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“To Own, or not to Own?” A multilevel analysis of intellectual property right policies' on academic entrepreneurship

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ABSTRACT

The political environment around universities has led them to create an infrastructure to manage academic inventions. While some consider that the advantages of a university entrepreneurial structure outweigh any potential negative effects, others question their detrimental effect on academic scientists' entrepreneurial behavior. However, this debate remains unresolved as none of these two views have been fully empirically supported. Using multilevel models for a population of 2230 professors in 27 universities in Canada (82 individuals per unit on average), we test the effect of three features of institutional intellectual property right policy characteristics, namely, property rights (ownership regime), control rights (obligation to disclose and option to commercialize), and income-sharing schemes (when commercialization involves the university or an individual inventor) on two commercial behaviors of faculty members, namely, formal commercialization (patent and spinoff creation), and informal commercialization (consulting and commercial agreement). Our results suggest that contrary to most of the literature, academic inventors' behavior is influenced not by the invention ownership regime but by the control rights in place and the sharing of income between the university and the academic inventors. The findings have some implications for the importance of an ownership regime and the ineffectiveness of institutional policies which create contradictory motivations for academic entrepreneurs. It suggests some directions for future research using multilevel models.

1. Introduction

Following contention and debate, visions of what universities are for have moved over time towards a versatile and complex orientation that goes beyond their research and teaching roles (Deem, 2008). For example, universities increasingly are seen as providers of value-added inputs for societal economic development through their interactions with other public and private organizations (Von Proff et al., 2012). These interactions occur within a complex knowledge transfer process that involves various knowledge exchange channels such as joint research (Olmos-Peñuela et al., 2014), commissioned or contracted research (Hewitt-Dundas, 2012), technological consultancy services (Amara et al., 2013), ad hoc advice and networking with practitioners (Perkmann et al., 2013), and education and training (Kochenkova et al., 2016). University researchers contribute not only by broadening the science base but also by producing inventions relevant for industry application, and by exploiting their knowledge through the creation of spinoffs (Sterzi, 2013). Thus, maximizing the footprint of the university

through publicly-funded research and development (R & D) is on the agendas of both policy-makers and universities' administrators (Jacobsson et al., 2013). Policy-makers have been particularly active in reforming the intellectual property rights (IPR) regime for university inventions (Giuri et al., 2013). During recent decades, Public Law 96–517 issued in 1980, known generally as the Bayh-Dole Act, is described as the most important recent change to technology transfer policy (Grimaldi et al., 2011). The Bayh-Dole act was initiated in the US during a period of decreasing public funding of universities and provides universities with a set of unique rules. Previous to its implementation, universities were subject to the different IPR policies of funding agencies (Della Malva et al., 2013). The Bayh-Dole Act requires researchers to disclose inventions resulting from federal research grants to their universities (Grimaldi et al., 2011) which then can retain the IPR on them (Grimaldi et al., 2011; Von Proff et al., 2012). Despite various critiques (Grimaldi et al., 2011), faith in the efficacy of the Bayh–Dole Act persists, and policy-makers in other countries have implemented similar policies in their search for the right model to foster

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university-industry interactions (Von Proff et al., 2012).

These various reforms have thus spurred universities to develop their own regulations, and to create the conditions for the emergence of institutional intellectual property rights policies (IIPRP) (Geuna and Rossi, 2011; Grimaldi et al., 2011; Kochenkova et al., 2016), and the development of an infrastructure to manage academic inventions (Della Malva et al., 2013). Since knowledge commercialization tends to be individually driven, and pursued on a discretionary basis (Abreu and Grinevich, 2013; Halilem, 2010; Halilem et al., 2011; Halilem et al., 2016), IIPRP have been oriented towards increasing the transfer of commercial knowledge from academic researchers (Grimaldi et al., 2011). Some scholars claim that institutional arrangements support academic entrepreneurs' knowledge commercialization (Von Proff et al., 2012). For example, new IPR regimes insure academic inventors against the risk of losing money from patent applications (Love, 2015). Moreover, working with the university's knowledge and technology transfer (KTT) office helps the academic entrepreneur to negotiate with private partners and to handle commercial agreements (Fitzgerald and Cunningham, 2015; Von Proff et al., 2012). However, there are some detailed empirical studies on changes to regulations and policies implemented at the country or university level which show that institutional ownership might be detrimental to academics' entrepreneurial behavior (Grimaldi et al., 2011; Kenney and Patton, 2011). Institutional ownership regimes have led universities to be more aggressive about reclaiming their share of IPRs from academic researchers (Della Malva et al., 2013), to create rigid patenting procedures, and to force patenting and licensing even when they are not necessary for commercialization (Walter et al., 2016). Moreover, sharing their commercialization revenue with their institution could discourage academic entrepreneurs from pursuing entrepreneurial opportunities (Jacobsson et al., 2013). Consequently, while some expect that the advantages of IPR regimes outweigh their potential negative effects (Von Proff et al., 2012), others question their detrimental effect on academic scientists' entrepreneurial behavior (Czarnitzki et al., 2012; Lissoni and Montobbio, 2015). In the absence of thorough empirical evidence, this debate continues unresolved (Galushko and Sagynbekov, 2014; Grimaldi et al., 2011; Okamuro and Nishimura, 2013). The objective of this paper is thus to understand whether institutional IPR regimes increase or decrease the commercialization of research from university researchers.

Section 2 provides a review of the literature on the influence of IIPRP on commercial knowledge transfers from university to industry. Section 3 describes the methodology used to conduct a multilevel – institutional and individual – analysis, and Section 4 presents the descriptive results, estimations of the group level effect, and an estimation of the effect of the IPR characteristics on academics' commercial behaviors. The paper concludes in Section 5 with implications and suggestions for future research.

2. Literature review

2.1. The theoretical foundations

In recent years, a dynamic emerging literature on academic entrepreneurship has offered insights into the commercialization of knowledge produced within universities (Abreu and Grinevich, 2013; Halilem, 2010; Perkmann et al., 2013). Its commercialization depends not on a single event but rather on a process comprised of a series of events (Friedman and Silberman, 2003). The integrative literature review in Wood (2011) highlights a process that starts with the discovery in the course of university research of an invention – a technology or an idea with commercialization potential. For academic entrepreneurs, the process typically continues with disclosure of intellectual property, awareness and securing of industrial partners, and selection and planning before final commercialization (Paul et al., 2015; Wood, 2011). While this process can be managed by entrepreneurial scientists

(Goethner et al., 2012), when the IP is secured, it can also be overseen by the university KTT office with or without the active participation of the academic inventors (Perkmann et al., 2013). Thus, scholars have differentiated between formal commercialization which implies a legal instrument such as IP, and potentially could generate revenue for the university (Link et al., 2007), and informal commercialization (Siegel et al., 2007) which facilitates the flow of technological knowledge without the involvement of the university KTT office (Link et al., 2007). Formal commercialization involves another agent, a KTT officer, and can occur through patenting and spinoff activity (Siegel et al., 2007). Informal commercialization of research involves a knowledge transfer via a contractual agreement or via consultancy between the researcher and a private actor (Heumann et al., 2010). While formal commercialization represents a traceable way that academic research contributes to the economy and to society, the importance and volume of the overall academic knowledge transfer activity tend to be underestimated (Grimaldi et al., 2011). For example, D'este and Perkmann (2011) study UK researchers in the physical and engineering sciences and show that involvement in formal commercialization in the form of patent applications (29%) and spinoff creation (19%) is lower compared to involvement in informal (not IP based) commercialization such as consultancy services (68%). Moreover, most studies of knowledge transfer from universities to industry adopt a narrow definition of knowledge transfer and consider a single mechanism such as patents (Geuna and Rossi, 2011; Giuri et al., 2013; Sterzi, 2013), spinoffs (Damsgaard and Thursby, 2013; Kenney and Patton, 2011; Muscio et al., 2016), licensing (Buenstorf and Schacht, 2013), or university-industry contracts at either the institutional or individual level (Freitas et al., 2013; Okamuro and Nishimura, 2013). Thus, knowledge transfer between universities and industry implies a wider range of commercialization mechanisms, either formal or informal (Amara et al., 2013; Halilem et al., 2011; Hewitt-Dundas, 2012; Landry et al., 2013; Perkmann et al., 2013) that includes in addition to patents and spinoffs, consultancy services, and commercial agreements. All these channels need to be considered in a study of commercial knowledge transfer.

Most studies of individual academic entrepreneurship adopt resource-based theory and assume that like private entrepreneurs, researchers control bundles of idiosyncratic resources and capabilities which are mobilized in the commercialization of their research (Landry et al., 2007; Ortín-Ángel and Vendrell-Herrero, 2014). According to Goethner et al. (2012) and Schmitz et al. (2016), studies of academic entrepreneurs' characteristics are dominated by economic approaches. These characteristics are not sufficient to explain academic entrepreneurship because unlike private entrepreneurs, academic entrepreneurs have to comply with a distinct set of incentives and institutional rules (Goethner et al., 2012) including those related to IPR (Crespi et al., 2010; Damsgaard and Thursby, 2013; Galushko and Sagynbekov, 2014; Geuna and Rossi, 2011; Grimaldi et al., 2011; Kauppinen, 2014; Kenney and Patton, 2011; Schmitz et al., 2016; Siegel and Wright, 2015). Aghion and Tirole (1994) develop a theory related to the effect of innovation rights in contract research which has been mobilized to study academic researchers' behavior (Lissoni and Montobbio, 2015; Okamuro and Nishimura, 2013; Sterzi, 2013). Their theory implies that institutional contractual provisions for how to share the property rights on inventions, how to allocate control over research, and how to structure monetary compensation affect the behavior of researchers. Aghion and Tirole (1994) consider that a contract, that specifies *ex ante* the allocation of the property rights on any forthcoming innovation, or includes a rule about sharing the revenue from potential commercialization, will influence the involvement and motivation of researchers in the development and commercialization of an innovation. In particular, they propose a differentiation between property and control rights, and the sharing of revenue (Aghion and Tirole, 1994). Although the inventor may have the ownership of his or her invention (Galushko and Sagynbekov, 2014): 1) it is generally necessary for the invention to be disclosed to the university KTT office,

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