

SMEs' Green Initiatives: Balancing Sustainability and Financial Realities

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Abstract

Using a unique dataset covering more than 25,000 firm-year observations across 32 European countries, this paper examines the influence of firms sustainability efforts on their capital structure. This research finds that green strategies have only a limited influence on SMEs' capital structure. Resource efficiency actions are associated with lower debt levels, suggesting a reduced reliance on external financing, whereas launching green products or services does not significantly affect firms' use of debt. Small and medium-sized enterprises (SMEs) may still face constraints in accessing credit, particularly when undertaking environmentally oriented investments, while the adoption of green products does not appear to enhance their financing opportunities. These results highlight the financial implications of sustainability initiatives and demonstrate how different green strategies can shape firms' financial positions. Our study offers insights for policymakers aiming to foster sustainable practices in SMEs : targeted support for green improvements may yield both environmental and financial benefits.

Keywords : Small and medium-sized enterprises, Green strategies, Capital Structure, Flash Eurobarometer, Orbis Europe.

1 Introduction

A growing interest in firms' environmental actions has been highlighted in recent years, with companies increasingly under scrutiny for their sustainable impact. Small and medium-sized enterprises (SMEs) are responsible for approximately 70% of global carbon dioxide emissions, primarily as a result of their business activities (Cusmano and Kauffmann, 2022). As awareness of climate change issues has grown, SMEs have emerged as pivotal actors in the transition toward a sustainable economic model (Aragón-Correa et al., 2008). Despite this growing recognition, the barriers smaller firms face in adopting green initiatives are still poorly understood (Bartolacci et al., 2020). One particularly underexplored aspect is how sustainability efforts affect SMEs' capital structure. While SMEs acknowledged the importance of environmental issues, they often saw compliance as a cost with limited customer benefit (Simpson et al., 2004).

Against this backdrop, our study contributes to the growing body of literature on this topic by examining the impact of green initiatives on the capital structure of European SMEs. According to Chen et al. (2023), firms with strong Environmental, Social and Governance (ESG) performance are more resilient to risks, enjoy enhanced growth potential, and have improved financial health. However, their study also suggests that large companies are better placed to meet ESG criteria due to their greater resources. Similarly, Simpson et al. (2004) find that small firms did not view adopting environmental good practice as a source of competitive advantage due to resource constraints. In related work, Cecere et al. (2020) find that access to public funding and fiscal incentives can accelerate the development of eco-innovations, with their effectiveness particularly influenced by firms' access to external finance. Furthermore, Hart (1995) argues that green activities, such as pollution prevention practices, can reduce both costs and emissions; however, the financial resources required for their implementation are often overlooked.

Cariola et al. (2020) find that while debt generally harms the performance of European energy SMEs, this effect is reversed in countries with strong environmental policies, where debt instead enhances performance. This suggests that national environmental commitment can improve the financial efficiency of debt use for energy firms in transition. Furthermore, Scholtens (2016) argues that external financing, particularly from venture capitalists and banks, has a greater capacity to impact business sustainability than equity markets. On the other hand, using World Bank survey data of China's enterprises and taking ISO14000 as a proxy for firm environmental performance, Tian and Lin (2019) suggest that SMEs tend to have poorer environmental performance, or a higher probability of poor performance in terms of pollution reduction when they face more difficulties in obtaining external finance in the market.

Therefore, on the one hand, we have SMEs, which tend to have less access to external financing than their larger counterparts. On the other hand, an increasing body of literature on sustainable finance asserts that green activities could facilitate companies' access to external financing and increase their profitability.

In line with existing literature, we use the leverage ratio as a primary indicator of firms' capital structure, recognizing its multiple formulations. The one we choose to use is the ratio of non-current liabilities and loans to shareholders' equity defined by Gallucci et al. (2025) which reflects well the reliance proportion on external financing. Another measure used a lot to capture the capital structure of a company is the long-term debt ratio, which reflects firms' reliance on long-term financing (Mulier et al., 2016 ; Gallucci et al. 2025 ; Daskalakis et al., 2017). We argue that higher levels of long-term debt can signal greater financial credibility, suggesting that banks and other creditors may be more willing to lend to firms engaged in environmental strategies. Finally, we also use the short-term debt ratio, defined as short-term debt divided by the total asset, offering a complementary view of the firm's debt capacity to secure its activity (Gallucci et al. 2025).

Moreover, the relationship between green strategies and capital structure may be affected by reverse causality, as financially healthier firms are more capable of accessing external financing and may therefore be better positioned to invest in green strategies. To address this concern, in addition to our ordinary least squares (OLS) model, where the dependent variable is measured one year ahead. We further estimate our regression using several robustness methods, including entropy balancing and propensity score matching (PSM), following similar approaches used by Albitar et al. (2023). These additional techniques allow us to assess whether our findings remain consistent.

In this study, we employ a unique dataset developed by Moretti et al. (2024) by statistically matching the Flash Eurobarometer survey on 'SMEs, resource efficiency, and green markets' (hereafter FE) and Orbis Europe. The FE survey has already been widely used in research studying the impacts of environmental practices on SMEs (e.g., Hoogendoorn et al., 2015; Shrivastava and Tamvada, 2019; Neumann, 2021). The advantage of this dataset is that it links information about SMEs' green activities and their financial data, allowing us to more accurately study the impact of green strategies on capital structure. Furthermore, since the FE survey is anonymous, this data is less likely to be affected by greenwashing. We aim to use more sophisticated measurements for both financial data and environmental actions to fill the gap in the current literature.

The results we gather are that green strategies do not significantly affect debt levels but are linked to a lower reliance on debt, suggesting a shift toward equity financing. This may reflect better access to

sustainable funding or cautious borrowing. Also, small and medium sized enterprises may face reduced access to external financing with green strategy adoption in brown industries.

Our study contributes to the literature by exploring whether firms that adopt internal and/or external green strategies experience different leverage dynamics. To the best of our knowledge, this is the first study to examine the impact of green strategies on the capital structure of SMEs in Europe. While the relationship between environmental strategies and financial performance has been investigated (Moretti et al., 2024; Shrivastava and Tamvada, 2019; Neumann, 2021), and several studies have analyzed the determinants of SMEs' capital structure (Joeveer, 2013; Demirguc-Kunt et al., 2020; Casino-Martinez et al., 2020; Mc Namara et al., 2017), no existing research directly addresses the link between sustainable strategies and capital structure. This gap is particularly relevant given the increasing regulatory pressure for environmental compliance and the strategic importance of financing for SMEs. This paper aims to shed light on how environmental engagement can shape financing outcomes in the SME context. Moreover, we believe that firms pursuing a green transition often require environmental certifications, which, as Stahl and Strausz (2017) suggest, can enhance transparency and promote greater accountability. This increased transparency can reduce agency problems by better aligning the interests of shareholders and managers. In addition, green strategies can help firms anticipate and adapt to evolving regulatory frameworks and mitigate exposure to climate-related risks, such as resource scarcity or energy supply shocks. As such, sustainability not only influences operational decision-making but may also improve firms' financial resilience, an aspect we investigate through the lens of capital structure and debt dynamics.

The remainder of the paper is organized as follows: In Section 2, we provide a literature review and develop our hypotheses. Section 3 presents the data and summary statistics, detailing the datasets utilized. In Section 4, we conduct the empirical analysis, outlining the methodologies employed and presents the results. Finally, Section 5 concludes the paper by summarizing our findings and their implications.

2 Literature Review and Hypothesis Development

2.1 Theoretical Foundations of Capital Structure

Corporate capital structure has attracted sustained academic interest since the pioneering work of Modigliani and Miller in 1958. Although their initial assumptions are unrealistic, they provide fundamental insights into how financing decisions impact firm value. Indeed, relaxing these assumptions emphasizes the practical importance of capital structure choices. Building on this foundation, Signaling Theory (Ross, 1977) posits that financing decisions convey information to external investors. Debt issuance generally interpreted as a positive signal of firm quality and financial

strength, whereas equity issuance may signal overvaluation or weakness. This information asymmetry between managers and investors shapes firms' actual financing behavior. Myers and Majluf (1984) formalize this dynamic through Pecking Order Theory, which explains that firms prioritize internal financing through retained earnings, followed by debt, and resort to equity issuance only as a last option. This financing hierarchy ultimately affects firm value by influencing the cost and availability of capital thereby closing the loop from MM's initial insight on the value relevance of financing decisions. Given that the present study focuses on SMEs, most of which are privately held, attention is restricted to internal financing and debt as the primary funding sources. On the other hand, Trade-Off Theory offers a contrasting prediction regarding firm maturity and leverage. While Pecking Order Theory suggests that older firms rely more on accumulated internal funds and thus exhibit lower leverage, Trade-Off Theory predicts the opposite. Mature firms face reduced agency problems and information asymmetries, which lower their financial distress costs and enhance debt capacity (Kraus and Litzenberger, 1973). Consequently, they should exploit greater tax benefits through higher leverage (Modigliani and Miller, 1963).

2.2 Determinants of SME Capital Structure

A growing body of empirical research examines the determinants of SMEs' capital structure and the financial constraints they face (Joeveer, 2013; McNamara et al., 2017; Demircuc-Kunt et al., 2020; Casino-Martinez et al., 2020). SMEs are consistently shown to be more financially constrained than larger firms (Moscalu et al., 2020) and thus less leverage than their larger counterpart (Demircuc-Kunt et al., 2020), mostly due to higher informational opacity and limited access to external funds (Joeveer, 2013). Information asymmetries play a central role in shaping SMEs' access to finance. Casino-Martinez et al. (2023) show that higher bank concentration can reduce informational frictions and improve financing conditions for constrained firms. Institutional factors, such as credit information sharing and robust legal systems, help ease these financing constraints (McNamara et al., 2017; Demircuc-Kunt et al., 2020). In addition, Chen et al. (2024) show that eponymous¹ firms can signal stronger reputation and higher-quality information to lenders, allowing them to secure cheaper credit, longer maturities, and improved access to long-term financing, particularly for smaller private firms. However, because capital market financing is inaccessible, small and unlisted firms rely on specific banks, making them particularly vulnerable to credit supply shocks (Demircuc-Kunt et al., 2020). Theoretical and empirical evidence consistently demonstrates that financial constraints constitute a defining feature of SMEs (López-Gracia and Sogorb-Mira, 2008), with firm age and size serving as additional determinants, though these characteristics are strongly correlated (Hadlock and Pierce, 2010). Casino-Martinez et al. (2020) further emphasize the strong link between firm age, size, and financial constraints, with

¹ Firms that bear the name of its owner.

younger firms typically facing more severe limitations. Tangible asset availability emerges as a key determinant of debt access. Avery et al. (1998) show that smaller firms rely more heavily on personal guarantees and collateral, whereas larger firms obtain loans without such requirements. By pledging personal wealth, SME owners increase their personal risk exposure while mitigating lenders' concerns about creditworthiness. SMEs with higher levels of fixed assets are better able to signal creditworthiness and secure long-term debt (Mac an Bhaird and Lucey, 2010; La Rocca et al., 2010). Collateral therefore serves as a mechanism to reduce information asymmetry (Bester, 1985), systematically disadvantaging smaller firms with limited asset bases. In contrast, Santos and Cincera (2022) provide contrasting evidence, finding that firm size and age are not statistically significant determinants of financial constraints, suggesting that the relationship may be context-dependent.

2.3 Theoretical Foundations of Corporate Sustainability

More recently, companies' sustainability practices, which have emerged in response to growing concerns over climate change, have become a prominent area of research. Sustainability is a multidimensional concept encompassing economic, environmental, and social considerations. One of the earliest theoretical approaches to this broader view of the firm is Stakeholder Theory (Freeman, 1984), which argues that stakeholders can directly influence firms' capital structure decisions, notably through mechanisms such as trade credit from suppliers that increases working capital and enables firms to support growth (Nicolas, 2022). This stakeholder perspective connects directly to the debate on environmental regulations and firm performance, where Porter's analysis challenges the traditional view that environmental compliance necessarily imposes net costs, arguing instead that well-designed regulations can stimulate innovation that may partially or fully offset compliance costs through improved resource efficiency and productivity gains (Porter and van der Linde, 1995). Hart (1995) operationalizes these concepts through a natural-resource-based view that identifies three interconnected strategies: pollution prevention, product stewardship, and sustainable development. However, he acknowledges that sustainable development strategies require substantial upfront investments with limited certainty regarding short-term financial returns, creating potential tensions for SMEs with constrained access to capital. Building on this view, Elkington's (1997) Triple Bottom Line framework broadens the evaluation criteria by emphasizing the simultaneous assessment of economic, social, and environmental outcomes, while recognizing that sustainable value creation involves both synergies and trade-offs between these dimensions. Environmental innovation may generate internal resources through productivity gains (Porter and van der Linde, 1995), thereby reducing reliance on external financing. This theoretical framework helps explain why green strategies may have different effects on capital structure.

2.4 Green Strategies and Access to Finance in SMEs

Despite the growing importance of small and medium-sized enterprises undertaking the green transition, relatively few studies have thoroughly examined the advantages and disadvantages of sustainable development for SMEs. Drawing on Signaling Theory (Ross, 1977), corporate environmental strategies can be understood as an additional channel through which firms convey information to capital providers. For privately-held SMEs, reduced disclosure requirements regarding the quantity and quality of information create financing obstacles that ultimately undermine firm competitiveness (Palazuelos et al., 2018). Green strategies may therefore serve as a particularly valuable signaling mechanism in this constrained informational environment. By adopting environmental initiatives, these firms signal their commitment to sustainability, long-term value creation, and proactive risk management to banks, private equity investors, and other financial intermediaries. Following the logic of Myers and Majluf (1984), this reduction in perceived information asymmetries should influence financing behavior. Consequently, green strategy adoption may alter the firm's optimal capital structure by affecting both the cost and availability of different financing sources, as lenders and private investors integrate environmental performance into their assessment of firm creditworthiness and future viability.

Some empirical studies suggest that there is a positive link between environmental performance and financial performance (Horváthová, 2010). However, a direct causal relationship remains elusive (Konar and Cohen, 2001). Yet, companies demonstrating strong environmental performance are perceived as lower-risk borrowers and are thus better positioned to secure external financing (Zhang, 2021). In addition to improved financing opportunities, environmental initiatives may lead to cost reductions. De Blick et al. (2022) observe that financially constrained SMEs often adopt management innovations to enhance organizational efficiency, which in turn reduces costs and fosters growth by achieving similar results with fewer resources. Indeed, Hart (1995) argues that green activities, such as resource efficiency and waste reduction, can streamline operations and lower costs. In contrast, Lamperti et al. (2021) finds that green financial policies steer firms toward investing in more productive and cleaner capital, reducing emissions but also increasing financial fragility through higher leverage. However, the precise impact of such policies remains inconclusive. Based on these findings, we hypothesise that :

H1 : External financing may be easier to access for companies that implement internal green strategies.

Drawing on Flash Eurobarometer survey data on “SMEs, resource efficiency, and green markets,” Shrivastava and Tamvada (2019) demonstrate that the adoption of greening strategies can enhance firm profitability. This finding is consistent with broader evidence suggesting that firms with stronger

financial performance are less likely to encounter financial constraints. Schauer et al. (2019) reinforce this view by showing that financially constrained firms typically exhibit lower profitability and reduced investment activity, highlighting profitability as a key mechanism through which financial constraints can be mitigated. Nonetheless, other research underscores the complexities of this relationship. Many firms, particularly SMEs, possess the capacity to invest in environmental performance but refrain from doing so due to perceptions of limited profitability. For example, Di Giuli and Kostovetsky (2014) examine whether corporate social responsibility (CSR) enhances sales via reputational gains and find no evidence to support such claims. Similarly, Simpson et al. (2004) observe that some SMEs regard green investments primarily as cost centres rather than long-term value drivers, a perception that may overlook the reputational and stakeholder benefits associated with environmental responsibility. Indeed, subsequent studies on CSR emphasize the financial advantages of trust and reputation-building. Lins et al. (2017) show that firms engaged in CSR outperform their peers during times of crisis, benefiting from greater stakeholder trust, stronger profitability, higher gross margins, and more robust sales growth. This suggests that stakeholders and investors are more inclined to support firms perceived as trustworthy in periods of economic uncertainty.

H2 : Green strategies increase profitability, which in turn improve internal financing through retained earnings.

Financing conditions also play a critical role in the adoption of greening strategies. Costa et al. (2024) show that restricted access to affordable credit significantly reduces the likelihood of firms pursuing sustainability initiatives, underlining the importance of cost-effective financing. Conversely, firms engaging in environmentally responsible practices are more likely to secure favorable loan conditions. Martin and Moser (2016) find that both institutional and individual investors prioritize CSR initiatives in large firms, leading to greater allocations toward socially responsible funds. From the perspective of financial health, research indicates that firms with greater financial constraints experience significant challenges in accessing external financing, particularly in the aftermath of negative economic shocks (Korajczyk et al., 2003). On this basis, we propose the following hypothesis:

H3 : Leveraged SMEs that adopt green strategies have greater access to external financing.

Cariola et al. (2020) provide evidence that a country's high environmental performance enhances the debt value of energy SMEs. Furthermore, Du et al. (2017) show that lenders view firms in certain industries, especially those aligned with stricter environmental regulations, as lower-risk, offering them cheaper loans and better terms, highlighting how industry and regulatory factors shape lending decisions. This illustrates how some industries can benefit from a green transition, as it improves

access to finance, which can strengthen firms' financial resilience. Building on these insights, we advance the following hypothesis:

H4: The positive relationship between green strategies and access to finance is stronger in industries facing higher environmental regulation and stakeholder pressure.

3 Data and summary statistics

This study utilizes a novel dataset developed by Moretti et al. (2024), created through the statistical matching of two key sources. The first is the Flash Eurobarometer (FE) survey on "SMEs, resource efficiency, and green markets" (waves 3 to 5), which spans the years 2015, 2017, and 2020. This survey² provides cross-sectional data on firms' green strategies, as it does not track the same firms over time. The second source is Orbis Europe, which offers financial and accounting data for private and public companies in Europe for the same years, as well as the years immediately preceding and following them. The datasets are merged using advanced statistical techniques, resulting in a short panel structure for the reference years. Specifically, for the 2015 FE survey, financial data from 2014 to 2016 are included; similarly, for the 2017 and 2020 surveys, financial data from 2016 to 2018 and 2019 to 2021, respectively, are incorporated. However, the dataset does not form a complete panel, as the enterprises surveyed in each wave of the FE survey differ. This means that companies appearing in the 2015 FE survey are not the same as those included in the 2017 or 2020 surveys. The dataset covers 25,772 firms-year operating in several sectors such as mining, manufacturing, services, industry, and retail (NACE codes between B and M), and located in the 27 member states of the European Union, Albania, Iceland, the former Yugoslav Republic of Macedonia (FYROM), Moldova, Montenegro, Norway, Serbia, and the United Kingdom. These countries can be divided into four geographical regions. Table A.3 shows that one region in particular dominates the sample, with 50% of companies coming from Eastern Europe, followed by 19% from the South, 18% from the North and 13% from the West. The advantage of this dataset is that it provides detailed data on firm's green strategies as well as accounting information allowing an in-depth study of the intersection between green activities and capital structure in European SMEs.

3.1 Variables for capital structure

To better understand how a firm finances its operations, we analyze three related but distinct variables, each offering a different perspective on the sources of funding. The main one is financial leverage, defined as the ratio of non-current liabilities and loans to shareholders' equity (Gallucci et al., 2025).

² The survey uses a non-probability quota sampling design. Quotas were set by country and company size to ensure coverage of SMEs and large firms across participating countries. Firms were recruited via Computer-Assisted Telephone Interviewing (CATI) until quotas were met. As the sample is not probabilistic, results should be interpreted as indicative rather than strictly representative of the underlying business population.

Then, another variable that is well-known to be used in order to proxy the capital structure of a company is the long-term debt ratio, defined as the ratio of long-term debt to total assets (Mulier et al., 2016). This metric indicates the extent to which a company's assets are financed through long-term borrowing, shedding light on its financial leverage and debt burden (Korajczyk, 2003). And finally, the third one is the short-term ratio, defined by Gallucci et al. (2025) as the ratio of short-term debt to total assets.

3.2 Green strategies

As highlighted at the beginning of section 3, we use a dataset that has been obtained through statistical matching. Information on green strategies is from the qualitative FE survey. These variables are mostly dummies. In fact, for the green strategy number one (GS1), the survey's question is: "Does your company offer green products or services³? "and the answer can be either 'Yes', 'No but you are planning to do so in the next 2 years' and 'No and you are not planning to do so'. We create a binary variable that is 1 if the company does offer green products or services and 0 otherwise (GS1). Then, green strategy number two was linked to the question "What actions is your company undertaking to be more resource efficient?" As the answer can be one or more resource efficiency actions, we create a dummy that is 1 if the company is taking at least one or more actions and 0 otherwise (GS2). This approach also helps to capture green activities that might otherwise be overlooked. As Block et al. (2025) argue, many environmentally innovative firms may not be identified using traditional metrics based on patents or trademarks, since their innovations tend to focus on internal operational or supply chain improvements aimed at enhancing resource and energy efficiency rather than new product development. More detailed definitions of these variables can be found in the Table A.2 in the Appendix.

3.3 Control variables

Lastly, our choice of control variables was guided by existing literature on capital structure determinants for SMEs. The control variables include firm's age (age), logarithm of total assets (size), level of riskiness of a firm (RISK) (Daskalakis et al., 2017), assets growth (AssetGrow)⁴, cash holding (Cashholding), tangibility controls (TangCont), return of assets before taxes (ROABT), and net working capital (NWC). To calculate RISK indicator, we follow Daskalakis et al. (2017) by considering a three-year rolling window of the standard deviation of earnings before interest and taxes. Assets growth is calculated as the difference between total assets in the current year and the previous year, divided by total assets in the previous year. Cashholding is the ratio of cash and cash equivalents to total assets.

³ Green products and services are those with a predominant function of reducing environmental risk and minimise pollution and resources. For the purpose of this survey, this may also include products with environmental features (e.g. organically produced, eco-labelled, with significant recycled content, or eco-designed...). (Flash Eurobarometer definition)

⁴ We assigned "NA" to observations where the total assets variable has negative values, as such values are not meaningful in this context.

TangCont is measured as the ratio of tangible fixed assets to total assets. ROABT calculated as net income divided by total assets, and NWC calculated as current assets minus current liabilities, scaled by total assets. Finally we use as control also business-to-business (B2B), and business-to-public-institution (B2P) that are dummy variables indicating whether a company targets only businesses or public administrations, where a value of 1 indicates targeting and 0 otherwise.

As noted by Becchetti et al. (2010), size and age are important predictors of a firm's difficulty in obtaining credit. Besides these controls, we also consider assets growth as it affects a firm's cash flow needs and its ability to secure financing. Indeed, according to Whited and Wu (2014), firms with strong investment opportunities are more likely to invest extensively, potentially leading to financial constraints. Then, cash holding is also crucial, as firms with higher cash reserves generally face fewer financial constraints due to greater liquidity for managing operational needs and unexpected expenses. Tangibility control is included because firms with more tangible assets can often secure loans more easily, using these assets as collateral. Lastly, net working capital is crucial for understanding a firm's operational liquidity and financial flexibility, as Baños-Caballero et al. (2014) demonstrate that it significantly impacts corporate performance. In addition to Cariola et al. (2020) controls, we have included ROABT variable (Musso and Schiavo, 2008), as it accounts for differences in financial performance across firms, ensuring that any observed impact of green strategies on financial constraints is not merely a result of varying profitability levels. Moreover, to account for the likelihood that a company will repay the debt it seeks to obtain, and thus the assessment made by any external financing institution or investor, we use the risk indicator developed by Daskalakis et al. (2017). A higher risk level reduces a firm's access to external financing, a pattern that is particularly pronounced for SMEs. These controls ensure that the influence of green strategies on capital structure is independent of other influential factors.

4 Empirical analysis

To assess the impact of green strategies on SMEs' capital structure, we, first, estimate the following model:

$$Y_{i,t+1} = \alpha + \beta_1 GS_{i,t}^{(k)} + \varphi X_{i,t} + \delta_c + \delta_n + \delta_y + \varepsilon_{i,t+1}, \quad k \in \{1,2\} \quad (1)$$

where $Y_{i,t+1}$ denotes a measure of capital structure (e.g., leverage, LT debts ratio, ST debts ratio), GS represents green strategy indicators for $k = 1$ (GS1: offers green products/services) and $k = 2$ (GS2: resource-efficiency actions), $X_{i,t}$ is a vector of control variables (RISK, size (log assets), log age, asset growth, cash holding, tangibility, net working capital, ROA, B2B and B2P). Additionally, we included country (δ_c), industry (δ_n), and year (δ_y) fixed effects. For the timing of our variables, GS is measured

at t (FE survey) and the outcomes at $t+1$ (Orbis). We employ three estimation methods: ordinary least squares (OLS), an entropy balancing model and PSM approach.

Subsequently, to mitigate omitted-variable bias arising from the joint occurrence of strategies, we employ equation (2) to estimate the direct effect of each strategy while conditioning on the other. Given the low pairwise correlation between GS1 and GS2, concerns regarding multicollinearity are minimal.

$$Y_{i,t+1} = \alpha + \beta_1 GS1_{i,t} + \beta_2 GS2_{i,t} + \varphi X_{i,t} + \delta_c + \delta_n + \delta_y + \varepsilon_{i,t+1} \quad (2)$$

Moreover, we include the interaction term $GS1 \times GS2$ to assess whether the strategies operate as complements or substitutes. This term captures whether the joint adoption of both strategies influences financing outcomes beyond the sum of their individual effects. A positive coefficient ($\beta_3 > 0$) indicates complementarity, whereas a negative coefficient ($\beta_3 < 0$) suggests substitution. If β_3 is approximately zero, the effects of GS1 and GS2 are additive and largely independent.

$$Y_{i,t+1} = \alpha + \beta_1 GS1_{i,t} + \beta_2 GS2_{i,t} + \beta_3 (GS1_{i,t} \times GS2_{i,t}) + \varphi X_{i,t} + \delta_c + \delta_n + \delta_y + \varepsilon_{i,t+1} \quad (3)$$

Finally, we extend our baseline (1) by introducing an interaction term between $GS^{(k)}$ and ω_j in equation (2) to assess effect heterogeneity and to examine whether the strategies operate as complements or substitutes along dimension j . In our context, ω_j may capture several firm-level characteristics, including **Levtsup0**, an indicator equal to 1 if the firm carries debt at time t and 0 otherwise; **Size**, a continuous variable; **GreenIndustry**, which equals 1 for firms classified in environmentally oriented industries and 0 otherwise; and **AssetGrow**, which proxies whether the firm is in an investment-intensive phase.

$$Y_{i,t+1} = \alpha + \beta_1 (GS_{i,t}^{(k)} \times \omega_j) + \varphi X_{i,t} + \delta_c + \delta_n + \delta_y + \varepsilon_{i,t+1}, \quad k \in \{1,2\}, \quad j \in J \quad (4)$$

4.1 Methodology

The scientific methodology employed to examine our hypotheses involves estimating equation (1) using three different methods; ordinary least squares, an entropy balancing regression and a PSM approach. Initially, we apply OLS to assess the impact of each green strategy on various financial measures. This approach involves testing each strategy against each indicator sequentially. In our case, the dependent variable is a measure of capital structure, and the independent variable is the green strategy.

Previous research has largely focused on the effect of funding choices on green strategies, often identifying only association rather than a definitive causal link (Konar and Cohen, 2001). In contrast,

we hypothesize that, given the current economic environment, SMEs that implement green strategy may experience improved access to credit due to their adherence to green regulations or enhanced market appeal as consumers increasingly prefer sustainable businesses. To establish a clear effect, we test our results by doing an entropy balancing method and a PSM approach as Albitar et al. (2023) have been doing to test endogeneity.

4.2 Results

The initial results from the full-sample analysis reveal several consistent patterns across specifications (1), (2), and (3). Table 2 provides a detailed assessment of the effects of each green strategy on the three measures of capital structure. We find that launching green products or services (GS1) has no statistically significant effect on firms' financing choices, suggesting that external, market-oriented green initiatives do not materially alter capital structure decisions. In contrast, resource-efficiency actions (GS2) are linked to lower leverage, suggesting that firms adopting GS2 rely less on external debt, which is inconsistent with the expectations of our first hypothesis. Consistent with these findings, the interaction model reported in Table 3 shows that GS2 continues to exert a negative effect on leverage. Moreover, for short-term debt, the interaction between GS1 and GS2 suggests a complementary relationship: both strategies, individually, are linked to decreased access to short-term debt, and their joint implementation reinforces this pattern.

[Insert Table 2 and 3 about here.]

Our dataset focuses on SMEs, and a notable share of these firms report leverage equal to 0. This is not uncommon in SME samples, as many small firms either avoid debt due to limited collateral (Demirguc-Kunt et al., 2020) or rely primarily on internal financing (Joeveer, 2013). However, the presence of many firms with leverage equal to 0 can weaken the significance of our results, as these firms may behave differently compared to their leveraged counterparts. To address this, in Table 4 we introduce an interaction between green strategies and a dummy variable, $Levtsup0$, which equals 1 if the firm has a non-zero leverage at time t . Introducing this interaction allows us to examine whether the effect of green strategies differs between firms that are already engaged in debt financing and those that are not. The results in Table 4 reveal meaningful heterogeneity. For overall leverage, the coefficient on GS1 remains negative and marginally significant, indicating that firms launching green products tend to exhibit lower future leverage. However, the interaction term $GS1 \times Levtsup0$ is not statistically significant, suggesting that this negative association does not differ systematically between leveraged and non-leveraged firms. Conversely, evidence suggests that firms with higher debt burdens often reduce their reliance on long-term borrowing and progressively lower their leverage ratios (Demirguc-Kunt et al., 2020). For long-term debt, neither GS1 nor its interaction with $Levtsup0$ exhibits a

statistically significant effect, implying that green product strategies do not meaningfully influence firms' access to or use of long-term borrowing. By contrast, for short-term debt, the interaction term becomes positive and statistically significant, which confirm our third hypothesis. This indicates that among firms with existing debt, the adoption of GS1 is associated with an increase in short-term indebtedness at $t + 1$. One possible interpretation is that indebted SMEs may rely more heavily on short-term financing to support green product development, perhaps due to its flexibility or lower collateral requirements. Non-leveraged firms, by comparison, do not exhibit this pattern.

[Insert Table 4 about here.]

In Table 5, we report the regression results incorporating the interaction between green strategies and firm size. The aim of this specification is to assess whether larger SMEs benefit from easier access to external finance when implementing green strategies. The results indicate no statistically significant interaction effects, suggesting that firm size does not materially condition the relationship between green strategies and financing outcomes.

[Insert Table 5 about here.]

Table 6 shows that the adoption of resource-efficiency strategies (GS2) is associated with a significant reduction in overall leverage for firms outside green industries. However, this negative effect is largely offset among firms operating in green sectors, as indicated by the positive and significant interaction term $GS2 \times GreenIndustry$. This suggests that the leverage-reducing effect of GS2 is primarily driven by non-green-industry SMEs, whereas green-industry firms already characterized by lower debt ratios exhibit little additional adjustment. Therefore, these results are consistent with our fourth hypothesis, which posits that industry context shapes the financial implications of adopting green strategies. The observed heterogeneity indicates that firms in green-oriented industries experience different financing outcomes than those in other sectors. In particular, the industry effect manifests primarily through leverage, as no significant differences arise for long-term or short-term debt.

[Insert Table 6 about here.]

Table 7 further investigates whether the effects of green strategies vary depending on firms' investment intensity, proxied by the growth rate of tangible assets. The results reveal no meaningful heterogeneity for GS1. Its modest negative association with leverage remains unchanged across investment phases, and no significant effects emerge for long- or short-term debt. By contrast, GS2 displays strong differential effects. While resource-efficiency actions reduce leverage among firms not engaged in investment, the interaction term $GS2 \times AssetGrow$ is positive and significant, indicating that firms in an investment phase tend to increase their use of debt when implementing GS2. This suggests

that resource-efficiency actions may require additional external financing when combined with broader investment efforts, whereas non-investing firms respond by reducing leverage.

[Insert Table 7 about here.]

Given the potential for endogeneity in our results, we perform additional robustness checks using both the entropy balancing method and the PSM approach (Table 8). First, we apply an entropy-based reweighting technique that adjusts the distribution of covariates in the control group to match the covariate moments of the treatment group. To apply entropy balancing, we use our binary variables GS1 and GS2 that include the treatment (companies that do green strategies) and control groups. Second, we further address endogeneity concerns by implementing a PSM procedure. We perform the matching separately for GS1 and GS2, using each variable in turn as the treatment indicator. For each treatment variable, we estimate the first stage with a logit model using our firm-specific controls and fixed effects, compute the corresponding propensity scores, and apply nearest-neighbour matching. After obtaining the matched samples, we re-estimate our main model using our three measures of capital structure as dependent variables and report the matched-sample results.

[Insert Table 8 about here.]

The results remain consistent across specifications. Our variables of interest are GS1 and GS2, and the baseline model is tested. The findings are consistent with our main analysis and show a negative association between GS2 and leverage, suggesting a higher use of equity or a lower reliance on external financing when firms undertake resource efficiency initiatives. For GS1, we continue to find no significant association, indicating that this green strategy does not materially influence the way firms finance their core business activities.

5 Conclusions

Research on SMEs is often neglected, commonly attributed to poor data availability. However, as Zingales (2000) argues, this neglect is not driven by data limitations alone. While data on large public firms are more readily available, this is partly because sustained research interest has encouraged their systematic collection. In this spirit, this paper exploits a novel dataset that can also support future research on SMEs and thereby contribute more broadly to the literature.

Using this new dataset, the paper provides fresh evidence on the financial implications of environmental strategies among European SMEs. We examine how green strategies affect capital structure across 32 European countries. Our findings suggest that green strategies have a limited overall effect on SMEs' financing choices. Specifically, resource-efficiency actions (GS2) are associated

with lower leverage, whereas the sale of green products or services (GS1) does not have a statistically significant impact on debt levels.

Our study provides valuable insights for policymakers seeking to foster sustainable practices in SMEs. Targeted support for external green improvements may generate financial benefits, whereas internal green strategies remain controversial in terms of their effectiveness in easing access to debt financing. Future research could build on this analysis by examining how the cost of debt varies depending on the type of transition companies pursue. Moreover, further investigation is needed into the role of public incentives in supporting SMEs' green investments, particularly in how such incentives might serve as collateral to facilitate access to external financing during investment phases.

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Tables

Table 1 - Summary Statistics

Variables	Mean	Median	Std. deviation	Min	Max	Obs.	
GS1 (Launching green products/services)	0.317	0	0.465		0	1	24,548
GS2 (Resource efficiency actions)	0.89	1	0.313		0	1	25,637
Leverage	0.484	0.023	1.965	-5.243	13.497		23,070
Long-Term (LT) debt on assets	0.109	0	0.208		0	1.203	17,705
Short-Term (ST) debt on assets	0.073	0	0.173		0	1.16	19,658
RISK	157.574	31.695	588.202		0	17482.651	22,556
Size (Log(Asset))	6.339	6.454	2.111	0.732	10.668		25,772
LogAge	26.64	23	19.569		3	122	25,772
Asset growth	0.156	0.019	0.68	-0.673	5.037		25,298
Cash holding	0.206	0.115	0.232		0	0.97	24,175
Tangibility controls	0.252	0.16	0.257		0	0.951	24,792
Return on asset	0.07	0.05	0.196	-0.638	0.717		24,474
Net working capital	0.182	0.273	0.681	-4.2	0.973		25,551

Table 2 - Baseline estimation

Variable	Leverage_lead			LTonTOAS_lead			STonTOAS_lead		
(Intercept	1.269***	1.281***	1.322***	0.242***	0.246***	0.248***	0.097***	0.108***	0.104***
	0.198	0.189	0.191	0.031	0.03	0.031	0.035	0.034	0.035
GS1	-0.042		-0.037	0.001		0.001	-0.002		-0.002
	0.028		0.029	0.003		0.003	0.002		0.002
GS2		-0.074*	-0.066*		0.000	-0.001	0.000	0.000	0.000
		0.04	0.038		0.005	0.005	0.000	0.000	0.000
RISK	-0.000*	-0.000*	-0.000*	0.000	0.000	0.000		-0.005	-0.005
	0.0000	0.0000	0.000	0.000	0.000	0.000		0.003	0.004
size	0.044***	0.047***	0.045***	-0.002	-0.001	-0.002	0.002	0.002	0.002
	0.013	0.014	0.014	0.002	0.002	0.002	0.002	0.002	0.002
LogAge	-0.150***	-0.151***	-0.148***	-0.018***	-0.020***	-0.019***	-0.003	-0.004	-0.003
	0.031	0.032	0.032	0.004	0.004	0.004	0.003	0.003	0.003
AssetGrow	0.110***	0.109***	0.109***	0.011**	0.012***	0.011**	0.009	0.008	0.009
	0.028	0.029	0.029	0.004	0.004	0.004	0.01	0.01	0.01
Casholding	-0.570***	-0.529***	-0.569***	-0.092***	-0.089***	-0.092***	-0.053***	-0.050***	-0.053***
	0.098	0.101	0.098	0.015	0.014	0.015	0.012	0.011	0.012
TangCont	0.777***	0.791***	0.778***	0.149***	0.147***	0.148***	-0.064***	-0.065***	-0.064***
	0.103	0.106	0.103	0.018	0.018	0.018	0.016	0.016	0.016
ROABT	-0.298***	-0.318***	-0.308***	-0.095***	-0.095***	-0.095***	-0.035***	-0.036***	-0.036***
	0.103	0.098	0.102	0.016	0.016	0.016	0.013	0.013	0.013
NWC	0.149***	0.158***	0.149***	0.011*	0.010*	0.011*	-0.093***	-0.095***	-0.094***
	0.029	0.03	0.028	0.006	0.005	0.006	0.017	0.017	0.017
B2B	-0.023	-0.032	-0.023	-0.005	-0.005*	-0.005*	0.002	0.001	0.002
	0.038	0.041	0.039	0.003	0.003	0.003	0.003	0.003	0.003
B2P	-0.017	-0.006	-0.014	-0.002	-0.002	-0.003	-0.006***	-0.006***	-0.006***
	0.025	0.024	0.025	0.003	0.003	0.003	0.002	0.002	0.002
Industry	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year	Y	Y	Y	Y	Y	Y	Y	Y	Y
R2.Adj	0.04644027	0.04570051	0.04653474	0.1577559	0.1573336	0.1572284	0.1945266	0.1983603	0.1956494
Obs.	18456	19282	18381	14572	14513	14513	16097	16807	16030

Note: The table reports regressions coefficients. The independent variable we focus on are GS1 (launching green products and/or services) and GS2 (implementing resource efficiency actions). The dependent variable and the estimation method are reported at the top of each column. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Table 3 - Baseline with GS interaction

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.326***	0.251***	0.107***
	0.193	0.032	0.035
GS1	-0.062	-0.017	-0.022**
	0.084	0.01	0.011
GS2	-0.071*	-0.004	-0.009**
	0.038	0.006	0.004
GS1*GS2	0.026	0.019*	0.021**
	0.087	0.01	0.01
RISK	-0.000*	0.000	0.000
	0.000	0.000	0.000
size	0.045***	-0.002	0.002
	0.014	0.002	0.002
LogAge	-0.148***	-0.019***	-0.003
	0.032	0.004	0.003
AssetGrow	0.109***	0.011**	0.009
	0.029	0.004	0.01
Casholding	-0.569***	-0.092***	-0.053***
	0.098	0.015	0.012
TangCont	0.778***	0.148***	-0.064***
	0.103	0.018	0.016
ROABT	-0.308***	-0.095***	-0.036***
	0.102	0.016	0.013
NWC	0.149***	0.011*	-0.094***
	0.028	0.006	0.017
B2B	-0.023	-0.005*	0.002
	0.039	0.003	0.003
B2P	-0.014	-0.003	-0.006***
	0.025	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.Adj	0.0464854	0.1573152	0.195858
Obs.	18381	14513	16030

Note: The table reports regressions coefficients. The independent variable we focus on are GS1 (launching green products and/or services) and GS2 (implementing resource efficiency actions). The dependent variable and the estimation method are reported at the top of each column. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Table 4 : OLS interaction Leverage time t = 0 dummy

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.346***	0.241***	0.095***
	0.199	0.03	0.035
GS1	-0.096*	0.005	-0.005
	0.056	0.005	0.003
GS1*Levtsup0	0.106	-0.007	0.005*
	0.076	0.006	0.003
Levtsup0	0.334***	-0.024***	-0.002
	0.036	0.007	0.002
RISK	0.000	0.000	0.000
	0.000	0.000	0.000
size	0.006	0.000	0.002
	0.012	0.002	0.002
LogAge	-0.164***	-0.017***	-0.003
	0.031	0.003	0.004
AssetGrow	0.118***	0.011**	0.009
	0.028	0.004	0.011
Casholding	-0.542***	-0.094***	-0.052***
	0.096	0.016	0.011
TangCont	0.688***	0.155***	-0.063***
	0.100	0.018	0.015
ROABT	-0.480***	-0.083***	-0.037***
	0.092	0.015	0.014
NWC_cal	0.106***	0.016***	-0.093***
	0.03	0.006	0.017
B2B	-0.035	-0.005	0.002
	0.04	0.003	0.003
B2P	-0.026	-0.001	-0.006***
	0.026	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.07562468	0.1751179	0.193398
Obs	18639	14648	16133

Note: The interaction term captures how the effect of GS1 on the outcome depends on Levtsup0—an indicator that takes the value 1 if the firm has debt at time t and 0 otherwise—and how this relationship varies with our dependent variable. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.393***	0.246***	0.107***
	0.182	0.031	0.034
GS2	-0.132	-0.001	-0.006
	0.093	0.007	0.005
GS2*Levtsup0	0.15	0.000	0.005
	0.164	0.008	0.005
Levtsup0	0.215	-0.026***	-0.005
	0.159	0.008	0.005
RISK	0.000	0.000	0.000
	0.000	0.000	0.000
size	0.011	0.001	0.002
	0.012	0.002	0.002
LogAge	-0.163***	-0.019***	-0.004
	0.031	0.004	0.004
AssetGrow	0.117***	0.011**	0.008
	0.029	0.004	0.01
Casholding	-0.501***	-0.092***	-0.049***
	0.102	0.015	0.011
TangCont	0.706***	0.153***	-0.064***
	0.106	0.018	0.015
ROABT	-0.487***	-0.083***	-0.038***
	0.092	0.016	0.013
NWC_cal	0.116***	0.014***	-0.094***
	0.033	0.005	0.017
B2B	-0.042	-0.005*	0.002
	0.042	0.003	0.003
B2P	-0.015	-0.001	-0.006***
	0.025	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.07167253	0.1739437	0.1954544
Obs	19491	15303	16854

Note: The interaction term captures how the effect of GS2 on the outcome depends on Levtsup0—an indicator that takes the value 1 if the firm has debt at time t and 0 otherwise—and how this relationship varies with our dependent variable. All the regressions include year, industry and country fixed effects.

Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Table 5 : OLS interaction size

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.283***	0.242***	0.096***
	0.202	0.032	0.036
GS1	-0.026	0.000	-0.001
	0.113	0.013	0.014
GS1*size	-0.002	0.000	0.000
	0.015	0.002	0.002
size	0.037***	-0.002	0.002
	0.014	0.002	0.002
RISK	-0.000*	0.000	0.000
	0.000	0.000	0.000
LogAge	-0.148***	-0.018***	-0.003
	0.031	0.004	0.003
AssetGrow	0.109***	0.011**	0.009
	0.029	0.004	0.01
Casholding	-0.577***	-0.092***	-0.053***
	0.098	0.015	0.011
TangCont	0.783***	0.149***	-0.065***
	0.103	0.018	0.016
ROABT	-0.305***	-0.095***	-0.035***
	0.103	0.016	0.013
NWC_cal	0.153***	0.011*	-0.093***
	0.028	0.006	0.017
B2B	-0.023	-0.005	0.002
	0.039	0.003	0.003
B2P	-0.016	-0.002	-0.006***
	0.025	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.04616788	0.1576973	0.1944637
Obs	18456	14572	16097

Note: The interaction term captures how the effect of GS1 on the outcome depends on Size, measured as the logarithm of total assets, and how this relationship varies with the dependent variable. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.211***	0.230***	0.118***
	0.224	0.034	0.038
GS2	0.029	0.019	-0.016
	0.115	0.016	0.015
GS2*size	-0.017	-0.003	0.002
	0.02	0.002	0.002
size	0.055**	0.001	0.001
	0.026	0.003	0.002
RISK	-0.000*	0.000	0.000
	0.000	0.000	0.000
LogAge	-0.148***	-0.019***	-0.004
	0.031	0.004	0.003
AssetGrow	0.109***	0.012***	0.008
	0.03	0.004	0.01
Casholding	-0.534***	-0.089***	-0.050***
	0.101	0.014	0.011
TangCont	0.798***	0.147***	-0.066***
	0.106	0.018	0.016
ROABT	-0.325***	-0.094***	-0.036***
	0.098	0.016	0.013
NWC_cal	0.162***	0.010*	-0.095***
	0.03	0.005	0.017
B2B	-0.031	-0.005*	0.001
	0.041	0.003	0.003
B2P	-0.006	-0.002	-0.006***
	0.024	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.04547586	0.1573799	0.1983545
Obs	19282	15219	16807

Note: The interaction term captures how the effect of GS1 on the outcome depends on Size, measured as the logarithm of total assets, and how this relationship varies with the dependent variable. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Table 6 : OLS interaction green industry

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.551***	0.266***	0.106***
	0.156	0.027	0.02
GS1	-0.075*	-0.005	0.002
	0.039	0.004	0.003
GS1* GreenIndustry	0.065	0.010	-0.006
	0.06	0.006	0.004
GreenIndustry	-0.065	0.002	-0.002
	0.041	0.005	0.003
RISK	-0.000**	0.000	0.000
	0.000	0.000	0.000
size	0.046***	-0.002	0.002
	0.013	0.002	0.002
LogAge	-0.150***	-0.018***	-0.003
	0.032	0.004	0.003
AssetGrow	0.110***	0.011**	0.009
	0.029	0.004	0.01
Cashholding	-0.564***	-0.090***	-0.056***
	0.097	0.015	0.011
TangCont	0.810***	0.161***	-0.068***
	0.100	0.019	0.016
ROABT	-0.302***	-0.096***	-0.036***
	0.104	0.016	0.014
NWC_cal	0.147***	0.009	-0.093***
	0.029	0.006	0.017
B2B	-0.028	-0.007**	0.003
	0.035	0.003	0.003
B2P	-0.019	-0.005	-0.007***
	0.025	0.003	0.002
Industry	N	N	N
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.04570652	0.1553182	0.192812
Obs	18778	14710	16280

Note: The interaction term captures how the effect of GS1 on the outcome depends on the type of industry, classify in two groups - either green or brown, and how this relationship varies with the dependent variable. All the regressions include year and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.640***	0.267***	0.116***
	0.163	0.028	0.02
GS2	-0.158**	-0.005	-0.009
	0.061	0.007	0.006
GS2* GreenIndustry	0.145*	0.008	0.007
	0.085	0.010	0.007
GreenIndustry	-0.181**	-0.002	-0.011
	0.092	0.009	0.008
RISK	-0.000**	0.000	0.000
	0.000	0.000	0.000
size	0.049***	-0.001	0.002
	0.013	0.002	0.002
LogAge	-0.152***	-0.019***	-0.003
	0.032	0.004	0.003
AssetGrow	0.108***	0.011***	0.008
	0.030	0.004	0.010
Cashholding	-0.523***	-0.088***	-0.053***
	0.100	0.014	0.010
TangCont	0.823***	0.157***	-0.069***
	0.102	0.018	0.015
ROABT	-0.323***	-0.096***	-0.037***
	0.098	0.016	0.013
NWC_cal	0.156***	0.008	-0.094***
	0.03	0.005	0.017
B2B	-0.037	-0.008***	0.002
	0.037	0.003	0.003
B2P	-0.011	-0.005	-0.007***
	0.025	0.003	0.002
Industry	N	N	N
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.04514673	0.1550642	0.1948167
Obs	19631	15367	17004

Note: The interaction term captures how the effect of GS2 on the outcome depends on the type of industry, classify in two groups - either green or brown, All the regressions include year and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Table 7 : OLS interaction growth rate of tangible asset

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.271***	0.242***	0.097***
	0.198	0.031	0.035
GS1	-0.053**	0.002	-0.001
	0.025	0.003	0.002
GS1* AssetGrow	0.076	-0.008	-0.004
	0.073	0.005	0.004
AssetGrow	0.086***	0.014***	0.01
	0.024	0.005	0.011
RISK	-0.000**	0.000	0.000
	0.000	0.000	0.000
size	0.044***	-0.002	0.002
	0.013	0.002	0.002
LogAge	-0.150***	-0.018***	-0.003
	0.031	0.004	0.003
Casholding	-0.570***	-0.092***	-0.053***
	0.098	0.015	0.012
TangCont	0.776***	0.149***	-0.064***
	0.102	0.018	0.016
ROABT	-0.297***	-0.095***	-0.035***
	0.103	0.016	0.013
NWC_cal	0.149***	0.011*	-0.093***
	0.028	0.006	0.017
B2B	-0.023	-0.005	0.002
	0.038	0.003	0.003
B2P	-0.016	-0.002	-0.006***
	0.025	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.04631268	0.1578788	0.1945105
Obs	18456	14572	16097

Note: The interaction term captures how the effect of GS1 on the outcome depends on whether a companies is in an investment phase (proxies by the growth of tangible assets), and how this relationship varies with the dependent variable. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Variable	Leverage_lead	LTonTOAS_lead	STonTOAS_lead
(Intercept	1.299***	0.246***	0.107***
	0.187	0.03	0.035
GS2	-0.094**	-0.001	-0.004
	0.041	0.005	0.004
GS2* AssetGrow	0.115***	0.002	-0.007
	0.039	0.007	0.009
AssetGrow	0.011	0.01	0.014
	0.025	0.006	0.016
RISK	-0.000**	0.000	0.000
	0.000	0.000	0.000
size	0.047***	-0.001	0.002
	0.014	0.002	0.002
LogAge	-0.151***	-0.020***	-0.004
	0.032	0.004	0.003
Casholding	-0.529***	-0.089***	-0.050***
	0.101	0.014	0.011
TangCont	0.791***	0.147***	-0.065***
	0.106	0.018	0.016
ROABT	-0.316***	-0.094***	-0.036***
	0.098	0.016	0.012
NWC_cal	0.157***	0.010*	-0.095***
	0.03	0.005	0.017
B2B	-0.031	-0.005*	0.001
	0.041	0.003	0.003
B2P	-0.006	-0.002	-0.006***
	0.025	0.003	0.002
Industry	Y	Y	Y
Country	Y	Y	Y
Year	Y	Y	Y
R2.adj	0.04564354	0.1572767	0.1984047
Obs	19282	15219	16807

Note: The interaction term captures how the effect of GS2 on the outcome depends on whether a companies is in an investment phase (proxies by the growth of tangible assets), and how this relationship varies with the dependent variable. All the regressions include year, industry and country fixed effects. Under the coefficients are robust standard errors.

* Coefficient significant at 10% confidence level.

** Coefficient significant at 5% confidence level.

*** Coefficient significant at 1% confidence level.

Table 8 : Endogeneity test.

Variable	Entropy balancing			PSM		
	Ext. Fin - Lev	Ext. Fin - LTDT	Ext. Fin - STDT	Ext. Fin - Lev	Ext. Fin - LTDT	Ext. Fin - STDT
GS1	-0.043	0.001	-0.002	-0.027	0.000	-0.005*
	0.026	0.003	0.002	0.033	0.003	0.003
RISK	-0.000*	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
size	0.031**	-0.002	0.001	0.038***	-0.002*	0.001
	0.012	0.002	0.002	0.011	0.001	0.001
LogAge	-0.139***	-0.019***	-0.003	-0.125***	-0.020***	-0.002
	0.036	0.004	0.003	0.027	0.003	0.002
AssetGrow	0.132***	0.010**	0.01	0.169***	0.012***	0.008***
	0.043	0.004	0.011	0.028	0.003	0.002
Casholding	-0.607***	-0.095***	-0.057***	-0.559***	-0.095***	-0.048***
	0.097	0.015	0.011	0.093	0.01	0.008
TangCont	0.814***	0.153***	-0.061***	0.827***	0.155***	-0.065***
	0.109	0.02	0.016	0.077	0.008	0.006
ROABT	-0.324***	-0.105***	-0.036**	-0.318***	-0.111***	-0.032***
	0.121	0.02	0.014	0.098	0.01	0.008
NWC	0.163***	0.012*	-0.091***	0.168***	0.009**	-0.096***
	0.031	0.007	0.016	0.038	0.004	0.003
B2B	-0.018	-0.004	0.005	-0.017	-0.004	0.004
	0.047	0.003	0.003	0.042	0.004	0.004
B2P	-0.014	0.000	-0.006***	-0.032	-0.001	-0.005*
	0.023	0.003	0.002	0.036	0.004	0.003
Industry	Y	Y	Y	Y	Y	Y
Country	Y	Y	Y	Y	Y	Y
Year	Y	Y	Y	Y	Y	Y
Intercept	1.461***	0.247***	0.099***	1.227***	0.247***	0.113***
	0.211	0.029	0.035	0.329	0.033	0.029
R2.adj	0.04650903	0.1617566	0.1942822	0.045	0.167	0.197
Obs	18456	14572	16097	11788	9634	10426

Variable	Entropy balancing			PSM		
	Ext. Fin - Lev	Ext. Fin - LTDT	Ext. Fin - STDT	Ext. Fin - Lev	Ext. Fin - LTDT	Ext. Fin - STDT
GS2	-0.104*	-0.002	-0.005	-0.259**	-0.014	-0.008
	0.057	0.005	0.004	0.126	0.013	0.011
RISK	-0.000**	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
	0.034	0.000	0.001	0.059***	0.001	0.002
	0.022	0.002	0.002	0.02	0.002	0.002
	-0.157***	-0.018***	0.002	-0.195***	-0.015***	0
	0.041	0.006	0.007	0.049	0.005	0.004
row	0.069***	0.009**	0.016	0.078	0.007	0.009*
	0.024	0.004	0.016	0.052	0.005	0.005
ding	-0.660***	-0.101***	-0.045***	-0.670***	-0.099***	-0.038***
	0.115	0.016	0.015	0.159	0.017	0.014
int	0.850***	0.141***	-0.064***	0.672***	0.116***	-0.081***
	0.185	0.02	0.019	0.136	0.014	0.012
	-0.328***	-0.085***	-0.028	-0.244	-0.074***	-0.030*
	0.115	0.017	0.02	0.176	0.018	0.016
	0.179***	0.013*	-0.108***	0.106*	0.001	-0.125***
	0.046	0.007	0.022	0.064	0.007	0.006
B2B	-0.036	-0.007	0.003	0.034	-0.001	0.004
	0.062	0.005	0.005	0.078	0.008	0.007
B2P	0.041	-0.004	-0.006	0.055	-0.002	0.001
	0.046	0.003	0.004	0.068	0.007	0.006
Industry	Y	Y	Y	Y	Y	Y
Country	Y	Y	Y	Y	Y	Y
Year	Y	Y	Y	Y	Y	Y
Intercept	0.911***	0.220***	0.155***	1.374***	0.217***	0.123**
	0.209	0.045	0.038	0.485	0.046	0.055
R2.adj	0.05531928	0.1659913	0.2091854	0.034	0.166	0.232
Obs	19282	15219	16807	4146	3108	3286

Variables are defined in Table 1.

* p < 0.1.

** p < 0.05.

*** p < 0.01.

Appendix

Data cleaning steps

To enable consistent temporal analysis, we deflated all monetary variables using the GDP deflator to control for inflation effects. To improve the quality of the data, we systematically removed observations with unreliable or erroneous values, especially negative figures for important financial metrics such as total assets, intangible assets, tangible assets, capital, cash, long-term debt, short-term debt, sales and turnover. Due to differences in their capital structure that could skew our results, the Financial and Insurance Services sector (NACE Rev. 2 – K) has been omitted. Acknowledging the potential for distortion caused by extreme outliers, we applied winsorisation to all continuous variables at the first and 99th percentiles.

Table A.1 - Criteria for firm selection

Sampling criteria
1. The number of employees: min is 1 and max is 249.
2. Annual turnover (= Operating revenue): min €1 and max is €50,000,000.
3. Balance sheet total (= Total asset) : min is €1 and max is €43,000,000.

Table A.2 - Definitions and sources of dependent and independent variables.

Variable	Description	Source
GS1	Dummy variable equal to 1 if the firm offers green products or services.	Flash Eurobarometer
GS2	Dummy variable equal to 1 if the firm engages in resource efficiency activities.	Flash Eurobarometer
Leverage_lead	Ratio of non-current liabilities and loans to shareholders' equity (lead value — data from the following year).	Bureau Van Dijk Amadeus database
LTonTOAS_lead	Ratio of long-term financial obligations (including loans and credit) to total assets (lead value).	Bureau Van Dijk Amadeus database
STonTOAS_lead	Ratio of financial obligations due within 1 year (e.g., loans from credit institutions and current portions of long-term debt) to total assets (lead value).	Bureau Van Dijk Amadeus database
LogAge	Natural logarithm of the number of years since the firm's establishment.	Bureau Van Dijk Amadeus database
RISK	Three-year rolling window of the standard deviation of earnings before interest and taxes.	Bureau Van Dijk Amadeus database
Size	Natural logarithm of total firm assets.	Bureau Van Dijk Amadeus database
AssetGrow	One-year growth rate of total assets.	Bureau Van Dijk Amadeus database
Cashholding	Ratio of cash holdings to total assets.	Bureau Van Dijk Amadeus database
TangCont	Ratio of tangible fixed assets to total assets.	Bureau Van Dijk Amadeus database
ROABT	Return on assets (ROA), calculated as net income divided by total assets.	Bureau Van Dijk Amadeus database
NWC	Net working capital, calculated as current assets minus current liabilities, scaled by total assets.	Bureau Van Dijk Amadeus database
B2B	Dummy variable equal to 1 if the firm sells products/services exclusively to other businesses.	Flash Eurobarometer
B2P	Dummy variable equal to 1 if the firm sells products/services exclusively to public administrations.	Flash Eurobarometer

Table A.3 - Final sample with GS adoption description

No.	Country	GS1	%	GS2	%	GS1 & GS2	%	N
1	AT	179	46%	372	96%	177	46%	389
2	BE	297	33%	854	94%	289	32%	908
3	BG	187	21%	744	82%	169	19%	911
4	CY	84	30%	235	84%	76	27%	279
5	CZ	224	23%	896	92%	216	22%	971
6	DE	113	35%	297	93%	110	34%	321
7	DK	101	36%	242	86%	92	33%	283
8	EE	265	23%	820	71%	216	19%	1160
9	ES	359	30%	1127	95%	351	29%	1191
10	FI	401	39%	964	93%	385	37%	1036
11	FR	363	32%	1067	94%	355	31%	1140
12	GB	185	31%	583	97%	184	31%	600
13	GR	424	33%	1036	81%	390	31%	1274
14	HR	265	26%	930	93%	254	25%	1002
15	HU	196	17%	1023	90%	185	16%	1135
16	IE	124	36%	317	91%	112	32%	349
17	IS	168	44%	351	91%	159	41%	384
18	IT	190	21%	828	90%	186	20%	915
19	LT	236	30%	691	88%	220	28%	789
20	LU	34	41%	73	89%	32	39%	82
21	LV	283	23%	1042	85%	253	21%	1227
22	ME	36	21%	145	85%	31	18%	171
23	MK	163	27%	435	72%	141	23%	605
24	NL	163	36%	419	94%	159	35%	448
25	NO	326	46%	592	84%	293	41%	707
26	PL	304	26%	1031	90%	276	24%	1150
27	PT	374	32%	1093	95%	359	31%	1153
28	RO	279	23%	949	79%	257	21%	1203
29	RS	92	25%	329	89%	87	24%	369
30	SE	567	46%	1180	96%	554	45%	1234
31	SI	422	33%	1108	87%	392	31%	1276
32	SK	373	34%	1043	94%	360	32%	1110
Total								25772

No.	Region	GS1	%	GS2	%	GS1 & GS2	%	N	%
1	East	3289	25%	11041	86%	3026	23%	12908	50%
2	North	1872	41%	4229	92%	1779	39%	4593	18%
3	South	1467	29%	4464	90%	1393	28%	4983	19%
4	West	1149	35%	3082	94%	1122	34%	3288	13%
Total								25772	100%

No.	Wave Year	GS1	%	GS2	%	GS1 & GS2	%	N
1	2015	2159	27%	6777	86%	1992	25%	7886
2	2017	2143	28%	6669	87%	2002	26%	7699
3	2021	3475	34%	9370	92%	3326	33%	10187
Total								25772

No.	Industry	GS1	%	GS2	%	GS1 & GS2	%	N
1	[B - Mining and quarrying]	48	27%	167	93%	45	25%	179
2	[C - Manufacturing]	1763	29%	5671	94%	1706	28%	6020
3	[D - Electricity, gas, steam and air conditioning supply]	99	42%	219	93%	93	40%	235
4	[E - Water supply, sewerage, waste management and remediation]	174	44%	372	95%	170	43%	392
5	[F - Construction]	1178	28%	3705	88%	1124	27%	4197
6	[G - Wholesale, retail trade; repair of motorcyces and -vehicles]	2742	36%	6660	87%	2531	33%	7660
7	[H - Transportation and storage]	324	19%	1427	84%	299	18%	1698
8	[I - Accommodation and food service activities]	577	39%	1375	92%	557	37%	1489
9	[J - Information and communication]	268	23%	980	83%	245	21%	1174
11	[L - Real estate activities]	90	17%	443	84%	85	16%	527
12	[M - Professional, scientific and technical activities]	514	23%	1797	82%	465	21%	2201
Total								25772

Table A.4 - Correlation matrix

Variable	GS1	GS2	Leverg	LTOAS	STTOAS	RISK	Size	Age(lg)	Assetgrow	Cashhld	Tangbt	ROA	NWK
GS1	1												
GS2	0.108***	1											
Leverage	-0.014	-0.002	1										
LTonTOAS	0.013	0.006	0.273***	1									
STonTOAS	-0.014	-0.027*	-0.004	0.053***	1								
RISK	0.040***	0.048***	-0.005	-0.022	0.012	1							
Size	0.052***	0.102***	0.055***	0.026	-0.003	0.389***	1						
Age (log)	0.015	0.061***	-0.021	-0.037***	-0.040***	0.087***	0.350***	1					
Asset growth	0.002	-0.02	0.021	0.007	0.081***	0.003	-0.041***	-0.174***	1				
Cash holding	-0.002	-0.017	-0.112***	-0.198***	-0.169***	-0.018	-0.293***	-0.120***	0.048***	1			
Tangibility	-0.014	0.019	0.116***	0.264***	0.043***	-0.024	0.105***	0.038***	-0.057***	-0.321***	1		
ROA	0.000	-0.013	-0.058***	-0.137***	-0.131***	0.039***	0.007	-0.065***	0.151***	0.257***	-0.145***	1	
Net working K	0.007	0.004	-0.019	-0.117***	-0.322***	0.033**	0.093***	0.074***	-0.049***	0.284***	-0.350***	0.289***	1