

WHAT DRIVES ENERGY-EFFICIENCY AND ENVIRONMENTAL INVESTMENTS IN SLOVENIAN MANUFACTURING INDUSTRIES?

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Overview

Both energy efficient investments and “green investments” (e.g. investments in environmentally friendly technologies) are essential to achieve the EU 20-20-20 targets. While energy efficient investments in transport, residential and tertiary sector have been (or are envisaged to be) heavily supported from public funds (including the EU cohesion and structural funds), the industrial sectors is expected to finance EE investments mainly from its own resources or external sources obtained mostly on commercial basis. Theoretically it has been recognised that many opportunities for energy efficient investments that are at the same time profitable for the firms, exist, but they have been only to a limited extent adopted in practice. This is known in the literature as the energy efficiency gap (DeCanio, 1993, Jaffe and Stavins, 1994, Sorrell et al., 2004, Sorell et al., 2011). Many empirical studies in different countries have been searching for the explanatory factors for this gap, known as barriers to EE investments. Theoretically the most known classification of barriers is the Sorrell taxonomy (Sorell, 2004, Sorell et al, 2011) used by several empirical studies. Many studies also try to identify both, barriers to adopt EE investments as well as drivers. The most important drivers found in our literature review are (1) market-driven (expectations of rising energy prices, cost reductions resulting from lower energy use, opportunities to realise long-term benefits and (international) competition); (2) current and potential energy policies (public financing, external financing – subsidies, programmes for improving energy efficiency in energy intensive industries; (3) organisational and behavioural factors (people with real ambitions and long term strategies, environmental management systems, electricity certificate systems) and (4) environmental regulation including taxes on emissions. Among other factors in the literature survey firm’s characteristics profitability and the size have also a positive effect on investments, while the EMS certifications (ISO 14001) have shown no significant effect. In our previous study we tried to identify both, barriers and drivers of energy efficient investments in the Slovenian manufacturing industries in 2005-2011 period, based on theoretical taxonomies and data availability. This paper represents an extension of our previous research by investigating the determinants of two types of investments, i.e. energy efficient and environmental investments, to establish if various factors influence both types of investments in the same way or if firms’ motivation behind investment behaviour differs in the two cases. The inclusion of pre and post crisis years also allows us to examine if the financial crisis had the same effect on both kind of investments or if firms differentiate their investment behaviour with respect to these two types of investments. The principal drivers and barriers of both types of investments will be examined for the representative sample of Slovenian manufacturing firms over the period 2005 – 2011.

Methods

Our data is based on the unbalanced sample of around 840 Slovenian manufacturing firms during the period of 2005 through 2011, which implies around 3,700 observations. The survey on investments is conducted annually by the Statistical office of the Republic of Slovenia (SORS), assuring the representativeness of the sample according to the The Joint Harmonised EU Programme of Business and Consumer Surveys. Data is collected from four primary sources: (1) the survey on business investments, conducted by the SORS; (2) data from annual reports of firms (balance sheets and income statements), collected by the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES); (3) the survey on R&D activity of Slovenian firms, conducted by the SORS; and (4) data on firms’ participation in voluntary environmental management systems (ISO14001) from the Slovenian Chamber of Commerce. The investment data and data on R&D activity are confidential and provided to the authors upon confidentiality agreement with the SORS. The inclusion of pre-crisis (2005-2008) and crisis years makes it possible to test first if the crisis significantly affected investments and second if there is a similar (negative) effect on both types of investments.

To examine drivers (and possible barriers) of EE and environmental investments bivariate probit model is used. In this way it is possible to jointly analyse two correlated binary outcomes. Both dependent variables are therefore dichotomous, where the value 1 denotes a firm’s investment in the energy efficiency or environmental investments, respectively, while values 0 non-existence of such investments in a given year.

Based on the theoretical foundations, empirical findings from other studies and the data availability we examine the following factors impacting investment decisions: (1) firm level data: ownership type (domestic vs. foreign), profitability (ROA), leverage, innovativeness (firm's R&D activity), energy costs (share of energy costs in total expenditures), firm's market share, international competition (share of total revenues earned abroad), firm's participation in voluntary environmental management programs (ISO 14001); (2) industry specific factors including industry-specific dummy variables and stringency of environmental regulation; and (3) manager's perceptions of future demand, availability of financial sources and technological expectations, and other regulatory factors. The impact of financial crisis is tested with the dummy variable (dummy variable with a value of 1 for years 2009-2011). Other types of investments (such as replacement of existing technology, investments in workers' safety, etc.) are also included among explanatory variables to see if they have any effect.

Results

Preliminary results of the bivariate probit model indicate that energy cost, export orientation and the firm's market share have a statistically significant and positive impact on the likelihood to invest in energy efficiency and environmental improvements. In addition, energy-efficient investments are positively influenced by foreign ownership and favourable managerial expectations about the future demand, while environmental investments are negatively influenced by the economic crisis with expected improvement of business conditions in the next period exhibiting positive effect. On the other hand, the stringency of environmental regulation with respect to CO₂ emissions and the effect of environmental commitment (ISO 14001) are not found to be statistically significant. Also firm's profitability, indebtedness, R&D activity and financial and regulatory constraints do not have statistically significant impact on investments. We furthermore control for the sectoral differences and investigate the impact of other types of investments. Among other types of investments, investments into automation and safety at work have a positive impact on both types of investment, where environmental investments are also positively influenced by replacement of old equipment and introduction of new technologies. On the other hand, investments in expansion of existing capacities hinder investments in energy efficiency.

Conclusions

Our paper adds to the existing knowledge in several ways. Similarly to the literature review of theoretical taxonomies of drivers and barriers of EE investments and empirical findings we are going to provide also a literature review on theoretical findings on why firms adopt environmental friendly investments. In addition, findings from empirical studies on drivers and barriers of environmental friendly investments will be reviewed. The findings from our study provide a solid ground for the comparisons of drivers for the two types of investments. We can see that large exporting firms with higher energy costs and favourable expectations about future conditions are more likely to carry out both, energy efficient and environmental investments. Other investment activity also plays a significant role indicating the presence of investment complementarity, although not all investments carried out have the same relevance for energy-efficient and environmental investments. Only in the case of investments in expansion of existing capacities a substitution effect with energy-efficient investments can be confirmed. It is found that the economic crisis had a negative impact on environmental investments, while energy-efficient investments do not seem to have been much affected by the crisis. Surprisingly, the stringency of environmental regulation and environmental commitment are not found to influence the two investment decisions. The former effect may already be captured by the sectoral dummies, while the later may be explained by the fact that majority of environmental investments had already been carried out in the past which resulted in obtaining ISO 14001 certificate. Consequently policy recommendations on how to stimulate one or the other or both types of investments could be drawn from our analysis.

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