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Complements or substitutes? The role of universities and local context in supporting the creation of academic spin-offs

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ABSTRACT

In this paper, we analyze the extent to which University-Level Support Mechanisms (ULSMs) and Local-Context Support Mechanisms (LCSMs) complement or substitute for each other in fostering the creation of academic spin-offs. Using a sample of 404 companies spun off from the 64 Italian Science, Technology, Engineering, and Mathematics universities (STEM universities) over the 2000–2007 period, we show that the ULSMs' marginal effect on universities' spin-off productivity may be positive or negative depending on the contribution offered by different LCSMs. Specifically, in any given region, ULSMs complement the legislative support offered to high-tech entrepreneurship whereas they have a substitution effect with regard to the amount of regional social capital, regional financial development, the presence of a regional business incubator, regional public R&D expenses as well as the level of innovative performance in the region. Results support the idea that regional settings' idiosyncrasies should be considered for universities to develop effective spin-off support policies. This paper contributes to the debate on the evaluation of economic policies supporting entrepreneurship.

1. Introduction

The economic importance of New Technology-Based Firms (NTBFs) as key components of development and growth (Roberts, 1991; Schumpeter, 1912) has found consistent support over time and is recurrently cited in numerous positioning papers that set the agenda of governments around the world (Lerner, 2010). Academic spin-offs—i.e., companies created to exploit technological knowledge that originated within universities—represent a specific category of NTBFs (Shane, 2004). Such companies, especially in the last two decades, have received increasing attention from researchers and policymakers because of their ability to create wealth and to advance scientific knowledge (Mustar et al., 2006, 2008).

There are several reasons for their growing economic importance. First, the increasingly rapid evolution of knowledge fields as well as their multidisciplinarity—which is core to new disciplines like, for example, nanotechnologies (Gibbons, 1994)—requires access to multiple research environments, which may be offered by academic spin-offs (Shane, 2004). Secondly, the organization of R&D activities in large firms in different industries has evolved toward more open models as part of which alliances with smaller and more dynamic firms with sophisticated scientific bases, such as academic spin-offs, become a central pillar for the pursuit of new technologies (Pisano, 2006; Zucker et al., 2002). Moreover, academic spin-offs have enjoyed increasing visibility and importance following legislative changes that have involved several countries across the world and have specifically targeted the creation of new firms by universities and, at the same time, provided a more liberal framework for academic institutions to pursue technology transfer activities.

With this specific regard, the Bayh-Dole Act is the first and most studied legislative change; it provided the framework for universities to patent inventions funded by federal agencies. Although its net effects have been questioned (Kenney and Patton, 2009), even the harshest critics recognize that it contributed to raising the overall awareness that US universities could play an active role in technology transfer, including licensing, patents, university–industry collaborations, the pursuit of research contracts with companies, and academic spin-offs (Mowery et al., 2004).

Following mid-1990s legislative reforms that pushed public research institutions toward greater proactiveness in commercializing their research results, universities in many parts of the

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world have started to invest in the creation of internal mechanisms (organizational procedures, incentives, regulations, etc.) aimed at supporting academic entrepreneurship in its different forms (Baldini et al., 2006; Geuna and Rossi, this issue). These internal, university-level mechanisms and policies have contributed significantly to the professionalization of activities that encourage the exploitation of research results (Meyer, 2003; Siegel et al., 2003).

Yet, unlike in the US, where there has been a systematic effort to assess the impact of legislation (particularly, Bayh-Dole) and of the mechanisms/policies implemented by universities to support the commercial exploitation of research results, in Europe, both per se (Di Gregorio and Shane, 2003; Link and Siegel, 2005; Mowery et al., 2004; O'Shea et al., 2005) and conditional to local context specificities (Brunitz et al., 2008; Roberts and Malone, 1996), the effects of universities' interventions are still mainly anecdotal (for notable exceptions, see Degroof and Roberts (2004) and Rasmussen et al. (2011)).

Although several scholars have worked on either university patenting (e.g., Baldini, 2011a; Baldini et al., 2006; Breschi et al., 2008; Lissoni et al., 2008) or spin-off creation (e.g., Baldini, 2011b; Colombo et al., 2010; Fini et al., 2009; Lockett et al., 2005; Moray and Clarysse, 2005; Nosella and Grimaldi, 2009), there is a gap in the literature related to the joint impact that university and regional specificities might have on technology transfer activities in the European context and, more specifically, on how and to what extent each single university mechanism either complements or substitutes for various regional characteristics in fostering the creation of academic spin-offs. Therefore, considering the increasing attention devoted to these topics by several decision-making bodies in the EU and other parts of the world, we believe that a more systematic assessment of the impact of universities' interventions to support academic entrepreneurship in EU countries is timely and desirable.

In this study, we start filling this gap by focusing on one of the major European countries, Italy, and assessing the impact of universities' activities in fostering spin-off companies in a given regional setting. We look at the nature and role of University-Level Support Mechanisms (ULSMs) for the creation of academic spin-offs, and the way they interact with other forms of support mechanisms—which we call Local-Context Support Mechanisms (LCSMs)—that are generally available in the regional context in which universities operate. By focusing on a single country, we try to control for the national-level institutional setting and for the regulations to which all universities must adhere. Moreover, given the variety of support mechanisms across Italian regions, we assess the impact of university-level policies that depend on the specificities offered by regional contexts.

Using longitudinal data on the population of the 404 Italian university spin-offs that have originated from the 64 Italian Science, Technology, Engineering, and Mathematics universities (STEM) (www.nsf.gov/nsb/stem/) over the 2000–2007 time period, we adopt a set of multi-level specifications in order to disentangle the impact of ULSMs and LCSMs on university spin-off productivity. More specifically, we address the following research question. Do ULSMs and LCSMs complement or substitute for each other in fostering the creation of academic spin-offs?

Our results show that, in any given region, ULSMs complement the legislative support offered to high-tech entrepreneurship. Ceteris paribus, therefore, the higher the marginal productivity of the legislative support, the greater the marginal productivity of ULSMs. On the other hand, ULSMs have a substitution effect with respect to amount of regional social capital, regional financial development, presence of a regional business incubator, regional public R&D expenses as well as level of innovative performance in the region.

Our findings shed some light on how and to what extent universities' efforts complement or substitute local specificities in fostering academic entrepreneurship. They also support the belief that regional settings' idiosyncrasies should be taken into account in order for universities to develop effective spin-off-support policies.

The remainder of the paper is organized as follows. In Section 2, we focus our attention on the specific mechanisms that support academic spin-off creation and on their expected effects. In Section 3, we lay out the research design, describing the Italian normative contexts, our data, and the method. In Section 4, we present the results, discussing the empirical evidence that has emerged from our analyses. Section 5 concludes with implications for university technology-transfer activities and policy-making decisions.

2. Forms and sources of support mechanisms for academic spin-offs

Academic spin-offs, given their technology basis, combine both the traditional problems associated with the start-up of a new business and the difficulties associated with the development of new technologies (Oakey et al., 1996). According to several contributions that are core to the Economics of Innovation (Hall and Rosenberg, 2010; Stoneman, 1995), academic spin-offs are, therefore, particularly sensitive to various kinds of market failures that are typically associated with early stages of business.

First, they are both capital and credit rationed. On the capital side, academic entrepreneurs are prone to generating information asymmetries either due to inability to properly communicate key characteristics of the knowledge on which the new venture is based to investors, or because of unwillingness to share too many details of their technologies, fearing leakage/dissemination of information that they consider critical to the new venture's competitive advantage (Nerkar and Shane, 2003). Moreover, several studies show that financial markets are not equally developed around the world, thus oftentimes lacking the presence of specialists in the provisioning of risk capital or, when present, the necessary expertise (Rajan and Zingales, 1998). On the credit side, it has been well established that start-ups, and particularly high-tech ones, lack several elements that are key for signing debt-contracts: from regular cash flows needed to pay dividends and reimburse capital to collaterals and reputation (for a review see Hall, 2002).

Market failures also arise because of the appropriability characteristics of new technologies, which account for the higher risks associated with investing in academic spin-offs, and might not always be resolved by intellectual property rights. Moreover, academic spin-offs might not be able to appropriate the rents from their technologies because they may lack the complementary resources/technologies to exploit them and the resources to efficiently locate and involve partners able to provide them (Roberts, 1991; Roberts and Malone, 1996).

Several mechanisms and policies can therefore be devised to try to solve these market inefficiencies. In the following sections, we explore in greater detail these various mechanisms, distinguishing between those directly under the control of universities, and those more generally related to the presence of specific environmental (i.e., local context) conditions.

2.1. University-level support mechanisms (ULSMs)

The set of policies and instruments that can be put in place by universities to support academic spin-offs is quite varied, depending on the phase of intervention, the subjects targeted, the type of support provided, the nature and type of resources mobilized for