

EXPLORING DETERMINANTS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY INVESTMENTS IN SMEs

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Overview

Energy efficiency and climate neutrality are of paramount importance to EU Member States' energy policy objectives and overall development goals, particularly because of their potential to improve societal competitiveness, green growth, and employment potential. Consequently, this has been embedded in key EU energy strategies. For example, as part of the European Green Deal, the EU recently adopted a package of legislative proposals entitled "Fit for 55," which aims to achieve climate neutrality by 2050 while reducing net emissions by at least 55% by 2030 compared to 1990 levels (European Commission, 2021). One of the priority areas of policy action to make transformative changes is small and medium-sized enterprises (SMEs), which are considered particularly vulnerable and have fewer resources and information to ensure a successful green transition.

Energy efficiency investments are seen as a cost-effective way to achieve these goals, but the energy efficiency gap persists (Jaffe and Stavins, 1994; Allcott and Greenstone, 2012; Gerarden et al., 2017). A number of empirical studies have been published based on theoretical taxonomies of this phenomenon and their adaptations (Sorrell et al., 2011, Cagno et al., 2013, Cagno and Trianni, 2013), trying to identify the causes of this gap, also called barriers to energy efficiency investments (e.g., Cagno et al., 2013). On the other hand, studies have also tried to identify factors that accelerate these investments (e.g., Cagno and Trianni, 2013), the results of which have been summarized by Solnørdal and Foss (2018). According to Hrovatin et al. (2021), for SMEs, economic barriers and drivers are the most important determinants of their energy efficiency investment decisions, followed by behavioral and organizational barriers and drivers.

In contrast to the theoretical literature in the field of energy efficiency or energy efficiency gaps at the firm level, there are few taxonomies or categorizations of barriers and drivers to investment in RES. An exception in the conceptualization of drivers for investment in RES is the contribution of Wüstenhagen and Menichetti (2012), which recognize energy policy as a key driver for investment in RES in corporate investment, through its influence on two factors, risk and profitability of the investment. On the empirical studies side, there are almost no studies that would focus on discovering the factors of investment in RES at the firm level. The only study that addresses this issue is the one by Segarra-Blasco and Jové-Llopis (2019), which concludes that companies are more inclined to invest in EE than in RES, but that there are significant complementarities between the two types of investments, with energy efficiency strategies being more related to cost efficiency and regulation, and RES strategies being more related to public support programs and environmental awareness.

The objective of this study is to analyze what factors, both barriers and drivers, influence SMEs' decisions to invest in energy efficiency measures and renewable energy investments while determining whether different factors influence both types of investments in the same way or whether firms' motivations for investment behavior differ in the two cases.

Methods

The data set consists of two data sources. The first is a self-administered survey with extensive questionnaires conducted via telephone interviews in 2019 and 2020, and the second is the Slovenian Business Register, an official statistical database of all companies in Slovenia. The final sample is a cross-sectional sample of 270 small and medium-sized enterprises in Slovenia. A bivariate logit model is used to investigate barriers and drivers to investment in EE and RES. In this way, it is possible to analyze two correlated binary outcomes in the joint model as functions of the same explanatory variables. Both dependent variables are therefore dichotomous, with a value of 1 indicating a company's investment in EE and RES, respectively, while a value of 0 indicates the absence of such investment in a given year.

Based on theoretical foundations, empirical evidence from other studies, and data availability, we examine the following factors that affect investment decisions: first, firm- and business-related characteristics such as size, ownership (domestic vs. foreign), profitability (ROA), debt, foreign market participation, innovativeness (company R&D activities), perceived market competition, ownership of company premises, and perception of investment risk; second, energy- and EE -related characteristics such as energy costs (share of energy costs in total expenditures), EE

awareness in the company, managers with real ambitions and long-term strategies, energy person, employee awareness of EE, energy audits, and potential for energy savings.

Results

The preliminary results of the bivariate logit model show that the joint decision to invest in EE and RES is influenced by the following factors. Ownership of the firm's site, a hired energy consultant, or an audit increase the likelihood of both investments. The share of investments in R&D in all investments and the relative importance of EE in the company increase the probability of investments in EE, while the presence of energy officers in the company and energy expertise increase the probability of investments in RES.

In addition, we test whether there is a difference in perceptions of barriers and drivers to investment in EE and RES between groups of firms that are small vs. medium-sized, manufacturing vs. non-manufacturing, and energy-intensive vs. non-energy-intensive. The results show that barriers and drivers to EE are more prevalent in medium-sized companies than in small companies, as are drivers such as the potential for cost reductions and educational programs in the company. Manufacturing firms consider investments in EE less profitable compared to non-manufacturing firms, while non-manufacturing firms consider awareness-related barriers more important. Interestingly, there are no statistically significant differences between energy-intensive and non-energy-intensive firms in terms of barriers and drivers to investing in EE.

On the other hand, small firms perceive some barriers to investment in RES more strongly than medium-sized firms, such as low return on investment and hidden costs. Non-manufacturing companies perceive barriers such as lack of financial resources and lack of standards and certificates more than manufacturing companies, while the latter perceive the lack of necessary knowledge and awareness in the company more. Non-energy-intensive companies perceive barriers to investment in RES such as too low subsidies, uncertainty about take-back prices, and return on investment more than energy-intensive companies.

Conclusions

Our study adds to the existing body of knowledge in several ways. Similar to the literature review on theoretical taxonomies of drivers and barriers to investment in EE and empirical findings, we also provide a literature review on theoretical findings on why firms make RES investments. In addition, we review the results of empirical studies on the drivers and barriers to RES investment. The results of our study provide a solid basis for comparing the drivers of the two types of investments. For example, we can find that companies that own their buildings and receive energy advice are more likely to make investments in both EE and RES. Thus, the results of this study provide answers to the question of which factors should be promoted and which should be restricted in common energy policies to improve EE and increase the use of RES. In this way, the goals in both areas could be achieved more quickly without undesirable interactions.

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