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Formal and informal appropriation mechanisms: The role of openness and innovativeness

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ABSTRACT

This paper analyses how firms' degree of openness and innovativeness influence their use of formal and informal appropriation mechanisms. Patents, trademarks, copyrights, and design rights are formal appropriation mechanisms. Secrecy, lead-time, and complexity are examples of informal appropriation mechanisms. Both external search breadth and depth are positively associated with firms' use of informal appropriation mechanisms, while only external search breadth is positively associated with formal appropriation mechanisms. Firms' degree of radical (incremental) innovation orientation is negatively (positively) associated with their use of formal appropriation mechanisms. Analysis of the joint impact of openness and innovativeness, suggests that for radical innovators it is external search breadth (rather than depth) that has a positive association with the use of informal appropriation mechanisms. In contrast, for radical innovators external search depth (rather than breadth) is associated with the use of formal appropriation mechanisms. For incremental innovators, external search breadth (rather than depth) is associated with the use of both formal and informal appropriation mechanisms.

1. Introduction

This study examines how firms' degree of openness and innovativeness is individually and jointly associated with their use of formal and informal appropriation mechanisms. Empirical work by Cohen et al. (2000) and Levin et al. (1987) already established that both formal and informal appropriation mechanisms are relevant for protecting the innovative endeavours of firms. Formal appropriation mechanisms, based on intellectual property (patents, trademarks, copyrights, and design rights), give innovating firms time-limited rights to exploit their discoveries, inventions, and new designs. These formal appropriation mechanisms create incentives for firms to re-invest in innovations, new technologies, and to diffuse new products based on innovations that are protected by law. In addition, firms can use informal appropriation mechanisms, such as secrecy, lead-time, and complexity (Neuhaeusler, 2012; Hall et al., 2014). In general, informal appropriation mechanisms are not protected by law, although in particular trade secrets can be enforced through confidentiality contracts and non-disclosure contracts. Lead-time and complexity are based on confidential and usually tacit knowledge that enables

innovating firms either to benefit from first mover advantages through early commercialization of innovations or to benefit from complex new products and processes that are difficult for other firms to imitate within a short period of time.

Given the increasing strategic importance of such appropriation mechanisms (e.g. Pisano and Teece, 2007; Somaya, 2012), recent research has begun to investigate factors that influence firms' use of formal and informal appropriation mechanisms (see James et al., 2013 for a comprehensive review of that literature). For instance, the degree of patenting has been shown to be influenced by industry-level conditions (Cohen et al., 2000), firm size (Arundel and Kabla, 1998), and capital intensity (Hall and Ziedonis, 2001). Likewise, there is some preliminary understanding of industry- and firm-level factors that are associated with the cost of utilizing secrecy as an appropriation mechanism, such as competitive conditions (James et al., 2013), or the complexity of knowledge residing inside the firm (Liebeskind, 1997). A recent study by Neuhaeusler (2012) investigates to what extent firm characteristics, such as size and industry affiliation influence the preference for formal and informal appropriation mechanisms. Despite this evidence, less is known about how firms'

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innovation activities are associated with the implementation of formal as well as informal appropriation mechanisms. This is surprising, since appropriation mechanisms are relevant tools for translating innovation activities into sources of competitive advantage (Milesi et al., 2013) and are, therefore, likely to be influenced by characteristics of the innovation process.

This paper addresses this gap by investigating how the degrees of openness and newness of firms' innovation activities influence firms' use of both formal and informal appropriation mechanisms. Appropriability conditions are no longer to be considered as primarily exogenously given and as such firms can influence the characteristics of their appropriability context by means of specific strategies and behaviours (Pisano, 2006; Pisano and Teece, 2007; Hurmelinna-Laukkanen, 2011; Neuhaeusler, 2012; Milesi et al., 2013). Innovative activities of firms involve resource-intensive processes to create new knowledge and to find commercially viable combinations of knowledge or technology. As new knowledge is created and combined, issues of protecting these innovative activities via appropriation mechanisms become particularly pertinent. Milesi et al. (2013) already suggested that characteristics of the innovation process influence firms' choices as to how to appropriate innovation profits. They argue that since the innovation process is unpredictable, the implementation of appropriation strategies is an ex-post decision or, in the best case, arises at the same time as the innovation process. This study adds to this prior work by investigating how two specific characteristics of the innovation process – the degree to which it is open and the degree to which it is radical versus incremental – influence the implementation of both formal and informal appropriation mechanisms. As such this study follows prior research in suggesting that characteristics of the innovation process impact firms' use of appropriation mechanisms. Since both independent and dependent variables are strategic choice variables that are not exogenous (see also Laursen and Salter, 2014) the research questions and hypotheses in this paper are formulated in terms of 'associations' rather than causal effects.

The concept of open innovation suggests that firms make greater use of external knowledge and increasingly collaborate with a variety of external partners (Chesbrough, 2003; Mortara and Minshall, 2011). In particular, firms search more broadly and deeply across different types of external knowledge sources (e.g. Laursen and Salter, 2006; Chiang and Hung, 2010; Drechsler and Natter, 2010; Köhler et al., 2012; Garriga et al., 2013). An obvious risk associated with such openness lies in the fact that resources are made available for others to exploit. This might make it more difficult to protect the innovative efforts of firms and to capture benefits that accrue from collaborative and shared innovative efforts (Helfat and Quinn, 2006; Dahlander and Gann, 2010; Huizingh, 2011). Securing certain legal rights in terms of formal appropriation mechanisms as well as making use of informal alternative forms of appropriation seem particularly critical for firms that are open in their innovative efforts but that also want to survive competitive pressures created by actions of other firms (Hurmelinna et al., 2007). Hence, the first research question refers to the influence of openness in innovation – in terms of external search breadth and depth – on the use of both formal and informal appropriation mechanisms.

Also, innovative activities of firms, whether they stem from traditional closed innovative activities or from open innovation, demonstrate different degrees of newness (Schmidt and Calantone, 1998). Radical innovative activities involve products that are new to the market (Dewar and Dutton, 1986) including, for instance, new product lines and product line extensions with new technology (Garcia and Calantone, 2002). Conversely, incremental innovative activities involve the adaptation, refinement and enhancement of products, thereby largely building on existing common technological knowledge (Dewar and Dutton, 1986). While they are usually new to the firm, products from incremental innovative activities only offer minor improvements for markets (Garcia and Calantone, 2002). The degree to which firms have a more or less incremental innovation orientation, or alternatively

a more or less radical innovation orientation is likely to be related with their strategies for protecting these innovative efforts (see also Hall et al., 2014). One the one hand, as firms create more new and advanced, i.e. distant, knowledge and hence, develop more radical innovations, they may be hesitant to disclose this distant knowledge via the use of a large number of formal appropriation mechanisms. Alternatively, the distant nature of this knowledge may make the use of informal appropriation mechanisms, such as secrecy, more valuable for these firms. On the other hand, firms with a higher incremental innovation orientation may derive little benefits from informal appropriation mechanisms that can hardly protect innovations that closely build on existing knowledge. Instead, the higher their incremental innovation orientation, the more these firms may protect their incremental knowledge via formal appropriation mechanisms. Hence, the second research question is: to what extent does the degree of innovativeness of firms influence their use of formal as well as informal appropriation mechanisms?

Finally, firms are expected to consider both characteristics of their overall innovation strategies. i.e., their openness and their degree of innovativeness, in using formal and informal appropriation mechanisms. Depending on firms' overall degree of innovativeness, external search breadth and depth may have differential impact on their appropriation strategies. For instance, for firms with a more incremental innovation orientation, external search breadth poses a higher appropriation risk than external search depth, as the incremental nature of the produced knowledge is easily accessible by a broad range of external partners. On the contrary, for firms with a more radical innovation orientation, external search depth (as opposed to breadth) leads to higher appropriation risk, since in-depth search with partners increases the risk of knowledge spill-overs by reducing the distance of the knowledge underlying the more radical innovations. Accordingly, a third research question deals with the joint impact of the two aspects of firms' overall innovation strategies, i.e., their openness and innovativeness, on appropriation mechanisms. In sum, the contribution of this study is a more detailed investigation of the direct and interactive impact of the degree of openness (in terms of external search breadth and depth) and the degree of innovativeness (in terms of radical versus incremental innovators) on formal and informal appropriation mechanisms.

2. Hypotheses

2.1. Openness in innovation and formal and informal appropriation mechanisms

As suggested by previous literature (e.g. Laursen and Salter, 2006; Chiang and Hung, 2010; Drechsler and Natter, 2010; Köhler et al., 2012; Garriga et al., 2013; Salge et al., 2013), the degree of openness in innovation of firms can be conceptualized in terms of the breadth and depth of their external search strategies. In particular, external search breadth refers to the diversity of external sources of knowledge for innovative activities (different categories of firms, universities, and research or technology institutions, as well as other specialized sources such as conferences or trade fairs). External search depth is understood in terms of the importance of these external sources of knowledge. Both external search breadth and depth can then characterize a firm's degree of openness in its innovation process. A number of prior contributions already suggest that in the context of open innovation the systematic use of appropriation mechanisms is relevant as it ensures that firms can still capture value from their innovative activities while they search extensively across their external partners (Sandulli and Chesbrough, 2009; Laursen and Salter, 2014; Hagedoorn and Zobel, 2015; Zobel et al., 2016).

First, formal appropriation mechanisms, such as patents, trademarks, copyrights, and design rights provide a certain degree of knowledge protection, such that the intangible assets of firms are

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