for firms to develop potential absorptive capacities and appropriate and internally recombine external knowledge from other co-located actors (e.g. Shaver and Flyer, 2000). Second, they need to actively engage

[1] UKIS data are provided under restricted access to approved researchers only by the UK Data Service (https://discover.ukdataservice.ac.uk/catalogue?sn=6699).