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Science and Technology Parks and cooperation for innovation: Empirical evidence from Spain

Ángela Rocío Vásquez-Urriago[a], Andrés Barge-Gil[b,*], Aurelia Modrego Rico[a]

[a] Laboratory of Analysis and Evaluation of Technical Change, Carlos III University of Madrid, Calle Madrid 126, 28903 Getafe, Madrid, Spain
[b] Department of Economic Analysis II (Quantitative Economics), Complutense University of Madrid, Campus de Somosaguas, 28223 Pozuelo de Alarcón, Madrid, Spain

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ABSTRACT

Science and Technology Parks (STPs) are one of the most important innovation policy initiatives. Previous studies show that location in a park promotes cooperation for innovation, but do not investigate whether this cooperation produces better results. We extend this literature by analyzing the effect of location on an STP on the results of cooperation for innovation and the mechanism facilitating this effect. We rely on a much larger sample of firms and STPs than previous studies, and, where necessary, account for selection bias and endogeneity. The results show that location in an STP increases the likelihood of cooperation for innovation, and the intangible benefits of cooperation with the main innovation partner, due mainly to a more diverse relationship.

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1. Introduction

Agglomerations of firms, universities and other knowledge-intensive organizations are beneficial for the generation and utilization of knowledge (Ponds et al., 2010; Boschma and Frenken, 2011). This has been used to justify the development of science parks, technology parks, science and technology parks, technopoles, innovation centres, research parks, science-based industrial parks, university research parks, as a component of public policy to stimulate innovation. These initiatives can be encompassed by the broad category of Science and Technology Parks (STPs) since they are all policy-driven and have a main common objective to promote cooperation and technology transfer, especially between firms and knowledge providers such as universities and research institutes (Hogan, 1996; Bigliardi et al., 2006).

Previous academic research mostly analyses the effect of location in an STP on firms' results and behaviour (Löfsten and Lindelöf, 2005; Fukugawa, 2006; Squicciarini, 2008). While the effect on results is unclear, the empirical evidence shows that the likelihood of cooperation for innovation between firms and knowledge providers increases. However, most existing studies use very small samples of firms and STPs.

The present work extends this literature in a number of ways. First, it focuses on analyzing the influence of STPs on the results of cooperation, how STP effects are channelled, and how much they increase the likelihood of cooperation.

Second, it uses a substantially larger sample of firms and exploits the responses from a standard Community Innovation Survey (CIS) type questionnaire to evaluate the influence of STPs on cooperation. This allows the use of already tested covariates that capture the innovation behaviour of firms. This study relies on the 2007 Spanish Survey of Technological Innovation in Companies, undertaken by the Spanish Institute of Statistics (INE), and includes 39,722 companies which are representative of the size, sector and regional location of the population of Spanish companies, 653 of which are located in 22 of the 25 Spanish STPs.

Third, it takes account of endogeneity and sample selection bias problems. The former problem arises because firms are not randomly located in a STP: their location is the result of the firm's decision and the STP's agreement, and these decisions rely on partially unobservable factors. The latter problem arises if the subsamples used are not representative of the population being analyzed.

Fourth, it provides evidence for the Spanish case. STPs are a major Spanish innovation policy initiative; the first STPs were created in the 1980s and their number has grown considerably

* Corresponding author. Tel.: +34 913942355.
E-mail addresses: angelvasur@yahoo.com (Á.R. Vásquez-Urriago), abarge@ccee.ucm.es (A. Barge-Gil), modrego@eco.uc3m.es (A. Modrego Rico).

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since then. Nevertheless, evidence on their performance is scarce (Vásquez-Urriago et al., 2014).

Our results show that, even after accounting for endogeneity, STPs are important for fostering cooperation for innovation. We also find that the intangible outputs from cooperation are higher for park firms for the main reason that their location facilitates the development of more diverse cooperative relationships.

The paper is organized as follows. Section 2 reviews previous arguments on the effect of proximity on cooperation behaviour, summarizes the empirical evidence on the role of STPs on cooperation, and provides a description of the Spanish context. Section 3 explains the methodological issues related to the empirical work; Section 4 presents the results of our analysis of the effect of STPs on the likelihood of cooperation; and Section 5 focuses on the effect of STPs on the results of cooperation and the main drivers of this effect. Section 6 presents the conclusions.

2. Previous literature

We first review the literature on the relationship between proximity and cooperation for innovation more generally before focusing on the more specific literature on STPs and cooperation for innovation. Finally, we provided a detailed description of Spanish STPs. We adopt an explicit interdisciplinary perspective since the main scholarly arguments on these topics come from various disciplines such as economics, geography, management and innovation studies.

2.1. Proximity and cooperation for innovation

The agglomeration of knowledge intensive organizations traditionally was considered a source of innovation (Marshall, 1890; Jacobs, 1970), but it was not until the early 1990s that research has focused on this effect in particular (Feldman and Kogler, 2010). An important reason for the influence of agglomeration on innovation is that agglomeration favours the initiation and development of linkages between different organizations (Baptista, 1998; Hervás-Oliver and Albors-Garrigos, 2009). The likelihood of establishing relationships is higher for firms in agglomerations; geographical proximity increases the chances of casual meetings and conversations that identify common interests and may lead to joint projects (Guillain and Huriot, 2001).

There is a lack of agreement about why relationships between co-located partners work better (Breschi and Lissoni, 2001; Dahl and Pedersen, 2004; Giuliani, 2007; Ibrahim et al., 2009). This debate is based on two main arguments. First, geographical proximity facilitates knowledge flows and, as a result, learning processes because closeness has a positive effect on the number of interactions (Torre and Gilly, 2000). Since tacit knowledge plays an important role in innovation processes (Polanyi, 1966), and frequent and repeated face-to-face contacts are key to its transmission (Baptista, 1998; Amin and Wilkinson, 1999), geographical proximity is a facilitator. Maskell and Malmberg (1999) argue that the higher the tacit component of the knowledge, the more important is geographical proximity for knowledge to flow between partners. Accordingly, innovation partnerships among firms in agglomerations should achieve higher flows of knowledge due to the more diverse relationships they enable.

Second, geographical proximity reduces uncertainty; it reduces search costs (Feldman, 1999) and increases the likelihood of explicit search for innovation partners (MacPherson, 1997). Also, it contributes to the building of trust which reduces the transaction costs involved in joint projects and results in more stable and longer lasting relationships (Bennet et al., 2000; Love and Roper, 2001). Longer relationships encourage the sharing of more valuable knowledge, resulting in a better adjustment between expectations and results, greater trust and increasing returns from collaboration (Izushi, 2003; Abramovsky and Simpson, 2011), especially in relation to intangible results (Barge-Gil and Modrego, 2011).

However, geographical proximity is necessary, but not sufficient for effective inter-organizational learning (Lane and Lubatkin, 1998). Following Knoben and Oerlemans (2006, p. 80), other types of proximity may be relevant for cooperation: technological proximity, defined as 'the level of overlap of the knowledge bases of two collaborating actors' (Lane and Lubatkin, 1998) and organizational proximity, defined as 'the set of routines – explicit or implicit – which allows coordination without having to define beforehand how to do so. The set of routines incorporates organizational structure, organizational culture, performance measurements systems, language and so on' (Rallet and Torre, 1999). This broader notion of proximity influences the frequency and density (variety and duration) of interactions (Baptista, 1998; Torre and Gilly, 2000).

2.2. STPs and cooperation for innovation

STPs guarantee geographical proximity and encourage other types of proximity that fosters cooperation between firms and research and technology organizations.

Several empirical studies, focusing mainly on firm-university links, analyze the role of STPs on cooperation for innovation. Table 1 presents two main groups of studies. The first group is composed of case studies of STPs, which investigate whether location in an STP fosters university–industry links, inter-firm links and other links. These works analyze the behaviour of park firms and find that they frequently develop links with universities, other firms and other institutions.

The studies in the second group are mostly quantitative. They use matching techniques to develop a control group of off-park firms to allow the effect of location in a park to be estimated or they use comparative analysis. The evidence tends to show a positive effect of location in an STP on collaboration with local universities and firms. However, these studies mostly do not control for endogeneity of park location. The decision to locate in an STP might be related to the propensity to cooperate and these firms would have cooperated for innovation wherever they were located. This is an important consideration which could bias results. The exception is the study by Fukugawa (2006), which finds that STP location has an effect on firms' links with universities and is not restricted to local universities.

To sum up, these studies provide evidence that location in a park promotes cooperation for innovation. However, none of this work investigates the influence of an STP location on the results of cooperative projects. These results fall into the two groups (Barge-Gil and Modrego, 2011) of economic results (including sales, exports costs, profits, employment, internal R&D or productivity) and intangible results (including increased ability to formulate strategies, enhanced human resources and better management of information and relationships). Analyzing the influence of STP location on the results of cooperative projects is the main focus of the present analysis.

2.3. STPs in Spain

Spanish parks are a relatively recent phenomenon. Since the 1980s, STPs have been seen as initiatives that contribute to regional development via technology transfer and revitalization and diversification of the local industry. Efforts have been made to attract high-tech, often multinational firms to strengthen the dynamics of the local economic environment (Ondategui, 2001; Infyde iD, 2008). Spanish parks were originally technology rather than science parks. However, over the years, both new and existing parks have

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