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## Can a magic recipe foster university spin-off creation? ☆

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## ABSTRACT

This study examines factors that explain the creation of university spin-offs. The study focuses on mechanisms that technology transfer offices (TTOs) and universities employ to foster spin-offs. These mechanisms include technology transfer activities that support spin-offs, normative frameworks, support infrastructures (i.e., business incubators and science parks), and TTO staff's specialist technical skills. The analysis also differentiates between public and private universities. Spin-offs belong to one or more of the following groups: spin-offs with support from the university's TTO, spin-offs operating under a license agreement, and spin-offs in which the TTO or university holds equity. Qualitative comparative analysis (QCA) of 2011 data from 63 Spanish universities (46 public and 17 private) identifies recipes of antecedent conditions that effectively foster spin-offs. Results show that no unique combination of antecedent conditions yields more university spin-offs than any other does. This finding indicates that several strategies can successfully lead to academic entrepreneurship.

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## 1. Introduction

Exploiting scientific and technological developments in universities is a central theme in economic and industrial policy (Harrison & Leitch, 2010; Lawton-Smith, 2007). Universities must contribute to their region's economic development by promoting effective university–industry relationships to exploit and commercialize research findings.

Several mechanisms enable knowledge flow from academia to business. Traditional commercialization models comprise licensing and patenting, university–industry partnerships, and research contracts with firms. Recently, however, university spin-offs have garnered more attention than any other mechanism (Bekkers, Gilsing, & van der Steen, 2006; Bercovitz & Feldmann, 2006; Lockett, Siegel, Wright, & Ensley, 2005).

Although a common definition of university spin-offs remains elusive, a university spin-off, strictly speaking, is the outcome of entrepreneurship within a university. University spin-offs exploit research breakthroughs (Rasmussen, 2008). Because of their technological basis, university spin-offs encounter the same difficulties as any other new technology would, in addition to traditional problems for all start-ups (Oakey, Hare, & Balazs, 1996). Nevertheless, spin-offs

definitely differ from other high-tech start-ups (Vohora, Wright, & Lockett, 2004). First, spin-offs creators start to commercialize their projects in university settings, so university spin-offs are subject to university protocol, which occasionally hinders progress (Rasmussen, 2008). Second, because of their university background, academic entrepreneurs may lack resources and skills to transform an idea into a market-ready product (Bathelt, Kogler, & Munro, 2010). Third, many parties contribute to an university spin-off (e.g., academic inventor, university, and venture capitalist), often with conflicting interests that may reduce success probabilities (Boardman & Ponomariov, 2009; McAdam & McAdam, 2008; Mustar et al., 2006).

Spin-offs stem from a push view of demand, whereby technology or inventions seek a place in the market. Although few spin-offs actually satisfy national markets or create new ones (Markman, Siegel, & Wright, 2008), spin-offs represent an important mechanism to stimulate economies. Accordingly, stimulating academic entrepreneurship is becoming a crucial issue for universities and governments (Hess & Siegwart, 2013).

Several circumstances are raising university spin-offs' popularity. First, social pressures are forcing universities to generate a new revenue stream to foster regional economic growth (Clarysse, Wright, Lockett, Mustar, & Knockaert, 2007). Second, technology transfer offices (TTOs) encourage the dissemination of scientific research and support scientists in commercializing their discoveries (Algieri, Aquino, & Succurro, 2013). Third, scientists can access public funds aiming to narrow financial and knowledge gaps (Wright, Clarysse, Lockett, & Binks, 2006). Fourth, policies stimulate an entrepreneurial culture

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within universities (Mustar et al., 2006). Finally, institutional programs, measures, and schemes offer business support and low-cost advantages (Jacob, Lundqvist, & Hellsmark, 2003).

Research on university spin-off creation focuses on factors that explain university spin-offs but fails to consider the role of TTOs and universities. This study addresses this research gap. The study differentiates between three types of university spin-offs. A single spin-off may belong to more than one of these groups. First group spin-offs enjoy active involvement from TTOs. In these spin-offs, academic entrepreneurs work closely with TTOs, receiving personalized assistance during technological development, business start-up, and the initial stages of business operations. The second group spin-offs operate under license agreements. In the third group, the TTO or university holds equity in the spin-off. By holding a financial stake in the spin-off, the university bears a risk. Studying these three complementary types of spin-off yields a more comprehensive picture of university spin-off activity, particularly university involvement in spin-offs. Antecedent conditions relate to the institutional, normative, and organizational assets that, according to the literature, affect the creation of university spin-offs.

The study uses qualitative comparative analysis (QCA). This method is particularly suitable for cases with small data samples, yet allowing the generalization of conclusions and implications to larger populations.

The structure of the study is as follows: Section 2, theoretical background; Section 3, sample and method; Section 4, results; Section 5, conclusions; and Section 6, limitations and future research.

## 2. Theoretical underpinnings

The literature on university spin-off activity spans a number of topics and is continually expanding. Some authors explore factors that lead individuals to found university spin-offs (e.g., Fini, Grimaldi, & Sobrero, 2009; Lockett & Wright, 2005). Other studies examine the performance and survival of university spin-offs at the micro level (Müller, 2006; Walter, Auer, & Ritter, 2006). Such studies complement those that compare university spin-off performance with performance of corporate start-ups (Müller, 2010). Currently, the business-model approach is garnering attention (Bower, 2003). Following Chesbrough and Rosenbloom (2002), business-model approaches analyze the firm's value proposition, market segment, position in the value chain, cost structure, and profit potential.

Many scholars investigate university spin-off firms from the resource-based view (RBV), examining factors such as institutional support, financial resources, human capital, technological resources, university policies, and networks that enable university spin-offs ventures to form and develop (e.g., Lockett & Wright, 2005; Rasmussen, Mosey, & Wright, 2011). However, some authors suggest that transaction cost economics (TCE) is also worth exploring (e.g., Fontes, 2005; Shane, 2004). Whereas the RBV focuses on unique combinations of resources and capabilities (Barney, 1991; Penrose, 1995), TCE focuses on exchange processes. TCE aims to identify the informational barriers that hamper a certain phenomenon's success (Williamson, 1979).

According to the current research, focusing on either the RBV or TCE is necessary but insufficient. Like Eun, Lee, and Wu (2006), this study shows the need for an integrative framework that covers both approaches and the external environmental. Accordingly, building on the TCE theory, this study considers three types of spin-offs: spin-offs with TTO support, spin-offs acting under license agreements, and spin-offs in which the TTO or university hold equity. Each of these types has different associated costs and represents a different opportunity to exploit the knowledge universities generate. The study also builds on the RBV to examine which of the following three factors enable spin-off creation: support activities, human capital resources, and support infrastructures. An additional external environment factor captures the effect of the normative framework. Lastly, the analysis controls for university ownership structure.

### 2.1. Support activities

Research on TTOs shows that successful technology transfer depends on TTOs' functions (Siegel, Waldman, & Link, 2003). Such functions indicate how the TTO, and by extension the university, manage technology transfer. Among their other functions, TTOs assist researchers to disseminate findings, promote and manage the university's intellectual property, introduce entrepreneurs to venture capitalists, and support researchers to create university spin-offs. Nevertheless, given universities' resource constraints, only some TTOs perform all these functions, while others have to outsource some of these services. This research studies essential functions for universities to successfully create spin-offs: specific programs within the TTO to support spin-off creation and the provision and management of seed capital.

Universities with spin-off creation support programs should create more spin-offs than other universities do (Caldera & Debande, 2010; Harrison & Leitch, 2010). Support programs encourage scientists to exploit technology, provide legal intellectual property protection, and offer business advice during spin-off creation. Likewise, universities that manage seed capital should create more spin-offs than other universities do. Spin-offs need to access financial resources to secure funding for initial development (Fini, Grimaldi, Santoni, & Sobrero, 2011; Harrison & Leitch, 2010). Thus, university-affiliated venture capital funds may boost spin-off creation by offering financial access.

### 2.2. Human capital resources

Researchers excel at R&D, but R&D skills differ from skills necessary further along the production chain (Chiesa & Piccaluga, 2000). Indeed, researchers usually have little or no business experience (Vohora et al., 2004) and lack commercial skills. These shortcomings hinder early firm development. Thus, technical consultants can help by advising researchers who are working on spin-offs (O'Shea, Allen, Chevalier, & Roche, 2005). Universities rely heavily on individuals' knowledge and capabilities (Benneworth & Hospers, 2007). Therefore, TTOs whose staff members have specialist professional skills and knowledge play an important role in spin-off creation (Kusku, 2003). Starting a business requires coaching and assessment. Staff working at TTOs can help by advising on, identifying, and evaluating new technologies (Etzkowitz, 2002). Therefore, having professionals to support spin-off creation should yield more spin-offs.

### 2.3. Support infrastructures

Universities with business incubators manifestly value spin-offs (O'Shea et al., 2005). The literature discusses the advantages of incubators (Grimaldi & Grandi, 2005). Business incubators support spin-offs during their early development by offering advanced services and facilities for entrepreneurs with mature or fledgling ideas that could become a business. Incubators also bring researchers together, thus fostering experience sharing and a creative atmosphere. Other advantages include access to a skilled work force, good infrastructure, and cost reductions for start-ups (Jensen & Thursby, 2002). In short, incubators accelerate business creation (O'Shea, Chugh, & Allen, 2008) and reduce the likelihood of failure (Rothaermel & Thursby, 2005). Accordingly, the presence of a university-affiliated business incubator should lead to more spin-offs.

University science parks also foster spin-off creation (Vinig & Van Rijnsbergen, 2009). These hubs stimulate and manage the flow of knowledge and technology among universities and help to create and grow innovation-based firms. University science parks thus provide an ideal environment to create, exploit, and share knowledge. These parks offer knowledge-building workspaces and forums, create business clusters, enhance the value of universities' research strategies, and bring high-tech firms and science-based businesses together.

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