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The university as a venture capitalist? Gap funding instruments for technology transfer

Federico Munari^a, Maurizio Sobrero^a, Laura Toschi^{b,*}

^a Department of Management, University of Bologna, Via U. Terracini 28, 40131 Bologna, Italy

^b Department of Management, University of Bologna, Via Capo di Lucca 34, 40126 Bologna, Italy

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ABSTRACT

The limited availability of private funding sources to support technology transfer activities represents a major barrier to the effective commercialization of university technologies. This article analyzes the key determinants of the activation of financial instruments by universities—such as seed funds and proof-of-concept programs—to address such funding gaps. Using data from a survey of technology transfer office managers in European universities, we detail the antecedents of the presence of such instruments at the university level and their perceived effectiveness. The findings, in turn, have notable policy implications.

1. Introduction

National governments and regional authorities have increasingly focused on the development of technology transfer (TT) activities in order to facilitate the flow of ideas from universities into industry. Unfortunately, the lack of private funding sources to support such activities in their different forms—the so-called funding gap—constitutes a major barrier to the effective commercialization of university technologies (Audretsch et al., 2012; Benner and Sandstrom, 2000; Lockett and Wright, 2005; Munari et al., 2016). To address this challenge, various universities and public research organizations (PROs) have formally invested in the creation of internal financial mechanisms (i.e., “gap funding” instruments) in order to support translational research and fuel the growth of academic spin-offs, often in collaboration with public institutions (Darcy et al., 2009; Lerner, 2009; Wright et al., 2006). In recent years, two complementary instruments have received increasing attention in policy debates and academic literature, namely, proof-of-concept (POC) programs (Bradley et al., 2013; Gulbranson and Audretsch, 2008) and university seed funds (USFs) (Croce et al., 2014; Munari and Toschi, 2011). However, our understanding of the appropriate conditions for the activation of these instruments and their ultimate effectiveness remains limited. Indeed, much of the research on this topic has relied on case studies and anecdotes, often from largely successful research institutions. To address such gaps, the current study seeks to answer two key research questions:

1. What key factors in technology transfer offices (TTOs), the university, and the external context determine the activation of gap

funding instruments by universities?

2. How effective are these instruments according to university TTO managers?

To investigate our research questions, we rely on empirical evidence from a survey of 128 university TTO managers across 32 European countries. With data from the survey, we first report a series of descriptive analyses of university-managed gap funding programs in Europe. Next, using a regression framework, we highlight that it is important to distinguish whether the efforts devoted to addressing the funding gap are a function of specific characteristics of the TTO or the university, or whether they are affected by the external ecosystem in which universities operate. In addition, we compare POCs and USFs in order to understand whether the conditions for activation and success vary according to the design of the scheme. To the best of our knowledge, this is the first study to provide a systematic analysis of the diffusion of university POCs and USFs across multiple countries and academic institutions. Understanding the factors that affect the creation of university gap funding measures may support university policies, organizational practices, and public policy choices, leading to a more favorable environment for the successful exploitation of results from research activities.

Our paper is organized in the following way. Sections 2 and 3 introduce the relevant literature and set out our multi-level conceptual framework. Section 4 describes the sample, the data and the methods used in the analyses. Section 5 presents the main empirical results. Section 6 concludes by discussing the policy implications of our findings for the design and implementation of effective gap funding

* Corresponding author.

E-mail addresses: federico.munari@unibo.it (F. Munari), maurizio.sobrero@unibo.it (M. Sobrero), laura.toschi@unibo.it (L. Toschi).

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programs in support of TT activities.

2. Literature review

2.1. Rationale and structure of “gap funding” instruments

The commercialization of new inventions and technologies is a widespread additional component to the activities of modern universities and PROs, pursued with the aim of contributing to local economic and societal development (i.e., Horizon 2020 Agenda). However, several barriers and inefficiencies limit the transformation of new, research-based inventions into successful products or services. One of the most frequently cited hurdles is the “funding gap”, that is, a lack of private funding sources to support TT activities in their different forms, regardless of the level of development of capital markets (Lockett and Wright, 2005; Mazzucato, 2013; Munari and Toschi, 2011). Such a gap is largely due to the “embryonic” nature of university-generated inventions, which tend to operate at the frontier of scientific advancements and thus involve considerable risks associated with their subsequent validation, industrialization, and commercialization. The time lag required to transform such discoveries into marketable products and the vast amount of resources needed to pursue the required development severely limit the opportunities to attract external funding. In the specific case of academic spin-offs, even in markets with a strong presence of dedicated financial operators, such as venture capital (VC), the general unavailability of private investments stems from high transaction costs, significant asymmetric information between science-based ventures and potential external investors, and high risks pertaining to the uncertainty of project outcomes (Mazzucato, 2013; Munari and Toschi, 2011; Murray, 2007; Murray et al., 1998). In addition, several countries face a more general underdevelopment of the VC infrastructure. For these reasons, private VC funding, which is typically focused on later-stage forms of financing, may not be available for academic start-ups at an early stage. The so-called ‘valley of death’ (Auerwald and Branscomb, 2003) thus emerges when government funding for research projects runs out but researchers and academic entrepreneurs have yet to secure external funding from private investors. Without the availability of funding instruments specifically dedicated to such a phase, research that may later be socially and economically useful, but is not yet commercially viable, can stall.

Different support mechanisms seek to address these gaps, both as general policies and as specific institutional initiatives, including university accelerators and incubators, start-up competitions, and university-managed seed funds (Croce et al., 2014; Munari et al., 2015; Rasmussen and Sorheim, 2012). With this study, we focus on two types of instruments that are relatively more recent and are diffusing rapidly across universities all over the world: university-oriented POCs and USFs. These gap funding instruments differ significantly in their targets and are labeled in various ways, depending on the involved universities, investors, and countries. Thus, we group them into two major categories to facilitate their identification (see Fig. 1):

POC programs represent a recent, innovative mechanism increasingly embraced by public policies (e.g., Startup America Initiative, EU Horizon 2020 Framework, ERC Proof-of-Concept grants). These programs encompass several funding schemes that combine money, expertise, and training to help new inventions and discoveries emerge and to demonstrate their technical and commercial feasibility. Despite diverse labels across different universities and nations (e.g., POC funds, proof-of-principle funds, translational funding, pre-seed funding, verification funding, maturation programs, innovation grants, ignition grants), they all share common objectives and characteristics: to evaluate the technical feasibility and commercial potential of early-stage university/PRO ideas and technologies and to demonstrate their value to potential industrial partners and investors. Such programs provide capital and assistance to individual researchers or research teams across a wide spectrum of areas, such as intellectual property rights (IPR)

protection, prototype building and technical verification, business plan development, market studies, entrepreneurial team formation, and networking with external partners. The ultimate goal is to advance the technology to a point at which it can be licensed to external industrial partners or a start-up can be created in order to attract the interest of investors in later stages of development. POC programs are typically administered in the form of grants, although different variants are available (e.g., repayment schemes, loans).

USFs, instead, are early-stage VC funds that have the deliberate and explicit mission of investing in university and PRO start-ups to support TT and the commercialization of university and public research endeavors. This general definition contains some features that define the nature of the USFs and differentiate them from other types of VC seed funds and from POC programs. Compared with other types of VC funds, USFs explicitly focus on investment in university and PRO start-ups because they are either activated and managed directly by the university/PRO, are partly funded by universities/PROs as limited partners, or involve formal partnerships or collaborations with universities/PROs. In contrast with POC programs, which fund individual researchers or projects in the pre-seed phase of development (i.e., before the company's legal foundation), USFs typically invest downstream in newly created start-ups. Their objective is to enhance the development of university/PRO start-ups to a point at which they are ready for investments by professional business angels or venture capitalists. They typically operate by providing equity capital to investee start-ups, although other forms (e.g., convertible loans) are also possible. Table 1 compares the two types of gap funding instruments by highlighting the differences in their objectives, focus of investment, investment typology, and investment stage.

2.2. Diffusion of gap funding instruments in universities

Despite their relative importance, very limited research addresses these emerging financial instruments for TT, and most available studies rely on single cases or anecdotal evidence (Bradley et al., 2013; Gulbranson and Audretsch, 2008; Maia and Claro, 2013; Rasmussen et al., 2011). With a few exceptions (Croce et al., 2014; Munari et al., 2015), multi-country comparisons are virtually absent in the literature, making it difficult to assess the diffusion of such instruments among universities in various national settings or the influence exerted by institutional and contextual factors. In addition, we suffer from a very limited understanding of the factors that determine the instruments' effectiveness in promoting TT.

Gulbranson and Audretsch (2008) compare two POC programs—the Deshpande Center at MIT and the von Liebig Center at UCSD—along several dimensions, such as initial funding, budget, number of employees, number of proposals funded, type of service provided (advisory, networking, education) and number of startups and licenses obtained. The aim of the paper is to provide insights into how these two centers have facilitated the transfer of university innovations into commercial applications and under which conditions these programs can prosper in order to determine possible key factors for the activation of similar exercises in other contexts. A clear message deriving from this work is that POCs are heterogeneous, as they offer a mix of approaches to provide customizable support and fill the funding gap.

Maia and Claro (2013) present a framework to assess the role of POC programs in a university ecosystem with a specific application to the case of the University of Coimbra, in Portugal. The aim of the work is to determine the main advantages associated with this type of instrument so that similar programs may be implemented in comparable university ecosystems. In particular, the POC plays a critical role for both the technology commercialization process, through networking outside academia, and the technology entrepreneurship education, by developing entrepreneurial skills for researchers. Also, in this case, strong attention is directed towards the external conditions surrounding the POC program.

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