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A resource-based view of university spin-off activity: New evidence from the Spanish case

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ABSTRACT

Universities now play a major role in regional economic and social development. This new mission is transforming the traditional university into an entrepreneurial university. This entrepreneurial activity has mainly been carried out by transferring technology to industry; in particular by creating spin-off firms. Drawing on a resource-based view, the objective of this paper is to understand why some Spanish universities are more successful than others at generating spin-offs. In order to determine the factors that influence the spin-off activity, we used a balanced panel comprising all 47 Spanish Public Universities using information that is biannually available between 2002 and 2006. The results showed that university spin-offs are significantly positively associated with industry-funded research, the tradition of the university spin-off activity, the research orientation, and the existence of incubation services in the university. Furthermore, we also found some unexpected results which highlight some peculiarities of Spain and other countries with little tradition in university entrepreneurial activity, such as the absence of the effect of a Technology Transfer Office (TTO) on spin-off production.

This study contributes to the literature on university spin-off activity. First, there are no similar empirical studies about Spanish universities. Second, we set out several policies to improve the dissemination of scientific knowledge and technology transfer activities.

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Una aplicación de la teoría de los recursos a la creación de spin-offs universitarias: nuevas evidencias desde el caso español

RESUMEN

Actualmente las universidades son uno de los agentes responsables del desarrollo económico y social de las regiones. Esta nueva misión ha transformado la universidad tradicional en una universidad emprendedora. Esta actividad emprendedora se ha llevado a cabo principalmente mediante la transferencia de tecnología a la industria, en particular mediante la creación de spin-offs. Partiendo del enfoque de la teoría de los recursos, el objetivo de este trabajo es entender por qué algunas universidades españolas tienen más éxito que otras en la creación de spin-offs. Con el fin de determinar los factores que influyen en la generación de estas empresas, se utilizó un panel que comprende 47 Universidades Públicas Españolas con información bianual de cada una entre el año 2002 y el 2006. Los resultados muestran que la creación de spin-offs mantiene una relación positiva con la investigación financiada por el sector privado, la antigüedad de la universidad en este tipo de actividades, la orientación de la investigación y la existencia de servicios de incubación en la universidad. Adicionalmente, han surgido algunos resultados inesperados y que ponen de manifiesto algunas particularidades de España y de otros países con menos tradición en emprendimiento universitario, tales como la ausencia de un efecto de las OTRIs en la generación de spin-offs.

Este trabajo contribuye a la literatura sobre creación de spin-offs universitarias ya que no existen estudios similares de carácter empírico sobre las universidades españolas, y en el mismo se proponen una serie de políticas para mejorar la difusión del conocimiento científico y la transferencia de tecnología.

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Introduction

The external environment in which universities carry out their activities has changed substantially in the last century. A historical milestone was the publishing of Bush's report in 1945. *Science. The Endless Frontier* has shaped science policy of the U.S. and most of the OECD countries for more than six decades. The fundamental principle of Bush's report was simple: basic research discoveries will be converted via technology transfer to become powerful drivers of economic development and social welfare.

More recently, as a consequence of a set of reforms targeted to improve the transfer of research results to industry, a reconceptualization of the universities' role started during the 1980s. In the U.S., Bayh-Dole Act allowed universities to own patents resulting from federal research money. Starting from early 1990s, structural changes in the external environment of European universities pushed them for a more proactive role in technology transfer, too (Baldini, Grimaldi, & Sobrero, 2006; Rasmussen, Moen, & Gulbrandsen, 2006; Siegel, Veugelers, & Wright, 2007). As a result, universities currently have to meet the social and economic needs of society. Therefore, the mission of universities is no longer limited to research and training (Etzkowitz, Webster, Gebhardt, & Terra, 2000); in addition, they are also expected to contribute to local economic development (the "third" mission). This objective is not entirely altruistic; the university's financial situation improves as it contributes to the economic development. The new University emerged from the "second revolution" has been labelled "the entrepreneurial University" (Etzkowitz et al., 2000).

There are a very wide range of university–industry interactions which may contribute to carry out this entrepreneurial activity (Agrawal & Henderson, 2002; Cosh, Hughes, & Lester, 2006; Hughes, 2007; Lester, 2005): informal contacts, recruitment of graduates, use of publications, collaborative research, faculty consulting, attending conferences, patenting and licensing, and new business formation around university science and technology (spin-offs).

Although founding a new company is only one of a number of mechanisms for the transfer of knowledge from universities to industry, this choice as an instrument for transferring university knowledge and fostering local economic growth has been growing in importance. In fact, recent decades have seen an increasing number of companies stemming from university-developed technology. This phenomenon is more evident in the U.S. (Carayannis, Rogers, Kurihara, & Allbritton, 1998; Degroof & Roberts, 2004) and in some European countries such as the U.K. (Lockett, Wright, & Franklin, 2003; Shane, 2004) or Sweden (Stankiewicz, 1994).

However, several recent studies have suggested that spin-offs are not the most useful of the available pathways for the transfer of knowledge from universities to industry, even in the countries where this phenomenon is more extended. In general, academic spin-off firms tend to remain relatively small and fail to grow. Some studies show that academic spin-offs tend to stay small (Zhang, 2009) and to grow less than other high-technology startups (Ensley & Hmieleski, 2005). In the European Union (EU) most of the spin-offs are not larger than 10 employees after 6 years of existence (Van Geenhuizen & Soetanto, 2009). Thus, according to Lester (2005), spin-offs is a very small fraction (2–3%) of the total rate of new business starts in the U.S. In addition, Hughes (2007) suggests that there is an overemphasis on spin-offs, which may lead decision makers to misunderstand the nature of the technology transfer model.

Therefore, the number of studies focused on university spin-off activity has rapidly expanded as a result of the growing number of spin-offs rather of their economic impact or sustainability. Until the late 1990s, this literature was rather fragmented (Rothaermel, Agung, & Jiang, 2006) and primarily atheoretical and based on case studies (Djokovic & Souitaris, 2004). However, in the 2000s this

approach has radically changed with the publication of several quantitative studies which attempt to explain the influence of the university's characteristics on the number of new firms created (see Table 1).

In Spain, the university system has traditionally been an example of a fully and highly centralized governance structure. After the restoration of democracy, the major change was introduced by the University Reform Act (1983). This increased the universities' administrative autonomy and transferred the responsibility for universities to the seventeen regional governments, which have had to take care of them in financial and organizational matters.

Despite these legal changes, Spanish universities have been characterized by a short tradition of ties with industry. In 1986, the *Law of Promotion & General Coordination of Scientific & Technical Research (Law of Science)* designed a new scientific and technological policy in order to face certain deficiencies of the national research system. Later, in 1988, the Government established the universities' Technology Transfer Offices (TTOs) to support and promote the dissemination of scientific knowledge and technology transfer activities.

Twenty years later, Spanish universities have substantially improved their contribution to the national research system by increasing the activities related to the commercial exploitation of knowledge. For instance, they created about 143 spin-offs in 2006. The research contracts have increased considerably in recent years, growing from 100 million Euros in 1996 to 428 million Euros in 2006. The requests of patents made in the Spanish University System have growth from the 282 requests in 2000 to 572 in 2006. The TTOs have also played an important role in this process by managing about the 98% of the knowledge protection in the Spanish universities (Office of Technology Transfer, 2007). Despite the efforts being made, this performance reflects the fact that the Spanish universities are not acting in a sufficiently proactive manner.

The objective of this paper is to understand why some Spanish universities are more successful than others at creating spin-offs. This analysis offers interesting opportunities for a better understanding of the universities' spin-off activity in countries such as Spain, where universities have been characterized by a short tradition of ties with industry and the technology transfer model presents important institutional differences with the Anglo-Saxon model. First, cooperation between industry and universities is still not sufficiently developed. Second, fundraising to bring new inventions to market is more difficult in Spain than it is in the U.S. Third, the high level of bureaucracy in the universities and their aversion to risk partially explain the low level of involvement of several universities in the process of the creation of companies (Fundación CYD, 2009).

This paper is organized as follows. The 'Theoretical development' section describes the theoretical background of the models and the hypotheses. In the 'Methodology' section the methodology is explained. In the 'Empirical results' section the empirical results are presented. In the 'Conclusions and implications' section, we conclude by summarizing the most important findings, discussing several implications for policy-makers, introducing the potential limitations of the research and discussing areas for further research.

Theoretical development

The literature on university spin-off activity has rapidly expanded in recent years. The creation of academic spin-offs is a multidimensional phenomenon, being conditioned by a wide range of institutional factors, social and legal (Gómez, Mira, Verdú, & Sancho, 2007). O'Shea, Chugh, and Allen (2008) suggest that the existing literature on this topic can be categorized into six separate

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