



How different policy instruments affect green product innovation: A differentiated perspective



Tobias Stucki^{a,*}, Martin Woerter^b, Spyros Arvanitis^b, Michael Peneder^c, Christian Rammer^d

^a University of Jyväskylä, Finland

^b ETH Zurich, Swiss Economic Institute (KOF), Zurich, Switzerland

^c Austrian Institute of Economic Research (WIFO), Vienna, Austria

^d Center for European Studies (ZEW), Mannheim, Germany

ARTICLE INFO

JEL classification:

O30
O34
Q55

Keywords:

Green innovation
Product innovation
Process innovation
Policy
Demand

ABSTRACT

Based on representative firm-level data for the three countries Austria, Germany, and Switzerland, we investigate the effects of energy-related regulations, taxes, voluntary agreements, and subsidies on the creation of green energy products, and analyze through which channels policy affects green product innovation and which factors mediate the observed effects. Policy may affect green product innovation by directly stimulating the supply of green products/services, or more indirectly by stimulating the demand for green products/services. Our data set allows us to distinguish between the two channels, which improves our understanding of the frequently observed positive net effect of policies. Controlling for the demand-side effect, taxes and regulations are negatively related with green product innovation. Hence, if taxes and regulation do not trigger additional demand, they decrease the propensity to innovate. These effects are ameliorated for technologically very advanced firms and for firms with a high level of financial awareness. Subsidies and (partly) voluntary agreements are positively related with green product innovation.

1. Introduction

Even though green innovations are essential in order to address climate change (IPCC, 2014), private firms are often not willing to invest in the creation of such technologies. Probably the main reason for this is that the greatest benefits from green products/services are likely to be public rather than private. Therefore, potential customers' willingness to pay for these products/services is low, which normally results in lower or even negative returns compared to traditional innovation activities (Marin, 2014; Soltmann et al., 2015). As a consequence, policy intervention is required to stimulate the creation of green products/services. In-depth knowledge about the meaning of different policy instruments for green product innovation is thus crucial.

Hence, it is not surprising that there are many studies analyzing how policies affect green innovation. In general, they confirm the expected positive relationship between policy and green innovation (for a review of this literature see Ambec et al. (2013) or Popp et al. (2010)). In the study at hand, we present a differentiated perspective looking in greater detail at the mechanisms through which policy affects green innovation.

First, most existing studies define green innovation activities broadly. However, a clear distinction between product and process

innovation is crucial, since policies are likely to show different effects on the two types of innovation. Although the focus of this study is on green product innovation, we also investigate – in an extension of the basic analysis – whether policies show significantly different effects on product than on process innovation. Moreover, as green process innovation is not cost-free, we also test a potential moderating effect of green process innovation on the effect of policy on green product innovation.

Second, policy may directly induce green product innovation by affecting the supply of green products/services, or more indirectly by stimulating the demand for green products/services. In this study, we capture a potential demand-side effect of the analyzed policy measures on innovation, which allows us to differentiate the two channels through which policy affects innovation. Most of the existing studies measure a mixed policy effect comprising demand- and supply-side factors. We argue that the direct (supply-side) policy effects are significantly smaller than the mixed policy effects.

Third, most existing studies use patent data in order to identify green innovation activities, limiting the investigation to a rather small group of mainly highly innovative firms (Griliches, 1990). Since technologically more advanced firms are more likely to respond with

* Corresponding author.

E-mail address: tobias.m.stucki@jyu.fi (T. Stucki).

innovation to cost increasing policy measures, such as regulations and taxes, the observed effects tend to be larger for such leading innovators than for innovation laggards, referring to firms that normally are excluded from patent statistics. In this study, we capture green product innovation activity more broadly and test a potential moderating effect of the firms' innovation potential.

Concretely, we investigate the effect of different policy instruments on the creation of green products/services based on a representative firm-level survey simultaneously conducted in 2015 in Austria, Germany and Switzerland. Hence, the focus of this paper is on green *product innovation*, i.e. the creation of new green products/services or services for end-user, and not on process innovations, referring to the adoption of green products/services to improve firms' own production processes. The survey considered innovation activities in the field of green energy technologies, which refers to energy saving technologies and technologies for the generation of energy from renewable sources. Besides information on the firms' innovation decision, the dataset also contains information on the relevance of energy-related taxes, subsidies, regulations and voluntary agreements for the firms. This allows us to investigate how a firm's *green (energy-related) policy exposure* affects its green (energy) product innovation activities.

The availability of information for different policy measures allows us to compare their effects with each other. Another important advantage of the dataset is that it includes firm-level information on a broad set of other drivers of green innovation activities, enabling us to test different potential moderators of the effect of policy on green product innovation. This is important because it is not the goal of this paper to precisely identify the effect of a single policy shock in a certain country at a certain point in time, but to improve our understanding through which channels policy affects green product innovation and which factors mediate the observed effects. Finally, the dataset also allows us to compare the effect of policy across the three countries, which is important as the characteristics of the environment (e.g., the firms' policy affinity) may moderate the effect of different policy types on innovation activities.

The empirical analysis indicates that existing studies are likely to overestimate the direct (supply-side) effects of policies on green product innovation. While public subsidies show the expected positive effect on product innovation, no significant effect is observed for voluntary agreements, and the (supply-side) effects of taxes and regulations on green product innovation are even negative in our setting. These findings withstand several robustness tests, e.g., they are not driven by a selection of specific firms that have few opportunities for green innovation, and the results do not significantly differ across the three countries considered in our data. In several extensions of the baseline model, we find that the negative policy effects are significantly ameliorated for firms operating at the technological frontier (leading innovators) and firms with a high financial awareness, which offers plausible explanations for the rather unexpected negative effects of taxes and regulations on green product innovation.

2. Conceptual background and hypotheses

2.1. The effect of policy on green product innovation

Our current understanding of how policy affects green innovation has strongly been influenced by the article of Porter and van der Linde (1995). They argued that firms face market imperfections, such as asymmetric information, organizational inertia or control problems (Rubashkina et al., 2015), that make it hardly possible for them to understand the full costs of incomplete utilization of resources and thus to identify all profitable opportunities for new products or processes. Policies help to overcome some of these market failure by signaling firms about likely resource inefficiencies and pursuing otherwise neglected technological improvements. In what Jaffe and Palmer (1997) later defined as the “weak” version of the porter hypothesis, Porter and van der Linde thus concluded that “properly designed environmental

standards can trigger innovation” (Porter and van der Linde, 1995, p. 98). While Porter and van der Linde (1995) focus in their analysis on regulation, their hypothesis can be extended to other policy types as well (see Lanoie et al., 2011). Hence, we would expect that not only energy related regulations, but also subsidies, taxes and voluntary agreements push green innovation.

There are many studies that analyze the impact of regulation on green innovation, and most of them find the expected positive link, although the strength of the link varies (see Ambec et al. (2013) for a review of this literature). Studies that analyze the impact of other policy types on green innovation are somewhat rarer, but most of them also identify a positive effect (e.g., Lanoie et al., 2011; Ley et al., 2016; Veugelers, 2012).

The green policy literature lacks a clear distinction between product and process innovation. Porter and van der Linde (1995) use the term innovation very broadly, which includes innovation referring to a “product's or service's design, the segment it serves, how it is produced, how it is marketed and how it is supported” (Porter and van der Linde, 1995, p. 98). Similar to Porter and van der Linde most other studies that analyze the relationship between policy and innovation do not specify which type of innovation is really considered. Hence, we would expect that the discussion above holds for innovation in general, and we thus formulate the following hypothesis for green product innovation, i.e. the creation of new products or services for end-user:

Hypothesis 1: *Taxes, regulations, voluntary agreements and subsidies positively affect a firm's green product innovation activities.*

2.2. Demand-side vs. supply-side effect of policies

Following the policy-induced innovation view, investments are directed to factors that become more expensive (e.g. energy). Hence, green policy leads to investments in ways to meet the policy-induced constraint at lower cost (Jaffe and Palmer, 1997), i.e. green investments, which in turn also increase the demand for new green products/services developed elsewhere.¹ And it is widely accepted that market demand is an important driver of product innovation in general (Kleinknecht and Verspagen, 1990; Schmookler, 1966), and demand is also found to be important for the creation of environmental innovation (Horbach, 2008).

Hence, policy can affect green product innovation by directly stimulating the supply of green product innovation (supply-side effect), or indirectly by increasing demand for new green products developed elsewhere (demand-side effect; see Fig. 1).

Based on the discussion above, policy should positively affect demand for green products, which in turn should stimulate green product innovation. Hence, the demand-side effect of policy should be positive. Most existing studies do not capture potential demand-side effects and thus identify a mixture of the demand-side and the supply-side effect (e.g., Johnstone et al., 2012; Lanoie et al., 2011; Veugelers, 2012). As the direction of the demand-side effect of policies should be positive, we expect the policy effects to be significantly lower when potential positive demand-side effects are captured, i.e., that the direct (supply-side) policy effects are significantly smaller than the mixed policy effects.

Hypothesis 2: *By capturing the demand-side effect of policies, the effect of taxes, regulations, voluntary agreements and subsidies on green product innovation is reduced, i.e. we expect their impact to be smaller or even negative.*

¹ Of course, firms/end-user can develop these technologies in-house. However, this is seldom the case. The survey among Swiss, German, and Austrian firms showed that around 8% of green technology adopting firms (partly) developed these technologies in-house. The in-house development of technologies requires a sufficient large in-house knowledge base and an in-depth knowledge about the whole production process (Porter and van der Linde, 1995).

Download English Version:

<https://daneshyari.com/en/article/7397523>

Download Persian Version:

<https://daneshyari.com/article/7397523>

[Daneshyari.com](https://daneshyari.com)