The importance of small and medium-sized enterprises (SMEs) in the sustainability crisis: Research on what makes SMEs perform better in resource efficient activities in Europe

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Abstract

This research analyses the role of small and medium-sized enterprises (SMEs) in the ongoing sustainability crisis. As SMEs represent 99% of all the businesses in Europe, it is important for governments and policy makers to understand what can be done in order to foster the contribution of SMEs to sustainability and the circular economy. Specifically, this report answers the question what makes SMEs perform better in resource efficient activities, i.e., having a green product or service portfolio and/or investing in resource efficiency, by taking into consideration the existing barriers and support factors and by investigating whether the effects of the barriers and support factors are moderated by company size, age and/or the political sustainability landscape. To answer this question, this report utilises data from the Flash Eurobarometer survey 456 which are a representative for SMEs in Europe. Contrary to expectations, the findings demonstrate that younger and smaller firms (in comparison to older and bigger firms) have less difficulties in overcoming barriers that prevent them from contributing to sustainability. The results also portray that the political landscape may play a pivotal role on the probability of an SME contributing to sustainability and consequently provide relevant policy recommendations.

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1. Introduction

The world is currently facing a sustainability crisis (Gare, 2006). The importance for sustainable solutions has increased critically over the last decade and has never been of greater importance then it is now. We have not yet reached the win-win situation where technological and efficiency improvements are able to lead to sustainable growth (Schneider, Kallis, & Martinez-Alier, 2010). However, economists (Schneider et al., 2010) argue that the current sustainability crisis is a threat that could be turned into green opportunities if managed and planned well. One of the examples the economists mention are investments in renewable energies, indicating that there is still room to be gained amongst various companies. In this light, the present study analyses the impact of barriers and support factors on resource efficiency and the offering of green products and services among small and medium-sized enterprises (SMEs) in the European Union (EU).

From the perspective of companies, sustainability can be defined as meeting the needs of their current stakeholders without compromising their abilities to meet the needs of their future stakeholders (Dyllick & Hockerts, 2002). In essence, there are many ongoing international projects that tackle the current sustainability crisis and aim to find sustainable solutions in the most time efficient manner. For instance, one of the ongoing potential solutions is the net zero carbon by 2050 project which is founded by the EU. Yet, there are still many concerns by a lot of economists on how we can actually reach there and what companies can do to foster and aid this process.

For instance, Simonelli (2016) who analyses another EU's program named Horizon 2020, the largest research and innovation programme ever made in the EU (European Commission, 2020b), argues that it is an ambitious and outstanding program but that it also has some drawbacks. Simonelli (2016) states that there are obstacles that prevent SMEs from efficiently contributing to the program and successfully meeting the targets. The economist states that strategic changes have to be made in the program to motivate SMEs' participation, maximise the impact of their grants and motivate them to have new sustainable and innovative targets for the future (Simonelli, 2016). With regard to the time dimension, that plays a key role in solving the sustainability crisis, Sovacool (2016) mentions that energy transitions take a lot of time and they are likely to be path dependent rather than revolutionary. In the article,

the economist concludes that some energy transitions can take a time of a century. However, with the current level of environmental damage, we do not have a century of time left and hence need to take an action now.

A large contribution to the EU's economy comes from SMEs. According to the definition of the European Commission (EC), small-sized companies have less than 50 employees and a turnover or balance sheet total up to 10 million euros (European Commission, 2020d). Medium-sized companies are defined with having less than 250 employees and a turnover or balance sheet up to 50 or 43 million euros respectively (European Commission, 2020d). SMEs comprise 99% of all the businesses, providing around two thirds of employment, and adding 50-60% of value in the Organisation for Economic Co-operation and Development (OECD) region (OECD, 2019). SMEs are considered to be a key for delivering sustainable and inclusive economic growth (OECD, 2019). Therefore, this research decides to focus on SMEs and their abilities to contribute towards a more sustainable future and the circular economy (CE). In short, circular economy's main idea is to preserve the value of products and materials as long as possible with the goal to minimise waste and resource use and to increase value at the end of the product life cycle (European Commission, 2020a). One of the central ideas of CE is resource efficiency. The European Commission (2020c) defines resource efficiency as using the earth's limited sources in a way that its whole effect on the environment is minimised.

It is generally agreed that we are currently facing a degradation of the environment which can lead to market failures. Nonetheless, it can be argued that entrepreneurs (including SME owners) can take advantage of these types of market failures (Dean & Mcmullen, 2007). In their article, Dean and McMullen (2007) discuss different types of market failures, i.e., public goods and externalities, that contribute to harmful behaviour of firms but at the same time provide opportunities for the solutions of this harmful behaviour. The fundamental reasons why natural resources are prone to market failures are that there are no property rights assigned, there is a time dimension attached as at one point the resources can become depleted, irreversibility, non-linear consequences and non-substitutability of natural resources. Nonetheless, from an environmental economists' point of view, Dean and McMullen (2007) do not favour government inventions but instead the inventions of private parties, i.e., entrepreneurs and companies, that are able to solve these market failures, make profit from it while also reducing environmentally degrading economic behaviours (Dean & Mcmullen,

2007). This notion further warrants the focus on entrepreneurs (SME owners) and their enterprises in the present study.

This paper contributes to the existing academic literature as becoming more sustainable and resource efficient is an important strategy of enterprises as well as an important driver of the CE. The need for environmental protection and increased consumer demand for natural resources is forcing SMEs to reconsider and restructure their business models and strategies (Wu & Pagell, 2011). Furthermore, there are numerous studies done, such as the studies of Anstine (2000) as well as that of Jacobs, Singhal and Subramanian (2008), on the relationship between the environmental efforts of firms and their effects on firm performance – however the findings have been mixed. Hence, this research aims to shed a clearer light on these findings and seeks to understand better the dynamics behind SMEs engagement in sustainability and resource efficiency. That is, by drawing on data from the Flash Eurobarometer survey 456, we analyse the barriers that hinder and the support factors that foster the contribution of SMEs to the CE.

From a societal perspective, the aim of this report is to know to what extent resource efficiency for SMEs is restricted and/or supported and whether these effects are amplified based on the characteristics of a firm (i.e., its size and its age), and the political attitude towards environmentalism in the country the firm resides. This is crucial as nowadays entrepreneurship plays a significant role in the economy (Acs, 2006) and with the current state of technology it is relatively easy for individuals today to become entrepreneurs themselves. Moreover, the more the population gets involved in "green" opportunity entrepreneurship, i.e., seeing an opportunity for green and resource efficient business, the higher might be the increase in economic development (Acs, 2006). Hence, it is important to know the factors that impact businesses' green portfolios and their resource efficiency to understand better the drivers for CE and economic development.

Ultimately, the report intends to answer to the question what makes SMEs perform better in resource efficient activities, i.e., having a green product or service portfolio and/or investing in resource efficiency, by taking into consideration the existing barriers and support factors and investigating whether they can exercise better opportunities from their company size, age and/or the political sustainability landscape. The research is utilising the data from the Flash Eurobarometer survey 456 (European Commission, 2018b) with the intention to bring

novelty to the existing scientific literature and research, as currently there only exists a small number of academic papers that have utilised the same dataset and there are currently not any reports available with the scope of this report (see Literature Review section). The rest of the thesis is organised as follows. Section 2 discusses the theoretical motivation of the topic and develops the hypotheses. Section 3 depicts the data and methodology utilised in this empirical study. Section 4 illustrates the empirical results. Section 5 discusses the implications of the empirical results together with the concluding remarks and limitations.

2. Literature Review

This section starts by discussing first the concept of sustainability and how it is operationalised in this research. This is followed by the exploration of the main variables of interest which are barriers and support factors that hinder or foster SMEs in engaging in sustainability. The former also leads to the development of the main hypotheses. Next, the moderators analysed in this research are discussed, which are company age, company size and eco-leadership, together with the development of the interaction hypotheses.

2.1. Sustainability

The definition of sustainability originates from the famous report by Brundtlant et al. (1987) that defines the development of sustainability as meeting the present needs without compromising next generations to meet their future needs. This concept holds its roots still today while it has different meanings for individuals. For some sustainability is about people, planet and profits whereas for others it is about human well-being for present and future generations, or the balance between local and global development, etc. (Hoogendoorn, 2020).

The Brundtlant et al. (1987) report discusses mainly the two aspects of sustainability that should be balanced: the development and the environment, which can be depicted as needs and resources, or short and long-term. However, nowadays three dimensions of sustainability are distinguished: the social, economic and environmental dimension (Kuhlman & Farrington, 2010). The social and economic aspects can be grouped together as they are mostly about the well-being of the present generation. The environmental dimension is about caring for the natural resources of the future. Consequently, sustainability can loosely be defined as the sum of natural resources and man-made resources that remain at least constant for the future generations (Kuhlman & Farrington, 2010). The former should lead to higher well-being and to a positive or neutral state of the future resources.

As seen from above, sustainability has many aspects to take into consideration. The Flash Eurobarometer survey 456 dataset, which this report utilises, focuses on two practices that can boost sustainable development and the CE: having a green product or service portfolio and resource efficiency. Both of these practices serve the core solution to find a balance between the socio-economic and the environmental dimensions in the current sustainability crisis. In

the survey a green product or service portfolio is defined as having products and services with a main function of reducing environmental risk and minimising pollution and resources (European Commission, 2018b). Examples include goods that are produced organically, have eco-labels, are eco-designed or are made of recycled content. Furthermore, the EC defines resource efficiency as using the limited resources of the earth in the most sustainable manner as possible to minimise the impact on the environment. The main idea of resource efficiency is to "create more with less and to deliver greater value with less input" (European Commission, 2020c).

Sustainability is complex in nature, and it may not be easy to engage in resource efficient activities (i.e., there are barriers) and therefore support may be needed for enterprises (DeSimone & Popoff, 2000; Machiba, 2010). As this research focuses on SMEs, the findings of DeSimone and Popoff (2000) and Machiba (2010) link well with the literature of Hockerts and Wüstenhagen (2010) that discusses about emerging Davids and greening Goliaths – making a distinction between entrepreneurial start-ups as Davids (generally younger and smaller firms) and incumbent firms as Goliaths (generally older and bigger firms). There are different reasons why barriers and support factors exist for both of them. Primarily, it can be said that sustainability is complex in nature (DeSimone & Popoff, 2000; Machiba, 2010) as it requires more resources and capital investments than traditional products and services that can use old infrastructure, older technology, etc. (Cecere et al., 2014). It is therefore difficult for enterprises to become sustainable as they have to upgrade their traditional way of production in the most resource-efficient manner. Moreover, the end customers cannot necessarily make a difference between sustainable and non-sustainable products and services (De Marchi, 2012), i.e., companies that have a green portfolio and/or produce resource efficiency. Therefore, high capital cost of adaptation may not reflect into product and services which are discernible by the end customer from the traditionally produced products and/or services. However, with the environmentally beneficial characteristics, sustainability can also provide opportunities for companies whose aim is to become sustainable. Here, the literature interprets support as factors that are specific within and outside of the company that make it easier for the SMEs to engage in sustainability efforts. It is important to note that in the existing literature there is no universal definition for support and the following section of Literature Review focuses more on the analysis of it in relation to sustainability, i.e., how it is conceptualised by various economists, what are the common trends seen and how its effects can be tested the most effectively.

Consequently, the following part of the Literature Review will identify the barriers as well as support factors for sustainability among the SMEs in the EU. This will further be explored with the interaction of the moderators of company size, company age and the eco-leadership environment (political sustainability landscape) of the country.

2.2. Barriers and support factors

The study by Cainelli, De Marchi and Grandinetti (2015) examines multiple drivers for environmental innovations by making a distinction between different factors in environmental innovation development. The economists note that the barrier or support factor that makes a company contribute to sustainability is exogenous, i.e., environmental regulation or the role of stakeholders. In this study, Cainelli et al. (2015) utilise the dataset of Spanish manufacturing firms to understand which type of factors play a crucial role and are relevant in sustainable development. The economists depict that the more uncertainty there is about the environmental innovation the higher is the company's reliance on external resources, emphasising that the large network effects and cooperation with other stakeholders play a crucial role when trying to overcome the barriers that prevent from contributing to sustainability.

Correspondingly, the findings of Ormazabal, Prieto-Sandoval, Puga-Leal and Jaca (2018) highlight the novelty of their study by noting that not much research has been done on the barriers and opportunities SMEs face when contributing to the CE. Their research investigates SMEs and their contribution to environmental management in the CE in Spain. Ormazabal et al. (2018) utilise a factor analysis in order to define and understand the CE barriers and opportunities SMEs face. From the results of the factor analysis, the economists highlight that all the variables regarding opportunities (in their research these are increases in prestige, cost reduction and financial profitability, recovery of the local environment, etc.) can be grouped into the same factor which implies that the benefits of the investigated variables for the CE are seen as a whole. However, the study also illustrates that there are two groups of barriers for contributing to the CE (i.e., barriers cannot be grouped into the same factor) and their effects on resource efficiency: hard and human-based barriers. They define hard based barriers as obstacles related to financial stimulation and technological modernization since they are related to lack of financial resources, technology, and adequate information technology (IT) systems. They define human based barriers as obstacles related to people, such as company leadership

and lack of supply (Ormazabal et al., 2018). In their research, the surveyed companies did not think that CE could aid them in increasing their profitability and sustainability in the market, which makes them less reluctant in investing in sustainable development. Yet, Ormazabal et al. (2018) found out that one of the most critical barriers that prevent SMEs in investing in CE is the lack of governmental support and policy instruments. Furthermore, the novelty of the paper of Ormazabal et al. (2018) lies in the fact that they explore the potential ways of how SMEs can be more engaged in the CE by considering various barriers and benefits they perceive. This thesis aims to extend their findings and investigate whether hard or human-based barriers play a greater role in the resource efficiency of SMEs in the EU, as the study by Ormazabal et al. (2018) was based on Spanish SMEs only.

Furthermore, the study by Lewis, Pun and Lalla (2006) depicts that the involvement of SMEs corporate social responsibility (CSR) efforts depends on the presence of hard and soft support factors. According to Garriga and Melé (2004), CSR has several aspects to take into consideration, most of them being linked to sustainability such as the use of business power in a responsible way, integration of social demands and a contribution to a society in an ethically correct way. In the article of Lewis et al. (2006), the economists define soft support as aspects strongly related to behavioural actions such as leadership, human resource management and relations with the stakeholders. More generally, based on multiple sources of academic literature, soft support can be defined by having non-quantifiable behavioural aspects that are mainly related to the communication of knowledge and skills, i.e., advice. It is difficult to assign a numerical value for the former and thus soft support is found to be more informative with qualitative factors that are open to interpretation (Black & Porter, 1996). With regard to soft support, the research of Wiese (2014) addresses the importance of certain factors contributing towards SME sustainability in the South African economy. The economist notes that communication skills are the most important characteristics for SMEs engaging in sustainability, as well as the ability to network. Moreover, Wiese (2014) states that the experience of managers and the knowledge of the owners is another important factor. Hence, it is clear that soft support plays a crucial role in the sustainability of SMEs.

On the other hand, hard support is related to quantifiable aspects of support, is more defined, and can be well measured. It is noted that currently there has not been made a lot of research with regard to the degree of soft and hard support factors that are implemented by different policy makers and institutions, especially the effects of their usage on the

sustainability of SMEs (Louise, 1996). The literature states that the effects of hard and soft support factors are found to be mixed (Gadenne & Sharma, 2009). Nevertheless, the literature also portrays that they both do have a positive effect on resource efficiency although little is known about their relative strength and their dependence on other important moderators such as the company age, size and/or the eco-leadership environment.

All in all, based on the literature, we expect to see that the barriers (hard and human-based) have a negative effect and support factors (hard and soft) have a positive effect on the sustainability of SMEs. This is also very intuitive as barriers hamper companies from engaging in sustainability, whereas support factors provide more favourable conditions for them. Therefore, our hypotheses follow quite naturally from the earlier studies on this topic. Consequently, the first four hypotheses of this research are:

H1: A company that experiences hard barriers, compared to a company that does not, is less likely to contribute towards sustainability, i.e., having a green portfolio and being resource efficient.

H2: A company that experiences human-based barriers, compared to a company that does not, is less likely to contribute towards sustainability, i.e., having a green portfolio and being resource efficient.

H3: A company that receives hard support, compared to a company that does not, is more likely to contribute towards sustainability, i.e., having a green portfolio and being resource efficient.

H4: A company that receives soft support, compared to a company that does not, is more likely to contribute towards sustainability, i.e., having a green portfolio and being resource efficient.

However, the literature has not been able to find out a clear effect of the above-mentioned barriers and support factors, together with the dynamics of various moderators and their characteristics, on the sustainability of SMEs. Consequently, we apply an innovative contribution in our analysis by examining interaction effects for the barriers and support factors. According to the existing literature and earlier studies (see the next sections of Company age, Company size and Eco-leadership) there are important factors to consider that make SMEs more engaged in investing in sustainability. Given the present dataset, important

moderators of interests that we are able to test are company age, company size and eco-leadership. Company age and company size are considered as internal factors of the firm whereas eco-leadership refers to the external political attitude towards sustainability. Moreover, we would like to note that this type of dynamic analysis has not been done before with the dataset of Flash Eurobarometer survey 456 in the existing literature.

2.3. Company age

The literature has two sides when it comes to the argumentation of whether younger firms are more likely or less likely to engage in sustainable actions. For instance, Michelon (2011) finds out that younger companies may be more sensitive to the new call for Corporate Social Responsibility and therefore more likely to be engaged in sustainability actions.

Nonetheless, the results suggest that while both external and internal greening strategies have an impact on the firm performance of young firms and small firms, internal greening strategies are more relevant for middle-aged firms and large firms (Shrivastava & Tamvada, 2019). Here, Shrivastava and Tamvada (2019) define external greening strategies as those that are externally visible to the stakeholders such as offering green products and services, signing up to environmental certification systems, etc. On the other hand, internal greening strategies are related to more internal processes that cannot be observed that well, including cost-savings, efficiency gains, investments in equipment, hiring employees that are more acknowledgeable about sustainability and green products, incorporation green processes in production, etc. All in all, Shrivastava and Tamvada (2019) suggest that having a green product or service portfolio may be more crucial for newer entrepreneurial firms rather than older incumbent firms. Moreover, the research of Hockerts and Wüstenhagen (2010) discusses that Goliaths have a fear of new and greener products or services cannibalizing the market share of their existing products and hence they are less likely to introduce radical and new green innovations. This supports Shrivastava's conclusion that also states that older firms are more likely to invest in incremental processes rather than doing radical changes such as introducing a new green product or service portfolio.

Furthermore, in the research of Hockerts and Wüstenhagen (2010), the economists make it clear that older incumbent firms have the financial resources as well as the established networks since they have been around for a longer time. Long experience in the market has

enabled them to create a network with policymakers, other institutions and have their own lobby channels. The latter enables them to have more power in the market as they have been long established in the market. Moreover, as the older incumbent firms have been around for a longer time, they have acquired relatively more knowledge in comparison to entrepreneurial young start-up firms who have are new in the market and much more limited options and resources available. Hence, Goliaths have more advantage relative to Davids, as they are older which has given them a comparative advantage. Therefore, we hypothesise:

H5.1: Younger firms, compared to older firms, have more difficulties in overcoming hard barriers when contributing to the sustainability, i.e., having a green portfolio and being resource efficient.

H5.2.: Younger firms, compared to older firms, have more difficulties in overcoming human-based barriers when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H5.3. Younger firms, compared to older firms, gain more advantage from hard support when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H5.4 Younger firms, compared to older firms, gain more advantage from soft support when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

2.4. Company size

The results of an empirical study by Cainelli, De Marchi and Grandinetti (2015) show that the larger the firm is, the more likely to engage in greening strategies. In their research they make a reference to the findings of Klewitz and Hansen (2014) who suggest that smaller sized SMEs have higher constraints in terms of financial and technical resources in comparison to larger firms. Consequently, smaller SMEs have also lower incentives to introduce a green product or service portfolio, especially when considering the lower levels of scrutiny from their stakeholders (Klewitz & Hansen, 2014).

Moreover, the paper of De Marchi (2012) shows that firm's size seems to be a structural characteristic that boosts green or environmental innovations to a greater extent than other innovations. This research of De Marchi (2012) focuses more on green and environmental innovations. The latter can be defined as innovative solution that involves new or modified processes or products that are able to benefit the environment and contribute towards sustainable development (Oltra & Saint Jean, 2009). The aim of the research of De Marchi (2012) is to find out whether there is heterogeneity in the determinants of environmental innovations among companies. De Marchi (2012) finds that there is a statistically significant positive effect for company size, which suggests that larger firms are more inclined to innovate environmentally, compared to smaller firms. Importantly, as in the present study, De Marchi (2012) measures company size as the natural logarithm of the number of employees in the firm.

Additionally, when referring again to the paper of Hockerts and Wüstenhagen (2010**)** and the comparison of Davids and Goliaths, it is clear that larger companies have stronger market power, a larger set of skills and more knowledge, which enables Goliaths to overcome the barriers relatively easier than Davids. Therefore, our hypotheses about the interaction effect with company size are:

H6.1: Small firms, compared to large firms, have more difficulties in overcoming hard barriers when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H6.2. Small firms, compared to large firms, have more difficulties in overcoming human-based barriers when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H6.3. Small firms, compared to large firms, gain more advantage from hard support when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H6.4 Small firms, compared to large firms, gain more advantage from soft support when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

2.5. Eco-leadership

Several studies have investigated how enterprises can benefit from the political environment and context they are operating in. Hence, the third moderator is focusing more on the political landscape in which the SMEs reside. For instance, the research of De Marchi (2012) aims to find out which factors aid companies in becoming more resource efficient. De Marchi (2012) analyses research and development (R&D) as it is a crucial factor when introducing environmental innovations. Contrary to what De Marchi (2012) expects to find, the R&D expenditure and its cooperation with institutions is not a strong indicator for showing the resource efficiency of companies. De Marci's research is based on Spanish manufacturing firms. The authors state that when looking at the R&D expenditures of companies in Spain, then their index indicated underperformance relative the other EU countries and hence their overall reported innovation-performance index is relatively low. However, from a deeper analysis De Marchi (2012) finds that Spanish industries benefit greatly from the very active role of the government and higher education sectors. In fact, Spain has a high specialization in renewable energy production (in 2007, Spanish wind energy accounted for a quarter of the entire EU27 production) and the highest number of environmental certified firms throughout all the industries (first European country for ISO14001 and among the first five for a number of EMAS and Ecolabel certifications). This is a clear example of how governmental policies and its regulation can shape a favourable landscape for companies to become more sustainable. Similarly, in the study of Wiese (2014), the author highlights that before the 1994 political election in South Africa, SME support policies for sustainability actions had very little importance for the government and hence they did not receive enough assistance and attention to increase their resource efficiency. Here, Wiese (2014) also highlights the importance of the government and the roles of policies for SMEs.

In this research, the eco-favourable conditions will be analysed based on the eco-innovation scoreboard index from the European Commission. The research of Smol, Kulczycka and Avdiushchenko (2017) depicts that the European Commission's eco-leadership and innovation indicators are good measures to evaluate and propose CE indicators for regional policy. Moreover, the economists discuss that these eco-leadership measures are able to greatly show the contribution of regional authorities in different areas. For instance, eco-innovation inputs (one component of the whole eco-leadership index), includes the government's investments into research and development (R&D) towards the circular economy.

In addition, Smol et al. (2017) note that each EU government has its own strategy for sustainable development and the regional authorities can have a direct impact on the sustainability of enterprises in a particular region in the country via its policies or for instance via investments in R&D activities that generate knowledge spill overs. Hence, it can be assumed that governmental regulations provide the beneficiary landscape for enterprises to become resource efficient and environmentally friendly, implying that companies that are in eco-leadership countries are more likely to overcome barriers and have more favourable support factors. Consequently, the following hypotheses are formulated:

H7.1: Companies in eco-leadership countries, compared to the ones not in eco-leadership countries, have less difficulties in overcoming hard barriers when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H7.2. Companies in eco-leadership countries, compared to the ones not in eco-leadership countries, have less difficulties in overcoming human-based barriers when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H7.3. Companies in eco-leadership countries, compared to the ones not in eco-leadership countries, gain more advantage from hard support when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

H7.4 Companies in eco-leadership countries, compared to the ones not in eco-leadership countries, gain more advantage from soft support when contributing to sustainability, i.e., having a green portfolio and being resource efficient.

3. Data & Methodology

3.1. Dataset

The data are derived from the Flash Eurobarometer survey 456 and downloaded from the European Commission Database (2018b). The survey is based on telephone interviews in the respective national language with the management of small and medium enterprises (SMEs) on the topic of resource efficiency and green markets. The sample was drawn randomly from the international business database from Dun & Bradstreet that contains a list of companies qualified to be interviewed (European Commission Database, 2018b). If necessary, an additional sample from the local sources was added.

The dataset contains cross-sectional data from 2017. The aim of European Commission (EC) with the survey was to explore the resource efficiency actions and the state of the green market amongst Europe's SMEs, but also in its neighbouring countries and the USA – to support decision-making and to design future European policies. Hence, besides the European Union (EU) countries, the dataset also included observations from Iceland, Macedonia, Moldova, Montenegro, Norway, Serbia, Turkey and the United States of America (USA). Data from these countries were dropped, to only keep the focus on EU countries. As a result, the 28 countries included in our sample are Austria, Belgium, Bulgaria, Croatia, Cyprus (officially named as the Republic of Cyprus), Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. We kept the United Kingdom in the data, because in 2017 it was still part of the EU.

The number of responses per country is relatively equal. In our analysis sample of EU countries, each country contributing on average 3.6% and less than 5% of the observations (see Appendix 1). Countries that have noticeably the least representation are Luxembourg (1.6%), Malta (1.4%) and Cyprus (1.2%). These low contribution rates can be explained by the fact that the abovementioned countries have the lowest population rates among all the EU countries, each individually representing less than 0.20% of the entire EU population (Eurostat, 2019).

3.2. The dependent variables

To foster the reliability of results, the hypotheses are tested using two dependent variables that are related but slightly different. The variable "green" is a binary variable that tells whether the company has a green product or service portfolio. The variable "engagement" captures how actively the company is investing into resource efficiency.

The "green" variable is based on question 9 from the survey. The question is "Does your company offer green products or services?", and responses can be either "Yes" or "No". In the survey green products and services are defined as "those with a predominant function of reducing environmental risk and minimise pollution and resources." In case of a reply of "Yes", the variable takes a value of one. In case of a reply of "No", the variable takes a value of zero. Observations with "Don't know/No answer" (DK/NA) are dropped.

The second dependent variable in the data is "engagement", which is based on responses to question 4 from the survey. The question is "Over the past two years, how much have you invested on average per year to be more resource efficient?" with the following answers "Nothing", "Less than 1% of annual turnover", "1-5% of annual turnover", "6-10% of annual turnover", "11-30% of annual turnover" and "More than 30% of annual turnover". Observations with "DK/NA" are dropped from the sample. As the majority of the responses are represented in the first three categories, the variable is recoded to have the following three categories: "Nothing" (1), "Less than 1% of annual turnover" (2), and "More than 1% of annual turnover" (3).

3.3. The main independent variables

There are four main independent variables of interested, reflecting the two types of barriers (hard/human-based) and two types of support factors (hard/soft). It is important to note that in order to answer the question whether the company relies on hard or soft support factors, the company had to previously state that it is relying on external support.

The first main independent variable of interest is "hard barriers", which is based on responses to question 7 from the survey. The question is "Did your company encounter any of the following difficulties when trying to set up resource efficiency actions?". The answers include multiple responses but according to Ormazabal et al. (2018), the hard-based barriers

include: “Complexity of administrative or legal procedures”, “Difficulty to adapt environmental legislation to your company” and “Technical requirements of the legislation not being up to date.” Hence, if the enterprise chose one, two or all of these replies the binary variable hard barriers will take a value of one, otherwise a value of zero.

The second main independent variable is “human-based barriers”, which is also based on question 7 from the survey. According to Ormazabal et al. (2018), the human-based barriers include: “Difficulty in choosing the right resource efficiency actions for your company” and “lack of specific environmental expertise.” In general, the human-based barriers can be related to management and internal decisions of the firm. Hence, if the enterprise chose one and/or two of the replies the binary variable human-based barriers will take a value of one, otherwise a value of zero.

The third main independent variable is “hard support”, which is based on question 6 from the survey. The question is “More precisely, which type of external support is it?”. The response categories for hard support are based on the paper of Lewis et al. (2006) and consequently the following responses are chosen: “Public funding such as grants, guarantees or loans”, “Private funding from a bank, investment company or venture capital fund” and “Private funding from friends and relatives”. If the company chooses all or either of the abovementioned responses the binary variable of hard support will take a value of one, otherwise a value of zero.

The fourth main independent variable is “soft support”, which is also based on responses to question 6 of the survey. Following the paper by Lewis et al. (2006), the following responses are chosen: “Advice or other non-financial assistance from public administration”, “Advice or other non-financial assistance from private consulting and audit companies” and “Advice or other non-financial assistance from business associations”. If the company chooses all or either of the abovementioned responses the binary variable of hard support will take a value of one, otherwise a value of zero.

3.4. The moderators

This research considers three moderators for the four main effects (hard barriers, human-based barriers, hard support and soft support): age, size and eco-leadership of the country of the SME.

The variable “company age” is based on question SCRQ12a from the survey: “In what year was your company established?”. Based on the response, the age was calculated by subtracting the survey year (2017) from the establishment year of the company. Consequently, age is a continuous variable.

The variable “company size” is based on question SCRQ10b from the survey: “How many employees does your company have?”. The variable is logarithmically transformed, because of its skewness. Moreover, a company with 60,000 employees is dropped from the data as it constitutes an outlier in the analysis sample.

The “eco-leadership” variable is a binary variable taken from the European Commission (EC). Namely, the variable used is a European eco-innovation scoreboard index that illustrates the eco-innovation performance of a country (European Commission, 2018a). The eco-innovation index, used to construct the “eco-leadership” variable, consists of these five different dimensions: eco-innovation inputs (activities aiming to stimulate eco-innovation activities), eco-innovation activities (indicators to monitor the scope and scale of eco-innovation activities undertaken by companies), eco-innovation outputs (monitoring the extent to which knowledge outputs generated by businesses and researchers relate to eco-innovation), eco-innovation socio-economic outcomes (changes in employment, turnover or exports that can be related to broadly understood eco-innovation activities) and eco-innovation resource efficiency outcomes (the effects of eco-innovation on improved resource productivity). A more detailed overview of which components are included in the five different dimensions and how they are measured can be found in Appendix 2. The variable “eco-leadership” takes a value of one if the eco-innovation index of the country is above the EU average and zero otherwise. In this sample, the former are the following countries: Austria, Denmark, Finland, Germany, Italy, Luxembourg, Portugal, Slovenia, Spain, Sweden, and the United Kingdom.

3.5. The control variables

Based on the rationale of Shrivastava and Tamvada (2019), who utilise the same database as we to investigate the effect of greening activities on firm performance, two control variables are included. That is, we include dummy variables for sector based on the Statistical

Classification of Economic Activities in the European Community (NACE) of the European Commission (2010) and dummy variables for the type of product the company offers.

Schaltegger and Synnestvedt (2002) note in their research that the type of sector impacts the environmental efforts of the company. The control variable "sector" includes the NACE code of a sector in which the SME operates in. In this dataset there are four sectors: Industry (NACE categories of B/D/E/F), services (NACE categories of H/I/J/K/L/M), retail (NACE category G) and manufacturing (NACE category C).

In the study of Hoejmose, Brammer and Millington (2012), the authors note that companies operating in B2B (business-to-business) markets have fewer opportunities for sustainable development and green engagement than the enterprises in B2C (business-to-consumer) market. The control variable "product" is a binary variable that takes a value of one when the company sells its products or services directly to consumers, and a value of zero otherwise such as "to other companies" or "to public administration".

3.5. The model

To test the hypotheses the binary and ordered logit model are used, for respectively the analysis of the "green" variable and "engagement" variable. The baseline model includes the four main independent variables, moderator variables, and control variables. The second model amends the baseline model with the interaction between the four main independent variables and company age. The third model does the same for company size, and the fourth model does the same for eco-leadership. We estimate average marginal effects to analyse the strength of the relationships.

4. Results

4.1. Descriptive statistics

There are 8,763 observations in the dataset from 28 EU countries (including the UK). Table 1 provides the descriptive statistics of the analysis sample. It also provides the descriptive statistics for the subsample of companies offering a green product or service portfolio.

	Total sample (*N*=8,763)		Subsample of companies with green portfolio (*N*=2,865)	
Outcome variables	**Mean**	**S.D.**	**Mean**	**S.D.**
Green (1=Yes; 0=No)	0.327	0.469	1.000	0.000
Engagement (1=No investment)	0.230	0.421	0.155	0.362
Engagement (2=Less than 1 % of annual turnover)	0.313	0.464	0.300	0.457
Engagement (3=More than 1% of annual turnover)	0.457	0.500	0.549	0.498
Main variables of interest				
Hard barriers (1=Yes; 0=No)	0.464	0.500	0.503	0.500
Human-based barriers (1=Yes; 0=No)	0.318	0.466	0.335	0.472
Hard support (1=Yes; 0=No)	0.144	0.351	0.166	0.372
Soft support (1=Yes; 0=No)	0.198	0.400	0.238	0.426
Moderators				
Company age (years)	26.640	25.321	29.329	28.662
Company size (logarithm)	2.665	1.725	2.769	1.793
Eco-leadership (1=Yes; 0=No)	0.436	0.496	0.484	0.500
Control variables				
Product (1=B2C, 0=B2B)	0.623	0.485	0.667	0.471
Sector (1=Manufacturing)	0.242	0.428	0.224	0.417
Sector (2=Retail)	0.300	0.458	0.346	0.476
Sector (3=Services)	0.273	0.446	0.230	0.420
Sector (4=Industry)	0.186	0.389	0.201	0.401

Table 1. Descriptive statistics of all the variables in the analysis sample.

In general, around 33% of the surveyed companies have already a green product or service portfolio, whereas 67% do not (see Table 1). On the country level, there are more companies without a green product and service portfolio than those with, except for Sweden that has a 50:50 ratio. Countries with a very low prevalence of green companies are Hungary, Bulgaria, Italy, Romania (where around 80% of companies do not offer green products or services). A more detailed overview of the response per country can be found in Appendix 3. Furthermore, 23% of the surveyed companies do not invest at all, 31% of the surveyed companies invest on average less than 1% of their annual turnover and around 46% of the surveyed companies invest more than 1% of their annual turnover to be more resource efficiency. The percentage of companies investing more than 1% of their annual turnover on resource efficiency is higher in the subsample of companies with a green portfolio (55%). On the country level, in most of

the countries the engagement is the highest in category 3 (more than 1% of annual turnover) with the exception of Romania and Czech Republic where companies invest slightly more in category 2 - less than 1% of annual turnover. A very opposite and the only outstanding pattern is seen for France, where the majority of the companies do not invest in resource efficiency at all or invest less than 1% of their annual turnover. Investment levels across countries (in terms of eco-leadership) can be found in Appendix 4. More details of investment levels per country level can be found in Appendix 5.

With regard to both types of barriers (hard and human-based), the minority of the companies encounters hard or human-based barriers with 46.6% and 31.8% respectively (see Table 1). However, in the subsample of companies with a green portfolio, the number of companies that do experience hard barriers (50.3%) and human-based barriers (33.5%) is higher. The majority of the companies do not rely on support factors, as 14.4% and 19.8% of the companies indicate the presence of hard and soft support respectively. Within the subsample of companies offering a green portfolio, the latter percentages are 16.6% and 23.8% respectively (see Table 1).

The average age of a company in the sample is around 27 years, with a minimum number of 0 years and maximum number of 167 years. The standard deviation of 25 years indicates that the data points are widely spread. On average, a company has 14 employees (a logarithmic value of 2.67), with a minimum of 1 employee (a logarithmic value of 0) and maximum of 12,088 employees[1] (a logarithmic value of 9.40). The standard deviation of 6 employees (a logarithmic value of 1.73) indicates that the data points are relatively close to the average number (see Table 1). Furthermore, 43.6%[2] of the companies in the dataset come from eco-leadership countries. Among the subsample of companies with a green portfolio, this percentage is 48.4%.

[1] It is important to note that while this survey is based on SMEs, the respondents of the survey had also an option to select "250 employees or more" as one of their responses to the question of how many employees they have. This implies that some companies in this sample do not comply with the definition of SME having less than 250 employees.

[2] From the database of EC's eco-innovation scoreboard, the eco-innovation index's average score is defined with a value of 100. Countries with an index value above the mean are considered as above EU average and countries below the mean are considered as below EU average. In the database there are more countries that are below the mean and hence the mean value of eco-leadership is not 50%.

62.3% of the SMEs in the sample sell their products to customers directly. This percentage is a little higher (66.9%) among the companies that have a green portfolio. In the sample, the sector that has the most SMEs is retail as 30.0% of the companies operate there. Thereafter, most observations are in the services (27.3%) and manufacturing (24.2%) sector. The industry sector contributes 18.6% of the companies (see Table 1).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Green	1.000													
(2) Engagement	0.147*	1.000												
(3) Hard barriers	0.058*	0.180*	1.000											
(4) Human-based barriers	0.027*	0.096*	0.320*	1.000										
(5) Hard support	0.049*	0.159*	0.109*	0.061*	1.000									
(6) Soft support	0.068*	0.164*	0.101*	0.102*	0.458*	1.000								
(7) Company size	0.042*	0.172*	0.109*	0.088*	0.122*	0.180*	1.000							
(8) Company age	0.075*	0.061*	0.040*	0.027*	0.068*	0.160*	0.299*	1.000						
(9) Eco-leadership	0.077*	0.075*	-0.089*	0.009	0.015	0.113*	-0.026*	0.146*	1.000					
(10) Product	0.064*	-0.012	0.014	-0.018	0.003	-0.025*	-0.164*	-0.039*	-0.068*	1.000				
(11) Manufacturing sector	-0.027*	0.116*	0.032*	0.027*	0.046*	0.039*	0.233*	0.127*	-0.005	-0.193*	1.000			
(12) Retail sector	0.067*	-0.083*	-0.020	-0.011	-0.028*	-0.021*	-0.148*	-0.042*	-0.034*	0.136*	-0.369*	1.000		
(13) Services sector	-0.068*	-0.029*	-0.052*	-0.018	-0.009	0.008	-0.046*	-0.030*	0.048*	-0.035*	-0.345*	-0.402*	1.000	
(14) Industry sector	0.028*	0.003	0.048*	0.004	-0.007	-0.028*	-0.030*	-0.057*	-0.010	0.092*	-0.268*	-0.313*	-0.293*	1.000
* Significant at the 0.05 level														

Table 2. Pearson correlation matrix.

A correlation matrix is provided to investigate the pairwise relationship across all the variables. The correlation between the two dependent variables, green and engagement, is 0.147 and statistically significant at the 5% level (see Table 2). The relatively low correlation coefficient implies that these two variables are not strongly correlated and hence with regard to the econometric models, different results may be expected for the different models. With regard to the independent variables, the highest significant correlations are between soft and hard support (0.458), human and hard barriers (0.320) and between company size and age (0.299). Nonetheless, the correlations are relatively small, below 0.50 and therefore we do not expect multicollinearity problems in the baseline model.

Furthermore, a more detailed overview of both of the dependent variables across NACE sectors and product type can be found in Appendix 6 and 7 respectively. In general, in all the sectors there are fewer companies with a green product or service portfolio than companies without (see Appendix 6). The highest investments (more than 1% of annual turnover) in resource efficiency are made in the industry, retail and manufacturing sector. The opposite pattern appears to hold for services, in which there are lower investments in resource efficiency (see Appendix 7).

4.2. Binary logistic regression results

	Baseline	w/ Company age	w/ Company size	w/ Eco-leadership
Hard barriers	0.211***	0.218**	0.225*	0.131*
	(0.000)	(0.002)	(0.015)	(0.049)
Human-based barriers	0.015	0.0481	0.182	0.0425
	(0.773)	(0.528)	(0.071)	(0.548)
Hard support	0.090	-0.133	0.077	-0.074
	(0.221)	(0.220)	(0.611)	(0.477)
Soft support	0.196**	0.359***	0.175	0.331***
	(0.000)	(0.186)	(0.001)	
Company size	0.049***	0.049**	0.069**	0.050***
	(0.001)	(0.001)	(0.001)	(0.001)
Company age	0.004. ***	0.005***	0.004***	0.004***
	(0.000)	(0.001)	(0.000)	(0.000)
Eco-leadership	0.361***	0.361***	0.361***	0.304***
	(0.000)	(0.000)	(0.000)	(0.000)
Retail sector	0.379***	0.377***	0.377***	0.378***
	(0.000)	(0.000)	(0.000)	(0.000)
Services sector	-0.103	-0.105	-0.103	-0.101
	(0.129)	(0.124)	(0.131)	(0.138)
Industry sector	0.256***	0.252***	0.254***	0.256***
	(0.000)	(0.001)	(0.001)	(0.000)
Product	0.279***	0.281***	0.278***	0.279***
	(0.000)	(0.000)	(0.000)	(0.000)
Hard barriers X Company age		-0.000		
		(0.966)		
Human-based barriers X Company age		-0.001		
		(0.545)		
Hard support X Company age		0.007**		
		(0.005)		
Soft support X Company age		-0.005*		
		(0.020)		
Hard barriers X Company size			-0.007	
			(0.806)	
Human-based barriers X Company size			-0.059	
			(0.052)	
Hard support X Company size			0.003	
			(0.934)	
Soft support X Company size			0.007	
			(0.841)	
Hard barriers X Eco-leadership				0.183
				(0.066)
Human-based barriers X Eco-leadership				-0.0741
				(0.481)
Hard support X Eco-leadership				0.323*
				(0.028)
Soft support X Eco-leadership				-0.250
				(0.054)
Constant	-1.600***	-1.617***	-1.649***	-1.568***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	8763	8763	8763	8763
p-values in parentheses				
Manufacturing sector serves as reference sector				
Source: Flash Eurobarometer 456				
* p<0.05, ** p<0.01, *** p<0.001				

Table 3. Results of the logistic regression with the binary dependent variable "green".

Table 3 present the results of the logistic regression explaining the binary dependent variable "green"

Model 1: The baseline model

Contrary to what expected based on the hypotheses, only the effects of hard barriers and soft support factors are statistically significant at 0.001% and 0.01% respectively in the baseline model. On average, a company that experiences hard barriers, compared to the one that does not, has a 4.50 percentage points higher probability of having a green product or service portfolio, ceteris paribus. Similarly, on average, a company that experiences soft support, compared to the one who does not, has a 4.17 percentage points higher probability of having a green product or service portfolio, ceteris paribus (see Table 3).

With regard to the moderators, the company age, company size and a company in an eco-leadership country have all a positive and statistically significant effect at the 0.001% level on the probability of having a green portfolio. This implies that, on average, the older the company is, the larger it is in size, and/or being in an eco-leadership country increases the probability of the company offering green products or services to its customers.

Model 2: Interactions with company age

In the second model, interactions between the barriers and types of support factors and company age are added. The interaction terms with company age are statistically significant for support (hard and soft) only with significance levels of 0.1% and 5% respectively. These interactions are graphically depicted in Figure 1.

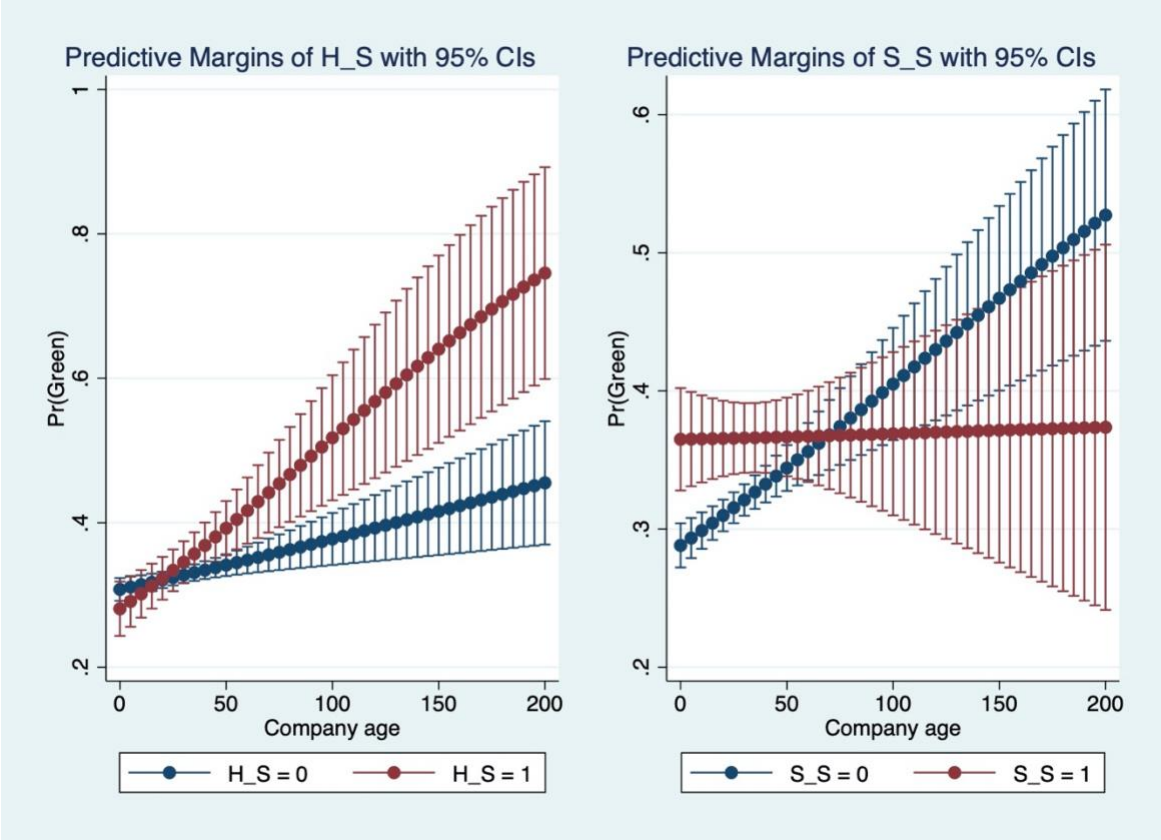

Figure 1. Average marginal effects of age interaction with hard support (H_S) and soft support (S_S), showing standard error bars with 95% confidence interval.

When looking at the marginal effects in Figure 1, on average a company which has hard support, compared to the one that does not, has a higher probability of having a green product or service portfolio when the company age increases by one year. This average marginal effect is statistically significant at the 1% level and hence the effect of hard support is stronger when company age increases (see Table 3). The average marginal effect of the interaction term is 0.01 percentage points, which is statistically significant at the 0.1% level. This implies that, on average, there is a 0.01 percentage point higher probability for a company that has hard support, compared to the one that does not, on having a green portfolio when the company age increases by one year, ceteris paribus.

Contrary, on average a company which has soft support, compared to the one that does not, has a lower probability of having a green product or service portfolio when the company age increases by one year. This average marginal effect is statistically significant at the 1% level and hence the effect of soft support is weaker when the company age increases (see Table 3). The difference of the average marginal effect of the interaction term, between the SMEs

that receive soft support and SMEs who do not, is 0.10 percentage points, which is statistically significant at the 0.1% level. This implies, on average, that there is 0.10 percentage points lower probability for a company that has soft support, compared to the one that does not, on having a green portfolio as company age increases by one year, ceteris paribus.

Model 3: Interactions with company size

In the third model, interactions between the barriers and types of support factors and company size are added. All the interaction terms with company size are not statistically significant and hence imply that company size does not significantly affect the impact barriers (hard/human-based) and support (soft/hard) may have on the probability of having a green product or service portfolio, ceteris paribus.

Model 4: Interactions with eco-leadership

In the fourth model, interactions between the barriers and types of support factors and eco-leadership are added. The only significant interaction term is between eco-leadership and hard support (see Table 3).

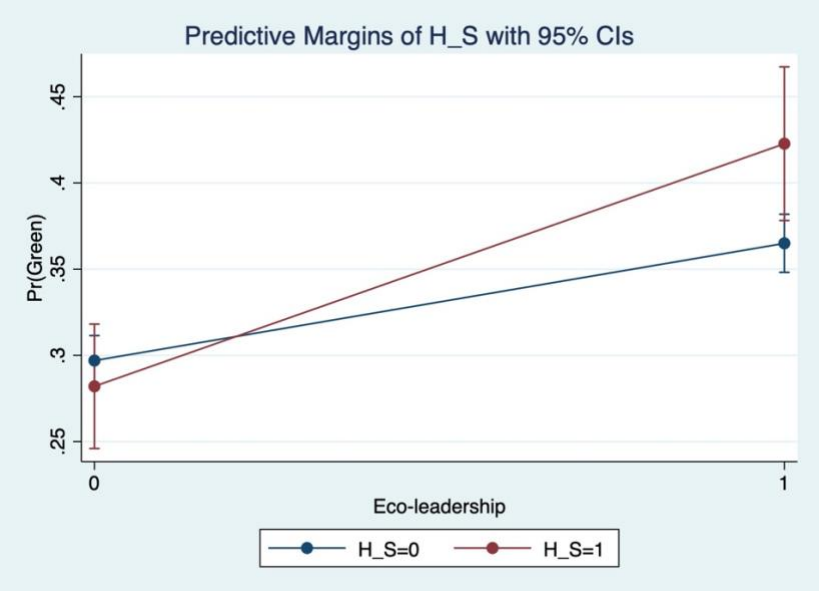

Figure 2. Average marginal effects of eco-leadership interaction with hard support (H_S), showing standard error bars with 95% confidence interval.

Therefore, when looking at the marginal effects at Figure 2, on average a company which has hard support, compared to the one that does not, has higher probability of having a green product or service portfolio when the company is in the eco-leadership country. This average marginal effect is statistically significant at the 5% level and hence the effect of having hard support is higher when a company is in an eco-leadership country (see Table 3). The difference of the average marginal effect of the interaction term, between the SMEs that receive hard support and SMEs who do not, is 5.33 percentage points, which is statistically significant at the 0.1% level. This implies, on average, that there is a 5.33 percentage points higher probability for a company that has hard support, compared to the one that does not, on having a green portfolio when the company is in eco-leadership country, ceteris paribus.

General overview of the "green" models

From the analyses, it can be concluded that when looking at the significant interaction effects only, the type of business support factors (hard and/or soft) has a statistically significant effect on the probability of a company having a green portfolio when the company increases its age by one year. The effect is positive, on average, when the company receives hard support and the company age increases. The effect is negative, on average, when the company receives soft support and the company age increases.

Similarly, to the interaction with company age, having hard support (compared to not having it) increases the probability of a company having a green portfolio when the company is in eco-leadership country. In fact, the average marginal effect of hard support is strongest for the interaction with the "eco-leadership" variable.

Furthermore, the overall results from the logistic regressions with the dependent binary variable of "green" show no significant effects for the interaction terms with barriers (both hard and human-based barriers). Moreover, apart from the four main independent variables of interest, all the other variables have a statistically significant effect on the dependent variable in all the models except for the variables services sector which has a statistically insignificant coefficient.

4.3. Ordered logistic regression results

Table 4 present the results of the ordered logistic regression explaining the dependent variable "engagement"

	Baseline	w/ Company age	w/ Company size	w/ Eco-leadership
Hard barriers	0.578***	0.677***	0.813***	0.592***
	(0.000)	(0.000)	(0.000)	(0.000)
Human-based barriers	0.0756	0.057	0.352***	-0.004
	(0.102)	(0.425)	(0.000)	(0.947)
Hard support	0.577***	0.766***	0.569***	0.578***
	(0.000)	(0.000)	(0.000)	(0.000)
Soft support	0.349***	0.258**	0.605***	0.254**
	(0.000)	(0.005)	(0.000)	(0.003)
Company size	0.125***	0.125***	0.212***	0.124***
	(0.000)	(0.000)	(0.000)	(0.000)
Company age	-0.002*	-0.000	-0.002*	-0.002*
	(0.035)	(0.754)	(0.040)	(0.040)
Eco-leadership	0.352***	0.353***	0.357***	0.267***
	(0.000)	(0.000)	(0.000)	(0.000)
Retail sector	-0.499***	-0.499***	-0.503***	-0.497***
	(0.000)	(0.000)	(0.000)	(0.000)
Services sector	-0.372***	-0.370***	-0.369***	-0.372***
	(0.000)	(0.000)	(0.000)	(0.000)
Industry sector	-0.310***	-0.309***	-0.313***	-0.313***
	(0.000)	(0.000)	(0.000)	(0.000)
Product type	0.126**	0.123**	0.124**	0.125**
	(0.004)	(0.005)	(0.005)	(0.004)
Hard barriers X Company age		-0.003*		
		(0.044)		
Human-based barriers X Company age		0.001		
		(0.735)		
Hard support X Company age		-0.006*		
		(0.016)		
Soft support X Company age		0.003		
		(0.151)		
Hard barriers X Company size			-0.088***	
			(0.000)	
Human-based barriers X Company size			-0.100***	
			(0.000)	
Hard support X Company size			0.002	
			(0.969)	
Soft support X Company size			-0.080*	
			(0.017)	
Hard barriers X Eco-leadership				-0.039
				(0.662)
Human-based barriers X Eco-leadership				0.200*
				(0.034)
Hard support X Eco-leadership				0.023
				(0.870)
Soft support X Eco-leadership				0.189
				(0.108)
Observations	8763	8763	8763	8763

p-values in parentheses
Manufacturing sector serves as reference sector
Source: Flash Eurobarometer 456
* p<0.05, ** p<0.01, *** p<0.001

Table 4. Results of the ordered logistic regression with the dependent variable "engagement".

Model 1: The baseline model

As in the baseline model with the dependent variable of "green", the effect of hard barriers and soft support is statistically significant (see Table 4). However, what is different from the economic model with the dependent variable of "green", the individual effect of hard support is also statistically significant (see Table 4). This implies that on average, a company that experiences hard barriers, compared to the one that does not, has a higher probability of investing more into resource efficiency, ceteris paribus. Similarly, a company that has hard support, compared to the one that does not, has a higher probability of investing more into resource efficiency, ceteris paribus. Moreover, a company that has soft support, compared to the one that does not, has a higher probability of investing more into resource efficiency, ceteris paribus.

The moderators (company age, company size and eco-leadership of the country the SME resides in) have all a statistically significant effect on the probability of investing more into resource efficiency. The effect of company size and eco-leadership are both positive and statistically significant at the 0.001% level. The same holds also for the baseline model with the dependent variable of "green". The effect of company age is negative and statistically significant at the 5% level in the baseline model with the dependent variable of "engagement". This implies that, on average the older the company is and/or being in an eco-leadership country, increases the probability of investing more into resource efficiency, ceteris paribus. However, the opposite effect holds for the baseline model with the dependent variable of "green" where the effect of company age on having a green portfolio is positive and statistically significant at the 0.001% level.

Model 2: Interactions with company age

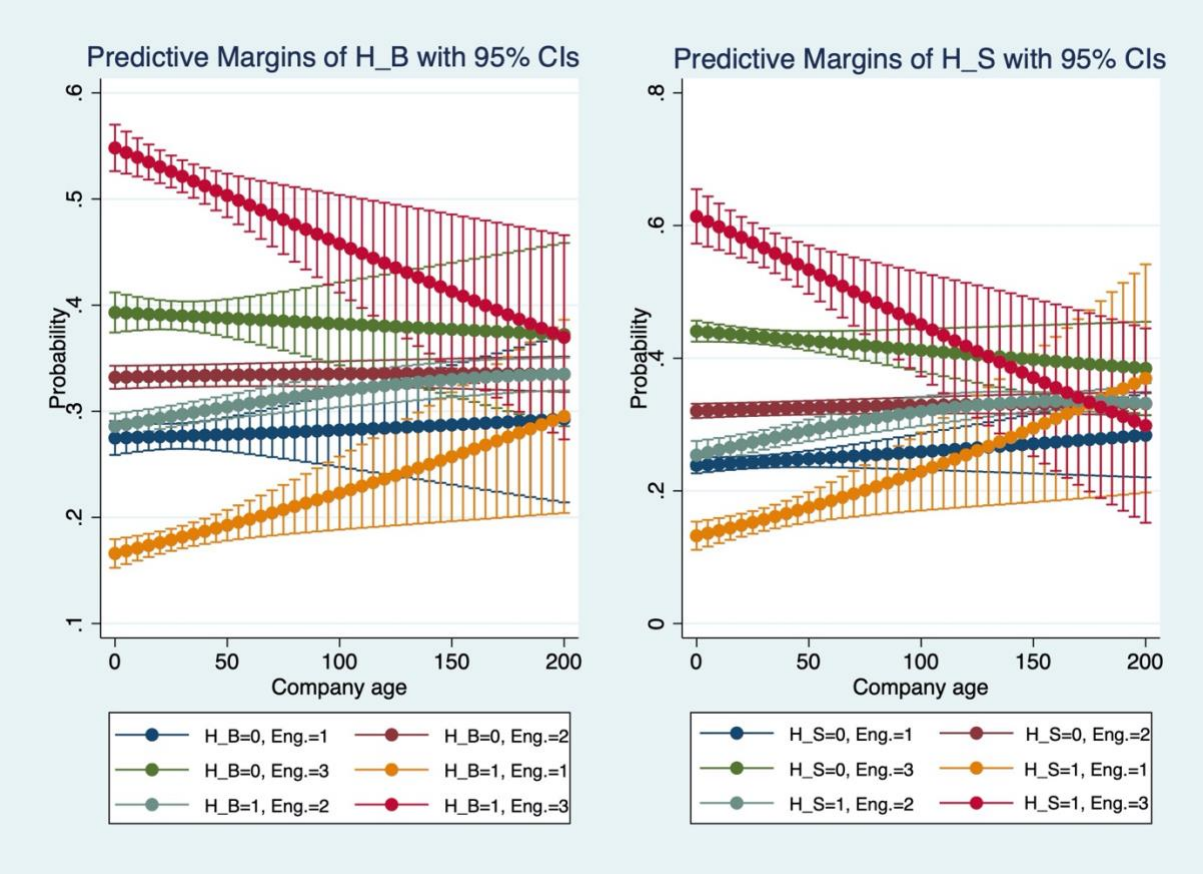

Figure 3. Average marginal effects of company age interaction with hard barriers (H_B) and hard support (H_S), showing standard error bars with 95% confidence interval.

The interaction effect between company age and hard barriers is statistically significant at the 5% level (see Table 4). On average, the younger the company with hard barriers is, compared to the one without, the higher is the probability of investing more than 1% of annual turnover to resource efficiency. In general, when looking at the graph on the left side from Figure 3, the probability of a company investing in resource efficiency (engagement levels two and three) decreases or remains relatively stable with an increase in the age of a company when they experience hard barriers, compared to companies that did not experience hard barriers.

The interaction effect between company age and hard support is statistically significant at the 5% level (see Table 4). The graph on the right side of Figure 3 depicts that, on average, the younger the company with hard support is, compared to the one without, the higher is the probability of investing more than 1% of annual turnover to resource efficiency. Moreover, a pattern seen from both graphs in Figure 3, shows that a company experiencing hard barriers

and/or having hard support, compared to one without, is more likely to not invest at all in resource efficiency as the company age increases (the yellow line).

Model 3: Interactions with company size

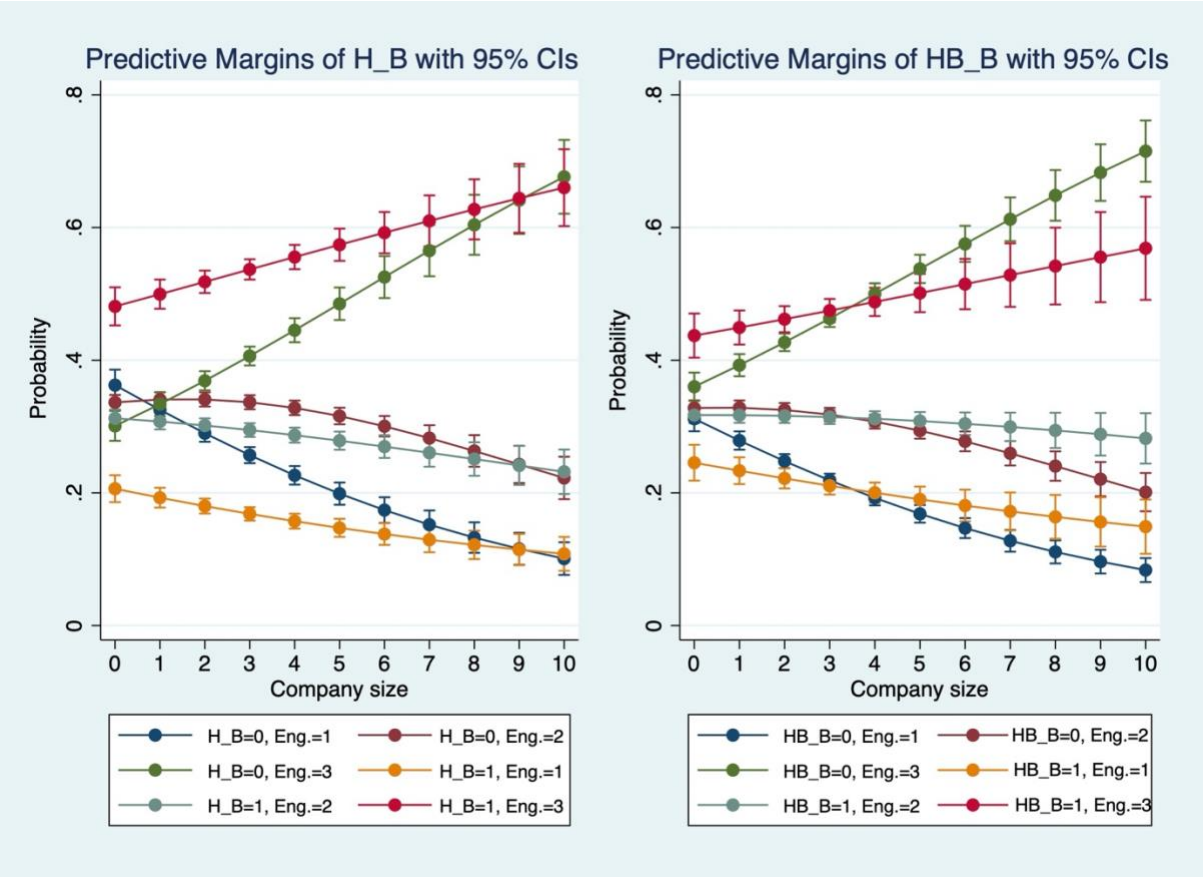

Figure 4A. Average marginal effects of company size interaction with hard barriers (H_B) and human-based barriers (HB_B), showing standard error bars with 95% confidence interval.

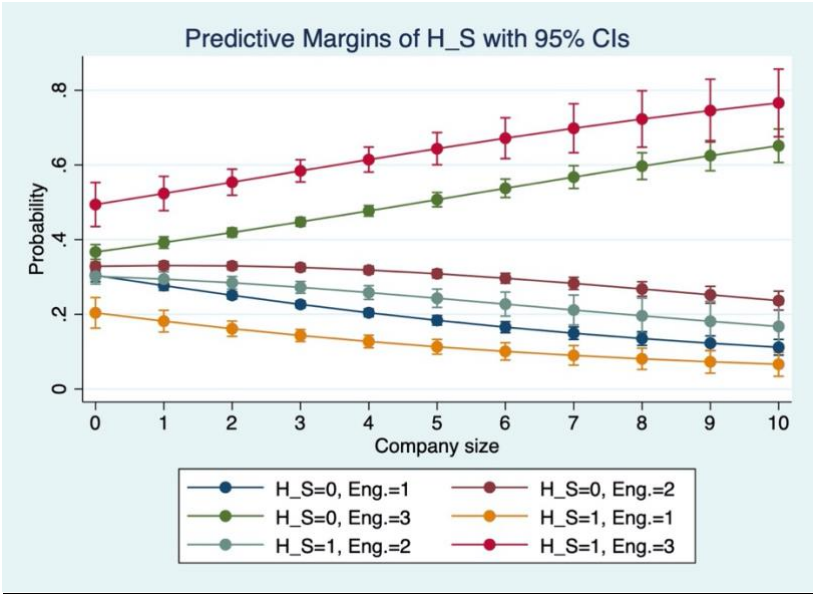

Figure 4B. Average marginal effects of company size interaction with hard support.

On average, a company with hard barriers, compared to the one without, has a higher probability to invest more than 1% of annual turnover in resource efficiency as the company size increases (see Figure 4A). The opposite pattern is seen with the other levels of engagement (no investment and less than 1% of annual turnover) in resource efficiency. Hence, this implies that companies that do not experience hard barriers are more likely to not invest at all or less than 1% of their annual turnover. The same trend can also be seen for a company that experiences human-based barriers, compared to the one without. It is interesting to note that when looking at both of the graphs that when comparing the companies that experience and do not experience barriers, at one point among all engagement levels the lines intersect where the probability of a company investing in resource efficiency without the barriers becomes higher than the one without the barriers. This implies that only companies above a certain size threshold seem to invest relatively much in resource efficiency.

Similarly, on average, a company that has hard support, compared to one without, has a higher probability to invest more than 1% of annual turnover when the company size increases (see Figure 4B). This probability ranges between 0.50 and 0.78 percentage points for the former compared to 0.38 to 0.62 percentage points for the latter. The companies that do not experience hard support, compared to the ones that do, have a marginally higher engagement in the two lower engagement levels (no investment and less than 1% of annual turnover).

Model 4: Interactions with eco-leadership

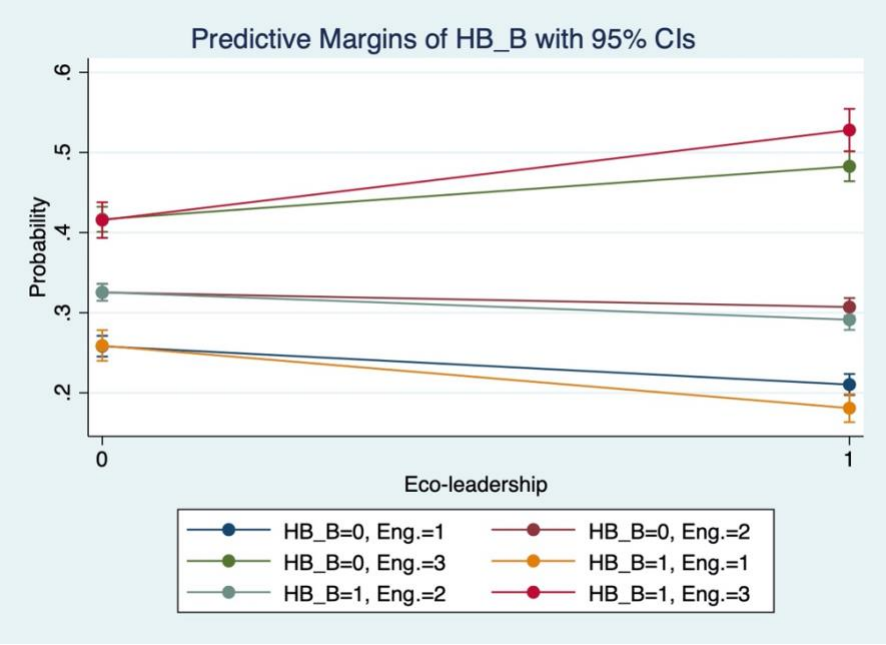

Figure 5. Average marginal effects of eco-leadership interaction with human-based barriers (HB_B), showing standard error bars with 95% confidence interval

For eco-leadership, the only significant interaction is with human-based barriers which is statistically significant at the 5% level (see Table 4). However, when looking at Figure 5, the lines are only slightly apart for all the engagement variable categories. Nonetheless, this indicates that a company that is in an eco-leadership country, compared to one without, has a slightly higher probability in investing or not investing in resource efficiency, despite whether it experiences human-based barriers or not.

General overview of the "engagement" models

From the analyses, it can be concluded that when looking at the significant interaction effects only, barriers have a statistically significant interaction effect with company age (hard barriers only), company size (hard and human-based barriers), and eco-leadership (human-based barriers only) on the probability of a company investing more in resource efficiency. The effect is negative, on average, when the company experiences barriers and the company age or company size increase, ceteris paribus. The positive effect is seen, on average, when the company experiences human-based barriers and is in eco-leadership country, in comparison of not being in it, ceteris paribus.

Specifically, with regard to age, on average, the younger is the company that experiences hard barriers and/or hard support, the higher is the probability of investing, ceteris paribus. With regard to company size, on average, the greater the company size the lower is the probability in investing in resource efficiency in case of the presence of barriers and hard support, ceteris paribus. With regard to eco-leadership, on average, a company experiencing human-based barriers in an eco-leadership country, in comparison of not being in it, has a higher probability of investing in resource efficiency, ceteris paribus.

Furthermore, the overall results from the ordered logistic regressions with the dependent binary variable of "engagement" show no significant effects for the interaction terms with soft support. Moreover, apart from the four main independent variables of interest, all the other variables have a statistically significant effect on the dependent variable in all the models, except company age which is insignificant in the second model. The latter includes the interactions between the variables of interest and company age.

5. Discussion

The present section provides an overview about whether the hypotheses proposed in Section 3 of the literature review can be accepted or should be rejected based on the results of Section 4. The discussion is divided and based on set of hypotheses of the (1) baseline models: the impact of barriers and support factors on sustainability; and the extended models of the interactions of barriers and support factors with (2) company age, (3) company size and (4) eco-leadership. Lastly, a small subsection briefly discusses the effect of the control variables.

5.1. Baseline models: The impact of barriers and support factors on sustainability

Contrary to the expectation, a company that experiences hard barriers, compared to a company that does not, is more likely to contribute towards sustainability, i.e., having a green portfolio and being resource efficient., ceteris paribus. This effect is seen for the likelihood of having a green portfolio and on the higher investments in resource efficiency. Therefore, we reject the first hypothesis. The second hypothesis is also rejected. Contrary to the expectation, a company that experiences human-based barriers, compared to a company that does not, is not less likely to contribute towards sustainability. In fact, the effect of human-based barriers is not statistically significant on the likelihood of having a green portfolio and being resource efficient. This implies that there is no significant difference among SMEs contributing to sustainability based on whether they experience human-based barriers or not, ceteris paribus.

The reason why the first and second hypothesis are rejected may lie in the nature of the barriers, as hard barriers relate to the difficulties when trying to set up resource efficiency actions and human-based barriers relate to the difficulty in choosing the right resource efficiency actions for your company and the lack of specific environmental expertise. In the research of De Marchi (2012) the economist discusses about the environmental innovations that can be described by uncertainty, especially when the approach towards sustainability includes novel ideas that do not have the relevant technologies and legislation requirements established yet. Hence, due to the novelty and newness of the environmental innovation, the SMEs that want to contribute to sustainability experience hard barriers, i.e., the complexity of administrative or legal procedures, the difficulty in adapting environmental legislation to the company, and/or the technical requirements of the legislation not being up to date. Therefore, the companies with the drivers for environmental innovation face more hard barriers than the

companies who do not engage in environmental innovation, meanwhile the former contribute significantly more to sustainability. This type of reversed causality may explain the positive effect of hard barriers on sustainability.

Similarly, with the characteristics of sustainability and environmental innovations, human-based barriers may not play an as important role as hard barriers. In the article of Cainelli et al. (2015), the economists discuss the drivers of environmental innovations by stating that they are either exogenous to the firm (i.e., environmental regulations) or/and the role of stakeholders in spurring firms to adopt greener practices. This implies that the SMEs' drive for environmental innovations is exogenous, meaning that human-based barriers, i.e., difficulties in choosing the right resource efficiency actions for your company and/or lack of specific environmental expertise, would not prevent neither aid companies from engaging in sustainability as given the exogenous market pull they would know how to act. However, this holds when SMEs engage in environmental innovations and therefore could be one of the reasons why the first and second hypothesis are rejected. Hence, these results correspond with the findings of De Marchi (2015) and Cainelli et al. (2015) but are against the findings by Ormazabal et al. (2018). The difference may be explained by the focus of the research as De Marchi (2015) and Cainelli et al. (2015) emphasise their research on environmental innovations in only Spanish manufacturing firms, whereas Ormazabal et al. (2018) investigate eco-innovation across numerous regions in Europe.

The third hypothesis is partially accepted. A company that has hard support, compared to a company that does not, is more likely to contribute towards sustainability, ceteris paribus. This effect is significant for higher investments in resource efficiency, but insignificant on the probability of having green product or service portfolio. The fourth hypothesis is accepted. A company that has soft support, compared to a company that does not, is more likely to contribute towards sustainability, ceteris paribus. This effect is significant for the likelihood of having a green portfolio and for higher investments in resource efficiency.

Hence, as expected, support factors (both hard and soft) significantly impact engagement in sustainability. Nonetheless, as the third hypothesis is accepted partially it indicates that hard support is more relevant for investing in resource efficiency than for having a green portfolio. As hard support is related to private or public funding, it is intuitively justifiable that in order for SMEs to increase their investments in resource efficiency they need

financial resources. This can be supported with the results from the correlation matrix in Section 4 of results that illustrate that the correlation between the variables of engagement and hard support is 0.159, whereas it is 0.049 between engagement and soft support. Hence, this may imply that having a green service or product portfolio may not necessarily inquire extra funding. Especially, as defined by the European Commission (2018b), the main function of a green product or service is to reduce environmental risk and minimise pollution and resources. For instance, when a delivery service starts using bicycles instead of cars it contributes to the environment and does not necessarily require additional funding for it, especially since bicycles are cheaper than cars. Therefore, partially accepting the third hypothesis implies that public or private funding may not be the main source that is needed to become more sustainable, as a shift in the way of working may be done without extra cost. Still, it can be concluded that hard support (such as public/private funding) as well as soft support (such as advice) is of crucial importance for SMEs when contributing to sustainability.

As seen in an earlier study by Wiese (2014), soft support plays a crucial role for SMEs, especially in terms of advice from different stakeholders. Referring again to the research of Cainelli et al. (2015), economists stress that with regard to environmental innovations when there is lot of novelty and uncertainty present the reliance on external resources becomes of pivotal importance, especially the cooperation with suppliers, educational institutions, etc. These results correspond with the findings of Wiese (2014), Cainelli et al. (2015) and Lewis et al. (2006) – yet give unexpected results. Specifically, the partial acceptance of the third hypothesis can be explained by the complex nature of sustainability (DeSimone & Popoff, 2000; Machiba, 2010) and its support factors (Gadenne & Sharma, 2009; Ormazabal et al., 2018). As discussed earlier in the Literature Review section, the findings of Gadenne and Sharma (2009) illustrate that the effect of hard and support factors on sustainability is mixed as some of their attributes can be related to each other. Similarly, the research of Ormazabal et al. (2018) depicts that the support factors that SMEs face when contributing to the CE can be grouped together into one factor as their benefit is seen as a whole. Hence, this suggests that the partial acceptance of the third hypothesis could be related to the acceptance of the fourth hypothesis, implying that some of the attributes of soft support may or may not be also present in hard support factors.

5.2. Extended models: Interactions with company age

Contrary to the expectation, younger firms, compared to older firms, have less difficulties in overcoming hard barriers when contributing to sustainability. We find a significant negative interaction effect for hard barriers and company age on the probability of becoming more resource efficient. However, an insignificant effect for the same interaction on the probability of having a green portfolio is seen. This rejects the first part of the fifth hypothesis. The second part of the fifth hypothesis is also rejected. Contrary to the expectation, younger firms, compared to older firms, do not have more difficulties in overcoming human-based barriers when contributing to sustainability. We find an insignificant interaction term for human-based barriers and company age on both probabilities, i.e., having a green portfolio and being resource efficient. This implies that there is no difference among SMEs contributing to sustainability regarding whether they experience human-based barriers or not as company age increases, ceteris paribus.

The reason why the first and second part of the fifth hypotheses are rejected may lie in the beneficial attributes of smaller and younger companies. The article of Sovacool (2016) emphasises that energy transitions among older and greater companies towards sustainable economy take a lot of time, in some cases even the time of a century. Intuitively, this is compatible with older and bigger firms having more bureaucracy and multiple levels of management present which makes the decision-making process longer and less effective when compared to smaller firms with less employees where communication among employees can be done more time efficiently (Hockerts & Wüstenhagen, 2010). Hence, the effect of hard barriers, i.e., difficulties in trying to set up resource efficiency actions, is negative for older companies that operate on relatively larger scale and have already established through history a traditional way of working than younger companies which are new and more agile and receptive to make effective and faster changes. Moreover, the effect of human-based barriers does not play a significant role with company age, indicating that there is no difference in the lack of expertise and/or difficulties in choosing the right efficiency actions. This also is in line with the study of Cainelli et al. (2015) which was mentioned earlier, stating that younger firms (i.e., start-ups) rely heavily on the R&D cooperation with other stakeholders (i.e., educational institutes, service firms, etc.). Hence, these findings suggest that even though older and more established firms have easier access to more knowledge and human-based resources, then with the help of an external network systems younger companies are able to receive the same type

of expertise. These results correspond with the findings of Sovacool (2016), Michelon (2011), Hockerts and Wüstenhagen (2010) but are against the findings by Shrivastava and Tamvada (2019) who show that older companies are more sensitive to calls for sustainable action. The difference may be explained by the fact that in the research of the former the economists focus on radical changes in sustainable development, whereas the investigation of the latter can be considered more incremental as they examine the effect of different factors on the sustainable activities of the companies.

Furthermore, as expected, younger firms, compared to older firms, gain more advantage from hard support when investing in resource efficiency. We find a negative and significant interaction term for hard support and company age on becoming more resource efficient. In addition, we find a positive and significant interaction term for hard support and company age on the probability of having a green portfolio. This partially accepts the third part of the fifth hypothesis. Similarly, the fourth part of the fifth hypothesis is accepted partially. We find a negative and significant interaction term for soft support and company age on the likelihood of having green portfolio, whereas the effect is insignificant for the probability of investing more in resource efficiency. This implies that the effect of whether a company receives soft support or not as its age increases is only significant on the probability of having a green portfolio.

An implication of the third and fourth part of the fifth hypothesis being partially accepted signifies the importance of support factors (both hard and soft) for younger companies, especially on the probability on having a green portfolio. The same argumentation as discussed earlier when explaining the non-significant interactions between barriers and company age (see above), can be used to explain the partially significant interactions between the support factors and company age. Namely, older firms have a longer history with an established network in the market which gives them an advantage when seeking for hard support (i.e., public/private funding) because due to the longer existence of their company they have lower credit risks when applying for external financing. Similarly, with regard to soft support, i.e., advice and/or non-financial assistance from different institutions, the older companies can contact and reach certain associations more effectively due to their lobbyist and long-lasting partnerships. Therefore, these results also correspond with the findings of Wiese (2014), Sovacool (2016) and Hockerts and Wüstenhagen (2010). Specifically, the partial acceptance of the hypotheses can be explained by the advantages of younger and smaller firms in certain situations, whereas in other situations the older and bigger firms may have the comparative advantage, which is

well discussed in the article of Hockerts and Wüstenhagen (2010) (see Literature Review section).

5.3. Extended models: Interactions with company size

The results in the extended model with interactions for company size show that smaller firms, compared to bigger firms, have less difficulties in overcoming hard and human-based barriers when contributing to the sustainability. We find significant negative interaction effects for hard barriers and human-based barriers with company size on the probability of being more resource efficient. However, insignificant effects with the same interactions are found on the probability of having a green portfolio. This accepts partially the first and second part of the sixth hypothesis. The latter implies that smaller firms compared to bigger firms have less difficulties in investing more in resource efficiency when barriers are present.

The reason why the first and second part of the sixth hypotheses are accepted partially may be due to the comparative advantage of smaller size firms. The same argumentation, based on the articles of Sovacool (2016) and Hockerts & Wüstenhagen (2010), used to explain the non-significant interactions between barriers and company age (see above) can be used to explain the partially significant interactions between the barriers and company size. Namely, the comparative advantage of smaller firms lies on their small scale, which minimises bureaucracy, transaction costs, communication levels and enables fast and effective interactions with multiple stakeholders. Similarly, as discussed previously, these findings are in line with the studies of Cecere et al. (2014) and Hockerts and Wüstenhagen (2010) but are against the findings of De Marchi (2012), Cainelli et al. (2015) and Klewitz and Hansen (2014). The differences may be explained by the type of sustainability the company chooses to contribute to, as with certain products or services overcoming barriers is relatively easier than with other types of product or service portfolio.

Furthermore, contrary to the expectation, small firms, compared to large firms, do not gain more advantage from hard support when contributing to sustainability. We find insignificant interaction terms for hard support and company size on both probabilities, i.e., having a green portfolio and being resource efficient. Therefore, the third part of the sixth hypothesis is rejected. This implies that whether a company experiences hard support or not does not play a statistically significant role on the probability of firms contributing to

sustainability as the company size increases, ceteris paribus. Nonetheless, the fourth part of the sixth hypothesis is partially accepted. We find a significant negative interaction term for soft support and company size on the probability of becoming more resource efficient. However, this relationship is found to be insignificant for the probability of having a green portfolio. This implies that on average, small firms, compared to large size firms, gain more advantage from soft support when contributing to sustainability.

An implication of the third part of the sixth hypothesis being rejected demonstrates that receiving hard support is not dependent on the company size. Intuitively, this could be explained by the fact that if an SME has a goal to become sustainable and seeks external funding, then as long as the idea is sustainable and contributes to the goals of the EC, receiving financing would not be dependent on the company size as long as the company, despite being large or small, is able to contribute to sustainability. Moreover, an implication of the fourth part of the sixth hypothesis being partially accepted implies that soft support is crucial for smaller companies. These results correspond with the findings of Cainelli et al. (2015) and Cecere et al. (2014) who find out in their research that younger firms (i.e., start-ups) rely heavily on the R&D cooperation with other stakeholders (i.e., educational institutes, service firms, etc.). Hence, the same argumentation as discussed earlier, based on the articles of Sovacool (2016) and Hockerts & Wüstenhagen (2010) when explaining the non-significant interactions between barriers and company age (see above), can be used to explain the partially significant interaction between soft support and company size. It is important to note that established companies can contact and reach certain associations more effectively due to their lobbyist and long-lasting partnership, hence soft support becomes of crucial importance for smaller firms. Consequently, the findings are in line with the insights from the studies of Cainelli et al. (2015), Cecere et al. (2014), Sovacool (2016) and Hockerts and Wüstenhagen (2010) but are against the findings by Oltra and Saint Hean (2009) and De Marchi (2012). The difference may be explained by the nature of company size, as in some circumstances a larger company size is beneficial and in other circumstances it is not.

5.4. Extended models: Interactions with eco-leadership

Contrary to the expectation, a company that is in an eco-leadership country, compared to the one not in eco-leadership country, does not have less difficulties in overcoming hard barriers when contributing to sustainability. We find insignificant interaction terms for hard barriers

and eco-leadership on both probabilities, i.e., having a green portfolio and being resource efficient. This rejects the first part of the seventh hypothesis. This implies that whether a company is in eco-leadership country or not and experiences hard barriers does statistically significant impact the probability of the firm contributing to sustainability, ceteris paribus.
However, the second part of the seventh hypothesis is partially accepted. As expected, companies in eco-leadership countries, compared to the ones not in eco-leadership countries, have less difficulties in overcoming human-based barriers when contributing to sustainability. We find a significant interaction term for human-based barriers and eco-leadership on the probability of being more resource efficient. However, this interaction effect is found to be insignificant for the probability of having a green portfolio. This implies that companies in eco-leadership countries, compared to the ones who are not, that experience human-based barriers are more likely to invest in resource efficiency, ceteris paribus.

An implication of the first part of the seventh hypothesis being rejected shows that the experience of hard barriers, i.e., the difficulty in trying to set up resource efficiency actions, is similar in both types of countries (eco-leadership countries and non-eco-leadership countries). This could be explained by the fact that all the countries are in the EU, hence regulations with regard to legal and administrational requirements are universal across all the EU member states. Therefore, whether a company is in eco-leadership country or not does not change the effect of experiencing hard barriers on its contribution on sustainability. Contrary, an implication of the second part of the seventh hypothesis being partially accepted illustrates that a beneficiary eco-environmental landscape in the EU aids SMEs in overcoming human-based barriers when contributing to sustainability. This is supported by the definition of the eco-innovation index that consists of multiple components that are related to overcoming human-based barriers, i.e., the difficulty in choosing the right resource efficiency actions for your company and the lack of specific environmental expertise. Namely, the high index of eco-innovation index (eco-leadership countries) depicts the high number of eco-innovation related academic publications and media coverage, as well as the high number of ISO 14001 registered companies (the criteria for environmental management systems, etc.) in a country (see Appendix 2 for more details). Here the relatively homogenous EU environment plays an important role as the establishment and setup of different environmental institutions and systems can be done relatively efficiently in a country, considering that the standards and requirements across EU member countries are the same. Consequently, these results correspond with the findings of Wiese (2014), De Marchi (2012) and Smol et al. (2017) who both depict the positive effect of a favourable political

landscape on sustainability efforts. The difference between the existing literature and the present findings may be explained by the fact that the previous studies did not utilise the eco-innovation scoreboard index the same way as we do (by dividing the eco-innovation scoreboard index into two) and due to the novelty of this research it is hard to make accurate predictions.

Furthermore, as expected, companies in eco-leadership countries, compared to the ones not in eco-leadership countries, gain more advantage from hard support when contributing to sustainability. We find a significant positive interaction term for hard support and eco-leadership on the probability of having a green portfolio. However, this interaction effect is found to be insignificant for being more resource efficient. Therefore, the third part of the seventh hypothesis is partially accepted. This implies that companies in eco-leadership countries, compared to the ones who are not, that receive hard support are more likely to invest in resource efficiency, ceteris paribus. However, the fourth part of the seventh hypothesis is rejected. We find insignificant interaction terms for soft support and eco-leadership on both probabilities, i.e., having a green portfolio and being resource efficient. This implies that whether a company is in an eco-leadership country or not does not change the effect of soft support on the probability of firms contributing to sustainability, ceteris paribus.

An implication of the third part of the seventh hypothesis being partially accepted depicts that receiving external finances, i.e., public/private funding, plays a crucial for companies that may seek to introduce a novelty in the form of a green product and/or service in the market. This suggests that having a green product and/or service portfolio is relatively more radical than simply increasing the level of investments in resource efficiency – hence indicating the higher need for financial support. These findings support the research of Sovacool (2016) who depicts the high costs of transforming traditional energy into sustainable energy. Similarly, this is supported by the findings of Cecere et al. (2014) who display that due to the complexity and novelty of eco-innovations high capital investments are required, which make switching to new technologies less appealing. Moreover, the results also indicate, given the relatively homogenous EU environment, that under the policies of the EU the SMEs that aim to have a green portfolio need to rely more on external financing. This could imply that under the program of EU companies that seek to increase their resource efficiency, in comparison to the ones seeking to have a green portfolio, need less external financing or they may be already receiving enough support in some other type of form.

In addition, an implication of the fourth part of the seventh hypothesis being rejected demonstrates that the relying on soft support, i.e., advice and/or non-financial assistance, is relatively similar in eco-leadership and not in eco-leadership countries. A similar argumentation for this can be given as for explaining the insignificant interaction effects between hard barriers and eco-leadership (see above). Namely, as all the analysed countries are in the EU, SMEs experience similar barriers as well as have access to the same type of support factors. Ultimately, the net zero carbon by 2050 project by the EU applies for all the members and hence on local, national and transnational level the EC and EU should make sure that all the SMEs are able to receive the required support. Hence, these results partially correspond with the findings of Sovacool (2016), Cecere et al. (2014) and Smol et al. (2015) who analyse the effect of various support factors on the SMEs' sustainability contribution. Nonetheless, as mentioned earlier, this research brings a novelty to the existing literature with the eco-innovation scoreboard index and since the earlier literature does not utilise the index the same way as we do it is difficult to make accurate predictions for the expected results.

5.5. The control variables

The retail sector, in comparison to the manufacturing sector, shows statistically significant effects across all the four economic models. Interestingly, the retail sector in comparison to the manufacturing sector, shows a positive effect on the probability of SMEs having a green portfolio and a negative effect on the probability of SMEs investing more in resource efficiency. The services sector, in comparison to the manufacturing sector, shows statistically significant positive effects across all the four economic models but only on the probability of investing more in resource efficiency. Similarly, the industry sector, in comparison to the manufacturing sector, shows statistically significant negative effects across all the four economic models but only on the probability of investing more in resource efficiency. Moreover, having a B2C product, in comparison to having a B2B product, illustrates statistically significant positive effects across all the four economic models on both probabilities (having the green portfolio and investing more in resource efficiency).

Therefore, the effect of industries on SMEs contributing to sustainability is significant but whether it is positive or negative is not particularly clear. Moreover, SMEs providing B2C products have a higher probability for contributing to sustainability in comparison to companies that offer B2B products.

6. Conclusion

In conclusion, the baseline model illustrates contrary to the expectations that experiencing hard barriers, i.e., the difficulty in trying to set up resource efficiency actions, has a positive effect on SME's contribution to sustainability, ceteris paribus. Moreover, whether a company experiences human-based barriers or not, has no impact on the contribution to sustainability, ceteris paribus. Nonetheless, both support factors have a positive effect on the SME's contribution to sustainability, ceteris paribus.

With regard to the relationship of barriers and support factors with the moderators, the findings show that the effect of the former on sustainability is very much dependent on the characteristics of a firm. Contrary to what was expected, young and small companies in the market seem to have a stronger advantage in overcoming barriers (both hard and human-based) when compared to older and bigger incumbents. Nonetheless, these characteristics of smaller and younger firms may be less beneficial in other circumstances. Namely, when looking at the support factors (hard and soft), then often there is no difference of receiving support on the contribution to sustainability irrespective of the age and size of the company.

Consequently, our study portrays that smaller and younger firms are more agile to adapt to the changes and to successfully contribute towards sustainability. Hence, as a policy recommendation it is important that governments assist younger start-ups. Especially since young and small firms have relatively more advantage in overcoming barriers and succeeding in a shorter period of time. Based on the findings of this study, the governments should take into consideration that firms, especially young start-ups, should have access to private or public funding, as well as to advice from public administration, business associations private consulting and audit companies, when choosing the right resource efficiency actions.

Moreover, it is important to note that eco-leadership may significantly impact SMEs contribution to the circular economy. This stresses the pivotal role of governments and the current policies and standards for SMEs. Based on the findings, we suggest that the future policies on sustainability in the EU should focus more on the engagement of younger and smaller enterprises who are able to effectively come up with sustainable ideas and solutions for the current ongoing sustainability crisis. The policies can be further strengthened via

following the lead of eco-leadership countries. For instance, by making sure that there are enough ISO 4100 institutions that specialise on international standards and requirements and assist companies in establishing environmental performance requirements within the country.

To answer to the research question, what makes SMEs having a green product or service portfolio and/or investing in resource efficiency, by taking into consideration the existing barriers and support factors, it can be concluded from the findings that younger and smaller firms have a comparative advantage over incumbent firms. Hence, governments and policy makers could consider assisting younger start-ups with different procedures and programs that would help them invest more in resource efficiency and have a green product or service portfolio. This being said, the contribution of incumbent firms is also very important because they have been long established in the market and have a larger market share which gives them an important role in the economy. Nonetheless, the research illustrates that younger start-ups are more receptive to adopt to changes and hence with their enhanced contribution to sustainability they may contribute to a time effective solution in the sustainability crisis.

7. Limitations & Suggestions

In this section, limitations of the present study are described and suggestions for future research are given.

First of all, this research is based on data from SMEs in the European Union. However, in order to solve the sustainability crisis, it is crucial to expand the scope of this research to other regions and continents, as doing it only on EU level would not be efficient. Moreover, the findings of the research implied that the policies and regulations are universal in EU and hence their effect on local level in the member countries is the same. Therefore, as there is lot of unity with regard to the legal requirements and administration policies in the EU present it is important to test our hypotheses on other countries that have varying political systems and landscapes. Hence, to improve the research, in the future the dataset should be expanded to all the other countries across the globe.

Furthermore, a bigger sample size with more observations would have provided more credibility for the results as it may have shown significant interaction terms and been easier to detect smaller effects amongst the findings. As seen from descriptive statistics, the subsample of SMEs with green portfolio represents 33% of the total number of observations. Hence, in the future it would for example be better to have a greater sample size with more companies with green product or service portfolio to understand even better the contribution of green companies on sustainability.

The type of dataset is also linked to the possibility of having reverse causality between the variables of interest (barriers and support) and the dependent variable(s) of contributing to sustainability. As described in Literature Review section, sustainability can become a barrier or opportunity, meanwhile there are also barriers and support factors to become more sustainable. Unfortunately, given the type of dataset and its provided variables, it was not possible to completely solve the reversed causality issue. Therefore, we suggest choosing an alternative database that would have longitudinal data over a longer time period. By using longitudinal data, it would be possible to control for reverse causality and to see whether the findings of 2017 are also representable over a period of time.

Unfortunately, due to the type of data it was also not possible to include other relevant moderators. In the future it would be important to include other moderators in the analysis as well, such as competition, network of suppliers, market openness, cultural and social norms, etc. (Wiese, 2014). Consequently, it would be interesting to do further research on the market structure of the countries (existence of monopolies, duopolies, many small players, many large players, etc.) to understand better the situation in the market and whether these attributes serve as moderators with barriers/support factors when contributing to sustainability. This could explain better companies' incentives on contributing to sustainability because if there is more competition then companies also push themselves more in becoming more environmentally sustainable. Another important factor is the type of government and its regimes, i.e., whether monopolies are allowed and how crucial governmental intervention is.

Relatedly, it is important to note that the eco-leadership index used in the present study is a dummy variable, indicating whether the country in which the SMEs resides has the political eco-innovation landscape above or below the average. However, the eco-innovation scoreboard actually divides the index into three categories: eco-leaderships (the highest ranking), eco-performers (the middle ranking) and eco-catchups (the lowest ranking). In the future, it would be interesting to look whether there are significant differences among those three groups. Moreover, in the future it would be interesting to carry out more advanced research using for instance the multilevel model. The multilevel model is able to comprehend several parameters that exist on multiple levels, such as on the local, national and EU level. It would be interesting to see whether the findings of this research comply with results of a multilevel model.

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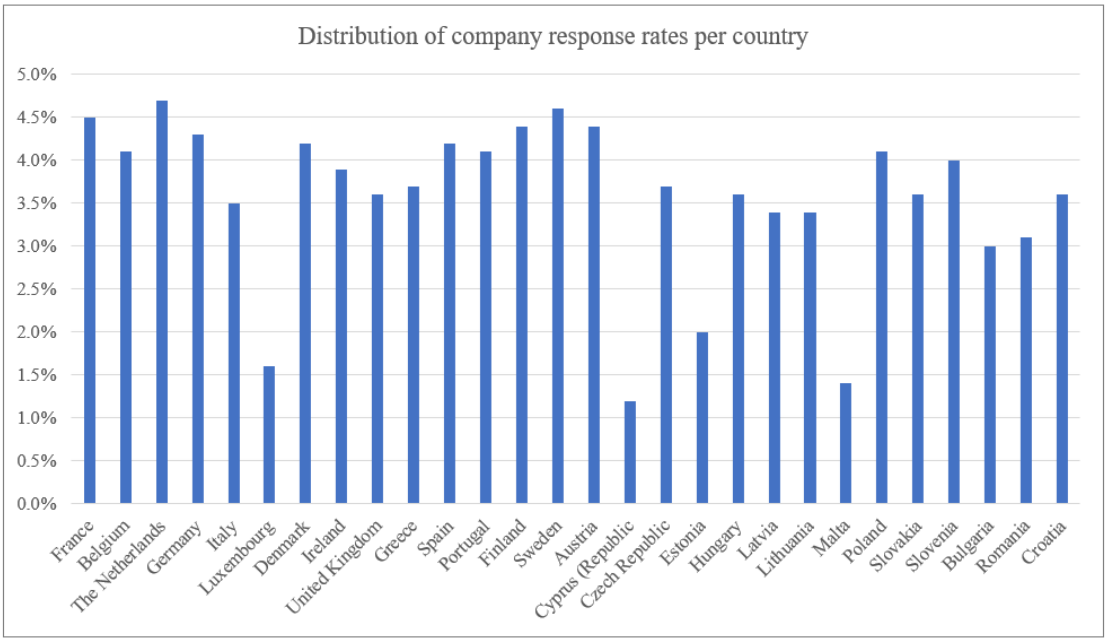
9. Appendix

Appendix 1



Appendix 2

The eco-innovation index, the "eco-leadership" variable, consists of these five different dimensions:

1) Eco-innovation inputs which include activities aiming to stimulate eco-innovation activities, having the following components:
   - Governments environmental and energy R&D appropriations and outlays (% of GDP)
   - Total R&D personnel and researchers (% of total employment)
   - Total value of green early stage investments (USD/capita)

2) Eco-innovation activities which include indicators to monitor the scope and scale of eco-innovation activities undertaken by companies. The component focuses on efforts and activities rather than on actual results of innovation activity. It has the following components:
   - Firms declaring to have implemented innovation activities aiming at a reduction of material input per unit output (% of total firms)

- Firms declaring to have implemented innovation activities aiming at a reduction of energy input per unit output (% of total firms)
- ISO 14001 registered organisations (per mln population)

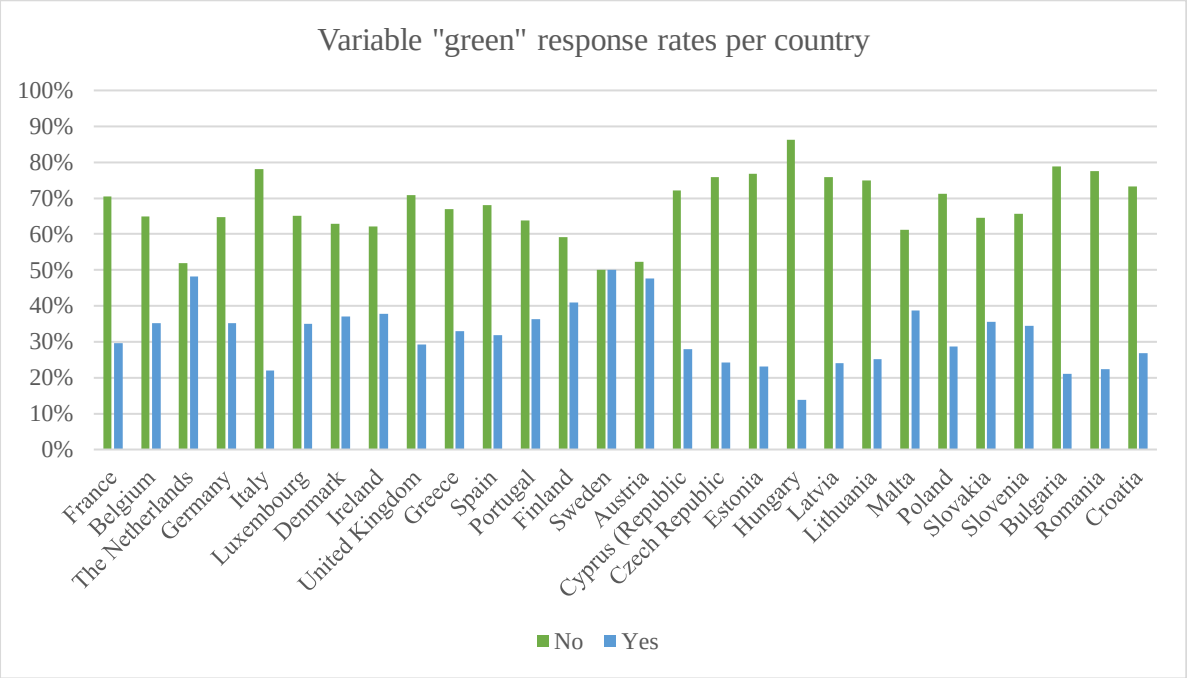
3) Eco-innovation outputs which in monitor the extent to which knowledge outputs generated by businesses and researchers relate to eco-innovation. It has the following components:
   - Eco-innovation related patents (per mln population)
   - Eco-innovation related academic publications (per mln population)
   - Eco-innovation related media coverage (per numbers of electronic media)

4) Eco-innovation socio-economic outcomes that include changes in employment, turnover or exports that can be related to broadly understood eco-innovation activities. It has the following components:
   - Exports of products from eco-industries (% of total exports)
   - Employment in eco-industries and circular economy (% of total employment across all companies)
   - Revenue in eco-industries and circular economy (% of total revenue across all companies)

5) Eco-innovation resource efficiency outcomes that are related to the effects of eco-innovation on improved resource productivity. It has the following components:
   - Material productivity (GDP/Domestic Material Consumption)
   - Water productivity (GDP/Water Footprint)
   - Energy productivity (GDP/gross inland energy consumption)
   - GHG emissions intensity (CO2e/GDP)

Source: European Commission (2018a)

Appendix 3



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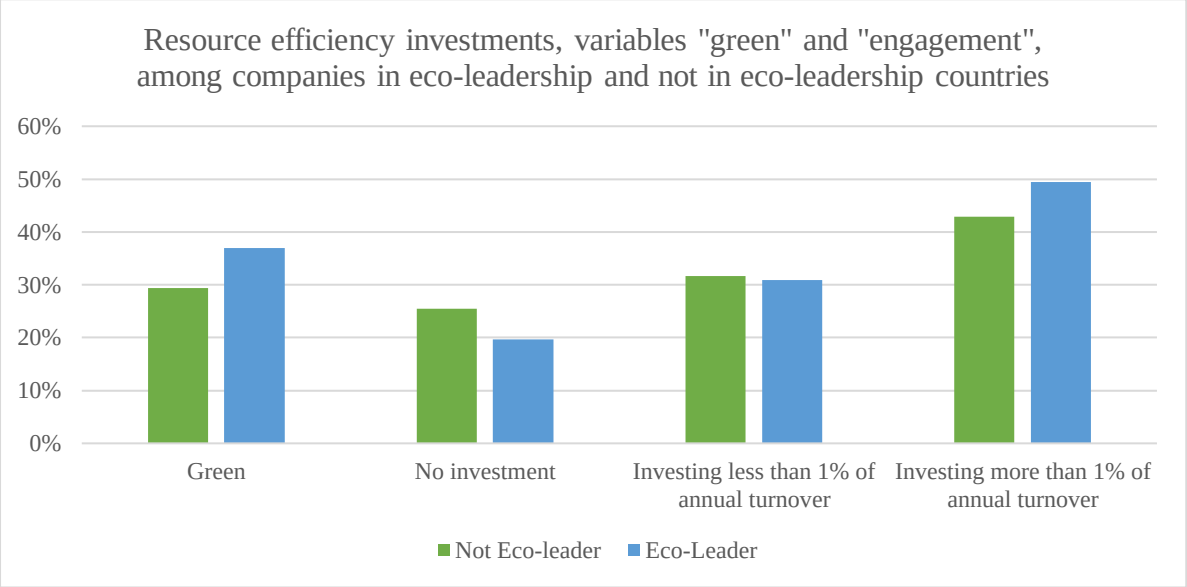
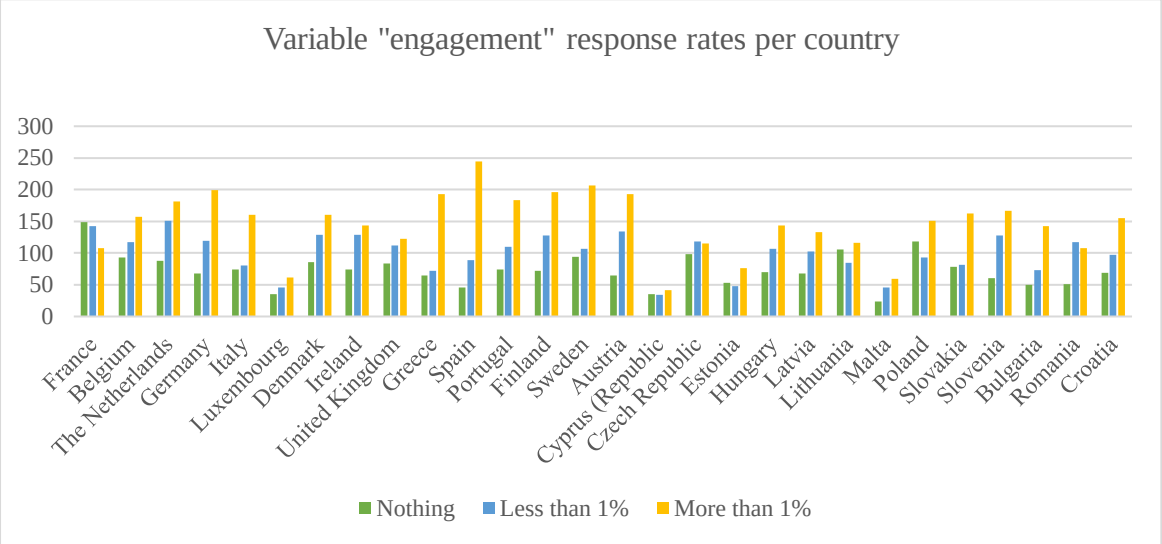
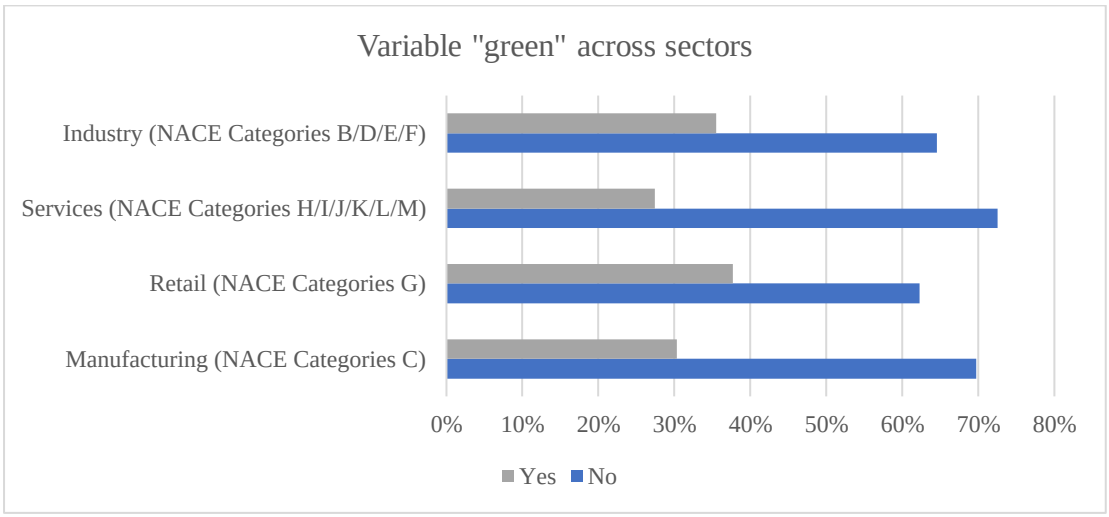
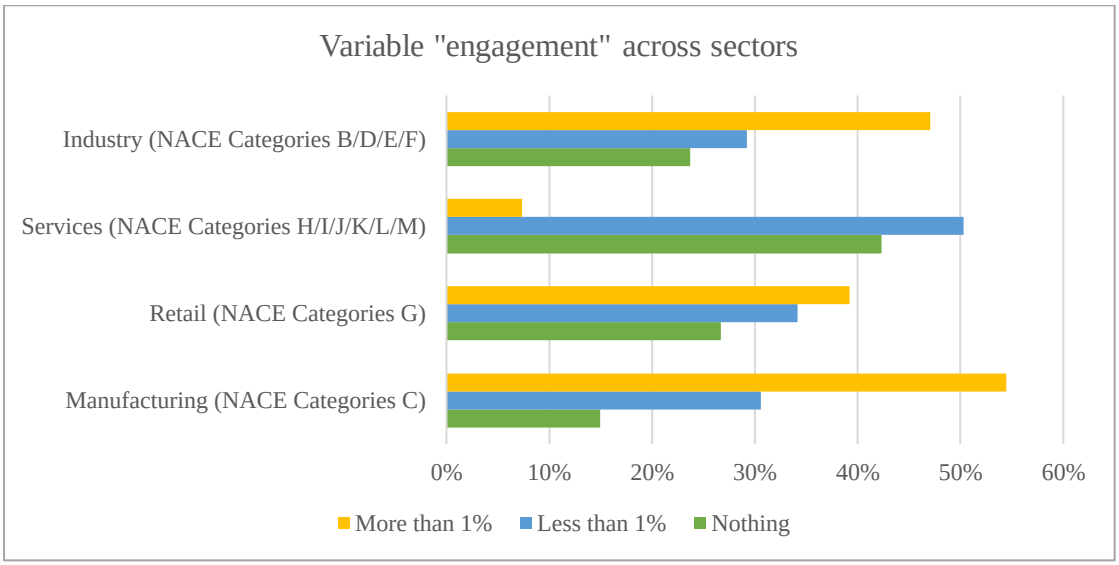


Appendix 5

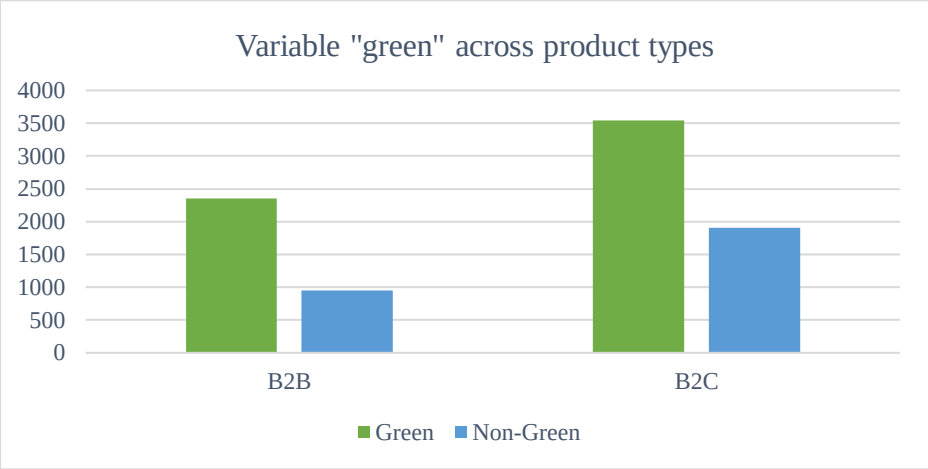


Appendix 6





Appendix 7


Variable "green" across product types
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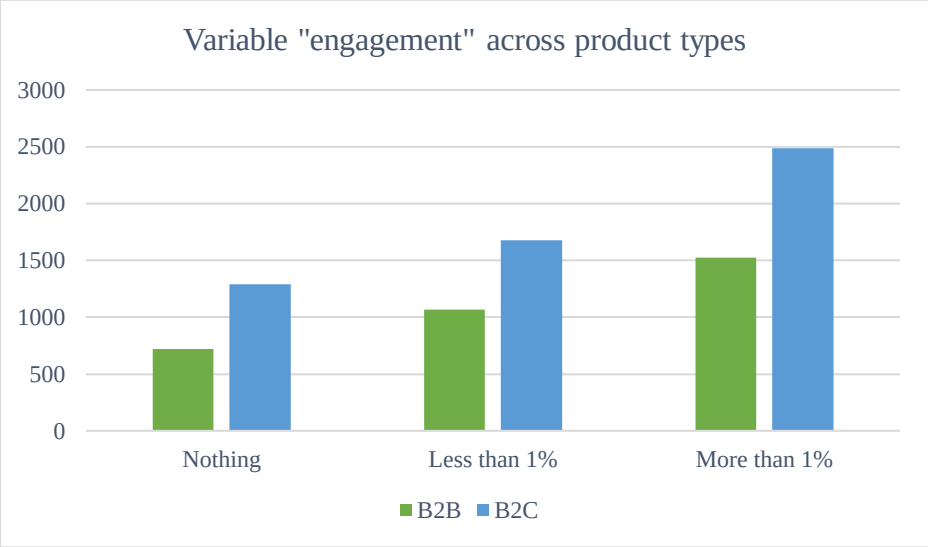
3000
2500
2000
1500
1000
500
0
B2B
B2C
Green
Non-Green


Variable "engagement" across product types
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2500
2000
1500
1000
500
0
Nothing
Less than 1%
More than 1%
B2B
B2C