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Does it pay for new firms to be green? An empirical analysis of when and how different greening strategies affect the performance of new firms

Highlights

- Substantive greening strategies pay off for new firms aged up to 10 years.
- This positive link is not linear but weakens with higher environmental efforts.
- Symbolic greening and brown-washing are not related to the performance of new firms.
- Green-washing may backfire for firms in their later start-up phases.
- The impact of greening strategies differs between groups of different firm age.

Abstract

Despite the significant attention devoted to the impact of corporate greening strategies on firm performance, research has so far focused on established firms, leaving the situation in new firms unclear. In this study, it is hypothesised that the impact of greening strategies on the performance of new firms depends on the type of strategy, and that the firm's age positively moderates this impact. Using a cross-sectoral dataset of 11,039 new firms from 36 countries, binary and ordinal logistic regressions were estimated for different start-up phases. The results indicate that new firms benefit from substantive greening strategies but, contrary to expectations, not from symbolic greening strategies. The performance of new firms in their later start-up phases was even found to be harmed if they adopt symbolic strategies but do not reinforce them with substantive actions (green-washing). No impact, or only a weakly positive impact was found for firms adopting both substantive and symbolic greening strategies (green-highlighting) or only substantive ones (brown-washing). Furthermore, the interaction analyses did not reveal any moderating effects of firm age, but additional investigation shows that the impacts of greening strategies do differ between age groups. Finally, robustness tests reveal that the relationship between substantive greening strategies and the performance of new firms is not linear but decreases with increasing environmental efforts.

1 Introduction

For two decades, there has been a lively debate about the Porter hypothesis and whether it pays to be green (Ambec et al., 2013; Ambec and Lanoie, 2008). The debate has shown that firms which adopt environmentally-friendly practices or which offer green products or

services are, contrary to conventional wisdom, not disadvantaged by trade-offs between environmental and profit orientation. And indeed, reviews and meta-analyses summarising the body of empirical research resulting from the debate confirm that firm performance is positively linked to environmental management practices (Tsai et al., 2020) and to social and environmental performance (Ambec and Lanoie, 2008; Dixon-Fowler et al., 2013; Orlitzky et al., 2003). However, these reviews and meta-analysis studies, in combination with more recent empirical work (Keszey, 2020; Shrivastava and Tamvada, 2019; Testa et al., 2018), reveal that the economic rewards of environmental actions are heterogeneous and vary according to the strategies for greening and environmental disclosure, as well as to the size and age of firms. Research indicates that new firms have a high innovative capacity and disruptive potential (Demirel et al., 2019; Hockerts and Wüstenhagen, 2010), which is not only a driver but also a solution for climate and environmental challenges (Dean and McMullen, 2007; Fichter and Clausen, 2016; Neumann, 2020). However, the focus of entrepreneurship and environmental management research has so far been on the social and environmental outcomes of so-called green, eco or environmental new firms, as well as on their institutional environment and the motivations behind them (Fichter and Tiemann, 2020; Kirkwood and Walton, 2014). Despite the high academic interest in research on green entrepreneurship (Gast et al., 2017; Terán-Yépez et al., 2020) and the economic outcomes of greening strategies in established firms (Ambec et al., 2013), studies combining both research fields by analysing the economic outcomes of new firms (Leoncini et al., 2019; Shrivastava and Tamvada, 2019) are scarce. Yet, knowing the economic outcomes of different greening strategies is critical to entrepreneurs, investors, and policymakers to make environmentally and economically viable decisions (Tietenberg and Lewis, 2016). The academic and practical relevance thus warrants an empirical investigation to ascertain whether Porter's hypothesis is also valid for new firms.

This study aims to fill this research gap by empirically investigating the impact of different greening strategies on the performance of new firms and, additionally, assessing how this relationship varies across different start-up phases, drawing on the theoretical propositions of Porter's hypothesis, the resource-based view (RBV), stakeholder theory, and signalling theory.

This study makes three significant contributions to environmental management and entrepreneurship literature. First, it explicitly distinguishes different greening strategies. The reason for this is that there is diversity in the definitions of what is 'green' (Dean and McMullen, 2007), the motivations for adopting greening strategies (Walley and Taylor,

2002), and variation in how 'greening' can be measured (Gast et al., 2017). Thus, to ensure comparability between studies, previous research recommends implementing multiple definitions and measures for greening simultaneously (Demirel et al., 2019; Gast et al., 2017; Hörisch et al., 2018). This is why this study not only assesses commonly analysed substantive and symbolic greening strategies but also green-washing, brown-washing and green-highlighting, three greening strategies that have only recently become the subject of research (Testa et al., 2018; Walker and Wan, 2012). Second, this study argues that the impact of these five greening strategies not only differs between new firms (≤10 years) and established firms (>10 years) but also among different start-up phases (≤4 years; 5-7 years; 8-10 years). Therefore, this study explicitly investigates how the impact of greening strategies on firm performance evolves in the first years of a new firm's existence. Third, this study answers the call for more quantitative, large-scale and cross-country research on green entrepreneurship (Demirel et al., 2019). Recent literature reviews show that empirical quantitative research on green entrepreneurship is scarce, illustrating that the research stream is still in its infancy (Gast et al., 2017; Terán-Yépez et al., 2020). To fill this research gap and to adequately address the complexity and uniqueness of green entrepreneurship (Gast et al., 2017), this study merges three waves of the European Commission's (2018a, 2016, 2014) Flash Eurobarometer Survey, which, to the best of the author's knowledge, has never been done before.

The remainder of this paper is organised as follows. Section 2 presents theoretical foundations for investigating the impact of greening strategies on firm performance and develops hypotheses. Section 3 explains the dataset used to test these hypotheses, the applied variables and the econometric methodology. The results of the empirical analyses are presented and validated in Section 4. Section 5 discusses the results, addresses the study's limitations and derives practical implications and future research directions.

2 Theoretical foundations and hypotheses

Following a recent stream of research on the microeconomic outcomes of different greening strategies (Schons and Steinmeier, 2016; Testa et al., 2018; Walker and Wan, 2012) this study distinguishes greening strategies into substantive and symbolic ones. While substantive strategies are understood here as the provision of green products or services or the engagement in environmental practices and the greening of operational processes, a symbolic strategy refers here to the ceremonial communication of a firm's greening aspirations without necessitating the implementation of these aspirations. Examples of symbolic greening strategies, which are not necessarily linked to substantive actions, include the disclosure of environmental information, the implementation and certification of environmental management systems, and stating the protection of the environment as one of the firm's top priorities (Walker and Wan, 2012; Yin et al., 2019).

Acknowledging that firms can pursue both strategies individually or in combination, this paper follows the frameworks of Walker and Wan (2012) and Testa et al. (2018), and further subdivides them into three additional greening strategies: 'decoupling' or 'green-washing' strategies are adopted by firms which implement symbolic strategies but do not back them with substantive actions (Walker and Wan, 2012); 'brown-washing' is adopted by firms which implement substantial actions but not implement symbolic strategies to promote these efforts and thus understate their environmental achievements (Kim and Lyon, 2015; Testa et al., 2018); and 'green-highlighting' refers to the application of both substantive and symbolic greening strategies (Walker and Wan, 2012). Figure 1 summarises how substantive (left circle) and symbolic greening strategies (right circle) are subdivided into green-washing (only symbolic greening strategies), brown-washing (only substantive greening strategies), and green-highlighting strategies (both symbolic and substantive greening strategies).

Fig. 1. Conceptual model.

2.1 Impact of substantive greening strategies

Research over the past two decades suggests a positive link between a firm's environmental and financial performance. Porter and van der Linde (1995) stress that productivity enhancements and an early introduction of environmental products may provide first-mover advantages and increased competitiveness. The so-called Porter hypothesis has been widely investigated and empirical evidence of an economic and environmental win-win situation has

been found. This research has been reviewed by Ambec and Lanoie (2008) who summarised, the following five reasons for the identified economic benefits for green firms: (a) better access to specific markets, (b) more differentiated products, (c) better risk management, (d) better stakeholder relations, and (e) lower costs of resources and labour. The latter reason is consistent with another strand of literature that adopts the RBV. The RBV contends that valuable internal resources and capabilities of firms are key drivers for competitiveness (Barney, 1991). Consistent with the RBV and its successor, the natural RBV (Hart, 1995), Leonidou et al. (2017) identified firms' resources and organisational capabilities as key sources for developing a green business strategy, which may lead to competitive advantages. Although these theories have primarily been developed to explain the impact of substantive greening strategies on the corporate performance of established firms, a very recent stream of research argues that they are also applicable to new entrepreneurial firms (Demirel et al., 2019; Leoncini et al., 2019; Shrivastava and Tamvada, 2019). New entrepreneurial firms have a higher probability of creating revolutionary innovations (Audretsch et al., 2014), particularly in the green economy (Fichter and Clausen, 2016). This higher potential for innovation and disruption might result in a higher economic impact of greening strategies in new firms than in established firms (Shrivastava and Tamvada, 2019). Furthermore, new firms generally have a higher environmental commitment than established firms and are therefore more attractive for a sustainability-oriented and solvent clientele (Hockerts and Wüstenhagen, 2010). However, there are also arguments for a less positive influence of greening strategies in new firms. Due to their 'liabilities of newness', 'liablilities of smallness', and 'liabilities of adolescence' (Aldrich and Auster, 1986; Brüderl and Schüssler, 1990), new firms may fail to translate their distinctive potential into firm performance. Furthermore, research has found evidence that green entrepreneurs are less likely to be profit-oriented (Kirkwood and Walton, 2014). Additionally, green entrepreneurs are more likely to have lower levels of business qualifications, business experience and market orientation (Bergset and Fichter, 2015; Kuckertz and Wagner, 2010). Therefore, new green firms face additional difficulties in raising funding to finance their green innovations (Bergset, 2018). Several meta-analyses have summarized the considerable number of empirical studies on the link between substantive greening strategies and firm performance and confirm a positive relationship (Dixon-Fowler et al., 2013; Tsai et al., 2020). However, only two empirical studies have considered the moderating role of firm age in this context. Leoncini et al. (2019) found in an analysis of Italian manufacturing firms that the impact of green patenting on the employment growth of fast-growing firms is positively moderated by firm age. In contrast,

Shrivastava and Tamvada (2019) analysed firms in 35 countries and discovered the opposite: going beyond complying with environmental legislations or offering either green products or services seems to be only positively related to the performance of new firms (≤10 years).

In summary, the theoretical and empirical evidence of the impacts of substantive greening strategies on the performance of new firms are mixed: while both negative and positive impacts are theoretically plausible, the empirical evidence of the impact in new firms is scant and inconclusive. Nevertheless, considering the significant body of empirical research suggesting a positive relationship in both established and small firms, this study hypothesizes that the benefits of substantial greening strategies outweigh their costs in new firms as well.

H1: *Substantive greening strategies have a positive impact on the performance of new firms.*

2.2 Impact of symbolic greening strategies

Unlike substantive greening strategies, symbolic greening strategies do not lead to cost reductions or efficiency improvements, and firms that apply such ceremonial strategies might fail to gain the financial benefits associated with substantive actions. Possible benefits of symbolic greening strategies can, however, be derived from stakeholder theory, signalling theory, and the reputational perspective. Stakeholder theory explains that to be successful, a firm must align its strategies with the needs and demands of its key stakeholders (Freeman, 1984). According to signalling theory (Connelly et al., 2011), these stakeholder expectations can also be satisfied by signalling compliance with environmental standards - regardless of whether these are indeed met. Firms that effectively signal their alleged greening efforts may enhance their reputation among stakeholders and thereby their firm performance (Keszey, 2020; Yin et al., 2019).

Empirical results on the microeconomic outcomes of symbolic greening strategies are mixed. While Walker and Wan (Walker and Wan, 2012) found that symbolic communication of environmental issues decreases the financial performance of Canadian industries which visibly pollute, Yin et al. (2019) found the opposite for the heavy-polluting-industries in China. Keszey (2020) analysed the impact of environmental marketing in 296 Hungarian firms, regardless of their polluting level, and also found a positive impact on firm performance. The more differentiated analysis of Schons and Steinmeier (Schons and Steinmeier, 2016) shows that symbolic corporate social responsibility actions targeted at low-proximity external stakeholders (e.g., customers or governments) increase firm performance, whereas they have no impact when directed at high-proximity internal stakeholders (e.g.,

employees). Finally, Shrivastava and Tamvada (2019) suggest that implementation of voluntary environmental management systems seem to have no impact on firm performance, regardless of firm age or size.

In summary, empirical findings on the impact of symbolic greening strategies on firm performance are mixed and partly contradict the assumptions derived from stakeholder theory and signalling theory. However, because of their flexibility and cost-effectiveness, this study hypothesizes that symbolic greening strategies are essential for new firms with limited resources.

H2: *Symbolic greening strategies have a positive impact on the performance of new firms*.

2.3 Impact of green-washing strategies

One motivation for firms to promote themselves as green might be to obtain the benefits of symbolic greening strategies without incurring the costs of concrete substantive actions (Walker and Wan, 2012). However, recent literature suggests that green-washing strategies are not necessarily rewarded and may in fact provoke adverse market reactions: firms misguiding their stakeholders face an increased risk of exposure (Testa et al., 2018), which in turn could lead to the withdrawal of stakeholder support and loyalty (Schons and Steinmeier, 2016), and ultimately to punishment by the market (Du, 2015).

The empirical findings of Walker and Wan (2012) suggest that the introduction of green-washing strategies in Canada decreases the financial performance of industries which visibly pollute. Similar to their results on symbolic greening strategies (see Section 2.2), Schons and Steinmeier (2016; Testa et al., 2018) show that green-washing may increase firm performance when targeted at low-proximity external stakeholders but decrease it when directed at high-proximity internal stakeholders. Finally, the recent study by Testa et al. (2018) suggests that green-washing is not associated with any kind of financial performance indicators.

Given the high threat of exposure, the absence of benefits from substantive greening strategies and the unambiguous empirical evidence, it seems likely that, if not accompanied by substantive actions, symbolic greening strategies negatively affect firm performance. Therefore, this study hypothesizes that green-washing is also detrimental to new firms.

H3: *Green-washing strategies have a negative impact on the performance of new firms.*

2.4 Impact of brown-washing strategies

Firms may decide not to disclose their substantive environmental efforts and thus bear the costs of them without collecting potential benefits of symbolic greening strategies.[1] The only known empirical study on the economic outcomes of this brown-washing strategy suggests that it might decrease a firm's market value and their accounting-based performance metrics (Testa et al., 2018). However, given the many benefits of substantive greening strategies, this study hypothesizes that new firms adopting brown-washing strategies may still benefit.

H4: *Brown-washing strategies have a positive impact on the performance of new firms.*

2.5 Impact of green-highlighting strategies

Finally, some firms follow a green-highlighting strategy by combining substantive and symbolic greening actions. Walker and Wan (2012) argue that pursuing green-highlighting strategies positively affects firm performance. They provide two arguments for their reasoning. First, firms backing their symbolic strategies with substantive actions strengthen their stakeholders' trust in their corporate greening activities and generally enhance credibility. Second, firms that effectively communicate their greening efforts demonstrate greater environmental commitment, which might lead to new market opportunities and competitive advantages (cf. Section 2.1). Walker and Wan (2012) tested their hypothesis empirically but found no significant impact of green-highlighting strategies on the performance of heavily polluting Canadian firms. Despite this first empirical evidence, this study hypothesizes that trustworthiness and credibility are essential for new firms and that new firms backing their green talk with substantive greening actions are more likely to perform better.

H5: *Green-highlighting strategies have a positive impact on the performance of new firms.*

2.6 The moderating role of firm age

Empirical evidence suggests that the impact of greening strategies on the performance of firms varies according to their age (see Section 2.1). This study goes a step further and hypothesises that the impact of greening strategies differs not only between new and established firms but also between different start-up phases of new firms (≤4 years; 5-7 years; 8-10 years). While the advantages discussed in Section 2.1 explain why new firms (≤10 years) might benefit more from implementing greening strategies than established firms (>10 years), the theory does not indicate that these advantages also differ significantly across start-

[1] See Kim and Lyon (2015) for a comprehensive overview of why firms adopt brown-washing strategies.

up phases. However, firms which have just started are likely to be smaller and equipped with fewer resources and knowledge (Hörisch et al., 2018) and are characterised by higher mortality rates (Preisendorfer and Voss, 1990). Therefore, the discussed liabilities of newness, smallness and adolescence are potentially more severe for firms in their early start-up phases. For these reasons, this study hypothesises that firms in later start-up phases have higher capacities and potentials to benefit economically from greening efforts and are thus more likely to gain an economic advantage over non-green firms.

H6: *The age of new firms positively moderates the impact of greening strategies on firm performance.*

Fig. 2. Overview of hypotheses.

3 Methods

3.1 Data source and descriptive statistics

To test the hypotheses summarised in Figure 2, this study merged waves I, III, and IV of the cross-sectional Flash Eurobarometer survey on "Small and Medium-Sized Enterprises, Resource Efficiency and Green Markets" (European Commission, 2018a, 2016, 2014). The Flash Eurobarometer surveys were conducted in 2012, 2015, and 2017 through telephone interviews with managers selected by a stratification procedure and randomly drawn from an international business register. The dataset for the surveys covers firms in the manufacturing, service, industry, and retail sectors of the 27 Member States of the European Union as well as from Albania, Iceland, Israel, Liechtenstein, Macedonia, Moldavia, Montenegro, Norway, Serbia, Turkey, United Kingdom, and the United States. It covers firm-specific questions on firms' age, number of employees, sector, turnover, external support, and resource efficiency measures and investments. As the answers to these questions depend on the managers' interpretation, it is noteworthy that many of the items are of a subjective nature (Jové-Llopis and Segarra-Blasco, 2018). The surveys have been used widely by previous studies to investigate firms' greening strategies (Horbach, 2018; Jové-Llopis and Segarra-Blasco, 2018; Özbuğday et al., 2020; Riillo, 2017; Shrivastava and Tamvada, 2019). A more detailed data description can be found in the respective survey reports (European Commission, 2018b, 2015, 2012).

The present study focuses on new firms, which is why the original dataset of 43,206 observations has been reduced to 11,039 for firms aged ten years or less. After discarding observations with missing values for the dependent and control variables, and after excluding observations from Liechtenstein, Israel and Moldavia due to data limitations, the final data sample comprised 9,984 observations. Table 1 provides a descriptive overview of the final sample. To test the hypotheses of the moderating role of age, the data sample was divided into three sub-samples of similar size. Since not all questions are included in all survey waves, the number of surveys included per independent variable varies. Across all three start-up phases, the sample is dominated by small firms with fewer than ten employees (58.0%), firms in retail (27.8%) and service sector (33.3%), and firms targeting multiple markets (42.0%).

Table 1 Descriptive statistics

	Survey waves	Total sample (≤10 years)		≤4 years	5-7 years	8-10 years
		Freq.	Percent.	Percent.	Percent.	Percent.
Dependent variable (*turnDev*)						
decreased	I, III, IV	2010	20.13%	14.72%	21.84%	18.11%
remained unchanged	I, III, IV	2685	26.89%	25.61%	26.67%	22.02%
increased	I, III, IV	5289	52.97%	59.67%	54.60%	35.87%
Independent variables:						
substGSI	I, III, IV	1314	13.16%	13.45%	13.440%	9.900%
substGSII	I, III, IV	1189	11.91%	12.74%	12.800%	8.140%
substGSIII	I	743	22.29%	21.05%	21.40%	19.21%
symGSI	I, III	1999	31.41%	31.23%	28.89%	30.18%
symGSII	I	735	22.05%	17.88%	19.01%	23.73%
greenWash	I	458	13.74%	12.52%	12.81%	12.62%
brownWash	I	445	13.35%	12.52%	13.52%	10.87%
highlight	I	446	13.38%	16.06%	17.66%	16.43%
Control variables:						
employees: >249	I, III, IV	242	2.420%	1.920%	2.250%	2.350%
employees: 50-249	I, III, IV	1029	10.31%	8.190%	9.940%	9.710%
employees: 10-49	I, III, IV	2926	29.31%	24.99%	31.13%	24.48%
employees: 1-9	I, III, IV	5787	57.96%	64.90%	59.80%	39.46%
age	I, III, IV		6.29[a] (2.730)[b]	2.98[a] (1.060)[b]	6.14[a] (0.0.84)[b]	9.29[a] (0.820)[b]
sector: industry	I, III, IV	2169	21.72%	21.19%	23.41%	16.16%
sector: service	I, III, IV	3327	33.32%	33.02%	33.44%	26.17%
sector: retail	I, III, IV	2778	27.82%	28.83%	28.36%	20.71%
sector: manufacturing	I, III, IV	1710	17.13%	16.96%	17.90%	12.95%
market: multiple	I, III, IV	4189	41.96%	42.22%	43.46%	31.57%
market: B2P	I, III, IV	182	1.820%	1.560%	1.660%	1.710%
market: B2B	I, III, IV	2824	28.29%	26.32%	30.18%	22.08%
market: B2C	I, III, IV	2789	27.93%	29.90%	27.81%	20.63%
year: 2012	I	3333	33.38%	35.81%	38.67%	26.93%
year: 2015	III	3032	30.37%	28.18%	30.85%	24.84%
year: 2018	IV	3619	36.25%	36.01%	33.59%	24.22%
Total observations:	I, III, IV	9984	9984	3077	3352	3555

[a]Mean.
[b]Standard deviation.

3.2 Dependent variable

To test whether greening strategies affect firm performance, a dependent variable was constructed based on whether the firm's annual turnover had decreased, remained unchanged or increased over the last two years. This measurement is the only way to determine firms' performance in this dataset. Although it does not allow to conclude the size of the turnover change, it is an established estimator for firm performance that has been successfully applied in previous research (s. Table 2). Table 1 shows that the turnover of 53.0% of the new firms has increased over the last two years, with the percentage decreasing as the firms mature.

3.3 Independent variables

Three dichotomous dummy variables for substantive (H1) and two for symbolic greening strategies (H2) were introduced, which enabled the hypotheses developed in Section 2 to be tested using independent measurement approaches. *substGSI* indicates whether firms are making substantive investments in their resource efficiency. Hoogendoorn (2015) defined a substantive investment in resource efficiency as an investment of more than 10% of a firm's

annual turnover. However, Özbugday et al. (2019) argue that investments of more than 1% already represent a significant amount of money for small firms. Due to data limitations, this paper follows Jovè-Llopis and Segarra-Blasco (2018) and sets the threshold for substantive resource efficiency investments at 5%. *substGSII* identifies a new firm's strategy as substantively green if green products and services account for at least 10% of annual turnover. The threshold used is based on earlier studies that describe a share of 10% as substantive involvement in green services and products (Hoogendoorn et al., 2015; Horbach, 2018). *substGSIII* identifies substantive greening strategies based on how firms comply with environmental legislation requirements. Following Shrivastava and Tamvada (2019), the strategy of a firm to go beyond these requirements is defined here as substantively green. *symGSI* describes a symbolic greening strategy by determining whether the environment is one of a firm's top priorities. In accordance with Jovè-Llopis and Segarra-Blasco (2018), firms mentioning the environment as one of their top priorities are identified here as following a symbolic greening strategy. Finally, as discussed in Section 2, *symGSII* is based on the understanding that the implementation of voluntary environmental management systems is a symbolic greening strategy (s. Section 2). Consistent with previous research (Hoogendoorn et al., 2015) and the arguments presented in Section 2, the use of at least one of these environmental management systems is identified here as a symbolic greening strategy. Based on the definitions presented in Section 2 and Figure 1, these five variables are used to construct the variables *greenWash* (green-washing; H3), *brownWash* (brown-washing; H4), and *highlight* (green-highlighting; H5).

3.4 Control variables

The literature suggests several variables related to both the independent and dependent variables of interest (see Table 2). Thus, to minimise the risk of omitted-variable-bias, a series of commonly used control variables was introduced. Additionally, to account for economic developments between the three survey periods and possible discrepancies in the surveys' implementations, it is controlled for the year in which the surveys were conducted. To control for country-level effects, country-dummies were included. A detailed description of all variables used, including an overview of previous studies where these variables were applied, is given in Table 2.

Table 2 Variable descriptions

Variable	Description	References
Dependent variable:		
turnDev	Turnover development: based on the survey question: "*Over the past two years, has your company's annual turnover increased, decreased or remained unchanged?*" Equals 1 if the turnover decreased over the past two years, 2 if it remained unchanged and 3 if it increased.	(Jové-Llopis and Segarra-Blasco, 2018; Özbuğday et al., 2020; Shrivastava and Tamvada, 2019)
Independent variables:		
substGSI	Substantive greening strategy I (H1): based on the survey question: "*Over the past two years, how much have you invested on average per year to be more resource efficient?*" Equals 1 if a firm invests at least 5% of the firm's annual turnover in resource efficiency and 0 if the firm invests less or nothing.	(Hoogendoorn et al., 2015; Jové-Llopis and Segarra-Blasco, 2018)
substGSII	Substantive greening strategy II (H1): based on survey questions: "*How much do these green products or services represent in your annual turnover of the latest available fiscal year?*" Equals 1 if the share of green products and services offered by a firm is >10% of the firm's annual turnover. It equals 0 if the share is lower or zero.	(Hoogendoorn et al., 2015; Horbach, 2018; Shrivastava and Tamvada, 2019)
substGSIII	Substantive greening strategy III (H1): based on the survey question: "*Among these statements, which one applies the best to your company? Your company ...*". Equals 1 if a firm goes beyond requirements of the environmental legislation and 0 if otherwise.	(Shrivastava and Tamvada, 2019)
symGSI	Symbolic greening strategy I (H2): based on the survey question: "*What are the main reasons why your company is taking actions to be more resource efficient?*" Equals 1 if the environment is one of the top priorities of a firm and 0 if not.	(Jové-Llopis and Segarra-Blasco, 2018)
symGSII	Symbolic greening strategy II (H2): based on the survey question: "*Does your company use one or more of these environmental management systems?*" Equals 1 if a firm has either an ISO 14001 or ISO 14064 in place and 0 if not.	(Riillo, 2017; Shrivastava and Tamvada, 2019)
greenWash	Green-washing (H3): equals 1 if *symGSI* or *II* are applied but neither *substGSI*, *II* nor *III*. It equals 0 if otherwise.	(Testa et al., 2018; Walker and Wan, 2012)
brownWash	Brown-washing (H4): equals 1 if either *substGSI*, *II* or *III* are applied but neither *symGSI* nor *II*. It equals 0 if otherwise.	(Testa et al., 2018)
highlight	Green-highlighting (H5): equals 1 if either *substGSI*, *II* or *III* are applied and either *symGSI* or *II*. It equals 0 if otherwise.	(Walker and Wan, 2012)
Control variables:		
employees	Indicates the number of employees of a firm; 1-9 employees, 10-49 employees, 50-249 employees or >250 employees.	(Jové-Llopis and Segarra-Blasco, 2018; Özbuğday et al., 2020; Shrivastava and Tamvada, 2019)
age	Equals to a firm age in years based on the stated age (wave I) or the difference between the survey data and the stated year of firm foundation (wave I and II).	(Özbuğday et al., 2020; Shrivastava and Tamvada, 2019)
sector	Indicates the primary sector a firm is operating in; manufacturing, retail, service, mining or other industries.	(Jové-Llopis and Segarra-Blasco, 2018; Shrivastava and Tamvada, 2019)

market	Indicates the primary market a firm is addressing; consumers only, other firms only, public administrations only or multiple markets.	(Horbach, 2018; Shrivastava and Tamvada, 2019)
year	Indicates the survey's year.	
country dummies	Dummy variables for each country in the analysis.	(Özbuğday et al., 2020)

3.5 Econometric model

3.5.1 Ordinal logistic regression

The analysis of the relationship between different greening strategies and firm performance requires a multivariate statistical method. Given the ordinal nature of the dependent variable *turnover development* with its three categories (decreased, remained unchanged, increased), ordinal logistic regression, a generalised linear model, was used. Of the various ordinal regression models available, cumulative odds ordinal logistic regression with proportional odds is one of the most common (McCullagh, 1980). The logistic ordinal regression equation for the dependent variable Y and its j categories can be expressed as follows:

$$logit[P(Y \geq j|X)] = ln\left(\frac{P(Y \leq j|X}{P(Y > j|X}\right) = \alpha_j - \beta X, \quad (1)$$

where X represents the independent and control variables and β their regression coefficients. The negative sign after the intercept α_j allows an intuitive interpretation of the sign of β: positive coefficients of the explanatory variables represent higher predicted values and vice versa.

4 Empirical analysis

4.1 Proportional odds assumption and multicollinearity

Concerning multicollinearity, the Spearman correlation coefficients between all independent variables were calculated and are presented in Table 3. Additional linear regressions were conducted to examine the variance inflation factors (VIF) of all independent and control variables. As expected, the complementary design of the independent variables causes problems with multicollinearity. While the VIF values range comfortably between 1.082 and 2.296 when all variables except *highlight* are included, after *highlight* is added, the values rise up to 7.949 and thus exceed the threshold of five for models without interaction effects (Hair et al., 2014). Therefore, the impact of each of the independent variables was estimated in separate regressions.

Table 3 Correlations between dependent and independent variables

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	*turnDev*	1								
(2)	*substGSI*	0.010	1							
(3)	*substGSII*	.057**	.110**	1						

(4)	*substGSIII*	.105**	.100**	.135**	1					
(5)	*symGSI*	.027*	-0.004	.098**	.142**	1				
(6)	*symGSII*	.028	.155**	.076**	.132**	.086**	1			
(7)	*greenWash*	-.042*	-.302**	-.211**	-.283**	.378**	.261**	1		
(8)	*brownWash*	.033	.326**	.197**	.234**	-.342**	-.305**	-.257**	1	
(9)	*highlight*	.057**	.399**	.306**	.439**	.446**	.467**	-.315	-.309	1

**p < 0.01; *p < 0.05.

Furthermore, the parallel odds model assumes that the effect of an explanatory variable is identical at each cumulative split of the dependent variable. To verify this assumption, full likelihood ratio tests (tests of parallel lines) were performed, which compare the fitting of proportional odds models to models with separate sets of coefficients for each of their categories. The significant results of these tests (see Table 4) show that the underlying null hypothesis of identical coefficients for all cumulative splits is rejected for models (1) to (5) – probably due to the large sample size and the large number of explanatory variables involved (Allison, 1999, p. 141). Thus, for further investigation of these five models, separate binomial logistic regressions on cumulative dichotomous dependent variables were run. The results show that for all independent variables analysed, the odds ratios of the different binomial logistic regressions are well within the 95% confidence intervals of the ordinal regression coefficients and vice versa. These refined test results indicate that the proportional odds assumption is met and that all of the ordinal logistic models conducted are tenable. The VIF values and the results of the binomial logistic regressions are not shown here but are available upon request.

Tabel 4 Greening strategies and turnover development (firms ≤10 years)

	(1) Coeff.	SE	(2) Coeff.	SE	(3) Coeff.	SE	(4) Coeff.	SE	(5) Coeff.	SE	(6) Coeff.	SE	(7) Coeff.	SE	(8) Coeff.	SE
Independent variables:																
substGSI	.177**	.061														
substGSII			.228**	.064												
substGSIII					.319**	.085										
symGSI							.066	.056								
symGSII									.036	.089						
greenWash											-.151	.104				
brownWash													.134	.106		
highlight															.197*	.097
Control variables:																
employees: >249	.989**	.162	1.016**	.155	1.071**	.237	.827**	.167	1.027**	.249	1.233**	.309	2.174**	1.438	1.156**	.310
employees: 50-249	.825**	.078	.871**	.077	.871**	.118	.879**	.091	.873**	.131	.773**	.147	.447**	.443	.743**	.147
employees: 10-49	.595**	.049	.595**	.048	.579**	.079	.581**	.060	.560**	.086	.537**	.098	.319**	.274	.521**	.098
employees: 1-9[a]																
age of new firm	-.096**	.008	-.096**	.008	-.102**	.013	-.105**	.010	-.109**	.014	-.104**	.016	-.154**	.146	-.104**	.016
sector: industry	-.199**	.069	-.202**	.068	-.091	.102	-.125	.082	-.114	.110	-.075	.124	-.541	.340	-.081	.124
sector: service	.019	.065	-.013	.063	-.096	.10	.047	.077	-.077	.107	-.051	.125	-.722	.329	-.042	.125
sector: retail	.010	.067	-.011	.066	.117	.1064	.098	.08	.133	.115	.178	.133	.029	.341	.183	.133
sector: manufacturing[a]																
market: multiple	.411**	.052	.404**	.051	.386**	.083	.394**	.065	.400**	.089	.318**	.104	.629**	.268	.323**	.104
market: B2P	.208	.163	.169	.158	.305	.231	.185	.188	.272	.259	.355	.306	.910	.833	.332	.306
market: B2B	.384**	.057	.372**	.056	.497**	.092	.504**	.072	.508**	.100	.553**	.117	.254**	.285	.557**	.117
market: B2C[a]																
year: 2018	.711**	.052	.701**	.051												
year: 2015	.428**	.053	.408**	.051			.373**	.054								
year: 2012[a]																
Wald test *country dummies*	356.37**		352.67**		294.86**		346.71**		263.36**		225.47**		226.58**		227.52**	
Goodness-of-fit:																
Pseudo (McFadden) R2	.057		.058		.076		.062		.075		.080		.080		.080	
LR Chi2	1013.30**		1075.52**		551.73**		739.75**		5393.38**		374.65**		374.11**		376.71**	
Test of parallel lines:																
LR Chi2	169.31**		173.69**		75.91**		117.44**		66.08*		50.64		50.95		51.62	
Observations:																
total	8772		9140		3407		5741		2949		2207		2207		2207	

**p < 0.01; *p < 0.05.

[a]Reference category.

4.2 Regression results

To isolate the impact of different greening strategies on the performance of new firms, based on equation (1), ordinal logistic regression models were estimated for each of the eight independent variables and are presented in columns (1) to (8) in Table 4. While the low values for McFadden's pseudo R^2 suggest a low predictive power of the presented estimation models, the Likelihood-ratio tests show that all models significantly predict the dependent variable over and above the intercept-only model. The positive and significant coefficients of *substGSI, II* and *III*, in columns (1), (2) and (3) of Table 5 confirm a positive impact of substantive greening strategies on firm performance and thus support H1.
As neither of the estimated coefficients of the variables *symGSI* and *symGSII* presented in columns (4) and (5) is significant, hypothesis H2 is rejected. Although the coefficient of *greenWash* in column (6) is indeed negative, and the coefficient of *brownWash* in column (7) is positive, both findings are insignificant. Accordingly, the ordinal logistic regressions provide neither evidence for a negative impact of green-washing (H3) nor for a positive impact of brown-washing (H4). Finally, the positive and significant coefficient of *highlight* in column (8) supports H5.

Hypothesis H6 predicts that the impact of all greening strategies will be stronger in later start-up phases. To test this hypothesis, interaction terms between *age* and the respective independent variables were added to each of the models (1) to (8) shown in Table 4. No significant results were found for any of the eight interaction terms, suggesting that firm age has no moderating effect. However, this lack of significance might also be due to possible non-linearity of the moderating impact of firm age. Thus, a more granular analysis was conducted: the eight ordinal logistic regressions presented in Table 4 were calculated again for the three subsamples of firms under five years of age, for firms five to seven years old and for firms aged eight to ten years. Columns (1) to (3) of Table 5 present the key results of these 24 additional regressions. For comparison, column (4) of Table 5 summarises the results of the eight regression models shown in columns (1) to (8) of Table 4. The results show that the impact of greening strategies does indeed differ between different age groups. Except for *substGSII*, the results show that greening strategies only have an impact on firms aged five to seven (*substGSIII*) or eight to ten years (*substGSIII, greenWash*) and thereby support H6. A significant impact could not be determined in the subsamples for *substGSI*, *highlight*, *symGSI* or *symGSII*. While there seems to be no impact for the measured symbolic greening strategies in general, the insignificant results of *substGSI* and *highlight* are possibly

due to the small size of the subsamples. However, contradicting H6, *substGSII* has a strong positive impact on firms younger than five years, which decreases with age. Noteworthy is the significant negative impact of *greenWash* on firms aged eight to ten years shown in column (3), which provides the first evidence for H3. The complete regression results for the eight interaction models and the 24 additional regressions presented in columns (1) to (3) in Table 4 are available upon request.

Table 5 Greening strategies and turnover development by age (32 independent ordinal logistic regressions)

	(1) ≤4 years		(2) 5-7 years		(3) 8-10 years		(4) ≤10 years	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
substGSI	.194	.114	.135	.105	.192	.101	.177**	.061
	(2695)		(2964)		(3113)		(8772)	
substGSII	.324**	.122	.230*	.109	.151	.109	.228**	.064
	(2821)		(3101)		(3218)		(9140)	
substGSIII	.183	.160	.411**	.145	.366*	.147	.319**	.085
	(1027)		(1188)		(1192)		(3407)	
symGSI	-.032	.106	.164	.097	.065	.092	.066	.056
	(1688)		(1956)		(2097)		(5741)	
symGSII	.002	.233	.145	.158	.047	.142	.036	.089
	(879)		(1037)		(1033)		(2949)	
greenWash	-.164	.201	.079	.179	-.382*	.177	-.151	.104
	(644)		(806)		(757)		(2207)	
brownWash	.119	.205	.072	.179	.178	.192	.134	.106
	(644)		(806)		(757)		(2207)	
highlight	.149	.194	.223	.166	.259	.168	.197*	.097
	(644)		(806)		(757)		(2207)	

**p < 0.01; *p < 0.05.
Respective sample sizes in brackets.

4.3 Additional analyses and robustness tests

Two robustness tests were performed to validate the regression results. First, two ordinal alternatives for the variables *substGSI* and *II* were introduced to test the selected thresholds. In general, these and other alternative constructs which were tested validate the robustness of the initial estimation results for *substGSI* and *substGSII,* and thereby provide further support for H1. However, the results also show that, compared to the reference categories of 0% of annual turnover, there is no significant benefit to firm performance by spending more than 30% of annual turnover on resource efficiency (*substGSI*) or for achieving more than 30% of the annual turnover with green services or products (*substGSII*). Thus, the results suggest that both variables are vulnerable to higher thresholds.

Second, to address potential difficulties arising from the ordinal structure of the dependent variable *turnDev* (see Section 4.1), a binary dependent variable was constructed, which indicates whether the average turnovers of new firms over the last two years increased or not. All eight regressions shown in Table 4 were then replicated using binary logistic regressions. The estimation results for substantive and symbolic greening strategies are

consistent with the previous results. However, while no significant impacts of *greenWash* and *brownWash* on the ordinal dependent variable *turnDev* were found (Table 5), the binary regression results suggest a negative and weakly significant impact of *greenWash* ($\beta = -.241$; $p < .05$) and a positive and weakly significant impact of *brownWash* ($\beta = .219$; $p < .05$). Thus, these findings provide further support for H3 and the first evidence for H4. Finally, as no significant impact of *highlight* could be found, there is no further support for the weak positive impact shown in column (8) of Table 5. The results for the robustness tests with ordinal independent variables and the binary logistic regressions are not shown here but are available upon request.

5 Discussion and conclusion

Previous empirical research on the impact of different greening strategies has mostly focused on established firms and suffered from small sample sizes and a variety of often interchangeably used definitions of greening. The objective of this study was to expand the existing entrepreneurship and environmental management literature by analysing several different greening approaches, their impact on the performance of new firms, and how this impact differs across different start-up phases. To address the variety of existing greening definitions, a conceptual model was derived in Section 2 which distinguishes between substantive and symbolic greening strategies as well as between green-washing, brown-washing and green-highlighting. The analysis of three extensive datasets and the application of an ordinal logistic regression model shows that new firms adopting substantive greening actions perform significantly better than their conventional counterparts, and thereby confirms the Porter's hypothesis for new firms. However, the results also show that the impact depends on the start-up phase the firms are currently in. The findings confirm that a more detailed analysis along the different phases of the start-up process was justified. In addition, no significant effects could be observed for new firms adopting symbolic greening strategies. Furthermore, this study contributes to the environmental management and entrepreneurship literature by introducing the relatively new theoretical constructs of brown-washing and green-highlighting (Kim and Lyon, 2015; Testa et al., 2018; Walker and Wan, 2012) and by examining their relevance to the performance of firms which have just been established.

The findings yield four important implications for practitioners. First, the robust and significantly positive results for all tested substantive greening-strategies suggest that the implementation of such strategies might lead to environmental and economic win-win situations for new firms. This double advantage also makes these new firms striving to establish a sustainable business more attractive for investors and public funding institutions. Second, while the offering of green products or services seems to have an immediate effect, other substantive greening strategies might require five or more years to pay off. Investors should thus be aware that efforts towards greater sustainability may only be rewarded in later start-up phases and that their investment strategies should be adapted accordingly. Third, the robustness tests show that the impact of substantive greening strategies is not linear but decreases with increasing environmental efforts. This inverted U-shaped relationship suggests that a threshold exists for the effectiveness of greening efforts. Accordingly, it is not

advisable for new firms to apply all greening strategies at once and overburden themselves, but to initially focus on implementing individual greening actions. The findings thus reinforce previous calls for policymakers to help firms identify and achieve their optimal investment in greening actions (Jové-Llopis and Segarra-Blasco, 2018; Schons and Steinmeier, 2016) and suggest that public support instruments targeting new firms should consider promoting and funding a progressive implementation of greening strategies. Fourth, the results reveal that symbolic greening strategies that are not necessarily linked to the implementation of substantive actions have no significant impact on the performance of new firms; neither in any of the three individual start-up phases nor aggregated across all of them. Thus, the advantages and disadvantages of symbolic greening strategies discussed in Section 2.2 either do not apply to new firms, or they cancel each other out. In fact, evidence suggests that not backing symbolic strategies with substantive actions can harm the performance of new firms in later start-up phases. This result is further supported by the fact that a weak but positive impact from the combination of symbolic and substantive strategies (green-highlighting) was found, whereas no significant advantage was observed for firms that pursue substantive without symbolic strategies (brown-washing). Thus, in order to prevent symbolic greening strategies from backfiring, entrepreneurs in later start-up phases should desist from green-washing and only communicate those measures publicly which are based on existing or firmly planned efforts to protect the environment and climate.

Nevertheless, the results are not without limitations and there is need for further environmental management and entrepreneurship research. First, due to limitations of the secondary data, firm performance was approximated in this study using a single ordinal variable with only three categories, making it impossible to determine the magnitude of the effects. This could lead to both under- and overestimation of firm performance. However, the test with a binary construction of the dependent variable confirms the robustness of the results. Furthermore, similar research suggests that the method of measurement of firm performance has no relevant impact on results (Horváthová, 2010). Nevertheless, future research should test the present findings using combinations of other common measures of firm performance such as a firm's Tobin's Q or ROI. Second, while the secondary data allows a rather versatile measurement of substantive greening strategies, the estimation of symbolic greening strategies is limited both in the number of suitable items and in the availability of these in the three individual datasets (see Table 2). Consequently, the derived measurements of green-washing, brown-washing and green-highlighting are also not comprehensive. The problematic measurement could be a reason why no or only weakly

significant results were found for symbolic strategies, green-washing, brown-washing, and green-highlighting. The results shown here can thus only represent an initial assessment. Future research should verify them by employing more sophisticated measurements of symbolic greening strategies, like measuring how new firms communicate environmental commitment in their visions, missions, annual reports, or websites (Testa et al., 2018; Walker and Wan, 2012). Third, the aggregated nature of the analysed data prevents drawing conclusions about the mechanisms underlying the observed effects. This study does not provide answers as to why the supply of green products and services has a more positive impact immediately after the founding of a firm than in later start-up phases, how and by whom green-washing in new firms is penalised, or why this only occurs in later start-up phases. Future research should thus use qualitative and methodological approaches to investigate these questions and to obtain a better understanding of how the different greening strategies are embedded at the firm level. Fourthly, in this study, fixed market, sector and country-wide effects were controlled to minimise the risk of omitted-variable-biases and heterogeneity. Moreover, the data did not allow for a distinction between entrepreneurial start-ups and non-innovative new firms. Therefore, it remains for future research to examine potential variations in the impact of greening strategies in different sectors and countries and across different types of new firms. Finally, as the data over the three years of the survey are not linked, this study can only provide conclusions for the relationship between greening strategies and firm performance, but not on its causation. However, research suggests that higher financial performance enables firms to prioritise expensive substantial greening strategies over cheaper symbolic strategies (Walker and Wan, 2012), which could be especially true for new firms where resources are naturally limited. The application of panel data could provide not only valuable insights into long-term economic effects of greening strategies but also help future research to investigate the causation.

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