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Patenting rationales of academic entrepreneurs in weak and strong organizational regimes

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ABSTRACT

This study explores why academic entrepreneurs seek patents for spin-off technology in weak organizational regimes (the employee owns her inventions) and strong organizational regimes (the employer, i.e. the university or research organization, owns these inventions). Specifically, we examine organizational and founding team characteristics as alternative explanations. Matched data of academic spin-offs from both contexts combined with patent data show that founding team characteristics (expert knowledge and entrepreneurial orientation) matter in weak, but not strong regimes. In contrast, organizational patenting norms are the key driver of patenting in strong, but not weak regimes. We discuss the implications of our results for the current literature and technology transfer policies.

1. Introduction

Legal reforms in many countries, such as the Bayh–Dole act in the US (Shane, 2004a) or the Employees' Inventions Act in Germany (Harhoff and Hoisl, 2007), have given property rights in federally funded research to the employer. Often this initiated a shift from a '*weak organizational regime*' (i.e., the employee holds the property rights in her inventions made at work) to a '*strong organizational regime*' (i.e., the employer—the university or research organization—holds property rights in employee inventions). This change *seems* to have radically altered the way academic entrepreneurs (i.e., scientists who commercially exploit their discoveries by creating their own ventures) can protect their firms' knowledge base. But how drastic is the change really? Some scholars now view the employer as the sole decision-maker in patenting (Shane, 2004b). Other scholars highlight the great informal influence scientists can still exert on their employers' decision to patent their inventions or not (Agrawal, 2006; Jensen and Thursby, 2001). However, to date, the literature has been resoundingly silent on the question why academic entrepreneurs seek patents and what difference the organizational regime makes in this context. This oversight is surprising given the ongoing debate about the efficacy of patents (e.g., Arundel, 2001; Lanjouw and Schankerman, 2004; Lowe, 1993; Shane, 2001)—in particular for start-ups and small firms (Leiponen and Byma, 2009; Thomä and Bizer, 2013)—and the threat that patenting could become an organizational automatism also in situations where other protection strategies are advisable.

In exploring patenting rationales, our study builds on different streams of existing research. One stream has suggested that scientists who conduct more applied research (Sellenthin, 2009), have published intensively (Azoulay et al., 2007; Dietz and Bozeman, 2005; Van Looy et al., 2006), gained more industry experience (D'Este and Perkmann, 2011; Meyer, 2006), or received industry funding (Carayol, 2007; Landry et al., 2007), are more likely to disclose and let the organization patent their inventions. A second stream has suggested that firms, which are intensively conducting R&D (Brouwer and Kleinknecht, 1999), export-oriented (Arundel and Kabla, 1998), and active in certain industries (Mansfield, 1986), are more likely to patent. A third stream has examined impacts of Bayh–Dole-like acts, suggesting, for instance, that the Bayh–Dole act had little effect on university patenting in general, but was influential only in certain fields and for certain universities (Henderson et al., 1998; Mowery and Ziedonis, 2002; Sampat et al., 2003; Shane,

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2004a). Universities outside the US, while showing increasing interest in claiming their intellectual property rights (Della Malva et al., 2013; Dornbusch and Neuhäusler, 2015), were found to initially lack the necessary support infrastructure to fully benefit from such legal reforms (Baldini, 2009). Research within this stream also suggests that US universities own a higher share of academic patents than their European counterparts, arguably as a result of the time lag in legal reforms (Lissoni et al., 2008; Lissoni, 2012). Another study shows that the size of technology transfer offices, of which many were created after the reforms (Sampat, 2006), promotes start-up activity, but not patenting activity (Van Looy et al., 2011).

Despite substantial scholarship, a few significant gaps remain in our understanding of academic entrepreneurs' patenting. First, previous findings for scientists and firms are not necessarily generalizable to academic entrepreneurs: unlike firms, academic entrepreneurs have, at least formally, lost discretion over patenting in countries implementing Bayh–Dole-like acts. Academic entrepreneurs can retain greater preference for publishing instead of patenting intellectual capital than entrepreneurs with business backgrounds (Link and Ruhm, 2011). Unlike non-founding scientists, academic entrepreneurs take financial responsibility for commercializing their inventions, can suffer from losing control over the invention by patenting via the employer (Shane, 2002; Thursby and Thursby, 2002), and have to balance academic and entrepreneurial careers as well as university and spin-off interests in patenting (Nicolaou and Birley, 2003). Second, although impacts of Bayh–Dole-like acts have been widely investigated, no study (that we know of) has illuminated how patenting by academic entrepreneurs differs in weak and strong organizational regimes. While the propensity to engage in patenting processes may hinge on a mix of individual and organizational influences (Azoulay et al., 2007; Bercovitz and Feldman, 2008) it is still unclear whether and how Bayh–Dole-like acts affect the relative importance of these influences.

To address the above gaps, this study examines the relative influence of founding team characteristics (expert knowledge and entrepreneurial orientation) vis-à-vis organizational characteristics (publication norms, patenting norms, and patenting capabilities) on academic entrepreneurs' propensity to seek patents. More specifically, we compare the role of these characteristics in two contexts, namely weak and strong organizational regimes. We use Ajzen's (1991) theory of planned behavior to illuminate the theoretical 'black box' surrounding our hypothesized relationships. A matched sample of spin-offs from public universities and public research organizations in Germany allowed us to study different organizational regimes. The university sample represents weak organizational regimes by containing spin-offs founded prior the reform of the Employees' Inventions Act in 2002—a time when university professors, lecturers, and scientific assistants still had de jure ownership in their inventions (Harhoff and Hoisl, 2007). Public research organizations represent strong organizational regimes as they are governed under the Employees' Inventions Act of 1957, granting the employer full ownership in employee inventions.

This article contributes to the extant literature in several ways. First, our results indicate that in strong organizational regimes, only organizational patenting norms, but not expert knowledge or entrepreneurial orientation matter for patenting. This extends the literature on Bayh–Dole-like acts by showing how much the implementation of such acts can affect patenting rationales of academic entrepreneurs up to a point, where patenting might become an organizational automatism. Second, our focus on academic entrepreneurs adds to the wider literature on patenting that has been limited to either scientists (e.g., Baldini, 2009) or established firms (e.g., Arundel and Kabla, 1998). Our findings suggest that academic entrepreneurs patent for reasons partly similar, partly different to those identified for scientists and firms. Third, scholars have theorized that the organizational influence on patenting may flow via two mechanisms, including organizational norms and organizational support (Baldini, 2009; Bercovitz and Feldman, 2008; Sellenthin, 2009). This study is one of the first to test both possibilities in concert. Significant findings for organizational patenting norms, but not organizational patenting capabilities seem to confirm the first explanation. Finally, our study contributes to the long-standing debate on the relationship between patenting and publishing (e.g., Geuna and Nesta, 2006; Larsen, 2011). According to our findings for academic entrepreneurs, there is no significant link between the two domains, suggesting that they co-exist rather than complement or substitute one another.

2. Theoretical development

In deciding whether to patent or not, academic entrepreneurs have to weigh several benefits and risks of patenting. Patents can safeguard their spin-off's knowledge-base against early imitation by defining property rights (Harter, 1994), attract venture capital (Wright et al., 2006; Mann and Sager, 2007), support inter-firm partnering (Hertzfeld et al., 2006), and, if effective, yield substantial competitive advantage (Kaiser, 2009; Song et al., 2008). Their signaling function can make patents a necessary cost for ensuring a start-up's viability (Levitas and McFadyen, 2009). On the other hand, patents require the disclosure of critical information, thereby enabling competitors to imitate or 'invent around' a patent (Arundel, 2001; Kultti et al., 2007). Patenting is considerably time-consuming and expensive and can be a suboptimal strategy for spin-offs lacking the resources to effectively litigate and enforce their rights in cases of infringement (Arundel, 2001; Lanjouw and Schankerman, 2004).

The patenting decision does not always rest with the academic entrepreneur alone because jurisdictions handle property rights to employee inventions differently. Some jurisdictions permit the inventor to retain full property rights and to independently file a patent (Sellenthin, 2009). Yet, even in this 'weak organizational regime', some academic entrepreneurs may involve the organization in the patenting process, in order to benefit from organizational support in writing and, if necessary, defending a patent or to comply with general expectations (Bramwell and Wolfe, 2008; Sampat, 2006). Other jurisdictions entitle organizations to patent on behalf of their employees, if the invention results from federally funded research. These 'strong organizational regimes' result from legal regulations that have been in place for research organizations for a long time (Harhoff and Hoisl, 2007). In contrast, many universities shifted to a strong regime through legal reforms that started in the 1980s with the Bayh–Dole Act in the US (Mowery et al., 2001) and were later also implemented in other countries (e.g., Baldini, 2009). The inventor is required to disclose discoveries made during working time, let the organization decide whether to patent and, in case, obtain a license prior to firm founding. Otherwise, the inventor is free to patent in his or her own name. To some academic entrepreneurs, this may appear as a choice between letting the technology transfer office (TTO) file a patent, thereby risking to lose control over the invention (Shane, 2002; Thursby and Thursby, 2002), or creating a venture without filing a patent prior to founding and accepting the involved legal and ethical risks (Aldridge and Audretsch, 2010; Bercovitz and Feldman, 2008).[1] Other academic entrepreneurs may welcome the organizational support. However,

[1] Many academic inventors do not disclose their inventions (Bercovitz and Feldman, 2008; Landry et al., 2007; Jensen et al., 2003). Of these, some are interested in commercialization but consider the TTO difficult to work with or are unwilling to share revenues with the university (Thursby et al., 2009).