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## Energy and material efficiency improvements, compliance strategies, and investments in resource efficiency: A cross-country study

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**SCHUMPETER DISCUSSION PAPERS**

# **Energy and Material Efficiency Improvements, Compliance Strategies, and Investments in Resource Efficiency: A Cross-Country Study**

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# **Energy and Material Efficiency Improvements, Compliance Strategies, and Investments in Resource Efficiency: A Cross-Country Study**

**Christian Dienes**

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**Abstract:** This paper empirically studies the relationship between different compliance strategies concerning environmental legislation and intentions of entrepreneurs to increase their firms' material and energy efficiency in the next two years. Moreover, I examine the relationship between such intentions and the extent to which entrepreneurs are satisfied with past investments in resource efficiency improvements. Using data covering small and medium-sized enterprises from 36 countries from 2013, this study also explores the institutional framework regarding the stringency and enforcement of national environmental regulations. The results based on the total sample indicate that entrepreneurs who are more satisfied with past resource efficiency investments and who follow a strategy which goes beyond compliance are more likely to intend material and energy efficiency improvements in the future. The results further suggest that entrepreneurs translate their pro-environmental attitudes into intentions to reduce their demand for energy but not their demand for materials. Furthermore, the results based on subgroup analyses also point to decreasing marginal productivities of resource efficiency investments.

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**Keywords:** energy and material efficiency improvements; return on investment; compliance strategy; environmental regulation

## 1 Introduction

Mounting environmental problems, such as the climate change, are among the most challenging problems facing society. For instance, the emission of greenhouse gas is argued to be an important factor driving this change and it can rationalize policies which aim at regulating pollution-intensive firms. Parallel to those market interventions, managers of firms show corporate social responsibility strategies which can positively affect the natural environment (Bénabou and Tirole 2010).

Strategies towards sustainability are often beyond compliance strategies complementing governmental regulation (King and Lenox 2000) or, more generally speaking, “actions that appear to further some social good, beyond the interests of the firm and that which is required by law” (McWilliams and Siegel, 2001, p. 117). In this context, a great deal of attention (e.g. by the media and the public) is paid to larger multinational companies because they are perceived to be disproportionately more responsible for driving climate change as compared to smaller firms (Williams and Schaefer 2013). However, although not being as visible as large corporations, small and medium sized enterprises (SMEs), also contribute significantly to resource depletion and are responsible for approximately 64% of the total pollution produced in Europe (European Commission 2010) and as much as 80% in the United Kingdom (Cassells and Lewis 2011), for instance.

At the same time, the characteristics of SMEs do not seem to be conducive for aspiring and achieving ecological sustainability (Hoogendoorn et al. 2014). Partly, because they lack additional resources (e.g. time and money) or management capability and capacity needed to pursue an environmental strategy (Bianchi and Noci 1998; Gonzalez-Benito and Gonzalez-Benito 2005). This justifies environmental policy which targets this subgroup of firms (Fleiter et al. 2012). In addition, studies also point to the relevance of the attitudes of SME entrepreneurs towards the natural environment. In particular, it is argued that SME entrepreneurs’ beliefs and values are linked to corporate social activities (Lee et al. 2015) and they exhibit environmental concerns which makes them feel propelled to reduce their firms’ ecological footprint (Revel et al. 2010; Williams and Schaefer 2013).

Besides the issues linked to a firm’s compliance strategy, factors associated with investments undertaken in order to improve resource efficiency are also crucial, because they may determine a firm’s resource efficiency development. Despite this relevance, existing literature examining SMEs rarely addresses investments in resource efficiency and provides mixed results with

respect to the entrepreneurs' evaluations regarding their profitability (e.g. Hitchens et al. 2005; Revell and Blackburn 2007; Revell et al. 2010).

A common feature of almost all these studies investigating SMEs is the reliance on qualitative in-depth interviews with only a few numbers of observations. Albeit those studies are important and yield relevant insights, they typically do not allow for drawing more general conclusions. In this study, I contribute to the field by making use of a large-scale database obtained from the Flash Eurobarometer Survey which was conducted in 36 countries in 2013. This allows me to investigate the association between environmental concerns of SME entrepreneurs and their intentions to improve their companies' energy and material efficiency as well as the link between such intentions and resource efficiency investments more broadly. Moreover, using an international database comprising SMEs allows exploring the effect of the stringency and enforcement of exogenous (to the firm) environmental regulations. This institutional environment is generally argued to shape managerial decisions in organizations and has an impact on sustainability strategies in firms (DiMaggio and Powell 1983; Jennings and Zandbergen 1995; Glover et al. 2014). Hence, with regard to the effects of environmental regulations, I split the sample into SMEs that are exposed to weaker and stronger environmental regulations by making use of additional data sources.

The results indicate that SME entrepreneurs who are more satisfied with their past investments in resource efficiency are more likely to intend energy and material efficiency improvements in the next two years. Examining the relationship between compliance strategies and intentions to invest in either energy or material efficiency reveals intriguing differences. That is, while there is a positive and significant correlation between environmental concerns of SME entrepreneurs and their intentions to improve their companies' energy efficiency, the same result does not seem to hold for material efficiency.

Subsample analyses further unveil that SME entrepreneurs who are more satisfied with resource efficiency investments intend to increase their firm's energy and material efficiency only in countries in which the government imposes relatively weak environmental regulations. In turn, the results imply that SME entrepreneurs face relatively low marginal productivities in countries with stronger environmental regulations which might make them halt their plans to further increase their energy and material efficiency.

The article is structured as follows. In the next section, I provide the conceptual framework and review existing literature on compliance strategies, resource efficiency investments, and

institutional theory. In section 3 I present the data. In the next section, I report and discuss the results (Section 4). In Section 5, I provide some conclusions on policy implications, limitations, and possible avenues of future empirical research.

## **2 Conceptual Framework**

### **2.1 Compliance Strategies and Sustainability**

The question of how enterprises can reduce their footprint on the natural environment is increasingly examined in literature. The emphasis is on the role of the firm's management. In particular, it is argued that the management can influence their company's resource efficiency. Bloom et al. (2010) find that employing good management practices is associated with higher productivity and lower energy intensities and hence with lower greenhouse gas emissions. Moreover, a similar study by Martin et al. (2012) shows that conducting climate-friendly management practices positively correlates with lower energy intensities. Those practices can involve, for example, lean manufacturing and often touch upon environmental management standards that are positively associated with a reduction of waste and pollution (King and Lenox 2001) and air emission reductions (Rothenberg et al. 2001). Similarly, Anton et al. (2004) find that the adoption of an environmental management system is negatively related to toxic pollution per unit of output. Arimura et al. (2008) also find that the implementation of ISO14001, which is an important nongovernmental voluntary program (Potoski and Prakash 2005), reduced the utilization of natural resources like energy.

In empirical literature, the results regarding the relation between a firm's environmental compliance strategy and pollution reductions are ambiguous. For instance, according to King and Lenox (2000), firms participating in trade-association-sponsored self-regulation programs which involve beyond compliance measures tend not to unfold positive effects on the firms' environmental performance because of a lack of sanctioning mechanisms.<sup>1</sup> This result is further corroborated by Potoski and Prakash (2005) who find that the existence of voluntary environmental programs that are at least accompanied by weak monitoring and sanctioning mechanisms is positively related to pollution emission reductions.

Company's actions to minimize adverse environmental effects can be motivated by various economic reasons. Among others, firms can pre-empt or shape future environmental regulations that may also increase the costs for potential rivals to enter the market (Dean and Brown 1995;

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<sup>1</sup> Also compare a recent study by Gamper-Rabindran and Finger (2013) which comes to the same conclusion.

Prakash 2001) and existing competitors (Innes and Bial 2002). Similarly, Khanna and Kumar (2011) find that the anticipation of more stringent environmental regulations in the future makes companies become environmentally efficient ahead of time. Ambec and Lanoie (2008) also point out that the management's intention to improve their firm's ecological footprint is to reduce the risk of worsening relations to other stakeholders (for instance, ecological groups and the media), for example if environmentally damaging conduct can be linked to the company.

Another important group of stakeholders are firms' employees. Grolleau et al. (2012) find that managers integrating an environment-related standard in their firms (e.g. ISO 14001, organic labelling, fair trade) experience an improvement regarding the recruitment of employees. In a recent study by Nyborg and Zhang (2013), the authors find that Corporate Social Responsibility (CSR) reputation is negatively correlated with wages which, in turn, could translate into a wage-related cost advantage as compared to other firms lacking this type of reputation. Furthermore, the results might also imply that workers accept lower wages, because of their preferences to work for a socially responsible employer. Another important stakeholder which can pressure a firm to go "green" is the consumer (Anton et al. 2004), who might exhibit a higher willingness to pay for products or services being produced environmentally friendly (Ambec and Lanoie 2008) or if the production process is perceived to be socially responsible (Besley and Ghatak 2007). Moreover, increasing a firm's resource efficiency can improve competitiveness (Aragón-Correa and Sharma 2003), whereas environmental regulations are considered to be the main impetus for firms to increase this kind of efficiency and positively relate to cost reductions (Porter and van der Linde 1995).<sup>2</sup>

Besides the already discussed reasons for firms to go beyond compliance, there are other factors not embedded in the profit-maximization framework. Chin et al. (2013) argue that if CEOs exhibit more liberal political ideologies, the companies are more likely to emphasize CSR as a corporate strategy. Pursuing a CSR strategy or an environmental strategy does not seem to be confined to large companies. Berrone et al. (2010) find that family-controlled public firms, which are smaller on average, are better in terms of their environmental performance as compared to nonfamily public corporations. The authors conclude that noneconomic preferences in family-owned firms, such as protecting their socio-emotional wealth linked to the firm, are positively associated with pursuing environmental initiatives. Studies also report that large proportions of SME entrepreneurs have altruistic feelings towards the natural environment which

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<sup>2</sup> Also compare Lyon and Maxwell (2008) for a more detailed review of possible explanations as to why firms engage in CSR and Khanna (2001) for an overview of economic rationales as to why firms go beyond compliance.

makes them concerned about environmental problems (Schaper 2002). Revell et al. (2010) also find that SME entrepreneurs perceive themselves as being responsible to help solve environmental problems. Williams and Schaefer (2013, p. 173), examining the characteristics of managers running environmentally pro-active SMEs, find that “While economic arguments and external pressure played a role in their pro-environmental engagement, perhaps the most notable motivation for managers in this study to engage with environmental and climate change issues was personal values and beliefs”.

SME entrepreneurs also seem to believe that the effect of enhancing their company’s sustainability is negligible, because of their small size (Freidman and Miles 2002; Vernon et al. 2003). This could result in low incentives to reduce the firms’ ecological footprint. In this context, studies also point to a relevant ‘value-action’ gap which can explain why entrepreneurs do not translate their environmental concerns into concrete actions linked to environmental practices and engagements (Schaper 2002; McKeiver and Gadenne 2005; Hitchens et al. 2005). The missing link between pro-environmental attitudes and actions is argued to be based on, among others, the fear that environmental management is a cost burden to SMEs and can result in a loss of competitiveness (Revel and Blackburn 2007).

## **2.2 Resource Efficiency Investments and Sustainability**

The examination of energy efficiency investments has established a broad strand of literature dealing with the question why firms do not undertake those investments although they represent a positive net value. Possible market failures are investment inefficiencies (Allcott and Greenstone 2012; Linares and Labandeira 2010; DeCanio 1998) which seem to be of particular importance in the case of SMEs (Fleiter et al. 2012). Moving beyond this question can touch upon the return on investments in resource efficiency improvements.<sup>3</sup> However, this question is rarely addressed in empirical literature. Most closely related, Simpson (2012) finds that investments in waste reduction are positively related to increased pollution and cost reduction for a sample of U.S. manufacturers. Khanna and Kumar (2011) argue that firms having higher returns on investments in the past are expected to be profitable and have the resources to take actions in order to become more environmentally efficient. Their empirical results, which are

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<sup>3</sup> While the direct benefits are, e.g., expenditure savings on energy and material, the accompanying costs of doing so are more versatile and can involve: first, capital costs associated with the purchase of technology equipment, second, labor costs linked to hiring or training of existing staff having the skills to implement resource efficiency measures in the company, third, information costs concerning the knowledge about how to create the organizational structure supporting resource efficiency, and fourth, structural change costs associated with, e.g., the installation of monitoring and control systems or internal audits (European Commission 2011).



based on a sample of S&P 500 firms, however, do not indicate a positive and significant relationship.

As noted earlier, studies examining SMEs are often based on qualitative in-depth interviews and yield inconclusive results. Hitchens et al. (2005), for example, find that there is a great deal of variation regarding positive and negative economic experiences by SME entrepreneurs from adopting environmental initiatives across countries and sectors. In a study by Revell and Blackburn (2007), the findings suggest that owners of SMEs in the UK are rather sceptical towards measures related to eco-efficiency, because they are perceived as too expensive. In contrast, Revell et al. (2010) show that a high fraction of SME entrepreneurs undertake such measures and see this as an opportunity to save costs.

### **2.3 Institutional Theory and Sustainability**

Another important strand of literature relates to rational, choice-based institutional theory that is argued to shape individual choices (Heikkila and Isett 2004) and is often used in the context of explaining organizational outcomes concerning their sustainability activities (Berrone et al. 2010). In general, it is argued that managerial decisions are strongly influenced by institutional mechanisms which create and diffuse a common ground regarding a set of values, norms, and rules producing similar practices and structures across organizations (DiMaggio and Powell 1983). Jennings and Zandbergen (1995) apply institutional theory in the context of a firm's practices regarding the achievement of natural sustainability. The authors argue that coercive forces, which primarily relate to regulations and their enforcement, are important drivers for firms to adopt environmental management practices. This external social and political environment is important, because it influences strategies of firms and their organizational decision-making in order to legitimize their practice from the point of view of other stakeholders (Jennings and Zandbergen 1995). Therefore, institutional theory is used to explain how regulations affect decisions regarding green sustainable activities (Glover et al. 2014) and, especially in the case of SMEs, it has proven to be an important theoretical source by which one can explain entrepreneurial outcomes (Bruton et al. 2010). In a recent study by Ferri et al. (2014), for instance, the authors show that the institutional context that varies across countries seem to affect barriers and enablers with regard to the implementation of responsible procurement practices.

Based on the conceptual framework, one can expect that a beyond compliance strategy positively relates to intentions of SME entrepreneurs to save materials and energy in the next two years.

Moreover, environmental concerns, i.e. the attitudes towards the environment, of SME entrepreneurs are positively associated with those intentions. Furthermore, a higher satisfaction of SME entrepreneurs from earlier resource efficiency investments should theoretically also positively correlate with plans to increase material and energy efficiency. As already described, the environmental regulatory framework is an important exogenous factor shaping management decisions regarding the sustainability strategies of firms. To address this framework, I distinguish SMEs according to the stringency and enforcement of the national environmental regulations they are exposed to. Hence, this approach can be useful in order to empirically explore whether the expected relationship between a beyond compliance strategy and a higher satisfaction regarding resource efficiency investments differs depending on the external institutional environment.

### 3 Data

In order to estimate the relationships, I use three different data sources. The main dataset I use refers to firm-specific data that are obtained from the Flash Eurobarometer Survey No. 381, titled “SMEs, resource efficiency and green markets, wave 2” and which was conducted upon the request of the European Commission in 2013. Moreover, this study uses two other datasets which each relate to country-specific information, i.e., first, the 2012 Executive Opinion Survey (World Economic Forum 2013) in order to measure the stringency and enforcement of environmental regulations and, second, World Bank statistics which comprise a country’s level of Gross Domestic Product in 2012.

In the Flash Eurobarometer Survey, a random technique is employed in order to obtain a nationally representative sample of 8,253 SMEs operating in 36 countries.<sup>4</sup> A special feature in this survey is that, for some questions, the suggested options from which the respondents can choose are modified (e.g. by adding an additional option or by using a slightly different description) in order to check whether this change has an impact on the responses as compared to the responses in the first wave of the survey being conducted in 2012.<sup>5</sup> Technically speaking, the sample in each country is split in half with respect to some variables in order to compare the

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<sup>4</sup> The countries are: France, Belgium, The Netherlands, Germany, Italy, Luxembourg, Denmark, Ireland, United Kingdom, Greece, Spain, Portugal, Finland, Sweden, Austria, Cyprus (Republic), Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria, Romania, Turkey, Croatia, Montenegro, Serbia, Albania, Norway, Iceland, Israel, and the United States of America. Macedonia and Liechtenstein are also part of the survey. However, for these countries there is no data concerning the stringency and enforcement of national environmental regulation. Therefore, in the analysis, I do not consider SMEs operating in these two countries.

<sup>5</sup> I refer to the Flash Eurobarometer Survey No. 342 “SMEs, Resource Efficiency and Green Markets”.

responses in these waves. Some variables I use in the analysis are affected by this split and will be described in the following sections. I first describe the variables which relate to the Flash Eurobarometer Survey and afterwards the sources from which I generate the variables linked to the stringency and enforcement of environmental regulations and the country's state of economic development.

### **Dependent Variables**

Interviewees of the firms report on the planned additional resource efficiency actions over the next two years.<sup>6</sup> Among other proposed actions, the respondents are asked whether the SME is planning to save energy and/or materials in the next two years.<sup>7</sup> Hence, the variables "Materials" and "Energy" are binary dependent variables, that each take on the value "1" if the enterprise is planning to reduce each input factor in the next two years and they equal "0" otherwise.

### **Explanatory Variables**

The main independent variables capture different compliance strategies with respect to national environmental legislation, i.e. whether the SME entrepreneur has difficulties in complying, whether the company (just) complies or the enterprise goes beyond compliance. The variables which refer to a beyond compliance strategy also capture slightly different facets which point to the lack or the existence of pro-environmental attitudes of the entrepreneur. In particular, the variables further distinguish between SMEs that perceive environmental concerns as being among the firm's priority objectives or not. To better separate these compliance strategies, I create dummy variables that each equal "1" if the SME entrepreneur follows a particular strategy and it takes on the value "0" otherwise (also compare Table 1 which lists the response options in detail).

Yet another factor which can rather be attributed to a company's profit maximization framework is the return on investments undertaken in order to increase the firm's resource efficiency. Following the reasoning of neoclassical economic theory, one can relate this return to the level of satisfaction it evokes. Hence, it can be argued that, for companies to aspire future resource efficiency improvements, it is important to consider the degree of satisfaction with these returns.

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<sup>6</sup> The question reads "Over the next two years, what are the additional resource efficiency actions that your company is planning to implement?"

<sup>7</sup> One slight modification by the sample split is that one half of the respondents are suggested a more specific definition of recycling as another measure to increase resource efficiency. This modification has an impact on the responses regarding this action, but virtually no impact on the responses concerning materials and energy as actions to increase resource efficiency (compare European Commission 2013).

In the analysis, the variable “Return on resource efficiency investments” captures the range in which the respondents evaluate their satisfaction with respect to the company’s resource efficiency investments, i.e. in the range of “0” to “3” where “0” stands for ‘very dissatisfied’ and “3” for ‘very satisfied’.

### **Control Variables**

Many entrepreneurs undertake actions to improve their firm’s resource efficiency. Consequently, compliance strategies, which are one focus in this paper, could be correlated with various economic reasons for firms to undertake such improvements. Against this background, it is important to control for these influences to mitigate potentially omitted variable bias. For instance, enterprises increase their resource efficiency, because consumers exhibit a higher willingness to pay for products or services being produced in an environmentally conscious way (Arora and Gangopadhyay 1995). Moreover, I also control for various other reasons, i.e. in anticipation of future changes in legislation, in anticipation of future professional or product standards, the creation of a competitive advantage or a business opportunity, and catching up with main competitors who have already taken action. Firms may also improve their resource efficiency, because financial and fiscal incentives or receiving other forms of public support is a reason for them to do so. To control for this, I use data comprising whether or not the firm receives support from the public or private sector which captures governmental support at least to some extent. Another reason to take action in order to increase resource efficiency is proposed to only one half on SMEs in the sample on a country base, i.e. a cost-reduction motive for which almost two thirds of the respondents opt for (European Commission 2013). Making use of this variable would result in a nearly fifty percent decrease in sample size, however. On the other hand, I argue that cost reduction motives are already captured by the variable “Return on resource efficiency investments” which measures the level of the interviewee’s satisfaction with those investments.

Another point relates to the question as to whether the firm’s workforce is experienced in dealing with resource efficiency related issues. In the estimations, I include a dummy variable that captures whether the enterprise employs workers in “green” jobs, i.e. employees who have specialized skills, knowledge, training or are experienced in dealing with measures aimed at improving environmental quality. Although this definition tends to be too vague in order to exclusively investigate resource efficiency actions by the firm, companies might be more likely to aspire to future resource efficiency improvements because of already existing knowledge in

the firm. Although the data used comprises a relatively homogenous sample with respect to the firm size, I include a dummy variable capturing whether the firm is small- (between one and 49 employees) or medium-sized (between 50 and 249 employees), because literature points to the relevance of size differences in the context of environmental practices of SMEs (Hitchens et al. 2005; Uhlaner et al. 2012).

Enterprises also differ with regard to their production technologies making them more material or energy intensive. Unfortunately, the dataset lacks this firm-specific information. However, I attempt to control for this by including industry-specific fixed effects.<sup>8</sup> I also include country dummy variables, because whether or not SMEs plan to save energy or materials in the future may also depend on the country in which the entrepreneurs do business.

### **Environmental Regulation and GDP per Capita Data**

The sample used consists of SMEs operating in 36 countries. A great deal of variance is therefore attributed to the stringency of environmental regulations and the state of economic development across countries. Regarding environmental regulations, one important feature of these policy interventions, however, is not only their stringency but also the extent to which they are enforced. The consideration of both features of environmental regulation is important because a strict environmental regulation, e.g., might not unfold its intended effects if its enforcement is weak (Hettige et al. 1996). In order to capture both, the stringency and enforcement of these regulations, I make use of data from the 2012 Executive Opinion Survey (World Economic Forum 2013) in which business executives are requested to rate the stringency of their country's environmental regulation on a scale from "1" to "7", where "7" stands for the world's most stringent environmental regulation. Another question asks the executives about the extent to which those regulations are enforced on a scale from "1" to "7" with the highest score representing the evaluation that the enforcement is perceived to be among the world's most rigorous.<sup>9</sup> Using this data for the empirical analysis requires the construction of one index that captures both, the stringency and enforcement of environmental regulations. To achieve this, I follow studies by Kellenberg (2009) and Manderson and Kneller (2012) that multiply both

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<sup>8</sup> The SMEs I investigate operate in the following industries: Manufacturing; Electricity, Gas, Steam, and Air Conditioning Supply; Water Supply, Sewerage, Waste Management and Remediation Activities; Construction; Wholesale and Retail Trade, Repair of Motor Vehicles and Motorcycles; Transportation and Storage; Accommodation and Food Service Activities; Information and Communication; Financial and Insurance Activities; Real Estate Activities; Professional, Scientific and Technical Activities; Administrative and Support Service Activities.

<sup>9</sup> Data referring to the stringency and enforcement of environmental regulation are available online at [http://www3.weforum.org/docs/TTCR/2013/TTCR\\_DataTables2\\_2013.pdf](http://www3.weforum.org/docs/TTCR/2013/TTCR_DataTables2_2013.pdf)

averages in each country to obtain one single country-related index which is captured by the variable “Environmental Regulation Index”.

In the analysis, I also consider the country’s state of economic development. By doing so, I take the country-specific GDP per capita as an indicator for this development on a logarithmic scale. Because this data also does not form a part of the Flash Eurobarometer sample, I make use of statistics provided by the World Bank which refer to the country’s GDP per capita in the year 2012.<sup>10</sup>

## **4 Results and Discussion**

### **4.1 Descriptive Statistics**

Starting with the results regarding the descriptive statistics, Table 1 details the distribution of the dependent and the independent variables as well as the underlying questions in the survey. With respect to the dependent variables, 55% of the firms consider plans to save material and almost two thirds aspire to increase their resource efficiency by reducing energy in the next two years. Of course, the underlying responses regarding their planned savings of materials and energy imply an alteration of absolute quantities of these input factors rather than a reduction of energy and material per unit of output. However, it can be expected that respondents have a relative measures in mind, because the whole survey is introduced as it investigates resource efficiency in the companies.

Another important statistic concerns the fraction of SMEs following a particular compliance strategy, because literature points to difficulties for SMEs to follow a beyond compliance strategy. The analyses show that almost half of the SMEs have either difficulties or are just complying with environmental legislation and do not wish to go beyond compliance. Therefore, the results in this study seem to be in line with existing literature that points to a lack of additional resources needed to follow a beyond compliance strategy (Bianchi and Noci 1998; Gonzalez-Benito and Gonzalez-Benito 2005). SME entrepreneurs that contemplate to do more comprise approximately 27% of the sample.

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<sup>10</sup> Compare World Bank statistics provided online at <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

Table 1: Variable descriptions and summary statistics

<b>Variables</b>	<b>Description</b>	<b>Share/Mean</b>	<b>Min</b>	<b>Max</b>
<i>Dependent:</i>				
Material	1 if the firm is planning to save materials over the next two years and perceives that measure as additional resource efficiency action, 0 otherwise.	55.36%	0	1
Energy	1 if the firm is planning to save energy over the next two years and perceives that measure as additional resource efficiency action, 0 otherwise.	64.15%	0	1
<i>Independent:</i>				
Compliance strategy	0 if the firm has difficulties in complying with environmental legislation,	2.81%		
	1 if the firm is complying with environmental legislation but does not wish to go beyond these requirements,	46.03%		
	2 if the firm is complying with environmental legislation and is contemplating doing more,	27.29%		
	3 if the firm is going beyond the requirements of the environmental legislation but environmental concerns are not one of its priorities,	10.17%		
	4 if the firm is going beyond the requirements of the environmental legislation and environmental concerns are among the firm's priority objectives.	13.7%		
Resource efficiency investments	Assessed satisfaction concerning the return on investments made on resource efficiency, i.e.			
	0 in the case of 'very dissatisfied'	3.68%		
	1 in the case of 'dissatisfied'	12.93%		
	2 in the case of 'fairly satisfied'	69.5%		
	3 in the case of 'very satisfied'	13.89%		
	Main reasons why the company is taking actions to be more resource-efficient:			
Reason: Future legislation	1 if the firm anticipates future changes in legislation, 0 otherwise	16%	0	1
Reason: Future professional /product standard	1 if the firm anticipates future professional / product Standards, 0 otherwise	14%	0	1
Reason: Demand from customers/providers	1 if the firm reacts to demand from customers or providers, 0 otherwise	26%	0	1
Reason: Competitive advantage	1 if the firm intends to create a competitive advantage / business opportunity, 0 otherwise	26%	0	1
Reason: Catch up with main competitors	1 if the firm is catching up with main competitors that have already taken action, 0 otherwise	12%	0	1
Turnover decreased	1 if the firm's annual turnover decreased over the past two years, 0 otherwise	33%	0	1

<b>Variables</b>	<b>Description</b>	<b>Share/Mean</b>	<b>Min</b>	<b>Max</b>
Turnover unchanged	1 if the firm's annual turnover remained unchanged over the past two years, 0 otherwise	28%	0	1
Turnover increased	1 if the firm's annual turnover increased over the past two years, 0 otherwise	38%	0	1
Medium-sized enterprise	1 if the firm's number of employees ranges between 50 and 249, 0 if the firm's number of employees ranges between 1 and 49.	21%	0	1
1% or more of annual turnover invested	1 if the firm invested one percent or more of its average annual turnover over the past two years to be more resource-efficient, 0 otherwise	56%	0	1
At least 1 employee in "green" job	1 if the firm employs at least one employee who has specialized skills, knowledge, training, or experience in dealing with information, technologies, or materials that preserve or restore environmental quality, 0 otherwise.	49%	0	1
Private external support	1 if the firm makes use of private external support to be more resource-efficient, i.e. either private funding, funding from friends or relatives, advice or other non-financial assistance from private consulting and audit companies, or advice or other non-financial assistance from business associations, 0 otherwise	18%	0	1
Public external support	1 if the firm makes use of public external support to be more resource efficient, i.e. either public funding or advice or other non-financial assistance from public administration	8%	0	1
Environmental regulation index	Index capturing the stringency and enforcement of national environmental regulation	23.29	6.76	40.96
GDP per capita	Gross Domestic Product per capita in the respective country	33.123	4.406	106.022

Sources: Flash Eurobarometer Survey (no. 381), 2012 Executive Opinion Survey, World Bank statistics. Summary statistics are based on the sample used in the regression analysis.

As already described in the prior section, the variable also distinguishes between whether or not the SME entrepreneurs prioritize environmental concerns in the companies. Ten percent of the entrepreneurs state that their companies go beyond compliance but do not consider environmental concerns as one of their priorities. Almost 14% of the SMEs go beyond compliance and prioritize environmental concerns, which points to pro-environmental attitudes of these entrepreneurs. Therefore, the results in this study do not seem to confirm as large a

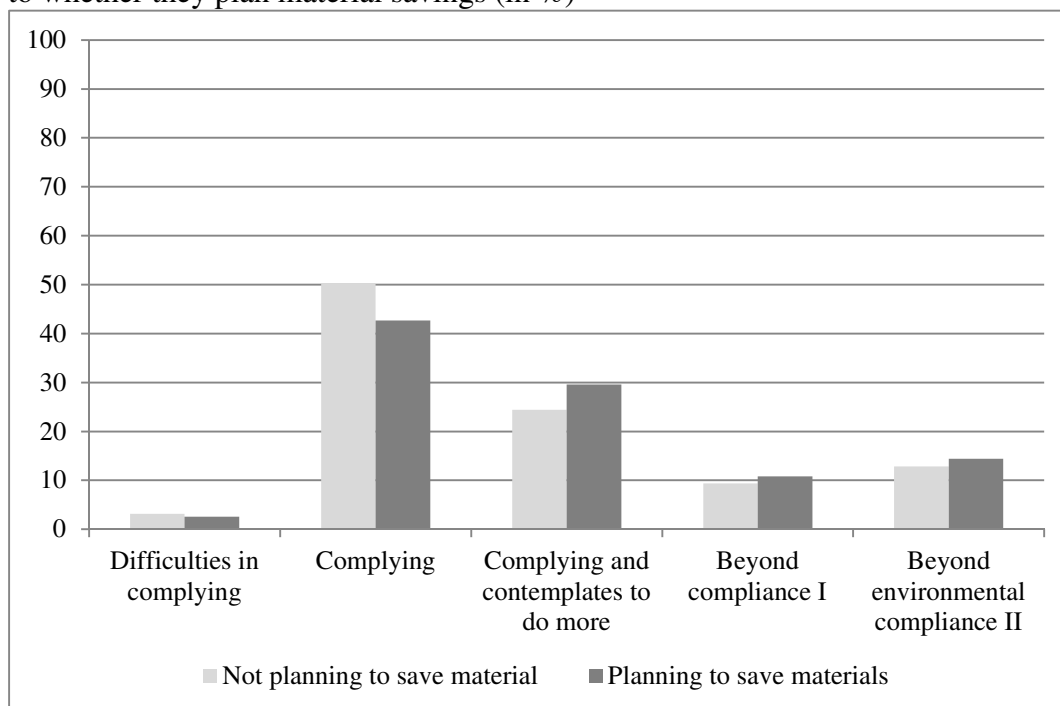


proportion of entrepreneurs exhibiting such concerns as extant studies suggest (for example, Revel et al. 2010; Williams and Schaefer 2013).

Looking at the distribution of companies depending on the degree of satisfaction with the return on investments made on resource efficiency unveils that a large majority of SMEs is fairly or very satisfied with those investments (almost 84%). Therefore, the results in this article seem to add an interesting observation to literature, because existing studies which are based on a little number of in-depth interviews provide mixed results in this regard (Revell and Blackburn 2007; Hitchens et al. 2005). Furthermore, the results also unveil that there seem to be discrepancies between the perception of resource efficiency measures regarding their economic outcome and the satisfaction of resource efficiency investments once they are undertaken. For instance, in a recent study by Cassells and Lewis (2011), the authors find that almost one third of SME entrepreneurs respond that they agree with the statement that they are sceptical about potential cost savings and market benefits accompanying environmental improvements.

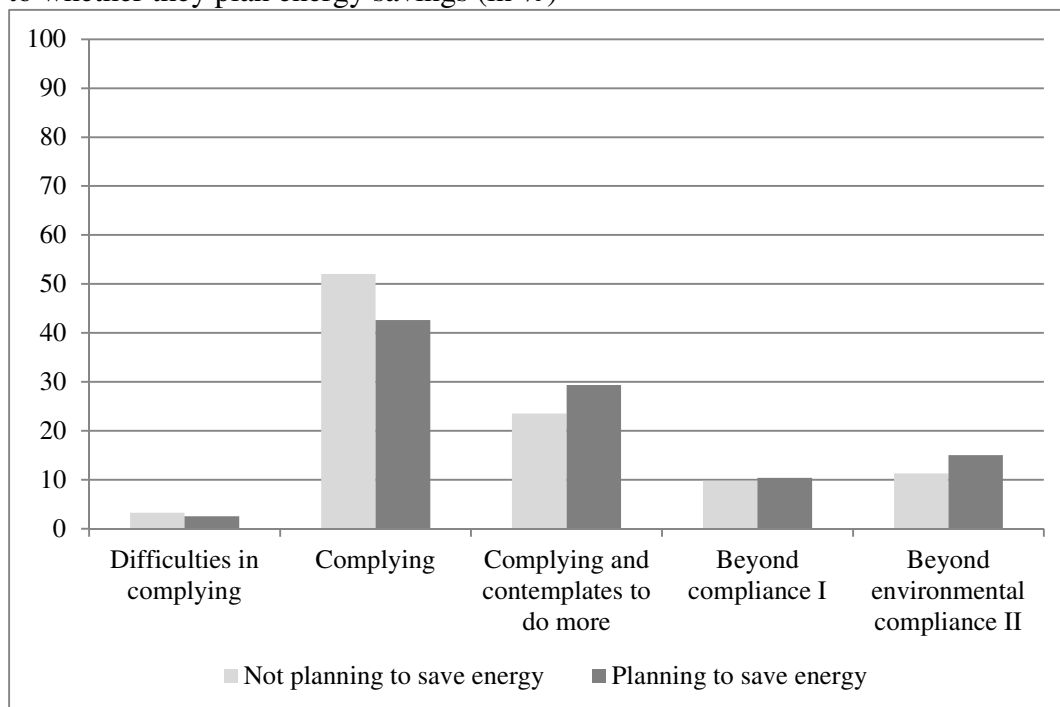
The main focus in this study is placed on the explanatory variables concerning the compliance strategy of SMEs and the variable which captures the entrepreneurs' satisfaction concerning past investments in resource efficiency. I commence with reporting the descriptive statistics regarding different compliance strategies and the corresponding fractions regarding whether or not SMEs plan to save material (in Figure 1) and energy (in Figure 2). At first sight, as already shown in Table 1, the fraction of SMEs which experience difficulties in complying with environmental legislation appears to be low and does not differ much in terms of whether the SME plans to save material or not. Regarding SMEs that are complying with environmental legislation but do not wish to go beyond these requirements, the fraction of these companies planning to save materials or energy is lower as compared to SMEs that do not. Focusing on the next higher level of compliance strategy, i.e. SMEs that are complying with environmental legislation and contemplate to do more, the statistics show that the share of firms planning to save materials or energy is higher than the fractions of enterprises that do not intend to save those input factors (almost 29.4% versus 23.5% in the case of materials and almost 30% versus 24.4%). Looking at both beyond compliance strategies which differ according to whether environmental concerns are among the firm's top priorities (Beyond compliance II) or not (Beyond compliance I), a similar picture can be drawn. The share of SMEs planning to save materials or to save materials in the future is higher in both cases as compared to SMEs that do not plan to do so.

Figure 1: Proportion of SME entrepreneurs following a particular compliance strategy according to whether they plan material savings (in %)



Source: Flash Eurobarometer Survey, no. 381. Calculations based on observations used in the total sample regressions.

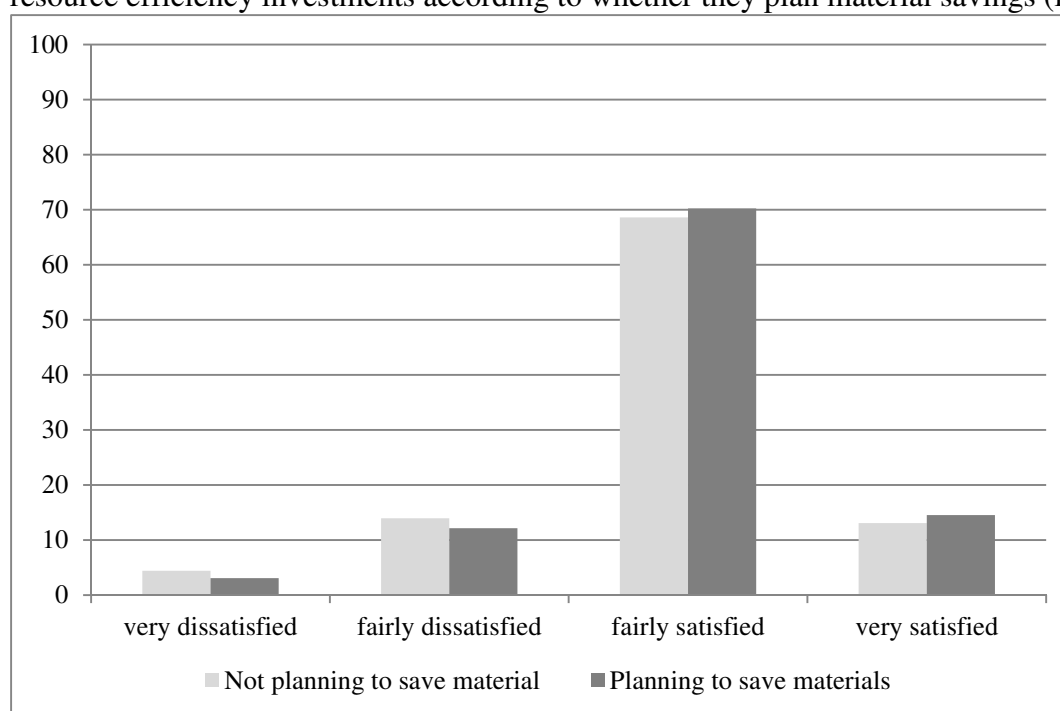
Figure 2: Proportion of SME entrepreneurs following a particular compliance strategy according to whether they plan energy savings (in %)



Source: Flash Eurobarometer Survey, no. 381. Calculations based on observations used in the total sample regressions.

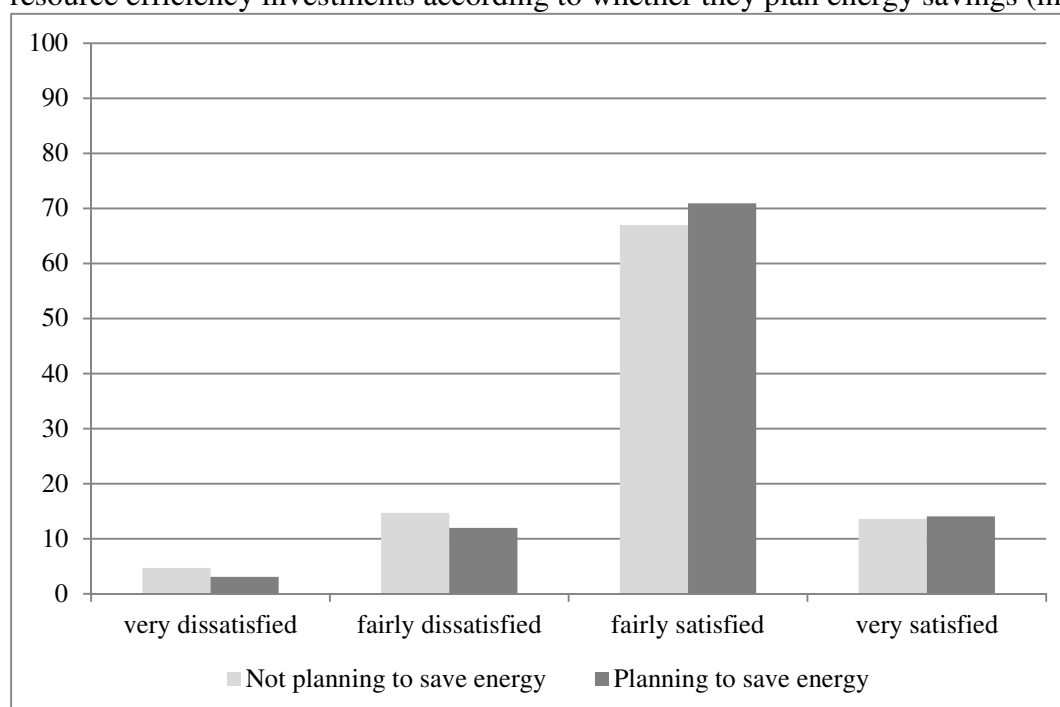
Figures 3 and 4 describe the variable “Return on resource efficiency investments”, presenting the fraction of SMEs perceiving a particular satisfaction level concerning such investments and whether or not these entrepreneurs plan to save materials and energy. In general, the statistics show that the share of SMEs planning to save one of these input factors in the next two years is lower for firms that are very or fairly dissatisfied with their resource efficiency investments. In contrast, the figures also indicate that the share of SMEs which are fairly or very satisfied with these investments is higher for SMEs that intend to save materials or energy in the next two years.

Figure 3: Proportion of SME entrepreneurs perceiving a particular satisfaction level regarding resource efficiency investments according to whether they plan material savings (in %)



Source: Flash Eurobarometer Survey, no. 381. Calculations based on observations used in the total sample regressions.

Figure 4: Proportion of SME entrepreneurs perceiving a particular satisfaction level regarding resource efficiency investments according to whether they plan energy savings (in %)



Source: Flash Eurobarometer Survey, no. 381. Calculations based on observations used in the total sample regressions.

## 4.2 Estimation Results

In Table 2 I present the results of logistic regressions, because both dependent variables are binary coded (“Material” and “Energy”) and estimate the following specification, i.e.

$$y_{ijk} = \alpha + \beta \cdot X_i + \delta \cdot Inv_i + \phi \cdot Z_i + \gamma \cdot W_j + \eta \cdot B_k + u_{ijk}$$

where  $y_{ijk}$  equals “1” if firm  $i$  in country  $j$  and industry  $k$  plans to save materials or energy in the next two years and takes on the value “0” otherwise.  $X_i$  is a vector of four different firm-specific compliance strategy variables regarding environmental legislation. The coefficient  $\delta$  captures the effect of the entrepreneurs’ satisfaction regarding past investments in resource efficiency and  $Z_i$  is a vector of further firm-specific control variables. Moreover,  $W_j$  is a vector of two country-specific control variables, i.e. first the stringency and enforcement of environmental regulation and second a country’s GDP per capita,  $B_k$  is a vector of industry-specific control variables and  $u_{ijk}$  is the error term.

In models Ia and IIa, I only include the main explanatory variables, i.e. the company’s compliance strategies and the satisfaction regarding resource efficiency investments, controlling

the country's economic development measured as the logarithm of GDP, the stringency of national environmental regulation captured by the variable "Environmental Regulation Index", and industry-specific fixed effects.<sup>11</sup> The results in both models (Model Ia and IIa) suggest that SME entrepreneurs that comply with environmental legislation and contemplate to do more are more likely to improve their firm's material and energy efficiency in the next two years as compared to entrepreneurs who just comply without considering a further engagement in environmental practices. This positive correlation also holds for both beyond compliance strategies. Looking at the results concerning the resource efficiency investments, it turns out that a higher satisfaction of those investments is positively and significantly correlated with the likelihood to plan to reduce materials in the next two years.

Including the control variables related to the various reasons why firms increase their resource efficiency (in the models Ib and IIb), the results suggest that the main explanatory variables are hardly affected by this inclusion in terms of significance. Moreover, the coefficients are smaller in size. This change in coefficients might point to the relevance of these control variables as discussed in section 3. Adding more firm-specific controls (in the models Ic and IIc), however, seems to slightly affect the results regarding the compliance strategy variables while the results for the variable "Return on resource efficiency investments" are almost unaffected. In the case of material, for instance, the correlation between the "Beyond Compliance II" strategy and intentions of SME entrepreneurs to save materials in the next two years is now insignificant. In the case of energy, however, the results point to a positive and significant correlation between this strategy and the aspiration to further minimize this input factor. Hence, the results suggest that those entrepreneurs are more likely to plan further increases in energy efficiency but not a further improvement in material efficiency. Therefore, the results indicate that SME entrepreneurs translate their pro-environmental attitudes into intentions to reduce their energy input but not the input of materials.

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<sup>11</sup> Including country-specific variables in the regressions suggests a clustering of the standard errors on the country level. However, I do not cluster the standard errors because, according to Bertrand et al. (2004), clustering performs well with at least 50 clusters which is not the case in the dataset I use (36 countries).

Table 2: Estimation results based on the total sample

	Material Model Ia	Material Model Ib	Material Model Ic	Energy Model IIa	Energy Model IIb	Energy Model IIc
Difficulties in complying <sup>a</sup>	-0.051 (0.137)	-0.114 (0.137)	-0.131 (0.138)	-0.012 (0.138)	-0.058 (0.139)	-0.067 (0.140)
Complying/contemplating doing more <sup>a</sup>	0.336*** (0.055)	0.262*** (0.056)	0.234*** (0.057)	0.411*** (0.057)	0.350*** (0.058)	0.293*** (0.059)
Beyond compliance I <sup>a</sup>	0.316*** (0.078)	0.243*** (0.080)	0.229*** (0.080)	0.238*** (0.080)	0.173** (0.082)	0.119 (0.082)
Beyond compliance II <sup>a</sup>	0.279*** (0.070)	0.162** (0.072)	0.107 (0.074)	0.483*** (0.075)	0.396*** (0.076)	0.270*** (0.079)
Return on resource efficiency investments	0.164*** (0.036)	0.166*** (0.036)	0.179*** (0.037)	0.131*** (0.037)	0.132*** (0.037)	0.138*** (0.038)
Reason: Future Legislation		0.359*** (0.064)	0.344*** (0.064)		0.381*** (0.068)	0.349*** (0.068)
Reason: Future Professional/product standards		0.357*** (0.067)	0.340*** (0.068)		0.404*** (0.072)	0.375*** (0.073)
Reason: Demand from customers/providers		0.341*** (0.053)	0.330*** (0.053)		0.127** (0.054)	0.095* (0.055)
Reason: Competitive advantage		0.414*** (0.053)	0.405*** (0.054)		0.345*** (0.056)	0.312*** (0.056)
Reason: Catch up with main competitors		0.509*** (0.073)	0.492*** (0.074)		0.483*** (0.078)	0.457*** (0.078)
Turnover decreased <sup>b</sup>			0.146*** (0.056)			0.141** (0.058)
Turnover unchanged <sup>b</sup>			0.057 (0.057)			-0.014 (0.059)
Medium-sized Enterprise			-0.075 (0.060)			0.206*** (0.064)
1% or more of annual Turnover invested			0.081* (0.047)			0.091* (0.049)
At least 1 Employee in "green" job			0.137*** (0.047)			0.180*** (0.049)
Private external support			0.127* (0.071)			0.270*** (0.076)
Public external support			0.139 (0.095)			0.150 (0.103)
Environmental Regulation Index	-0.003 (0.004)	-0.004 (0.004)	-0.003 (0.004)	0.012*** (0.004)	0.012*** (0.004)	0.014*** (0.004)
Logarithm(GDP per capita)	-0.192*** (0.060)	-0.183*** (0.061)	-0.212*** (0.061)	-0.250*** (0.063)	-0.252*** (0.064)	-0.283*** (0.065)
Industry Dummy Variables	YES***	YES***	YES***	YES***	YES***	YES***
Constant	1.985*** (0.545)	1.667*** (0.550)	1.751*** (0.555)	2.369*** (0.574)	2.166*** (0.579)	2.277*** (0.585)
Pseudo R square	0.0151	0.0340	0.0368	0.0146	0.0288	0.0352
Number of observations	8,253	8,253	8,253	8,253	8,253	8,253

Source: Flash Eurobarometer Survey, no. 381. <sup>a</sup> Dummy variable, Reference category: 'Complying/no wish to do more'.

<sup>b</sup> Dummy variable, Reference category: 'Turnover increased'. Robust standard errors in parenthesis. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01

Besides the main independent variables, the results regarding the control variables are also noticeable. While a higher stringency and enforcement of country-specific environmental regulations does not seem to significantly correlate with intentions to increase material efficiency, there is a positive and significant correlation in the case of energy efficiency.<sup>12</sup> In contrast, a higher GDP per capita reduces the likelihood of SME entrepreneurs intending to save energy and materials in the future. This result might relate to the fact that SME entrepreneurs have already taken actions to increase their resource efficiency.

The differences regarding materials and energy efficiency and the corresponding relationship between pro-environmental attitudes and intentions are a new result. Hence, in what follows, I check the robustness of this finding. A possible way to do this is to compare the results which relate to the reasons as to why companies take actions to improve their resource efficiency with respect to materials and energy only for SME entrepreneurs employing a “Beyond Compliance II” strategy. Hence, if pro-environmental attitudes and resource efficiency improving intentions are more relevant in the case of energy than in that of materials, a positive and significant correlation should only exist for materials, because environmentally concerned entrepreneurs would improve their company’s resource efficiency anyway. In the following, Table 3 presents the results for these regressions.

The results reveal that some of the variables capturing the various reasons are still positively and significantly correlated with both the intentions of SME entrepreneurs to reduce materials and energy. However, there are also differences. While the reasons concerning future legislation and the demands from customers/providers are positively and significantly correlated with the intention to reduce materials, these correlations are not significant in the case of energy. The results do not imply a causal relationship. Nonetheless, they can at least further support the findings from Table 2. SME entrepreneurs tend to be more inclined to reduce their demand for energy compared to materials which could imply that they unfold their pro-environmental attitudes rather in the case of energy.

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<sup>12</sup> The differences in values captured by the variable “Environmental Regulation Index” might not additionally inform about the stringency and enforcement of this regulation. Therefore, I have also checked whether the results are affected if the variable measures a ranking of countries. However, this is not the case.

Table 3: Estimations based on SME Entrepreneurs following Beyond Compliance II

	Material	Energy
Reason: Future Legislation	0.441** (0.176)	0.065 (0.184)
Reason: Future Professional/product standards	0.021 (0.170)	0.037 (0.180)
Reason: Demand from customers/providers	0.303** (0.137)	0.175 (0.147)
Reason: Competitive advantage	0.376*** (0.134)	0.396*** (0.145)
Reason: Catch up with main competitors	0.617*** (0.209)	0.550** (0.231)
Return on resource efficiency investments	0.208** (0.099)	0.174* (0.105)
Turnover decreased <sup>a</sup>	-0.004 (0.149)	-0.006 (0.159)
Turnover unchanged <sup>a</sup>	-0.182 (0.161)	-0.266 (0.172)
Medium-sized Enterprise	-0.078 (0.136)	0.323** (0.151)
1% or more of annual Turnover invested	0.119 (0.141)	-0.048 (0.150)
At least 1 Employee in “green” job	0.236* (0.139)	0.082 (0.149)
Private external support	0.025 (0.175)	-0.055 (0.188)
Public external support	-0.042 (0.221)	0.222 (0.247)
Environmental Regulation Index	0.005 (0.011)	0.010 (0.012)
Logarithm(GDP)	-0.251 (0.175)	-0.148 (0.197)
Industry Dummy Variables	YES	YES
Constant	2.118 (1.605)	1.656 (1.796)
Pseudo R Square	0.0328	0.0293
Number of observations	1,131	1,131

Source: Flash Eurobarometer Survey, no. 381. <sup>a</sup> Dummy Variable, reference category: ‘Turnover increased’. Robust standard errors in parenthesis. \* p<0.1; \*\* p<0.05; \*\*\* p<0.01

Existing studies have not come across this finding. One possible argument is that materials as input factors could be perceived as a production factor that needs to be minimized because of a cost reduction motive. This interpretation could be in line with the findings by Ilomäki and Melanen (2001, p. 215) who interviewed SME entrepreneurs and conclude that “...the increase of material efficiency is a natural aim of enterprises and it is not actually seen as an “environmentally friendly” activity among entrepreneurs.” Another explanation could be that “materials” represent a large group of very diverse inputs that are used for production, while energy is much more homogenous and easier to evaluate in terms of its negative impact on the natural environment. The latter perception could be further fuelled by the media that tend to confine their coverages on high demands for energy and the resulting effects on climate change making SME entrepreneurs relatively more aware of their own demand for energy.



Organizational outcomes which describe the firms' ecological sustainability are often explained in the light of institutional theory, according to which institutional forces, like environmental regulations or social expectations, induce firms to adopt environment-friendly practices (Berrone et al. 2010; Jennings and Zandbergen 1995). Another peculiarity is that similar forces are argued to affect managerial decisions which, in turn, create similar practices and structures across organizations (DiMaggio and Powell 1983). To address the issue of the regulatory environment, I distinguish the SMEs according to whether they face a weaker or a stronger stringency and enforcement of environmental regulation. Therefore, the sample is split at the median value of that index<sup>13</sup>.

In Table 4, I report the results of the regressions based on the sub samples. Concerning the different compliance strategies, the results show that in all models considered, there is a positive correlation of SMEs that comply with and contemplate to do more than environmental legislation as compared to SMEs which confine their sustainability measures to what environmental regulation calls for. Regarding the correlation between the "Beyond Compliance II" strategy and the investigated intentions of SME entrepreneurs, the results further corroborate the findings revealed by the total sample (Table 2), but do not add much to a further understanding of compliance strategies in different regulatory contexts.

Continuing with resource efficiency investments, the results suggest that a positive and significant correlation between the underlying variable ("Return on resource efficiency investments") and the intention of SME entrepreneurs seems to be confined to countries imposing weak regulations (the significance level for the variable "Return on resource efficiency investments" is slightly above 5% in the case of energy and SMEs operating in countries imposing weak regulations). Therefore, the results indicate that the marginal productivity of resource efficiency investments is higher for SMEs in countries with weak environmental regulations as compared to SMEs operating in countries with strong environmental regulations which, in turn, affects plans to further increase energy and material efficiency. Thus, SMEs in stronger regulated economies might have already undertaken sufficient investments to comply with environmental regulations.

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<sup>13</sup> The values taken by that Index range between 6.76 and 40.96. The median value is 20.25.

Table 4: Estimation results based on subsamples

	Material	Material	Energy	Energy
	Weak Regulation	Strong Regulation	Weak Regulation	Strong Regulation
Difficulties in complying <sup>a</sup>	-0.120 (0.183)	-0.275 (0.237)	-0.105 (0.186)	-0.125 (0.234)
Complying/contemplating doing more <sup>a</sup>	0.272*** (0.085)	0.326*** (0.089)	0.309*** (0.088)	0.412*** (0.092)
Beyond compliance I <sup>a</sup>	0.143 (0.130)	0.260** (0.114)	-0.103 (0.130)	0.287** (0.116)
Beyond compliance II <sup>a</sup>	0.087 (0.116)	0.147 (0.112)	0.284** (0.119)	0.336*** (0.117)
Return on resource efficiency investments	0.119** (0.054)	0.043 (0.061)	0.103* (0.054)	0.006 (0.063)
Reason: Future Legislation	0.408*** (0.099)	0.129 (0.095)	0.435*** (0.104)	0.152 (0.100)
Reason: Future Professional/product standards	0.329*** (0.103)	0.243** (0.103)	0.485*** (0.109)	0.252** (0.109)
Reason: Demand from customers/providers	0.312*** (0.086)	0.185** (0.078)	0.060 (0.085)	-0.026 (0.080)
Reason: Competitive advantage	0.386*** (0.082)	0.399*** (0.080)	0.381*** (0.085)	0.227*** (0.083)
Reason: Catch up with main competitors	0.523*** (0.105)	0.276** (0.126)	0.531*** (0.112)	0.211* (0.128)
Turnover decreased <sup>b</sup>	0.137 (0.087)	-0.019 (0.088)	0.137 (0.088)	-0.060 (0.090)
Turnover unchanged <sup>b</sup>	0.138 (0.092)	-0.117 (0.082)	0.076 (0.093)	-0.196** (0.084)
Medium-sized Enterprise	0.078 (0.090)	-0.051 (0.090)	0.285*** (0.094)	0.308*** (0.096)
1% or more of annual Turnover invested	-0.022 (0.072)	0.246*** (0.071)	0.068 (0.074)	0.150** (0.073)
At least 1 Employee in “green” job	0.078 (0.077)	0.243*** (0.073)	0.142* (0.078)	0.271*** (0.075)
Private external support	0.119 (0.118)	0.092 (0.098)	0.098 (0.119)	0.299*** (0.104)
Public external support	0.298* (0.160)	0.149 (0.128)	0.075 (0.160)	0.256* (0.140)
Country Dummy Variables	YES***	YES***	YES***	YES***
Industry Dummy Variables	YES**	YES***	YES**	YES***
Constant	-0.064 (0.261)	0.343 (0.222)	-0.444* (0.265)	0.238 (0.231)
Pseudo R Square	0.1388	0.1022	0.1256	0.0866
Number of observations	4,252	4,001	4,252	4,001

Source: Flash Eurobarometer Survey, no. 381. <sup>a</sup> Dummy Variable, reference category: ‘Complying/no wish to do more’, <sup>b</sup> Dummy Variable, reference category: ‘Turnover increased’. Robust standard errors in parenthesis.

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

## 5 Conclusions

In this article, I empirically investigate the relationship between different compliance strategies of SMEs and the intentions of entrepreneurs to increase the company’s material and energy efficiency in the next two years. Of course, intentions to improve the firm’s resource efficiency may or may not be realized in the future. However, as Ajzen (1991) argues, intentions are immediate antecedents of behaviour and can potentially predict a company’s future resource

efficiency development. In the analysis, I also investigate the correlation between such intentions and the extent to which SME entrepreneurs are satisfied with investments undertaken to increase resource efficiency in their firms. So far, related literature mainly bases the analysis on a small number of in-depth interviews (Revell and Blackburn 2007; Hitchens et al. 2005).

The presented analysis, which is based on data on SMEs in 36 countries, suggests that beyond compliance strategies and a higher satisfaction are positively related to planned energy and material efficiency improvements. Having a closer look at pro-environmental attitudes of SME entrepreneurs gives an interesting insight on differences between materials and energy as input factors. In particular, the results suggest a positive and significant correlation between environmental concerns of SME entrepreneurs and their intentions to improve energy efficiency. This relationship does not seem to hold in the case of material efficiency. One plausible interpretation is that entrepreneurs associate energy more directly with environmental degradation and, hence, feel more motivated to reduce this input factor as compared to materials which are not linked to this degradation. This study also addresses the stringency of national environmental regulations that are argued to have an important influence on the decision making process in companies and their natural sustainability strategies (DiMaggio and Powell 1983; Jennings and Zandbergen 1995). The results based on sub samples distinguishing SMEs according to this stringency, give intriguing insights on different marginal returns on resource efficiency investments. In particular, the results suggest that SME entrepreneurs face relatively low marginal productivities in strongly regulated economies which could hint at the fact that these firms had to invest in resource efficiency in order to comply with environmental regulations in the past. Thus, the results might provide evidence for hypotheses based on neoclassical economic theory.

The paper adds to an emerging stream of economic literature which integrates insights from behavioral science into environmental policy (compare, among others, Allcott 2011; Ayres et al. 2013; Allcott and Rogers 2014; Costa and Khan 2013; Ferraro and Price 2013). Allcott (2011), for example, finds that non-price interventions, like sending letters to households in which they are informed about their own energy consumption as compared to their neighbour's consumption makes households feel motivated to conserve energy if their demand is higher than that of a comparison group. A possible reason is that "People may conform to others' behaviour because they believe in a wisdom of crowds, i.e. that others took an action because they had more or different information about its benefits, or because there is some external approbation or inner comfort from conformity" (Allcott and Mullainathan, 2010, p. 3). More importantly, Allcott

(2011) also concludes that those low-level interventions can substantially and cost effectively change consumer behaviour as compared to traditional environmental policy measures. In a related study by Costa and Khan (2013), the authors show that “nudges”, as another low cost strategy, that aims at improving energy conservation in households is two to four times more effective if the household is supportive of achieving natural sustainability. Based on the results in these two studies and the results in this paper, there seems to be further potential for improving environmental policy measures aiming at resource efficiency increases in SMEs. For instance, one could use this type of policy intervention, i.e. sending letters regarding their relative resource efficiency performance to SME entrepreneurs. This could positively affect the strength of the attitude-intention relationship and thus result in resource efficiency-increasing actions. Moreover, based on the results in this paper, it might be more cost effective to confine this kind of policy intervention to energy, because SME entrepreneurs seem to focus their pro-environmental attitudes on a reduction of their demand for energy rather than for materials.

Of course, the present analysis has its limitations and provides first evidence for correlations rather than causal effects, because the results may be biased due to endogeneity issues. On the one hand, it could be that intentions of SME entrepreneurs to improve their resource efficiency in the future could also positively correlate with the responses regarding whether the SME entrepreneur follows a strategy which goes beyond compliance. Therefore, the direction of causation is not clear-cut. On the other hand, there is a substantial variation in stringency and enforcement of environmental regulations across countries. Thus, it could be that those intentions are just sufficient to comply with national environmental legislation and would not drive a positive correlation. Moreover, from a theoretical standpoint, Stern et al. (1995) suggest that environmental concerns are causal antecedents of pro-environmental intentions and, hence, give an indication concerning the direction of causation. This study relies on self-reported data regarding energy and materials. Thus, the results might be upward biased, because individuals tend to overstate their “true” plans to reduce these input factors in the future, since positive responses are socially desired. Another limitation relates to data concerning the stringency and enforcement of environmental regulations. This data is based on subjective perceptions of internationally experienced managers. Although I include industry dummy variables in the regressions in order to control for different energy and material intensities, these intensities might be measured with error. For example, Foster et al. (2008) find that very large differences with respect to the productivity of firms exist even within narrowly defined sectors in one country which, in turn, might also affect energy and material intensities.

An avenue for future empirical studies could be to further examine the relationship between pro-environmental attitudes and resource efficiency-increasing actions. By doing so, one could utilize instrumental variables that affect pro-environmental attitude variables but not corresponding actions. However, as Sutton (2002) already notes, it is very difficult to find good instruments for this purpose. Another possibility is to further refine the measurement of the returns on investments in resource efficiency. In particular, one could distinguish returns on investments undertaken in improving energy and material efficiency, which could not be addressed in this study. Finally, many empirical problems could be reduced by using panel data. With panel data, one could better investigate the effects of changing pro-environmental attitudes of SME entrepreneurs towards the demand for energy and materials (Allcott 2011).

**Appendix:**

Table A1: List of countries imposing weak and strong environmental regulations

<i>Weak Regulations</i>	<i>Index Value</i>	<i>Strong Regulations</i>	<i>Index Value</i>
Albania	6.76	Czech Republic	22.09
Serbia	7.29	France	24.48
Romania	9	Estonia	27.04
Bulgaria	10.24	United States of America	27.04
Greece	10.73	Iceland	28.09
Croatia	12.25	Ireland	29.68
Turkey	12.25	United Kingdom	29.7
Hungary	12.25	Belgium	31.9
Slovakia	14.44	Norway	33.64
Malta	15.21	Austria	34.81
Italy	15.3	The Netherlands	35.4
Montenegro	16	Luxembourg	36
Cyprus (Republic)	16	Denmark	37.21
Latvia	17.64	Sweden	37.21
Lithuania	17.64	Germany	39.68
Poland	17.64	Finland	40.96
Slovenia	18.49		
Israel	18.49		
Portugal	18.49		
Spain	20.25		

Source: Executive Opinion Survey (2012). The median value of the index is taken in order to distinguish between these countries.

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