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Explaining knowledge-intensive activities from a regional perspective☆

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ABSTRACT

Knowledge-intensive activities (KIAs) are a fundamental part of innovation. In turn, innovation drives economic growth and regional development. Logically, therefore, understanding the factors that are conducive to KIAs is important for regions to plan and build toward a sustainable future. The literature discusses a host of environmental factors that affect a region's capacity to engage in KIAs. Adopting a regional focus, this study discusses these factors and presents a causal model to explain how these environmental antecedents affect KIAs. The study then presents an application of fuzzy-set qualitative comparative analysis (fsQCA) to analyze knowledge-intensive activities in 181 European regions across 22 countries. The analysis shows that several causal configurations of environmental factors are conducive to KIAs. Accordingly, the study discusses the policy implications of these findings.

1. Introduction

The infrastructures that support innovation are becoming increasingly important in research and policymaking at all administrative levels (local, regional, national, and international) (Roig-Tierno, Alcázar, & Ribeiro-Navarrete, 2015). Innovation and entrepreneurship – individually and jointly – play fundamental roles in economic well-being. Innovation is central to the competitive development of regions, so promoting and assessing innovation is essential. From a regional perspective, the Regional Innovation Scoreboard (RIS) by the European Commission (2014) offers a framework for evaluating regional innovation. Innovative regions have the following characteristics: (1) they have innovative companies, (2) they have regional innovation enablers, and (3) they produce a considerable innovation output. One way of producing a substantial innovation output is through knowledge-intensive activities (KIAs), which exert a twofold effect on regional innovation. Firms that engage in KIA (i.e., knowledge-intensive services) not only innovate themselves, but also promote innovation in client companies (den Hertog, 2000). Hence, insight into what drives these knowledge-intensive activities is valuable.

This research builds on the RIS (European Commission, 2014) framework to characterize KIA in European regions. From a regional perspective, the study analyzes the activities and innovation-enabling elements that best explain KIA. Specifically, the study explores how the availability of a highly skilled workforce, R&D expenditure, the degree of collaboration among firms and other agents, and patent applications affect KIA. To do so, the method uses a fuzzy-set qualitative comparative analysis (fsQCA).

FsQCA tests a series of research propositions describing the relationship between innovation-enabling elements and KIA. Woodside (2013) argues that fsQCA overcomes a major limitation of traditional probability-based statistical techniques – namely, the need for large samples – without limiting the study to a few specific cases.

The structure of the article is as follows. Section 2 reviews the literature on the characteristics of innovative regions. Section 3 describes the research method and explains the advantages of QCA, together with the discussion of some key findings of the analysis. Finally, Section 4 presents the findings' main implications and some concluding remarks.

2. Theoretical background

Drawing upon the RIS (European Commission, 2014) framework, this section reviews the main indicators that characterize innovative regions.

2.1. Availability of highly skilled workers

Human capital affects economic growth (Aghion, Howitt, & García-Peñalosa, 1998; Queirós & Teixeira, 2014) because of its function as an innovation-enabling element. Investing in human capital builds

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the knowledge necessary to create new products (Bodman & Le, 2013), complement physical capital (Caselli & Coleman, 2006), and detect and capitalize on business opportunities (Justman & Teubal, 1991).

The literature shows that sectors with highly skilled workforces tend to develop product innovations more frequently (Schneider, Günther,et al., 2010) than sectors with unskilled workforces do. Regions capable of attracting or retaining highly skilled workers are at an advantage in terms of steering the economy toward sectors that intensively use human capital and that provide high value added (Afonso, 2013). Investing in knowledge-intensive sectors that promote specialization boosts economic growth and development (Queirós & Teixeira, 2014). As long as knowledge-intensive sectors employ people with a high level of human capital, the availability of highly skilled labor enables companies to innovate. The subsequent proposition follows from this logic. P1: Regions with large numbers of highly skilled workers have high rates of employment in knowledge-intensive activities.

2.2. R&D expenditure

R&D is a formal process whereby public or private agents create knowledge. In knowledge-based economies, investment in R&D boosts economic growth. According to the RIS (European Commission, 2014), investment in R&D is also a key indicator of an economy's competitiveness and future wealth. People's perceptions of R&D depend on whether investment is public or private. Private R&D investment is evidence of innovative business activity, whereas public spending on R&D is an enabler of regional innovation.

The literature contains extensive discussion on the complementarity or substitutability of public and private R&D investment. Numerous studies (Adams, 1990; Jaffe, 1989) explore the positive external effects of public R&D investment on private R&D investment, as well as the benefits for new technology creation and diffusion. Almus and Czarnitzki (2003) discuss whether public R&D investment has a crowding out effect on private investment. Even at the micro level, participation in public R&D investment programs and greater private R&D investment usually accompany one another, thereby demonstrating the complementarity of these two forms of R&D investment. These findings are similar to those of Hottenrott and Lopes-Bento (2014), who report that public support programs not only trigger private R&D spending, but also boost productivity because of the link between these programs and a higher number of innovative products reaching the marketplace. Other studies, however, report situations where public R&D spending and private R&D spending are interchangeable (Wallsten, 2000). David, Hall, and Toole (2000) present an in-depth study of the relationship between public and private R&D. The previous arguments lead to the following two propositions. P2: Regions with high public R&D spending have high rates of employment in knowledge-intensive activities. P3: Regions with high private R&D spending have high rates of employment in knowledge-intensive activities.

2.3. Collaboration with other agents

Complex innovations, especially those relating to ICTs, typically depend on the firm's capacity to combine diverse sources of information and knowledge. Firms seek to align themselves with external agents to boost their access to resources. These additional resources help firms to improve the novelty and speed of their innovations (Bouncken, Pesch, & Gudergan, 2015). In other words, firms collaborate to innovate.

Lasagni (2012) explains how innovation collaboration can take place among firms within the same sector (e.g., clients or suppliers) or with universities and research institutions. In the first case, collaboration contributes to improving knowledge of the firm's value chain, whereas in the second case, the collaboration contributes to developing the firm's products or services. Despite the potential of R&D collaborations, however, some studies show that not all R&D collaborations actually improve the quality and quantity of innovations (Joshi & Nerkar, 2011; Ribeiro-Soriano & Urbano, 2010). For instance, Wu (2014) shows that product innovation output does not have a linear relationship with the intensity of cooperation among competitors. Instead, innovation output relates to the intensity of cooperation with competitors through an inverted-U relationship. In addition, although cooperation increases information exchange and enables the resolution of problems, an excess of cooperation may be susceptible to unscrupulous acts of opportunism by collaborators.

From an innovation-systems perspective centering on the interaction among agents within the system, firms seek help from external sources to acquire knowledge that would otherwise be unavailable to them. These external sources include universities, research and technology centers, and other knowledge-intensive firms. These intermediary organizations play a key role in (1) the identification of relevant knowledge and technology, (2) knowledge transfer and application, and (3) the transfer of this application to different agents within the system.

The extent to which innovation within the firm benefits from collaborations with external organizations depends on the firm's absorptive capacity. Before embarking on the collaboration, the firm must ensure its absorptive capacity is sufficient to identify, monitor, and exploit external knowledge. Then, cooperation can improve SMEs' innovation capacity and competitiveness (Piperopoulos, 2012). Firms with a high absorptive capacity are in a better position to exploit external knowledge, and only firms with enough absorptive capacity will be able to benefit from collaborations with other agents. To a certain extent, collaboration between a firm and an external agent acts as a mediator between the firm's absorptive capacity and the firm's innovation performance (Flatten, Greve, & Brettel, 2011; Guzmán-Cuevas, Cáceres-Carrasco, & Soriano, 2009). For example, Nakos, Brouthers, and Dimitratos (2013) conclude that participating in alliances to overcome barriers (e.g., a lack of knowledge or resources) when internationalizing is more effective if the collaboration is not with competitors.

Regardless of whether firms with greater absorptive capacity benefit more from partnerships than other firms do, R&D collaborations and alliances are useful mechanisms for technological knowledge creation. R&D collaborations do not substitute but rather reinforce and complement in-house R&D (Lin, Wu, Chang, Wang, & Lee, 2012). The subsequent proposition follows from this theoretical argument. P4: Regions with strong collaboration between innovative SMEs have higher rates of employment in knowledge-intensive activities.

2.4. Patent applications

Although not all innovations are under patent (or are even patentable), the number of patent applications has a relationship with the number of product innovations by a firm, and these innovations are what ultimately determine the firm's competitive advantage. The number of patent applications within a region offers a proxy for the innovation intensity of firms within the region because patents constitute one of the firm's main intellectual assets. Although patents do not represent a measure of an innovation's commercial success, they represent an intermediate measure of the innovation output (Kemp, Folkeringa, de Jong, & Wubben, 2003). The informative value of patent application data, together with the availability of these data, means that the number of patent applications is a common measure of innovation output (Shi, Wu, & Zhao, 2014; Zahra & Nielsen, 2002). The following proposition is a consequence of this argument. P5: Regions with EPO patents have high rates of employment in knowledge-intensive activities.

3. Empirical analysis

3.1. Method

In this study, fuzzy-set qualitative comparative analysis (fsQCA) tests the propositions in Section 2. FsQCA is an analysis technique that combines Boolean algebra, set theory, and the principles of comparison