Stockholm School of Economics

Bachelor thesis

Accounting and Financial Management

Fall 2023

ESG Performance and Probability of Default

A Study of the Relationship Between ESG Performance and Probability of Default for Nordic Listed Firms in a Recent Context

Authors: Julius Bengtsson (25306) and Magnus Fredriksson (25309)

Supervisor: Irina Gazizova

Abstract

This study aims to investigate how firms' ESG performance affects their probability of default for Nordic listed firms. Based on stakeholder theory as well as findings from previous literature, we hypothesise that this relationship is negative as our main hypothesis. In addition, a sub-hypothesis for Swedish listed firms with the same negative relationship is formulated. To test this, we use the probability of default calculated by Altman's Z''-Score LR (logistic regression) model as the dependent variable, and the ESG score from Refinitiv Eikon as the main independent variable. When applying all control variables, where firm size is the most important, ESG is non-significant for the Nordic and Swedish listed firms. However, the relationship is negative and significant for larger Nordic firms. For the full sample we conclude two possible explanations of the results: 1) ESG performance does not significantly affect probability of default for firms in countries where general ESG performance is high and corruption is low, 2) ESG score as a proxy is not fully representative of stakeholder value. For larger firms, we conclude that ESG negatively relates to probability of default likely due to the benefits of higher ESG performance outweighing the financial costs induced to achieve higher ESG performance, which is not the case for smaller firms.

Acknowledgements

We want to express our gratitude toward our supervisor Irina Gazizova for providing insightful feedback while writing this bachelor thesis.

Keywords: ESG, CSR, probability of default, stakeholder theory

Table of Contents

1. Introduction

1.1 Background

Default probabilities are of interest to many stakeholders since defaults and bankruptcies affect both external and internal parties such as investors, creditors, suppliers, and employees. Related to default probabilities, much research has been performed to improve the predictions of default. Two of the most used default prediction models are Altman's Z-score from 1968 (Altman, 1968) and Ohlson's logit model from 1980 (Ohlson, 1980). However, these prediction models were initially developed for specific contexts and only rely on financial information. According to the Balanced Score Card, merely lagging information is not sufficient to evaluate performance, but leading measures should also be incorporated (Kaplan, 2009). One leading measure of increasing importance in recent times is Environmental, Social and Corporate Governance (ESG). ESG is defined by the European Commission as "a framework or criteria to measure the sustainability and ethical impact of an investment or a company focusing on 3 fields: Environmental, Social and Corporate Governance" (European Commission, 2022). As of 2022, internet searches on ESG had increased five times compared to 2019 (Pérez et al., 2022) which highlights the increased relevance. It has also been shown that investors to a greater extent than before incorporate ESG information in their investment decisions (Pedersen et al., 2021). However, few studies have explored the relationship between ESG and the probability of default (Badayi et al., 2021). Studies that have investigated this relationship include Badayi et al. (2021), Habermann and Fischer (2023) and Li et al. (2022). Stakeholder theory suggests that ESG activities performed by firms will increase goodwill and strengthen stakeholder relationships, therefore reducing risk (Badyi et al., 2021). Furthermore, evidence from the Chinese credit market shows that firms with higher ESG scores have a significantly decreased probability of default and that the significance increases when the examined timeframe widens (Li et al., 2022). Improving the understanding of the relationship between ESG and default probabilities yields benefits for a variety of stakeholders considering that losses can be avoided if information on ESG performance can be used to indicate future financial performance. In a ranking from April 2023, Finland, Sweden, Denmark, and Norway were ranked as the top four most sustainable countries in the world in that respective order (RobecoSAM, 2023). The last Nordic country, Iceland, was ranked at number six. Given these top rankings, it is of interest to see what the relationship between ESG performance and probability of default is when relative ESG performance is high in comparison to the results in less sustainable countries. To our knowledge, no published paper has investigated this

relationship for the Nordic countries. However, due to insufficient data from Iceland, only the four preceding countries will be studied. Labels such as *the Nordic countries* or *the Nordics* will refer to these four countries from now on. In line with Altman et al. (2017), we use default as equivalent to bankruptcy, failure, and financial distress. Some studies use the term *Corporate Social Responsibility* (CSR) instead of ESG while generally referring to the same aspects. Therefore, ESG and CSR are treated as equivalents in this study.

1.2 Research question

This study aims to investigate how firms' ESG performance affects their probability of default for Nordic listed firms. This study will build on research on the link between firms' ESG performance and their probability of default by examining how these variables relate to each other for listed firms in a Nordic context. By choosing to investigate how firms incorporated in countries that are the most sustainable might differ from the firms examined in prior literature, our study will extend prior research. Given this aim, the chosen research question is as follows:

> Is there a significant relationship between ESG performance and the probability of default for Nordic listed firms?

1.3 Contribution

This study builds on prior research on the relationship between ESG performance and probability of default, extending it by adopting a dependent variable estimated on more recent data and with more accurate prediction results for the chosen countries. Moreover, a Nordic sample is studied with a more extensive set of control variables than what has been previously performed. By including firm size as a control variable, a more representative relationship between ESG and probability of default is shown compared to previous work conducted on a Nordic sample (Nilsson & Wallin, 2023), considering that the relationship between ESG and probability of default only exists when firm size is not controlled for. Lastly, a subset of our sample will be studied consisting of only Swedish listed firms to highlight potential differences between the Nordic countries. To our knowledge, focusing on only Swedish data has not been investigated regarding the relationship between ESG and probability of default.

2. Literature and Theory

In this chapter, the background of the study's dependent variable will be explained. Then, previous research on the relationship between ESG and probability of default will be presented as well as critique of this relationship and ESG as a concept. Following this, the main theory of this study, stakeholder theory, will be contrasted against shareholder theory. Lastly, our hypotheses will be formulated.

2.1 Literature review

2.1.1 Probability of default calculated with Altman's Z''-Score LR model

Altman's Z''-Score LR (logistic regression) model was developed in a study by Altman et al. (2017). In their study, Altman et al. (2017) analysed 33 previous papers related to Altman's Z-Score and developed updated models based on a large international sample, which at that point was the most thorough analysis in an international context. The sample consisted of mainly private firms from 31 European and 3 non-European countries, where Altman's revised model from 1983, the Z''-Score model, was utilised as it applies to private and non-manufacturing firms. In addition, a new model named the Z''-Score LR model was implemented, which does not require statistical assumptions of multivariate normality of the independent variables, homoscedasticity, or linearity (Altman et al., 2017).

Altman et al.'s (2017) results showed that re-estimating the original Z''-Score model for a different sample only slightly improved prediction accuracy and the same applied to the LR model, thus indicating exceptional robustness of the original coefficients for both a different timeframe and different countries. Furthermore, they concluded that when estimating a model for specific countries rather than relying on an international model, the accuracy of predictions can be significantly enhanced by incorporating country-specific variables (Altman et al., 2017).

2.1.2 Relationship between ESG and probability of default

The possible positive effects of firms engaging in ESG activities have been well argued for. ESG activities have for instance been linked to increasing corporate financial performance (CFP) by enhancing firm reputation, increasing stakeholder reputation, mitigating firm risk, and strengthening innovation capacity (Vishwanathan et al., 2020). There have also been studies conducted that support the notion that firms with higher perceived ESG performance can increase their short-term sales and long-term financial performance through increased brand

equity (Lichtenstein et al., 2004). Literature on the topic of bankruptcy probability further provides a link between CFP and corporate default (Chava & Purnanandam, 2009) that validates the theoretical claim that a lower probability of default is related to higher ESG performance.

There have been a few studies conducted in the last few years on the topic of examining the link between ESG and probability of default. One of these studies was conducted by Badayi et al. (2021) and utilised a dataset comprised of firms active in developing countries. They use the lens of stakeholder theory, where insights from the theory suggest that ESG activities performed by firms will increase goodwill and strengthen stakeholder relationships, therefore reducing risk. The results show strong evidence for the prediction of ESG participation lowering probability of default in European, Asian, and Latin American regions with the exceptions of African and Middle Eastern regions. As the ESG coefficient was much higher in Africa and the Middle East, these regions might have overinvested in ESG to the extent that it reduced firm health. Regarding the implications of the results from Badayi et al.'s (2021) study, they conclude that ESG engagement reduces the risk of default while also strengthening relationships, which in turn enables access to equity capital and therefore reduces the reliance on debt.

Atif and Ali (2021) found a negative relationship between ESG disclosure and the probability of default in an American context. Their study connects prior research on factors that affect a firm's default probability (Chava & Purnanandam, 2009) with research that investigated firm benefits derived from ESG disclosure and performance (Endrikat et al., 2014; Plumlee et al., 2015). Prior research referenced by Atif and Ali (2021) has found that factors that influence a firm's probability of default are commonly indirectly or directly related to cash flow generation. ESG disclosure has, in turn, been linked to cash flow generation through positively affecting firm attributes. First, ESG disclosure is directly linked with brand value which is associated with higher revenue, profitability, and subsequently, liquidity. Second, ESG initiatives help firms build better relationships with stakeholders and secure moral capital, which ensures the firm with higher cash flow generation and less volatility in times of crisis. Third, ESG disclosure reduces agency cost and information asymmetry in firms which mitigates several risks: regulatory, controversy, managerial, and reputational. Investors evaluate firms based on the availability of nonfinancial information to determine default probability. The provision of such firm-specific information to the market builds investors' trust and loyalty, which increases the availability of funds at a relatively lower cost and reduces the cost of capital. Using a lifecycle proxy and firm age the sample was divided into subsamples based on age and maturity.

The results of Atif and Ali's (2021) study indicate a negative relationship between ESG disclosure and probability of default for the subsample of older and mature firms but no relationship for either younger or declining firms. Their study further investigated any discrepancies between the effect of ESG disclosure and ESG performance on probability of default. In the test, they used the Refinitiv ESG score as a proxy for ESG performance and found that ESG performance, in line with ESG disclosure, is negatively related to probability of default (Atif & Ali, 2021).

Li et al. (2022) studied the pricing of ESG on credit markets. The results of this study indicate that firms with higher ESG scores have a significantly decreased probability of default, and that the significance increases when the examined timeframe widens. The results also indicate that ESG is well-priced in the Chinese credit market. Additionally, the study examined the heterogeneous effects of ESG ratings on listed firms within the context of manufacturing- and non-manufacturing-related sectors. In Li et al.'s (2022) study, they found that firms in both manufacturing and non-manufacturing sectors are significantly influenced by their ESG ratings. Similar to the main results, the reduction in default risk was observed to increase as the examined timeframe lengthened. However, the impact of ESG ratings was found to be smaller in the manufacturing sector as compared to the non-manufacturing sector due to the presence of additional regulatory constraints for manufacturing firms (Li et al., 2022).

Habermann and Fischer (2023) found a non-significant relationship between ESG and probability of default. They expanded the previous research by investigating the link between ESG performance and probability of default during a period of economic upswing. Based on previous studies referenced by Habermann and Fischer (2023), evidence shows that ESG performance mitigates the risk of bankruptcy during a crisis, yet the effect diminishes as the crisis wears off. Habermann and Fischer (2023) argue that in times of upswing, loyal stakeholders are not as important to distressed firms as many stakeholders are willing to provide funding due to aggregate demand being high. Moreover, they investigated if investments made to improve ESG performance can increase the risk of bankruptcy during times of economic upswing as the positive effects are smaller than the financial costs induced. The results of their study showed that ESG has no effect on bankruptcy risk during times of economic upswing and positive changes in ESG score increased the probability of default. Thus, they conclude that the positive aspects of ESG performance on stakeholders are not realised when economic conditions are prosperous and that the net effect related to probability of default of investing in ESG therefore becomes negative due to increased financial costs (Habermann & Fischer, 2023).

The master's thesis by Nilsson and Wallin (2023) is to our knowledge the only study to examine the relationship between ESG performance and bankruptcy probability in a Nordic context. This relationship is explained by them through the lens of stakeholder theory. Of the Nordic countries, Sweden, Norway, Denmark, and Finland were included as the remaining country (Iceland) provided too few observations. The sample was chosen due to these countries' top rankings in ESG reporting and no previous studies having been conducted on this sample. Nilsson and Wallin (2023) found a negative association between ESG and bankruptcy probability. Likewise, the same association held for the environmental score (E-score) and the corporate governance score (G-score) where the social score (S-score) showed no association with bankruptcy probability. Nilsson and Wallin (2023) explain the discrepant result of the S-score with the motivation that firms might invest in social sustainability beyond the amount which justifies financial benefits.

See Appendix 1 for a summary of the aforementioned studies concerning period, sample size, geographical location and utilised variables.

2.1.3 Critique against ESG

Although studies such as Atif and Ali (2021) and Badayi et al. (2021) have reported a significant negative relationship between ESG performance and probability of default, the concept of ESG and its link to financial performance is not without its critics. Benabou and Tiroule (2010) discussed the occurrence of firms donating money to charities in which their board members and executives are active, thereby prioritising their own utility over the shareholders' profit-maximising interests, which they are meant to serve. This critique is supported by Friedman's (1970) article, in which he argues that firms do not have social responsibilities and should only focus on achieving returns for the shareholder.

Another issue related to ESG is greenwashing, which is defined by Yu et al. (2020) as disclosing misleading ESG information. As the ESG information published by firms is often unaudited, greenwashing is enabled (Yu et al., 2020). To deceptively position oneself as a sustainable firm entails several advantages, such as financial performance and reputational capital (Siano et al., 2017). Siano et al. (2017) studied one of the most famous greenwashing scandals in recent times: the Volkswagen Dieselgate scandal. Volkswagen not only communicated falsely but also manipulated emissions data while simultaneously marketing itself "as the most sustainable automaker in the world" (Siano et al., 2017, p. 29). Related to this, Prasad and Holzinger (2013)

suggest that substantial marketing efforts to present ESG initiatives may be an indication of deceptive behaviour.

In contrast to financial measures, ESG is qualitative and inherently difficult to measure. In a study by Berg et al. (2022), six of the leading ESG rating agencies were compared. The different ESG ratings showed great variation, with correlations spanning from 0.38 to 0.71. They found that a *rater effect* is present, which means that if an agency scores a firm highly in one category it is also likely to do so in other categories. A possible explanation for this presented by Berg et al. (2022) is that rating analysts are responsible for certain firms instead of categories, thus causing their overall assessment to affect different categories (Berg et al., 2022). Drempetic et al. (2020) found that firm size influences ESG performance. More specifically, size influences data availability through increased resources, which in turn influences the ESG score. An interpretation of these results made by Drempetic et al. (2020) is that what you report is not important, only the reporting itself matters as the non-availability of data is seen as negative. If the ESG score is not an adequate measure of true ESG performance, capital is not flowing to more sustainable companies (Drempetic et al., 2020).

Lastly, the causal link between ESG and financial performance has been questioned. As previously stated, financial performance is linked to probability of default. Orlitzky et al. (2003) conducted a meta-analysis of 52 studies regarding corporate social/environmental performance's link to financial performance. Based on this sample, they concluded that "the relationship tends to be bidirectional and simultaneous" (Orlitzky et al., 2003, p. 427). Moreover, the causation could be reversed as the most profitable firms are best suited to afford the costs of ESG (Benabou & Tiroule, 2010).

2.2 Theory

2.2.1 Stakeholder theory

Given that our study focuses on how a firm interacts with its external environment it is appropriate to link it to stakeholder theory (ST). ST is a theory of business ethics and organisational management. From the perspective of ST, the importance of firms not only benefiting their shareholders but all their stakeholders, is highlighted (Mahajan et al., 2023). ST can be defined as a theory that "(i) encourages organizations to acknowledge and consider their stakeholders, which exist internally or externally to the organization, (ii) promotes understanding and managing stakeholder needs, wants, and demands, and thus (iii) represents

a holistic and responsible framework that goes beyond the focus of shareholders in decision-making processes, which, in turn, (iv) enables organizations to be strategic, maximize their value creation, and safeguard their long-term success and sustainability." (Mahajan et al., 2023, p.1).

ST is described as useful in both normative and strategic dimensions. However, in comparison to its usefulness, the strategic component is not being fully utilised (Laplume et al., 2008). ST emphasises the effective management of relationships with stakeholders and the creation of value for all parties involved. The application of the theory's strategic dimension can provide organisations with insights into their overall strategy and their long-term optimisation. Companies can, therefore, benefit from incorporating the strategic component of the ST into their decision-making processes to enhance their competitive advantage and create sustainable value (Laplume et al., 2008). ST has also been said to have the possibility to explain firm behaviour that is left unexplained by traditional economic theory (Key, 1999).

The support for ST is not unanimous and ST has been criticised for lacking sufficient theoretical content and that it provides insufficient explanation of the relationship between firms and their stakeholders (Key, 1999). Other criticism has been raised regarding the application of the term *stakeholder* which is relatively ambiguous and has been defined differently in different studies and contexts (Wagner Mainardes et al., 2011).

2.2.2 Shareholder theory

Shareholder theory (SHT), sometimes referred to as the Friedman Doctrine, is a framework that emphasises that a firm's primary objective is to maximise the wealth of its shareholders. SHT has received outspread support and is seen as a cornerstone in corporate financial theory (Danielson et al., 2008). SHT in connection to ESG argues that a company lacks any type of responsibility and that its objective is to only pursue actions which heighten shareholder value (Friedman, 1970). Connections can also be made between SHT and *agency theory* where the executives of firms should serve as agents acting in the interest of the shareholders rather than principals acting on some other motivation (Friedman, 1970).

SHT further claims that ESG in terms of value-destroying charitable donations can cause a conflict of interest since it generally goes against the wishes of the firm's financiers (Friedman, 1970). Linking back to *agency theory* it has been explored whether ESG practices, specifically in terms of charitable donations, can be considered an agency cost (Brown et al., 2006).

SHT has been criticised for its disregard of other relevant stakeholders (Freeman & Reed, 1983). Further criticism has been raised claiming that SHT promotes short-term managerial thinking and unethical business practices (Danielson et al., 2008). Criticisms of SHT hold some validity but rather stem from actors incorrectly applying SHT in practice (Danielson et al., 2008). Short-termism is not inherently part of SHT and other theories such as stakeholder theory might run the same risk of short-term managerial thinking (Danielson et al., 2008).

Concerning this study, SHT supports that firms invest in ESG if it leads to higher firm value by lowering risk. In contrast to stakeholder theory which encourages firms to always consider all stakeholders, SHT will only advise firms to do so if it has concrete economic significance.

2.3 Hypotheses

Based on previous research on the relationship between ESG performance and probability of default, we will investigate the significance of this relationship for Nordic listed firms in a recent context. ESG performance is a multifaceted metric with an ambiguous connection to firm performance and default risk. Economists and researchers are divided on how ESG engagements lead to improved (worsened) firm health. If we rely on previous studies on the topic, we expect ESG performance to lead to decreased business risk through strengthened stakeholder relationships (Badayi et al., 2021), heightened brand equity (Badayi et al., 2021; Lichtenstein et al., 2004; Vishwanathan et al., 2020), reduced information asymmetry (Cho et al., 2013), increased access to capital (Badayi et al., 2021), and strengthened innovation capacity (Vishwanathan et al., 2020). If we on the other hand apply the reasoning of Friedman (1970), then we would expect ESG performance to be linked with decreased firm performance and increased agency costs, thus indicating a positive relationship between ESG performance and probability of default.

Our study, in line with studies such as Atif and Ali (2021) and Badayi et al. (2021), adopts stakeholder theory as the framework to connect ESG with probability of default. Therefore, the first and main hypothesis of this study is:

> H1: There is a negative relationship between ESG performance and probability of default for Nordic listed firms.

In addition to the main hypothesis, we will study a subsample consisting of only Swedish firms to compare the results of Nordic firms to one of the Nordic countries. Sweden is, to the best of

our knowledge, previously unexplored regarding the relationship between ESG performance and the probability of default. The sub-hypothesis is as follows:

> H2: There is a negative relationship between ESG performance and probability of default for Swedish listed firms.

3. Method

In this chapter, we present the data used in this study as well as the selection process performed to arrive at the final sample. We then describe our included variables, the rationale for including them, and the final regression model with its statistical assumptions.

3.1 Sample

To test our hypotheses, we will use data from the database Refinitiv Eikon for both the ESG score and financial data. Our sample selection consists of listed firms that are incorporated in Sweden, Denmark, Finland, or Norway. Our sample, in line with previous literature (Atif & Ali, 2021; Badayi et al., 2021; Habermann & Fischer, 2023; Li et al. 2022), will only study publicly listed firms. The reason why most studies on this topic have used samples comprised of only listed firms is due to limited available ESG data on private firms. The period used is 2018-2023 for financial data and the corresponding lagged year from the period of 2017-2022 for ESG data. This corresponds to the last five fiscal years per firm, with a few firms having their reporting date early in 2023 for their latest reporting period. The sample period is justified by a sharp drop in available ESG scores before 2016. As the latest reported financial year for accounting information is not equal to ESG information for all firms in Refinitiv Eikon, we have extracted the nominal dates to ensure that the one-year lag is achieved.

The initial sample consists of 1,653 firms. Firstly, all firms where Refinitiv does not provide an ESG score are excluded from the sample, which leaves 549 firms. We also exclude firms in banking, insurance, and other financial sectors since they have different capital structure requirements, in line with previous literature on bankruptcy probability (Badayi et al., 2021; Ohlson, 1980). In our dataset, this corresponds to these GICS industry names: Banks, Capital Markets, Consumer Finance, Financial Services, and Insurance. After the exclusion of financial firms, our sample consists of 502 firms. In addition, firms that have a gap between the latest reported accounting information and reported ESG score that is not equal to zero or one year are also excluded from the sample. This is performed both to ensure data reliability and to simplify data handling. After these adjustments, we are left with a sample consisting of 482 firms from 55 industries. The last adjustment consists of removing all missing values from the sample data, which results in an unbalanced panel consisting of 1,549 firm-year observations from 482 firms. After these adjustments, the ratio of firm-year observations to firms is 3.21 which implies that we have on average 3.21 years of coverage per firm out of a maximum of 5.

This corresponds to a coverage of 64.27% which is lower compared to previous studies (see Appendix 1) conducted on this topic, such as Nilsson and Wallin (2023) with 99.4% (ratio of 5.96 out of 6 years). Given the similar periods, the discrepancy between our sample and theirs is highly noticeable. We cannot in detail explain this discrepancy, but a likely explanation for the difference would be that they have adjusted for missing values to increase their coverage. We do not adjust for our low coverage as it would distort our data but instead highlight the low coverage as a limitation which potentially limits the validity of our findings.

The lack of ESG data provided by Refinitiv Eikon for Nordic listed firms is the main explanation for the reduction in sample size. The reduction may bias our estimates if ESG scores only are provided for firms that are systematically similar, therefore decreasing the validity of the study. However, no information is available regarding the selections made by Refinitiv Eikon of which Nordic firms they choose to rate.

In Table 1, the geographical spread of our sample is shown. It shows that most of the firms are incorporated in Sweden (291 firms), followed by Finland (72 firms), and Norway (68 firms). The share of firms in our sample that are incorporated in Denmark (51 firms) is the smallest. Similar distribution can be found for firm-year observations where most observations come from firms incorporated in Sweden (889 firm-year observations), followed by Norway (237 firm-year observations), Finland (234 firm-year observations), and Denmark (189 firm-year observations). Regarding the spread of firm-year observations between years, most of our firm-year observations based on reporting year are from 2022 and 2021 with a sharp decrease for earlier years. The main reason for the firm-year distribution is, as discussed earlier, due to a lack of coverage of the ESG score for earlier years.

Table 1: Distribution of sample with regards to country and reporting year

Country of incorporation	Number of firms	Percentage of sample
Sweden	291	60.37%
Norway	68	14.11%
Finland	72	14.94%
Denmark	51	10.58%
Total	*482*	*100%*
Country of incorporation	Number of firm-year observations	Percentage of sample
Sweden	889	57.39%
Norway	237	15.30%
Finland	234	15.11%
Denmark	189	12.20%
Total	*1549*	*100%*
Reporting year	Number of financial firm-year observations	Percentage of sample
2023	14	0.90%
2022	477	30.79%
2021	431	27.82%
2020	296	19.11%
2019	207	13.36%
2018	124	8.01%
Total	*1549*	*100%*

3.2 Dependent variable

To investigate the relationship between ESG and the probability of default our study will build on prior work (Badayi et al., 2021) and regress a proxy of default probability on ESG score. Unlike some of the earlier work on this topic, we will not utilise the older versions of Altman's Z-Score model (Badayi et al., 2021; Habermann & Fischer, 2023) as our proxy for default probability. Instead, we will use default probabilities calculated by using Altman's Z''-Score LR model (Altman et al., 2017). The reason behind our choice of dependent variable stems from the fact that Altman's Z''-Score LR model is more recently approximated making it more applicable to current data and that it uses an LR (logistic regression) instead of an MDA (multiple discriminant analysis) which requires fewer statistical assumptions (Altman et al., 2017). Moreover, the LR model outperformed Altman's older model from 1983 for all Nordic countries in bankruptcy prediction accuracy (Altman et al., 2017). Lastly, the LR provides a more intuitive interpretation as it concerns probabilities and changes in ESG score can therefore be compared to the percentage change of probability of default. Altman's Z''-Score LR model is calculated as:

$$Z = 0.035 - 0.495 \times WCTA - 0.862 \times RETA - 1.721 \times EBITTA - 0.017 \times BVETD$$

where Z is the overall index, WCTA is the working capital/total assets, RETA is the retained earnings/total assets, EBITTA is the earnings before interest and taxes/total assets, and BVETD is the book value of equity/total debt. To translate the Z''-Score LR model into probability of default we will insert it into the following equation:

$$PD = \frac{1}{1 + e^{-z}}$$

where PD is the probability of default within two periods (fiscal years).

3.3 Independent variable

ESG score is our study's main independent variable. Refinitiv Eikon gathers firm ESG data from annual reports, CSR reports, corporate websites, stock exchange filings, NGO websites, and media outlets. The ESG score is calculated by capturing and calculating over 630 company-level ESG measures, of which a subset of 186 of the most comparable and material per industry, power the overall company assessment and scoring process. These are grouped into ten categories that reformulate the environmental (E) score, social (S) score, (Corporate) Governance (G) score, and the final ESG score. The ESG score is a relative sum of the category weights, which vary per industry for the environmental and social categories. The respective weights are normalised to percentages ranging between 0 and 100 (Refinitiv, 2022). Refinitiv ESG scores are widely used in literature, less prone to selection bias, and show more relevant results in terms of variability and distribution than comparable ESG ratings (Habermann & Fischer, 2023). It should be noted that ESG performance is multifaceted and difficult to measure. As mentioned earlier, inherent size biases might skew the Refinitiv ESG score (Drempetic et al., 2020). Given the variation in different ESG ratings and the *rater effec*t (Berg et al., 2022), it is also questionable how well any ESG score captures actual ESG performance.

3.4 Control variables

The control variables utilised in this study replicate the control variables used in prior literature within the field of capital default probability and bankruptcy prediction (Atif & Ali, 2021; Badayi et al., 2021; Habermann & Fischer, 2023). The implementation of some variables is motivated by applying reasoning from trade-off theory. Trade-off theory is a theoretical framework that argues that firms' ultimate capital structure and best financing decisions depend

on the trade-off between the tax benefits of debt financing and the likely costs of financial distress (Badayi et al., 2021).

All financial information used in our study is expressed in Swedish Krona (SEK). The firms that use different currencies in their financial statements will have their financial information adjusted using exchange rates. The currency translation has already taken place when the data is exported from Refinitiv Eikon, thus we will assume that the translation is accurate and not perform any translation ourselves. The control variables used in this study are *debt ratio, firm size, profitability, fixed assets, market-to-book ratio,* and *non-debt tax shield*.

Debt ratio

Debt ratio (LEV) is defined as debt divided by total assets and will serve as a proxy for capital structure in this study. Capital structure can be viewed as how a firm finances its assets, as well as the ability of the firm to meet its financial obligations. Higher leverage is associated with higher business risk. Hence, debt ratio is expected to be positively related to default probability (Atif & Ali, 2021; Schultz et al., 2017).

Firm size

Firm size (SIZE) is measured by the natural logarithm of total assets (expressed in SEK). Firm size is a determinant factor of default probability (Badayi et al., 2021). Larger firms are generally more stable and consequently have less default risk (Atif & Ali, 2021). In trade-off theory, it is argued that larger firms are usually more leveraged due to them having lower levels of information asymmetry and more stable cashflows which gives them better access to debt markets (Matemilola & Ahmad, 2014). The trade-off theory does, however, also argue that larger firms are usually more stable and less likely to default (Badayi et al., 2021). To conclude, drawing from the insight of the trade-off theory, we expect the firm size to be negatively related to the probability of default especially when we control for leverage.

Profitability

Profitability (PROF) is measured by taking the firm's earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by total assets. Profitability based on accounting information indicates a firm's ability to generate sufficiently high returns to cover its financial obligations and operate efficiently (Atif & Ali, 2021). The trade-off theory argues that more profitable firms usually utilise more debt financing to enjoy the benefits of debt-related tax shields (Chang et al., 2014), subsequently making them riskier. Nevertheless, firms

with higher levels of profitability typically have a lower probability of default since such firms generate higher cash flows which can be used to pay off their debt obligations (Badayi et al., 2021). Thus, we predict that profitability is negatively related to probability of default.

Fixed assets

Fixed assets (FA) are determined by taking the level of property, plant, and equipment (PPE) divided by total assets. The trade-off theory argues that fixed assets can be used by firms as collateral to obtain debt financing (Badayi et al., 2021). The availability of firm collateral value of assets increases confidence and decreases fear of default by creditors toward firms (Belkhir et al., 2016). The reason why collateral has this effect on creditors is that, in the event of default, those assets can be used to settle the debt obligations (Badayi et al., 2021). Thus, firms that have higher levels of fixed assets have higher collateral value and are less likely to default. We, therefore, predict a negative relationship between fixed assets and probability of default.

Market-to-book ratio

Market-to-book ratio (MTB) is calculated as the market value of equity (MC) plus total debt divided by total assets. Market-to-book ratio is considered as a proxy for growth opportunities in this study. In trade-off theory, it is often argued that growth opportunities can be considered a form of intangible assets. Intangible assets are typically more difficult to use as collateral value in the event of bankruptcy (Matemilola et al., 2018). Previous studies present findings that support both a positive and negative relationship between growth opportunities and the probability of default (Badayi et al., 2021). Nevertheless, we will assume the position that the trade-off theory holds and predict that growth opportunities are positively related to the probability of default. Thus, we predict a positive relationship between market-to-book ratio and default probability.

Non-debt tax shield

Non-debt tax shield (NDTS) is defined as total depreciation divided by total assets. Non-debt tax shield represents certain tax-deductible firm expenses such as investment tax credits, tax deductions, and depreciation (Badayi et al., 2021). Depreciation divided by total assets will in our study serve as a proxy for firms' tax benefits related to non-debt costs. It has been argued that a non-debt tax shield is important towards determining default probability (Huang & Song, 2006). A higher non-debt tax shield signifies that a firm is incurring more expenses, which is linked to reduced profits and subsequently increased probability of default (Badayi et al., 2021).

This study predicts a positive relationship between non-debt tax shield (total depreciation divided by total assets) and probability of default.

In Table 2, our control variables are summarised, showing their definitions and expected signs.

Table 2: Definitions of control variables and their expected signs

Variable	Definition	Expected sign
Debt ratio (LEV)	Total debt / total assets	+
Firm size (SIZE)	Log(total assets in SEK)	-
Profitability (PROF)	EBITDA / total assets	-
Fixed assets (FA)	PPE / total assets	-
Market-to-book ratio (MTB)	(MC + total debt) / total assets	+
Non-debt tax shield (NDTS)	Total depreciation / total assets	+

3.5 Econometric model

We will use the estimated probability of default, PD, as the dependent variable in our panel model. The model used is estimated below:

$$PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \beta_3 SIZE_{it} + \beta_4 FA_{it} + \beta_5 PROF_{it} + \beta_6 MTB_{it} + \beta_7 NDTS_{it} + \emptyset_i + \alpha_t + \mu_{it}$$

where:

PD = *The probability of default* using Altman's Z''-score LR model

ESG_{t-1} =*ESG* (Environmental, Social and Governance) score from the previous fiscal year

LEV = *Debt ratio*

SIZE = *Firm size*

FA = *Fixed assets*

PROF = *Profitability*

MTB = *Market-to-book ratio*

NDTS = *Non-debt tax shield*

$\emptyset_i$ = Industry effects

α_t = Time fixed effects

μ = Error term

A lagged ESG score has been used in several other studies, mainly to reduce concerns related to reverse causality (Atif & Ali, 2021; Habermann & Fischer 2023; Li et al., 2022). Our model does not control for firm fixed effects as time variations in ESG performance are limited (Arouri & Pijourlet, 2017). As fixed effects estimation subtracts the average from the variables (Wooldridge, 2013), the variation in ESG score will be lost as the values do not vary over time on a firm level. To control for unobserved heterogeneity, we include time-fixed effects and industry effects in line with previous studies (Atif & Ali, 2021; Badayi et al., 2021; Habermann & Fischer, 2023). The industry effects are based on the industry groups as classified by the GICS industry names (see Appendix 2 for a breakdown of industry groups). Robust standard errors are clustered at the firm level (Arouri & Pijourlet, 2017) to control for heteroskedasticity and autocorrelation in the fixed effect model. Firm-level is deemed appropriate for our sample as a level of clustering given that clustering becomes problematic if the number of clusters is less than 50 (Huang et al., 2023).

The dependent variable, PD, will be winsorized at 1 and 99% to reduce the risk of outliers (Habermann & Fischer, 2023). Atif and Ali (2021) chose to winzorize the control variables instead and kept the dependent variable unchanged as extreme values of the dependent variable may indicate bankruptcy. We choose the former method given that the highest probability of default in our sample is 100% (see Table 2) which seems more likely to be an erroneous calculation than a predicted value. Therefore, *probability of default* will refer to winsorized values going forward.

4. Results

In this chapter, we summarise our variables and then present our regression results for the samples of Nordic and Swedish listed firms. Additionally, we include three robustness tests for the Nordic sample to enhance the validity of our findings.

4.1 Descriptive statistics, correlation analysis and variance inflation factor

4.1.1 Descriptive statistics

In Table 3, descriptive statistics of the included variables for Nordic firms are presented. The notation *PD_unwin* refers to the variable *probability of default* before the winsorization. The median and mean of both *probability of default (PD)* and *ESG* are relatively close, indicating a symmetric distribution of the variables (Altman et al., 2017). Similar to Badayi et al. (2021) as well as Habermann and Fischer (2023), who also used Refinitiv's ESG score, *ESG* exhibits a wide span between maximum and minimum. The mean of 41.9% for *probability of default* can be compared to the mean probability of default for non-failed firms in Altman et al. (2017) of 41.2%, where the similarity in probabilities is expected given that our sample consists of active and therefore also non-failed firms. *Profitability* is a variable with both a high maximum (3.764) and a low minimum (-3.503), considering that the variable is defined as EBITDA scaled by total assets. Precautions have been taken by us to ensure that the values were correctly extracted from Refinitiv Eikon. However, we cannot know for certain whether these values were correctly entered into Refinitiv Eikon. As a control measure, we also estimated the model without these outliers and the results were highly similar to our reported results. Therefore, we conclude that these outliers do not significantly affect the results.

Table 3: Summary statistics for the Nordic sample

Variable	Mean	Median	Max	Min	SD
PD_unwin	0.419	0.408	1.000	0.000	0.155
PD	0.419	0.408	0.991	0.001	0.155
ESG	49.931	51.155	93.134	1.317	20.648
LEV	0.261	0.237	2.976	0.000	0.200
SIZE	22.957	23.056	28.129	16.668	1.923
FA	0.200	0.132	0.917	0.000	0.194
PROF	0.082	0.109	3.764	-3.503	0.253
NDTS	0.030	0.025	0.171	0.000	0.025
MTB	2.317	1.263	41.120	0.225	3.138

In Table 4, descriptive statistics are presented for the Swedish sample. Compared to the Nordic firms, the Swedish firms have a higher *probability of default* and lower *ESG* on average.

Table 4: Summary statistics for the Swedish sample

Variable	Mean	Median	Max	Min	SD
PD_unwin	0.434	0.415	1.000	0.000	0.179
PD	0.434	0.415	0.991	0.001	0.179
ESG	46.594	45.734	93.134	1.317	21.201
LEV	0.256	0.232	2.976	0.000	0.212
SIZE	22.565	22.639	27.167	16.668	2.034
FA	0.158	0.096	0.917	0.000	0.185
PROF	0.054	0.102	0.545	-3.503	0.263
NDTS	0.026	0.021	0.146	0.000	0.024
MTB	2.599	1.335	41.120	0.315	3.691

4.1.2 Correlation analysis

Table 5 showcases the pairwise correlation coefficients between the variables utilised in the main regression for the Nordic firms. Most interesting is the relatively strong correlation between *ESG*, the independent variable of interest, and *firm size*. This correlation has also been relatively strong in the study by Habermann and Fischer (2023), being 0.586. However, in Badayi et al. (2021) the correlation between ESG and firm size was only 0.12. Atif and Ali (2021) applied the rule of thumb that a correlation coefficient of 0.7 raises concerns regarding multicollinearity. Thus, as *firm size* in our sample is only slightly below that threshold it will be included in the regression as the final step to compare the significance of *ESG* before and after the inclusion of *firm size*. Additionally, *non-debt tax shield* and *fixed assets* have a correlation of 0.65 which is expected since property, plant and equipment is strongly correlated with depreciation and both variables are scaled to total assets.

Table 5: Correlation matrix for the Nordic sample

	PD	ESG	LEV	SIZE	FA	PROF	NDTS	MTB
PD	1.000	-0.186	0.317	-0.227	-0.040	-0.528	0.017	-0.167
ESG	-0.186	1.000	-0.013	0.693	0.190	0.192	0.071	-0.169
LEV	0.317	-0.013	1.000	0.148	0.233	-0.066	0.200	-0.215
SIZE	-0.227	0.693	0.148	1.000	0.258	0.277	0.046	-0.328
FA	-0.040	0.190	0.233	0.258	1.000	0.167	0.652	-0.156
PROF	-0.528	0.192	-0.066	0.277	0.167	1.000	0.127	0.046
NDTS	0.017	0.071	0.200	0.046	0.652	0.127	1.000	-0.088
MTB	-0.167	-0.169	-0.215	-0.328	-0.156	0.046	-0.088	1.000

The results for the Swedish sample in Table 6 are similar to the Nordic sample. The correlation between *ESG* and *firm size* is 0.701, which exceeds the rule of thumb set by Atif and Ali (2021). To verify whether this is an indication of a multicollinearity problem we tested our model to estimate its variance inflation factor (VIF) (see Table 8).

Table 6: Correlation matrix for the Swedish sample

	PD	ESG	LEV	SIZE	FA	PROF	NDTS	MTB
PD	1.000	-0.185	0.296	-0.248	-0.040	-0.562	0.034	-0.152
ESG	-0.185	1.000	0.023	0.701	0.202	0.232	0.106	-0.189
LEV	0.296	0.023	1.000	0.219	0.141	-0.098	0.125	-0.229
SIZE	-0.248	0.701	0.219	1.000	0.188	0.324	0.018	-0.355
FA	-0.040	0.202	0.141	0.188	1.000	0.170	0.660	-0.150
PROF	-0.562	0.232	-0.098	0.324	0.170	1.000	0.115	0.041
NDTS	0.034	0.106	0.125	0.018	0.660	0.115	1.000	-0.081
MTB	-0.152	-0.189	-0.229	-0.355	-0.150	0.041	-0.081	1.000

4.1.3 Variance inflation factor (VIF)

Perfect multicollinearity in a model violates the basic assumptions that are needed to run our fixed effect regression (Wooldridge, 2013). Given that some of our variables display quite high levels of correlation, it is advisable to further investigate possible multicollinearity issues. A variable's variance inflation factor can tell us how correlated the variable is with the remaining variables. Generally, a VIF of 10 or higher indicates a multicollinearity issue that must be resolved (Wooldridge, 2013). In Table 7, the VIF of all our variables can be seen using the entire sample of Nordic firms. *Firm size* has the highest VIF out of the variables with a VIF of 2.421, thus indicating that our model does not have an issue with multicollinearity.

Table 7: Variance inflation factor for the Nordic sample

Variable	ESG	LEV	SIZE	FA	PROF	NDTS	MTB
VIF	2.005	1.152	2.421	1.940	1.148	1.828	1.189

In Table 8, the VIF of all our variables can be observed using the subsample of Swedish firms. *Firm size* is the variable with the highest VIF using the Swedish sample. *Firm size* has a VIF of 2.658 using the Swedish sample, which is slightly higher compared to the Nordic sample but

still lower than 10. The results of the VIF test indicate that we do not have a multicollinearity issue for the sample of Swedish firms.

Table 8: Variance inflation factor for the Swedish sample

Variable	ESG	LEV	SIZE	FA	PROF	NDTS	MTB
VIF	2.113	1.179	2.658	1.891	1.223	1.851	1.225

4.2 Results from the regression models

4.2.1 Estimating alternative models

Although our model does not show clear signs of multicollinearity, the correlation matrix indicates that *ESG* and *firm size* are highly correlated for both the Nordic and Swedish samples. Therefore, we will construct six different models with different levels of control variables. The control variables will be added in steps with *firm size* as the last one to analyse how the variables interplay with *ESG*. The first model will utilise only one control variable: *debt ratio*. *Debt ratio* has the lowest level of correlation with our independent variable: *ESG*. The following models will subsequently include more control variables that will be added in relation to their lack of correlation with *ESG* and other control variables, as well as, how correlated they are to our dependent variable. In other words, the variables that have a low correlation with *ESG* (and other control variables) and a high correlation with *probability of default* will be added before variables that do not. The models are defined as:

M1. $PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \emptyset_i + \alpha_t + \mu_{it}$

M2. $PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \beta_3 PROF_{it} + \emptyset_i + \alpha_t + \mu_{it}$

M3. $PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \beta_3 PROF_{it} + \beta_4 FA_{it} + \emptyset_i + \alpha_t + \mu_{it}$

M4. $PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \beta_3 PROF_{it} + \beta_4 FA_{it} + \beta_5 MTB_{it} + \emptyset_i + \alpha_t + \mu_{it}$

M5. $PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \beta_3 PROF_{it} + \beta_4 FA_{it} + \beta_5 MTB_{it} + \beta_6 NDTS_{it} + \emptyset_i + \alpha_t + \mu_{it}$

M6. $PD_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 LEV_{it} + \beta_3 PROF_{it} + \beta_4 FA_{it} + \beta_5 MTB_{it} + \beta_6 NDTS_{it} + \beta_7 SIZE_{it} + \emptyset_i + \alpha_t + \mu_{it}$

4.2.2 Results of ESG and probability of default for Nordic firms

In Table 9 we can observe the results of the respective models regressed on our sample of Nordic firms. The regression aims to test our main hypothesis that there is a significant negative relationship between *ESG* and *probability of default*. In the regressions on models 1 to 5 we find support for our main hypothesis that *ESG* is negatively related to *probability of default* at a 1% significance level. The R2-value is unsurprisingly higher for the models with more control variables. Model 1 has an R^2 -value of 0.248 and an adjusted R^2 -value of 0.200. In comparison we can observe that model 5 has an R^2 -value of 0.433 and an adjusted R^2 -value of 0.395. *Debt ratio* and *profitability* are both significant at the 1% significance level with expected signs, whereas *market-to-book ratio* is significant at 1% with the opposite sign compared to our expectation. *Non-debt tax shield* and *fixed assets* show no significance.

We can also observe that once *firm size* is added to the model, *ESG* loses all its significance. *ESG* also switches signs from negative to positive. Given the high correlation between *firm size* and *ESG*, it is not unexpected that adding *firm size* to our model will affect the significance of *ESG*. Model 6, like model 5, provides significant results for *debt ratio*, *profitability*, and *market-to-book ratio* at 1% significance. *Debt ratio* and *profitability* still exhibit the expected signs, while *market-to-book ratio* exhibits the reverse of the expected sign. *Fixed assets* and *non-debt tax shield* are not significant in model 4 to 6.

Table 9: Regression results for model 1 to 6 for the Nordic sample

	M1	M2	M3	M4	M5	M6
Var.	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
ESG	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	0.0001
LEV	0.299***	0.237***	0.237***	0.229***	0.228***	0.239***
PROF		-0.295***	-0.295***	-0.285***	-0.285***	-0.266***
FA			0.0003	-0.006	-0.023	-0.012
MTB				-0.006***	-0.006***	-0.007***
NDTS					0.216	0.080
SIZE						-0.016***
R^2	0.248	0.423	0.423	0.433	0.433	0.444
Adj. R^2	0.200	0.386	0.385	0.395	0.395	0.407
N	1549	1,549	1,549	1,549	1,549	1,549
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = p<0.01, ** = p<0.05, * = p<0.1

4.2.5 Results of ESG and probability of default for Swedish firms

In Table 10 we can observe the results of models 1 to 6 regressed on a sample of only Swedish firms (889 firm-year observations). The overall results of the regression resemble that of the Nordic sample. For model 1 we find support for our sub-hypothesis at the 1% significance level and for model 2 to 5 we find support at the 5% significance level. We can observe that once *firm size* is added, *ESG* loses its significance and switches its sign from positive to negative. *Debt ratio*, *profitability*, and *market-to-book ratio* are significant at 1%, where *debt ratio* and *profitability* exhibit the expected sign. Similar to the results for the Nordic sample, *market-to-book ratio* is significant at 1% and exhibits the reverse of the expected sign. What differs from the Nordic sample is that *fixed assets* is significant at the 10% level in model 6 for the Swedish sample, however not with the expected sign.

Table 10: Regression results for model 1 to 6 for the Swedish sample

	M1	M2	M3	M4	M5	M6
Var.	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
ESG	-0.001***	-0.001**	-0.001**	-0.001**	-0.001**	0.0004
LEV	0.332***	0.217***	0.205***	0.197***	0.195***	0.211***
PROF		-0.360***	-0.364***	-0.355***	-0.353***	-0.329***
FA			0.123***	0.119**	0.060	0.095*
MTB				-0.005***	-0.005***	-0.007***
NDTS					0.656*	0.396
SIZE						-0.021***
R^2	0.272	0.470	0.474	0.481	0.483	0.497
Adj. R^2	0.199	0.416	0.420	0.426	0.428	0.444
N	889	889	889	889	889	889
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = $p<0.01$, ** = $p<0.05$, * = $p<0.1$

4.3 Robustness tests

4.3.1 Sample split

Using the median of *firm size*, the sample can be divided into smaller and larger firms as a robustness test (Habermann & Fischer, 2023). The median in our sample is 23.0559 for the Nordic firms and the results are reported in Table 11 for models 1, 5 and 6 for small (774 firm-year observations) and large (775 firm-year observations) firms respectively. For small firms, the results are similar to those for the full sample as *ESG* changes from a significant and expected coefficient to a non-significant coefficient with the opposite sign when *firm size* is

added as a control variable. However, controlling for *firm size* using large firms yields significant and negative results at the 5% level for *ESG* as *firm size* is non-significant and does not increase the explanatory power of the model.

Table 11: Regression results for model 1, 5 and 6 for the Nordic sample when dividing into smaller and larger firms

	Small			Large		
	M1	M5	M6	M1	M5	M6
Var.	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
ESG	-0.002***	-0.001***	0.001	-0.0003	-0.0003**	-0.003**
LEV	0.332***	0.241***	0.245***	0.288***	0.232***	0.232***
PROF		-0.257***	-0.224***		-0.606***	-0.608***
FA		-0.031	0.068		-0.029	-0.030
MTB		-0.006***	-0.009***		-0.003	-0.003
NDTS		0.436	0.107		0.417***	0.429***
SIZE			-0.047***			0.001
R^2	0.249	0.410	0.440	0.548	0.738	0.738
Adj. R^2	0.169	0.343	0.376	0.493	0.704	0.704
N	774	774	774	775	775	775
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = $p<0.01$, ** = $p<0.05$, * = $p<0.1$

4.3.2 ESG pillars

To ensure that no one individual pillar is causing the results, each ESG pillar is regressed separately on probability of default (Atif & Ali, 2021). These regressions are performed for models 5 and 6 for the Nordic firms to see the effect of including *firm size*. The results are reported in Table 12 below, where both *E* and *S* exhibit the same characteristics as *ESG* with negative significant results for the independent variable without *firm size* and non-significance for the independent variable with *firm size* included. For *G*, the independent variable is significant with all controls included at the 1% level, although with a positive relationship. This significance can be connected to the correlation between *G* and *firm size* (see Table 13) which is the lowest correlation of any of the ESG pillars with *firm size*.

Table 12: Regression results for model 5 and 6 for the Nordic sample when using the separate ESG pillars as independent variables

	M5	M6	M5	M6	M5	M6
Var.	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
E	-0.001**	-0.0001				
S			-0.001**	-0.0001		
G					-0.0001	0.0005***
LEV	0.226***	0.236***	0.228***	0.237***	0.233***	0.240***
PROF	-0.283***	-0.267***	-0.281***	-0.267***	-0.294***	-0.264***
FA	-0.018	-0.011	-0.020	-0.011	-0.034	-0.007
MTB	-0.006***	-0.007***	-0.006***	-0.007***	-0.006***	-0.007***
NDTS	0.221	0.097	0.247	0.104	0.233	0.083
SIZE		-0.014***		-0.014***		-0.018***
R^2	0.435	0.444	0.436	0.444	0.425	0.447
Adj. R^2	0.397	0.407	0.398	0.407	0.387	0.410
N	1549	1549	1549	1549	1549	1549
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = *p<0.01*, ** = *p<0.05*, * = *p<0.1*

Table 13: Correlation matrix for the Nordic sample of ESG, ESG pillars and firm size

	ESG	E	S	G	SIZE
ESG	1.000	0.872	0.906	0.739	0.693
E	0.872	1.000	0.767	0.465	0.699
S	0.906	0.767	1.000	0.478	0.661
G	0.739	0.465	0.478	1.000	0.415
SIZE	0.693	0.699	0.661	0.415	1.000

4.3.3 High ESG performance

To focus on the effect of high ESG performance, a dummy variable for ESG performance can be constructed where ESG scores above the median are coded as one and those below as zero (Badayi et al., 2021). In our Nordic sample, the median ESG score is 51.155 (see Table 3). In Table 14, the notation *ESGH* indicates that the firm received an ESG score above the median value of the entire sample, irrespective of fiscal year. The variable, *ESGH*, is non-significant for models 1 to 6, thus not finding support that firms with higher ESG performance have a

decreased probability of default compared to firms with lower ESG performance. This is in line with our previous results for model 6.

Table 14: Regressions for models 1 to 6 with a dummy variable for high ESG performance

	M1	M2	M3	M4	M5	M6
Var.	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
ESG	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.00002
ESGH	0.009	0.008	0.008	0.008	0.008	0.007
LEV	0.299***	0.237***	0.236***	0.229***	0.227***	0.239***
PROF		-0.295***	-0.295***	-0.285***	-0.285***	-0.266***
FA			0.001	-0.005	-0.022	-0.011
MTB				-0.006***	-0.006***	-0.007***
NDTS					0.214	0.078
SIZE						-0.016***
R^2	0.248	0.423	0.423	0.433	0.433	0.444
Adj. R^2	0.199	0.385	0.385	0.395	0.395	0.406
N	1549	1,549	1,549	1,549	1,549	1,549
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** = p<0.01, ** = p<0.05, * = p<0.1

4.4 Summary of results

The results of the regression models run on the complete sample of Nordic firms and the subsample of Swedish firms indicate no significant relationship between *ESG* and *probability of default* when *firm size* is controlled for (see Table 9 and Table 10). The results of the first robustness test indicate that there is a negative relationship between *ESG* and *probability of default* for larger Nordic firms (above the median) even when *firm size* is held constant at a 5% significance level (see Table 11). When investigating the separate pillars (*E*, *S*, and *G*) individually for Nordic firms, we find that *E* and *S* have no significant relationship to *probability of default*, while *G* is positively associated at a 1% significance level when *firm size* is controlled for (see Table 12). The variable denoted by *ESGH* is a dummy variable that represents whether the firm-year observation includes an ESG score above the median. The result of the last robustness test indicates that there is no relationship between *ESGH* and *probability of default* for the Nordic sample, which supports our previous finding of no significant relationship when *firm size* is controlled for.

5. Discussion

In this chapter, we analyse our findings and relate them to previous studies and theory. By revisiting our research question and hypotheses, we discuss possible explanations for why our findings do not support our hypotheses. Lastly, we connect our findings to practical implications.

5.1 Discussion of results

Different settings, the effects of firm size and addressing causality

Our study aims to examine the relationship between ESG performance and probability of default for Nordic listed firms. In addition, the relationship has been examined for Swedish listed firms. This was examined by performing a fixed effect panel regression using a default probability proxy calculated by using Altman's Z''-Score LR model and ESG scores from Refinitiv Eikon as the main independent variable. When implementing the full set of control variables, our results do not indicate a significant relationship between ESG and probability of default, either for the Nordic or the Swedish sample.

Our results are opposing the findings of Atif and Ali (2021), Badayi et al. (2021), and Li et al. (2022). One explanation could be differences in settings compared to the findings of the abovementioned studies, such as geographical location and studied period. Badayi et al. (2021) find a negative relationship between ESG and probability of default in developing countries. Given that focus on ESG is less common in developing countries compared to the Nordics where an ESG focus is expected, stakeholders will likely value high ESG performance in a developing country more as the occurrence of high ESG performance is more uncommon. Hence, the negative relationship between ESG performance and probability of default is more likely to hold in developing countries than in the Nordics. As the US, which was used by Atif and Ali (2021) as a sample, also prioritises sustainability lower than the Nordics this explains the differing results. The results of Habermann and Fischer (2023) indicate that there is no relationship between ESG and probability of default during times of economic upswing. This reasoning is not directly applicable to our results since Sweden has experienced both economic upswing and downturn during the sample period (Statistiska Centralbyrån, 2023). Yet, as the investigated period partly contains a time of economic upswing, this will likely affect the relationship between the independent and dependent variable with a reduced linearity for the entire period due to a less linear relationship during the period of upswing. Among the published

studies, none use a sample of developed countries in Europe. The most comparable study is Nilsson and Wallin (2023), which focuses on the same Nordic countries during a similar period. Their study found a significant relationship between ESG and Z''-score. However, their model did not implement firm size as a control variable. Our study yields similar results as the study by Nilsson and Wallin (2023) in models 1 to 5 where firm size is not controlled for, which highlights the importance of including firm size as a control variable in the Nordic context.

Our study shows that firm size is relatively strongly correlated with ESG, which was also a finding by Habermann and Fischer (2023). Given that firm size is more correlated with probability of default than the ESG score is, it is not surprising that when firm size is added to our model the significance of ESG on probability of default is eliminated. The statistical interpretation of this finding is that when firm size is held constant, ESG does not have a statistically significant effect on probability of default. Drempetic et al. (2020) state that larger firms possibly score higher in ESG ratings due to greater publication of data, not due to the actual performance. If this holds, controlling for firm size would enable a more representative measure of ESG performance which suggests that model 6 is the only appropriate model to analyse.

When dividing the Nordic sample into smaller and larger firms, the non-significance of ESG when controlling for firm size is present for the subsample of smaller firms, but with a negative and significant relationship for larger firms. These results indicate that, for larger firms, ESG is negatively associated with probability of default when size is held constant. Habermann and Fischer (2023) argue that smaller firms increase their probability of default during times of economic upswing when investing in ESG as the financial costs are greater than the benefits gained, while not finding a significant relationship for larger firms. Relating this finding to our results, larger firms are likely not as affected by the financial costs and therefore receive a net gain from having a higher ESG performance compared to smaller firms where the costs of achieving a high ESG performance are relatively higher. If smaller firms produce smaller quantities of ESG data, it will also indicate that measurements of their ESG scores are less accurate due to insufficient information for raters. If the ESG scores are less accurate for smaller firms that might also explain why the result of the regression run on the subsample of smaller firms deviates from the findings of Atif and Ali (2021), Badayi et al. (2021), and Li et al. (2022).

In this study, a causal claim of the relationship between ESG and probability of default is not made as the method used does not address endogeneity concerns related to ESG. To test for

causality, an instrumental variable approach can be applied. A variable that is uncorrelated with the error term and correlated with the independent variable can be used as an instrumental variable. By using the instrumental variable to predict values of the independent variable, these predicted values can then be regressed on the dependent variable to claim causality (Wooldridge, 2013). Habermann and Fischer (2023) used the mean year-industry ESG as an instrumental variable for ESG while excluding the contribution of the focal firm to the mean. A similar instrument was previously used by Chang et al. (2014) with the rationale that the ESG performance of the focal firm is systematically influenced by the other firms in the industry. Given our sample distribution (see Appendix 2), the mean year-industry ESG instrument is not applicable as several industries only contain one or two firms due to our smaller sample. Another method to make causal inferences was used by Badayi et al. (2021), applying a two-step generalised method of moments (GMM). However, the complexity of that approach is beyond our understanding and would subsequently lead to imprecise conclusions. Given that we have not applied the instrument of mean-year ESG in our regression or GMM, ESG could be correlated with the error term and therefore cause a biased coefficient due to omitted variable bias. Hence, our findings only concern a relationship between ESG and probability of default instead of a causal relationship.

Relating results to theory

One reason why larger firms might experience greater benefits from conducting ESG activities could be that they interact more with different types of stakeholders. This would indicate that general ESG performance is more representative of stakeholder value for larger firms. Stakeholder theory (ST) suggests that firms that create stakeholder value are more likely to experience long-term benefits (Mahajan et al., 2023). Using the lens of ST, it would suggest that ESG performance as a standardised measure is only capable of capturing stakeholder value if the firm interacts with many different types of stakeholders.

When investigating the separate ESG pillars for the Nordic sample, both the environmental pillar score and the social pillar score are highly correlated with the ESG score and exhibit the same relationship to probability of default as the ESG score does. This holds both when including firm size as a control variable and when not including it. Corporate Governance is the deviating pillar, with no significant relationship without including firm size and a positive significant relationship to probability of default when firm size is added. As stated earlier,

conclusions about the relationship between ESG performance and probability of default can only be drawn when our model controls for firm size as larger firms score better in their metrics due to their greater quantity of output. Governance being positively associated with probability of default is explained by distractions for the management causing them to shift focus from the main business (Habermann & Fischer, 2023). Another possible explanation concerns how corporate governance performance in relation to firm-level characteristics is dependent on the level of corruption in the country in question. A study by Abdou et al. (2021) showed that the implementation of certain corporate governance mechanisms lowered agency costs due to decreased earnings management. The effectiveness of the implementation was heightened in countries and settings where a higher perceived level of corruption was present (Abdou et al., 2021). Given that the countries included in this study are ranked among the top five least corrupt states in 2022 based on the Corruption Perception Index (Transparency International, 2023), it is plausible that firms in these countries experience a less significant upside from engaging in corporate governance practices.

From the perspective of stakeholder theory, we do not find any support for our results when all control variables are applied. As our study, contrary to results in previous studies, does not provide results that support the claim of ESG performance lowering probability of default we cannot in turn find support in ST. Given that the results of our study do not indicate any significant positive or negative relationship between ESG performance and probability of default we also cannot find any support within shareholder theory (SHT). SHT suggests that if a firm conducts ESG practices without attaining clear traceable benefits it would be value destroying (Brown et al., 2006), which the results of our study cannot validate or disprove. When applying the lens of ST, it is relevant to question how well a firm's ESG performance overlaps with its ability to create stakeholder value. ESG performance generally refers to a firm's environmental, social, and corporate governance performance relative to other firms within the industry, as well as firms in general (Refinitiv, 2022). In Badayi et al.'s study (2021), ESG performance has been connected to stakeholder relationships. The connection between ESG performance and stakeholder relationship is often dependent on the underlying assumption that stakeholders value ESG performance or that ESG performance illustrates stakeholder value. While there is empirical evidence that suggests that certain stakeholders value and price ESG (Li et al., 2022), there is also evidence that indicates the opposite (Benabou & Tirole, 2010). ESG performance is typically not calculated with regards to the relative stake of different stakeholders, and to what degree stakeholder interest might differ between firms in the same

industry. It is possible that stakeholder value influences probability of default, but that ESG performance does not fully capture stakeholder value. By applying the reasoning of ST, our results suggest that stakeholders in general might not value Nordic firms' efforts to heighten their ESG performance to the extent that probability of default is decreased.

Interpretation of statistical method, chosen variables, and data

Other explanations as to why our results might deviate from the results of prior studies can be found in the statistical and theoretical assumptions that we made when conducting our study. It is possible that the effect of ESG performance on probability of default is not constantly linear, which our model does not account for. ESG performance might only provide benefits to a certain level where investing in ESG beyond that level becomes value-destroying. As mentioned in the introduction, the countries investigated in this study are considered the four most sustainable countries in the world (RobecoSAM, 2023). If we assume that the non-linear relationship holds it would explain why the result of our study deviates from prior literature given that Nordic firms might overinvest in ESG beyond the *necessary* amount.

It is also possible that the proxies we have used in this study do not capture the full effect of the factors which the proxies are meant to replicate. As previously mentioned, it is questionable to what degree the ESG score used in this study, or any ESG score, captures actual ESG performance. As exemplified by the Volkswagen scandal, greenwashing is an apparent issue where lack of regulation enables fraudulent behaviour. Prasad and Holzinger (2013) presented the notion that substantial marketing efforts of ESG may imply fraud. Given that Drempetic et al. (2020) showed that raters value the output of ESG information, marketing efforts of ESG should therefore increase the ESG score. Considering these two studies together would indicate that fraudulent firms might score highly in ESG and that the ESG score does not represent true ESG performance. Thus, even for significant results, such as the large firm subsample, confident conclusions should be made with caution as there exists uncertainty regarding what the ESG score represents.

The same reasoning of not capturing the full effect can be applied to our proxy for probability of default. Altman's Z''-Score LR model has proven effective at predicting bankruptcy risk in the short term (two fiscal years) using accounting information (Altman et al., 2017). However, this model is not perfect and does not capture all factors influencing the risk of corporate default. It is possible that risks that are believed to negatively affect the probability of default,

such as regulatory, controversy, managerial, and reputational risks (Atif & Ali, 2021), are not fully captured by Altman's Z''-Score LR model.

Another factor to consider is to what degree our limited data coverage affects the validity of our study. We have no reason to believe that missing data points are systematically excluded from the sample. Nevertheless, the overweight of certain firms may affect to what degree our sample is representative of the population. If this was to hold it would question the validity of the study's results. Our study has a lower number of firm-year observations per firm compared to certain prior studies (see Appendix 1), which might influence the comparability.

5.2 Implications

The implications suggested by the findings of the study are that firms, in general, do not lower their default probability by increasing their ESG performance. The findings suggest that this holds for both Nordic firms in general and Swedish firms specifically. From a practical standpoint, it can be argued that firms will not benefit from investing more into improving their ESG performance, at least not when firms are aiming at lowering their probability of default. On the other hand, the results do not indicate any significant, positive effect of ESG performance on probability of default. The practical interpretation of the results would not encourage or discourage firms from investing in improving their ESG performance. The result of one of the robustness tests (see Table 12) suggests that for larger firms the effect of ESG performance on probability of default is significantly negative at the 5% level. The practical implication of this result would suggest that larger listed firms can lower their probability of default by increasing their ESG score.

Another factor to consider when relating the results to practical application is the *economic significance*, in other words, if the benefit is of sufficient magnitude to incentivise change. The results for the Nordic sample suggest that ESG performance does not have a measurable, significant effect on default probability. However, for larger firms, the relationship is negative and significant at the 5% level. Thus, it is relevant to consider what the magnitude of the effect needs to be (positive or negative) to encourage larger firms to change their behaviour. The finding from one of the robustness tests suggests that if larger firms improve their ESG score by one point (on a scale of 100), their probability of default will decrease by 0.3 percentage points. Using profitability (EBITDA scaled by total assets) as a comparison, a one percentage point increase in profitability would decrease the probability of default by 0.6 percentage points.

It is beyond the scope of this study to argue whether that decrease in probability of default associated with improved ESG performance justifies any *economic significanc*e, but it is still an important factor to consider when evaluating the implications of the results of this study.

6. Conclusions

In this chapter, we summarise our findings and conclude the most relevant possible explanations for why our hypotheses do not find support. We then address the limitations of our study which are mainly related to data availability. Lastly, we suggest interesting aspects for further research.

6.1 Conclusions

In this study, we examined the relationship between firms' ESG performance and their probability of default for Nordic listed firms. The study utilised a dataset comprised of 482 listed firms incorporated in Denmark, Finland, Norway, and Sweden. The results of this study indicate that the marginal effect of ESG performance on default probability is insignificant for Nordic listed firms, therefore not finding support for the main hypothesis. The results further suggest that firm size has a significant negative relationship to default probability and is positively related to ESG performance, thus explaining the correlation between ESG performance and probability of default. In addition to the main hypothesis, a sub-hypothesis was investigated concerning firms incorporated in Sweden. The results for the Swedish firms are in line with the results for the Nordic firms, thus suggesting that ESG performance does not significantly affect the probability of default for Nordic firms in general or Swedish firms specifically.

As part of the robustness test section (see Table 11), the sample was divided into two groups based on firm size (small and large). The result of this robustness test suggests that ESG performance has a negative effect on default probability for larger firms at a 5% significance level, but no significant effect for smaller firms.

The findings of our study imply that the probability of default for Nordic listed firms, in general, is unaffected by ESG performance. The practical implications of these findings neither encourage nor discourage managers from investing or engaging in ESG practices. For larger listed firms, the findings of our study imply that ESG performance has a negative relationship to probability of default. When considering managers of larger listed firms, the findings of our study recommend increasing ESG investments when wanting to decrease their default risk. However, the economic significance of such investments should also be considered by managers.

For the full sample, we conclude two possible, not mutually exclusive, explanations for our findings. First, ESG performance does not significantly affect probability of default for firms in countries where general ESG performance is high, and corruption is low. Due to high ESG performance being expected in the Nordics to a greater extent than in countries with lower ESG focus, the added benefits of investing in ESG are not sufficient to decrease the probability of default. Second, the ESG score as a proxy is not fully representative of stakeholder value and therefore does not explain the associated benefits. This can be explained either because the ESG score does not represent actual ESG performance due to inaccurate measurements or that actual ESG performance does not fully capture stakeholder value. ESG performance might differ from stakeholder value since ESG performance does not fully account for the relative stake of stakeholders and their interest alignment.

For larger firms, we conclude that ESG performance negatively relates to probability of default. A likely explanation is that the benefits of higher ESG performance outweigh the financial costs induced to achieve a higher ESG performance. Conversely, the financial costs are relatively higher for smaller firms indicating that the benefits are offset by the costs and therefore do not reduce probability of default.

6.2 Limitations

Due to data availability, our study was only able to use active firms as part of its sample. By only including active firms when studying probability of default, an issue of survivorship bias is likely to arise. Survivorship bias is a common limitation in accounting and finance research that has been shown to have the ability to significantly affect the validity of empirical results (Elton et al., 1996). We have no reason to believe that survivorship bias has greatly affected the results of the study, but also cannot support any claim stating that it has not.

Another limitation is that we cannot with certainty make any claim regarding causality between ESG and probability of default. While precautions have been taken to minimise the risk of reverse causality, such as lagging the main independent variable, we cannot with certainty make any claim of actual causality. Where significant relationships have been found we can only with certainty say that the variables correlate and that some causal relationships are likely but not certain. This in turn will affect the implications of our study if the relationship is in fact merely a correlation, thus implying that ESG performance will not affect the probability of default.

A third limitation concerns data coverage. The sample in our study is smaller and contains more missing observations than comparable studies. The lack of data coverage gives reason to question the validity of the results especially if there are systematic reasons behind the missing variables. The main contributing factor behind the lack of coverage is the limited availability of ESG data. We have no information on how Refinitiv chooses which firms to cover and there might be a systematic selection process. If the selection process is to choose systematically similar firms that would question the results of our study and other studies that use this variable as a proxy for ESG performance.

6.3 Suggestions for further research

While the availability of ESG data has increased significantly in recent years, there is still missing coverage of several firms, especially private ones. It would therefore be of interest to repeat the study in a few years when ESG data is more available and reliable. Most of the studies conducted on this topic have utilised datasets comprised of public firms due to data availability reasons. In an ideal setting, we would have liked to examine the relationship between the ESG performance and probability of default for private as well as public firms due to the general differences between these types of firms in relation to their stakeholders and private firms being more likely to default. This subsequently leaves a gap in the research worth exploring.

Our study highlights the relevance of firm size as a determinant factor of probability of default and a factor that influences ESG performance. We do, however, not cover in detail what mechanisms link firm size with ESG performance. Previous research has examined possible explanations for why ESG performance is influenced by firm size, but few have drawn connections to firm risk. This leaves a gap in the literature that would be relevant to investigate.

In this study, we have also highlighted possible issues regarding ESG measures and how different measures tend to vary greatly while attempting to capture the same performance. Thus, it would be of relevance to examine how the results of our study and similar studies are affected by their choice of ESG metrics.

As previously mentioned, we do not make any claim of a causal relationship between the variables even when significant relationships can be found. To be able to distinguish between correlation and causality one could utilise an instrument that is uncorrelated with the error term and correlated with the independent variable (Wooldridge, 2013). Exploring an appropriate

instrument to address endogeneity is beyond the scope of this study which subsequently leaves a relevant gap in the literature worth exploring.

References

Abdou, H. A., Ellelly, N. N., Elamer, A. A., Hussainey, K., & Yazdifar, H. (2021). Corporate governance and earnings management nexus: Evidence from the UK and Egypt using neural networks. *International Journal of Finance & Economics*, *26*(4), 6281–6311. https://doi.org/10.1002/ijfe.2120

Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *The Journal of Finance*, *23*(4), 589–609. https://doi.org/10.1111/j.1540-6261.1968.tb00843

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's *Z*- Score Model. *Journal of International Financial Management & Accounting*, *28*(2), 131–171. https://doi.org/10.1111/jifm.12053

Arouri, M., & Pijourlet, G. (2017). CSR Performance and the Value of Cash Holdings: International Evidence. *Journal of Business Ethics*, 140(2), 263–284. https://doi.org/10.1007/s10551-015-2658-5

Atif, M., & Ali, S. (2021). Environmental, social and governance disclosure and default risk. *Business Strategy and the Environment*, *30*(8), 3937–3959. https://doi.org/10.1002/bse.2850

Badayi, S. A., Matemilola, B. T., A.N, B., & Wei Theng, L. (2021). Does corporate social responsibility influence firm probability of default? *International Journal of Finance & Economics*, *26*(3), 3377–3395. https://doi.org/10.1002/ijfe.1966

Belkhir, M., Maghyereh, A., & Awartani, B. (2016). Institutions and corporate capital structure in the MENA region. *Emerging Markets Review*, *26*, 99–129. https://doi.org/10.1016/j.ememar.2016.01.001

Benabou, R., & Tirole, J. (2010). Individual and Corporate Social Responsibility. *Economica*, *77*(305), 1–19. https://doi.org/10.1111/j.1468-0335.2009.00843

Berg, F., Kölbel, J. F., & Rigobon, R. (2022). Aggregate Confusion: The Divergence of ESG Ratings. *Review of Finance*, *26*(6), 1315–1344. https://doi.org/10.1093/rof/rfac033

Brown, W. O., Helland, E., & Smith, J. K. (2006). Corporate philanthropic practices. *Journal of Corporate Finance*, *12*(5), 855–877. https://doi.org/10.1016/j.jcorpfin.2006.02.001

Chang, C., Chen, X., & Liao, G. (2014). What are the reliably important determinants of capital structure in China? *Pacific-Basin Finance Journal*, *30*, 87–113. https://doi.org/10.1016/j.pacfin.2014.06.001

Chava, S., & Purnanandam, A. K. (2009). Is Default Risk Negatively Related to Stock Returns? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1003682

Cho, S. Y., Lee, C., & Pfeiffer, R. J. (2013). Corporate social responsibility performance and information asymmetry. *Journal of Accounting and Public Policy*, *32*(1), 71–83. https://doi.org/10.1016/j.jaccpubpol.2012.10.005

Danielson, M. G., Heck, J. L., & Shaffer, D. R. (2008). Shareholder Theory - How Opponents and Proponents Both Get it Wrong. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1309066

Drempetic, S., Klein, C., & Zwergel, B. (2020). The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review. *Journal of Business Ethics*, *167*(2), 333–360. https://doi.org/10.1007/s10551-019-04164-1

Elton, E. J., Gruber, M. J., & Blake, C. R. (1996). Survivor Bias and Mutual Fund Performance. *Review of Financial Studies*, *9*(4), 1097–1120. https://doi.org/10.1093/rfs/9.4.1097

Endrikat, J., Guenther, E., & Hoppe, H. (2014). Making sense of conflicting empirical findings: A meta-analytic review of the relationship between corporate environmental and financial performance. *European Management Journal*, *32*(5), 735–751. https://doi.org/10.1016/j.emj.2013.12.004

European Commission. (2022). *Corporate Sustainability and Responsibility*. Internal Market, Industry, Entrepreneurship and SMEs. https://single-market-economy.ec.europa.eu/industry/sustainability/corporate-sustainability-and-responsibility_en

Freeman, R. E., & Reed, D. L. (1983). Stockholders and Stakeholders: A New Perspective on Corporate Governance. *California Management Review*, *25*(3), 88–106. https://doi.org/10.2307/41165018

Friedman, M. (1970, September 13). *A Friedman doctrine-- the social responsibility of business is to increase its profits*. The New York Times. https://www.nytimes.com/1970/09/13/archives/a-friedman-doctrine-the-social-responsibility-of-business-is-to.html

Habermann, F., & Fischer, F. B. (2023). Corporate Social Performance and the Likelihood of Bankruptcy: Evidence from a Period of Economic Upswing. *Journal of Business Ethics, 182*(1), 243–259. https://doi.org/10.1007/s10551-021-04956-4

Huang, F. L., Zhang, B., & Li, X. (2023). Using Robust Standard Errors for the Analysis of Binary Outcomes with a Small Number of Clusters. Journal of Research on Educational Effectiveness, 16(2), 213–245. https://doi.org/10.1080/19345747.2022.2100301

Huang, G., & Song, F. M. (2006). The determinants of capital structure: Evidence from China. *China Economic Review*, *17*(1), 14–36. https://doi.org/10.1016/j.chieco.2005.02.007

Kaplan, R. S. (2009). Conceptual Foundations of the Balanced Scorecard (pp. 1253–1269). https://doi.org/10.1016/S1751-3243(07)03003-9

Key, S. (1999). Toward a new theory of the firm: a critique of stakeholder "theory." *Management Decision*, *37*(4), 317–328. https://doi.org/10.1108/00251749910269366

Laplume, A. O., Sonpar, K., & Litz, R. A. (2008). Stakeholder Theory: Reviewing a Theory That Moves Us. *Journal of Management*, *34*(6), 1152–1189. https://doi.org/10.1177/0149206308324322

Li, H., Zhang, X., & Zhao, Y. (2022). ESG and Firm's Default Risk. *Finance Research Letters*, *47*. https://doi.org/10.1016/j.frl.2022.102713

Lichtenstein, D. R., Drumwright, M. E., & Braig, B. M. (2004). The Effect of Corporate Social Responsibility on Customer Donations to Corporate-Supported Nonprofits. *Journal of Marketing*, *68*(4), 16–32. https://doi.org/10.1509/jmkg.68.4.16.42726

Mahajan, R., Lim, W. M., Sareen, M., Kumar, S., & Panwar, R. (2023). Stakeholder theory. *Journal of Business Research, 166*, 114104. https://doi.org/10.1016/j.jbusres.2023.114104

Matemilola, B. T., & Ahmad, R. (2014). Debt Financing and Importance of Fixed Assets and Goodwill Assets as Collateral: Dynamic Panel Evidence. *Journal of Business Economics and Management*, *16*(2), 407–421. https://doi.org/10.3846/16111699.2013.772916

Matemilola, B. T., Bany-Ariffin, A. N., Azman-Saini, W. N. W., & Nassir, A. M. (2018). Does top managers' experience affect firms' capital structure? *Research in International Business and Finance*, *45*, 488–498. https://doi.org/10.1016/j.ribaf.2017.07.184

Nilsson, W., & Wallin, J. (2023). Beyond profits- an analysis of the relationship between ESG and bankruptcy [unpublished master's thesis]. Umeå University

Ohlson, J. A. (1980). Financial Ratios and the Probabilistic Prediction of Bankruptcy. *Journal of Accounting Research*, *18*(1), 109–131. https://doi.org/10.2307/2490395

Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate Social and Financial Performance: A Meta-Analysis. *Organization Studies*, *24*(3), 403–441. https://doi.org/10.1177/0170840603024003910

Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, *142*(2), 572–597. https://doi.org/10.1016/j.jfineco.2020.11.001

Pérez, L., Hunt, D. V., Samandari, H., Nuttall, R., & Biniek, K. (2022, August 10). *Does ESG really matter-and why?*. McKinsey & Company. https://www.mckinsey.com/capabilities/sustainability/our-insights/does-esg-really-matter-and-why

Plumlee, M., Brown, D., Hayes, R. M., & Marshall, R. S. (2015). Voluntary environmental disclosure quality and firm value: Further evidence. *Journal of Accounting and Public Policy*, *34*(4), 336–361. https://doi.org/10.1016/j.jaccpubpol.2015.04.004

Prasad, A., & Holzinger, I. (2013). Seeing through smoke and mirrors: A critical analysis of marketing CSR. *Journal of Business Research*, 66(10), 1915–1921. https://doi.org/10.1016/j.jbusres.2013.02.013

Refinitiv. (2022). *Environmental, Social and Governance Scores from Refinitiv*. New York City, New York; Refinitiv. Retrieved September 2023,

https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf.

RobecoSAM. (2023, November 2). *How do companies and countries score on sustainability?*. Robeco.com - The investment engineers. https://www.robeco.com/en-ch/sustainable-investing/how-do-companies-and-countries-score-on-sustainability

Schultz, E. L., Tan, D. T., & Walsh, K. D. (2017). Corporate governance and the probability of default. *Accounting & Finance*, *57*(S1), 235–253. https://doi.org/10.1111/acfi.12147

Siano, A., Vollero, A., Conte, F., & Amabile, S. (2017). "More than words": Expanding the taxonomy of greenwashing after the Volkswagen scandal. *Journal of Business Research*, 71, 27–37. https://doi.org/10.1016/j.jbusres.2016.11.002

Statistiska Centralbyrån. (2023, November 1). *SCB Konjunkturklocka.* Experience.arcgis. https://experience.arcgis.com/experience/594bc505c87a49fbbe9a52655d99a8ef

Transparency International. (2023). *2022 Corruption Perceptions Index: Explore the results*. Transparency.org. https://www.transparency.org/en/cpi/2022

Vishwanathan, P., van Oosterhout, H. (J.), Heugens, P. P. M. A. R., Duran, P., & van Essen, M. (2020). Strategic CSR: A Concept Building Meta-Analysis. *Journal of Management Studies*, *57*(2), 314–350. https://doi.org/10.1111/joms.12514

Wagner Mainardes, E., Alves, H., & Raposo, M. (2011). Stakeholder theory: issues to resolve. *Management Decision*, *49*(2), 226–252. https://doi.org/10.1108/00251741111109133

Wooldridge, J. M. (2013). *Introductory econometrics: A modern approach* (5th ed.). South-Western Cengage Learning.

Yu, E. P., Luu, B. Van, & Chen, C. H. (2020). Greenwashing in environmental, social and governance disclosures. *Research in International Business and Finance*, 52, 101192. https://doi.org/10.1016/j.ribaf.2020.101192

Appendix

Appendix 1

Authors	**Sample (geographical location)**	**Period**	**Firms (firm-year observations)**	**Sustainability measurement**	**Bankruptcy measurement**	**Sustainability association with probability of default**
Li et al. (2022)	China	2015-2020	(185,125)	SSI Wind ESG score	RMI NUS PD	Negative
Badayi et al. (2021)	Developing countries globally	2010-2017	496 (3,968)	Refinitiv Eikon ESG score (adjusted)	Altman Z-Score	Negative
Habermann & Fischer (2023)	USA	2010-2019	1,215 (6,696)	Refinitiv Eikon ESG score	Altman Z-Score	None
Atif & Ali (2021)	USA	2006-2017	(5,206)	Bloomberg ESG disclosure score & Refinitiv ESG score	Merton's distance to default/Credit default swap spread	Negative & Negative
Nilsson & Wallin (2023)	Nordics	2016-2022	447 (2,666)	Refinitiv Eikon ESG score	Altman Z-Score	Negative
This study (2023)	Nordics	2017-2023	482 (1,549)	Refinitiv Eikon ESG score	Altman Z''-Score LR	None

Appendix 2

GICS industry name	Number of firms	Number of firm-year observations
Biotechnology	25	71
Hotels, Restaurants & Leisure	9	26
Software	23	55
Entertainment	10	28
Textiles, Apparel & Luxury Goods	6	18
Electronic Equipment, Instruments & Components	22	53
Oil, Gas & Consumable Fuels	8	28
Metals & Mining	7	30
Real Estate Management & Development	30	93
Media	8	30
Health Care Technology	7	21
Electrical Equipment	14	36
Machinery	35	138
Paper & Forest Products	8	32
IT Services	17	39
Trading Companies & Distributors	10	34
Construction & Engineering	14	45
Automobiles	1	2
Industrial Conglomerates	9	30
Building Products	14	54
Household Durables	10	39
Aerospace & Defense	5	18
Health Care Equipment & Supplies	22	65
Pharmaceuticals	11	35
Commercial Services & Supplies	15	48
Interactive Media & Services	6	13
Communications Equipment	7	21
Specialty Retail	12	42
Chemicals	14	49
Life Sciences Tools & Services	5	14
Air Freight & Logistics	3	8
Food Products	14	53
Professional Services	11	24

Diversified Telecommunication Services	4	17
Transportation Infrastructure	2	4
Household Products	2	7
Broadline Retail	5	16
Health Care Providers & Services	7	23
Leisure Products	4	11
Diversified Consumer Services	1	3
Automobile Components	4	15
Consumer Staples Distribution & Retail	2	10
Wireless Telecommunication Services	1	5
Energy Equipment & Services	6	26
Semiconductors & Semiconductor Equipment	3	10
Passenger Airlines	3	14
Technology Hardware, Storage & Peripherals	2	6
Independent Power and Renewable Electricity Producers	3	10
Containers & Packaging	4	18
Electric Utilities	3	13
Marine Transportation	6	22
Beverages	4	16
Ground Transportation	2	4
Tobacco	1	4
Construction Materials	1	3
Total	***482***	***1549***