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The impact of standards and regulation on innovation in uncertain markets

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ABSTRACT

This study analyses the impact of formal standards and regulation on firms' innovation efficiency, considering different levels of market uncertainty. We argue that formal standards and regulation have different effects, depending on the extent of market uncertainty derived from theoretical considerations about information asymmetry and regulatory capture. Our empirical analysis is based on the German Community Innovation Survey (CIS). The results show that formal standards lead to lower innovation efficiency in markets with low uncertainty, while regulations have the opposite effect. In cases of high market uncertainty, we observe that regulation leads to lower innovation efficiency, while formal standards have the reverse effect. Our results have important implications for the future application of both instruments, showing that their benefits heavily depend on the market environment.

1. Introduction

Innovation has become an integral part of economic policy to promote growth. However, public financial support (e.g. subsidies) for private innovation activities is constrained by limited public budgets. In this context, shaping the existing regulatory framework to support private innovation activities becomes more relevant and attractive (European Commission, 2016).

Regulatory framework is generally composed of regulations enforced by governmental institutions. Industry and other affected stakeholders may complement these governmental regulations by self-regulatory coordination (e.g. OECD, 1997).[1] Their efforts can result in voluntary commitments and standards released by publicly accredited or even administrated standardization bodies. As formal standards and regulations shape the paths of further technological developments (e.g. Swann, 2000; Blind, 2016), it is highly important to understand their influence and functionality in order to increase economic growth and welfare.

The impact of regulatory instruments on innovation has been discussed with great controversy in academic literature on environmental issues (see for example Palmer et al., 1995 versus Porter and van der Linde, 1995). On the one hand, complying with regulations is likely to increase costs or restricts firms' freedom of action (Palmer et al., 1995). On the other hand, well designed regulation may guide or even force firms to invest in innovative activities, implement innovative processes or release innovative products (Porter and van der Linde, 1995). Furthermore, research shows that the characteristics of regulatory instruments and their flexibility towards implementation are crucial for increasing economic welfare (Majumdar and Marcus, 2001). Not surprisingly, empirical research has given no consistent picture in matters of the impact of regulatory instruments on innovation (e.g. Aschhoff and Sofka, 2009; Blind, 2012).

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[1] This article does not discuss specific regulatory instruments available to the government, rather the focus is placed on regulation as a general form of coercive rule setting and on formal standardization as a self-regulatory activity.

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Our paper is related to two important streams of economic literature. The first stream intensively discusses regulation (in any form) strictly as it relates to environmental issues (e.g. Palmer et al., 1995; Porter and van der Linde, 1995; Majumdar and Marcus, 2001; Hysing, 2009). The second stream investigates regulation outside of the environmental field and considers regulation as a possible barrier to innovation (e.g. Baldwin and Lin, 2002; Galia and Legros, 2004; D'Este et al., 2012; Blanchard et al., 2013). D'Este et al. (2012) analyse regulatory requirements as one of the many barriers to innovation, e.g. financial constraints and a lack of human resources, without an explicit focus on the regulatory framework. However, this stream often neglects self-regulatory instruments. Surprisingly, most of the literature do not differentiate between formal standards and governmental regulations, probably because of a lack of data availability (e.g. Galia and Legros, 2004).[2]

However, it is important to decipher between the two as the instruments differ substantially. Formal standards are developed in recognized standardization bodies and they are voluntary and consensus-driven (WTO, 2011).[3] In contrast, regulations are mandatory legal restrictions released and enacted by the government. Most studies have not stressed this distinction sufficiently when discussing their impact on innovation.

By using a unique dataset for Germany that allows us to differentiate between both instruments, our empirical research contributes to the works mentioned above. More precisely, knowing whether regulations or formal standards have hampered firm innovation activities, we analyse their impact on a firm's innovation efficiency in different market environments. In general, efficiency is defined as the ratio between output and input. For a given output firms using less input are more efficient. For the purpose of this study, input is defined as the amount of resources (innovation expenditures) a firm invests in the innovation process and output is defined as the successful introduction of a new product (innovation) into the market. Hence, efficiency is defined as the capability of a firm to minimize innovation inputs given a certain quantity (or type) of innovation outputs.[4]

Our work is based on two main theoretical concepts: regulatory capture and information asymmetry. Regulatory capture defines the process in which stakeholders (e.g. industry) try to influence the regulation-making body in favour of their own interests (Stigler, 1971). We refer to this concept to highlight the motivations and capabilities of certain actors to influence formal standards and regulations in different market conditions. Information asymmetry models describe a situation where two actors have different levels of information (e.g. Akerlof, 1970). In our analysis, we combine both concepts to better understand the impact of regulation and standardization on innovation in different market conditions. This is done to support the argument that at different levels of market uncertainty, regulatory capture and asymmetric information have different effects on the setting of regulations and the development of standards and their impacts on the concerned organizations.

Based on these theoretical considerations, we develop and empirically test whether regulations and standards have divergent impacts on firms' innovation efficiency at different levels of market uncertainty. Our empirical analysis is based on the 2011 German Community Innovation Survey, a reliable and extensive dataset for firm-level innovation studies. For our analysis, we conduct a Heckman model in order to control for the fact that investment in innovation is only observable for firms that actually have decided to invest in innovation. This approach is common in innovation studies (e.g. Kesidou and Demirel, 2012; Catozzella and Vivarelli, 2014). Our results show that in markets with low uncertainty, firms must spend a higher amount of resources in order to be innovative if they experience problems with standards (i.e. standards decrease firms' innovation efficiency), while regulations have the opposite effect (i.e. they enhance firms' innovation efficiency). In the case of markets with high uncertainty, we find opposite effects: firms that experienced problems with regulations had to spend more resources to successfully introduce an innovation to the market while formal standards have the opposite effect.

Our results enhance the academic discussion on the impacts of formal standards and regulation on innovation. We show theoretically as well as empirically that both instruments have diverse effects on innovation in different market conditions. In addition to the contribution to literature, these results are particularly useful for policy makers to stimulate the discussion on how different regulatory instruments should be used to shape the optimal regulatory framework conditions in different market environments.

We proceed as follows: Section 2 outlines the theoretical framework providing the background to our study. Section 3 discusses the methods and data used. Section 4 presents the results about the impact of regulation and formal standards on firms' innovation efficiency, differentiating between markets with different uncertainty. Section 5 discusses the robustness of the results presented in Section 4. Section 6 concludes with the discussion of the results and their application to innovation policy.

2. Theoretical framework

Before discussing the impact of formal standards and regulations, the differences between both instruments have to be outlined in more detail. Formal standards are the result of a consensual negotiation process carried out by firms and other interested stakeholders in a voluntary process within standardization organizations (WTO, 2011). Therefore, standard setting can be seen as a self-regulatory process (Gupta and Lad, 1983), in which only a limited number of companies are actively involved. For example, Wakke et al. (2015) show that less than 5% of the Dutch service companies are active in standardization.

Regulations are developed and enacted by the government to shape the market environment and influence the behaviour of the concerned actors (e.g. Blind, 2012). Correspondingly, regulations stem primarily from a top-down approach, while formal standards are typically the result of a market-driven process (Büthe and Mattli, 2011), or as Gupta and Lad (1983) frame it: "industry self-regulation" vs. "direct governmental regulation", which we also apply in our conceptual model. Regulations and formal standards also differ substantially in terms of their enforcement. The exertion of regulations is mandatory, while the adoption of formal standards is, in most cases, voluntary.

In contrast to the noted differences, there are interdependencies of the two instruments, especially in the course of the "New Approach".[5] Nevertheless, around a third of European standardization activities are developed to directly support the implementation of European policies (CEN-CENELEC, 2013).

[2] A noticeable exception is the working paper of Swann and Lambert (2010) that without considering uncertainty, investigates innovation success looking at the informative and constraining effects of standards and regulation using UK Community Innovation survey data.

[3] Even though formal standardization is a consensual process, it is often strategically exploited by its participating firms. Hence, firms are using the formal standardization process, e.g. to raise a rival's costs (Salop and Scheffman, 1987; Swann, 2000) to form alliances (Rosenkopf et al., 2001) or to generate knowledge spillovers (Blind and Mangelsdorf, 2013).

[4] We are using a relatively simple measure of innovation efficiency, i.e. innovation expenses of successful product innovators. As shown in the robustness checks in section five, our results are not changing when measuring innovation efficiency as the ratio of innovative sales above innovation costs.

[5] For further information, please refer to www.newapproach.org. A similar division of work has been implemented in Germany.