Jesse Lindén

ESG ratings as a driver of CDS spreads

An analysis of ESG scores and government expenditures

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Author: Jesse Lindén
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ABSTRACT:

During the last two decades, ESG has received substantial attention among investors and academics. There is an ongoing debate about whether companies should focus on incorporating ESG into their business activities. Additionally, lenders are considering if companies with high ESG scores have a lower default risk than their peers with lower ESG scores. Also, political discussion around ESG has emerged considering, for example, the expenditure on ESG activities. The questions arise whether companies focusing on their ESG scores are rewarded by lower default risk and whether companies benefit from government ESG spending. By including years after 2020 in the sample period, the effects of the pandemic period and government spending shock are captured.

This thesis critically evaluates the relationship between ESG scores and default risk estimated using CDS spreads. Geographical differences are captured by comparing the US and European markets. The effect of government ESG expenditures on CDS spreads is examined by focusing on the US markets. In the absence of similar research, this thesis contributes to academic research by introducing an applicable and repeatable model to examine CDS spreads and government expenditures. Additionally, the effects of other relevant factors, such as leverage and debt increases, on default risk are estimated and discussed.

The results obtained indicate that ESG scores are not associated with CDS spreads in the combined sample of Europe and the US. However, there are existing differences between the two areas. According to the results, higher ESG scores are associated with higher default risk in Europe. The relationship appears to have changed from no effect to an apparently statistically significant effect during the 2019-2022 period. This suggests that European companies' ESG activities are not rewarded. Thus, companies should re-estimate the use of their resources. A similar effect is not captured in the US sample. Variance among pillar scores is also reported. Furthermore, the results obtained indicate that US government expenditures on ESG have, on average, increased the riskiness of US companies. Industry-specific examination reveals existing industry-wide variation in the relationship.

KEYWORDS: ESG scores, ESG performance, Government spending, CDS spreads, Default risk, Credit risk

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TIIVISTELMÄ:

Kuluneiden kahden vuosikymmenen aikana ESG on saanut merkittävää huomiota niin sijoittajien kuin akateemisen tutkimuksen keskuudessa. Keskustelua on käyty laajasti, tulisiko yritysten huomioida ESG-asiat liiketoimissaan. Toisaalta lainoittajat pohtivat ovatko, paremman ESG-luokituksen saaneet yritykset matalariskisempiä kuin niiden heikommin luokitellut verrokkinsa. Lisäksi ESG on ollut poliittisen huomion kohteena. Poliittista keskustelua on noussut esimerkiksi valtion kulutuksesta vastuullisuuteen liittyviin teemoihin. Aiemman perusteella herää kysymys, palkitaanko korkeampiin ESG-luokituksiin tähtäävät yritykset matalammalla luottoriskillä ja ovatko yritykset hyötyneet valtion ESG-teemoihin liittyvästä kulutuksesta. Sisällyttämällä tutkimukseen vuoden 2020 jälkeistä dataa, voidaan tarkastella pandemian sekä valtion kulutusshokin vaikutuksia tutkittuihin hypoteeseihin.

Tutkielmassa tarkastellaan kriittisesti ESG-suoriutumisen ja luottoriskin välistä yhteyttä. Luottoriskin mittarina hyödynnetään CDS-sopimusten hinnoittelua. Maantieteellisiä eroja löydetään tarkastelemalla sekä Euroopan että Yhdysvaltojen markkinoita. Valtion ESG-teemoihin liittyvän kulutuksen vaikutuksia CDS spredeihin on estimoitu keskittymällä Yhdysvaltojen markkinoihin. Tutkielman kontribuutiona akateemiseen tutkimukseen on valtion kulutuksen ja CDS-hinnoittelun väliseen yhteyden estimointiin käytettävän ja toisinnettavan mallin esittely. Lisäksi mallinnetaan relevanttien muuttujien kuten yritysten ja valtion velkaantuneisuuden vaikutusta luottoriskiin.

Saadut tulokset indikoivat ettei ESG-pisteiden ja yritysten luottoriskin välillä keskimäärin ole yhteyttä, mikäli sitä mitataan eurooppalaisten ja yhdysvaltalaisten yritysten yhdistetyssä otannassa. Alueiden erillinen tarkastelu paljastaa olemassa olevia maantieteellisiä eroja. Tutkimustulosten perusteella ESG-pisteiden ja luottoriskin välillä on positiivinen suhde Euroopassa. Suhde vaikuttaa muuttuneen tilastollisesti merkitseväksi vuosien 2019-2022 aikana. Käytännössä tulokset indikoivat, ettei eurooppalaisia yrityksiä ole palkittu niiden ESG-suoriutumiseen käyttämistä panostuksista. Näin ollen yritysten tulisi kriittisesti tarkastella kulutustaan ESG-aktiviteetteihin. Samanlaista suhdetta ei tunnistettu Yhdysvaltojen markkinoilla. ESG-pilarien ja luottoriskin välisessä suhteessa havaittiin olevan vaihtelua. Yhdysvaltojen ESG-kulutuksen ja yritysten keskimääräisen luottoriskin välillä on tulosten perusteella positiivinen yhteys. Toimialakohtainen tarkastelu paljastaa toimialoittaista vaihtelua.

AVAINSANAT: ESG scores, ESG performance, Government spending, CDS spreads, Default risk, Credit risk

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Abbreviations

BIS	Bank for International Settlements
BP	Basis Point
CAPM	Capital Asset Pricing Model
CCI	Consumer Confidence Index
CC	Central Counterparty
CDS	Credit Default Swap
CSR	Corporate Social Responsibility
CSRD	Corporate Sustainability Reporting Directive

EMH	Efficient Market Hypothesis
ESG	Environmental, Social, Governance
FE	Fixed Effects
GDP	Gross Domestic Product
GNP	Gross National Product
HML	High Minus Low
LSEG	London Stock Exchange Group
OLS	Ordinary Least Squares
OTC	Over-The-Counter
SMB	Small Minus Big
UN	United Nations
US	United States
YTM	Yield-to-Maturity

1 Introduction

The modern history of corporate sustainability goes back to the beginning of the 1950s when the term corporate social responsibility (CSR) was first introduced. In contrast to pure profit maximisation, CSR focuses on other aspects of business, such as having a positive impact on surrounding society and stakeholders. CSR was the dominant term in the field of corporate responsibility to the beginning of this millennium. The hot topic in finance and business generally during the last two decades has been the framework incorporating environmental, social, and governance (ESG) factors. Thus, ESG consist also other aspects than maximised profits. By incorporating the ESG factors in business processes, companies might seek to achieve operational efficiencies and enhanced reputational capital. For example, environmentally friendly companies might receive more favourable funding and have higher stock returns. Furthermore, in the European Union, a legislative reform known as the Corporate Sustainability Reporting Directive (CSRD) mandates a growing number of companies to report on the environmental and social impact of their activities. Hence, it can be expected that the ESG concept will receive substantial attention in the coming years.

In addition to businesses, ESG has received attention from governments and non-governmental organisations. Thus, ESG has also become a political concept. Therefore, debate has emerged on e.g. how much tax-payers resources should be channelled into ESG activities. In 2015, worldwide government expenditures on sustainable development goals were over 20 trillion dollars, which is expected to rise significantly during the next decade (Brookings, 2019). Financial markets are not isolated from the surrounding society. Thus, at some level, they are subject to economic agents' behaviour and beliefs. From a behavioural perspective, the attention that ESG has received will tend to drive investment decisions (see e.g., Barber & Odean, 2008). Globally sustainable investments in all asset classes were over 30 trillion dollars in 2022 (GISA, 2022). The significant amount of investments highlights the importance of understanding the relationship between sustainability and financial markets.

The financial markets are constantly changing. The changes are driven by e.g. regulation, financial innovations, speculation, and investor sentiment. A financial innovation introduced slightly before the term "ESG", called credit default swap (CDS), has been a hot topic in the credit derivatives market during the last two decades. Regarding received attention and outstanding amount, the peak of CDS was during the financial crisis from 2007 to 2009 (BIS, 2018). Academics have stated that CDS is perhaps one of the most influential financial innovations of the last decades (Oehmke & Zawadowski, 2017). Practically, CDS is an insurance contract where the lender hedges against the borrower´s default risk. The cost of this insurance is usually referred to as spread. The higher the default risk is, the higher the spread should be. During the last few years, the market has witnessed an increase in CDS as the notional amount of CDS has reached almost 10 trillion dollars (BIS, 2023). Given the fundamental purpose of CDS as an insurance contract against the risk of default, it is not surprising that the outstanding amount has increased during the last three years due to uncertainty in the market environment.

1.1 Purpose of the study

The relationship between ESG and financial markets has been extensively studied in academic research. Thus, it has been found, for example, that the ESG performance of a company has correlated with, e.g. stock returns (Khan, 2019), nonperforming loans (Liu et al., 2023), and the risk of default (Kanno, 2023). The thesis aims to provide an in-depth look at the relationship between ESG and CDS spreads. More precisely, considering the use of CDS for hedging, the relationship between default risk and ESG scores is researched. In other words, are more sustainable companies rewarded by the credit markets? The data expands the US and European markets to capture possible geographical differences. Although the CSRD was not applied during the sample period, the results for the European sample might suggest what effects on default risk could be expected when the directive has completely come into effect. For example, the introduction of CSRD might motivate European companies to use more resources on ESG activities. This highlights the novelty of this research topic. On the other hand, this thesis contributes to the existing research cap since, to the best of my knowledge, this thesis includes most recent

data. Examining the relationship between ESG and default risk with CDS is appealing since it has been captured that information flows from CDS to stock prices (Acharya & Johnson, 2007) and bond yields (Gadgil, 2024). Also, CDS have other advantages compared to alternative default risk measurements such as bond yields, credit ratings, and accounting-based variables such as Z-score. CDS spreads, e.g. are continuous and do not require a definition of correct "risk-free" rates.

There is variability in the results of studies focusing on ESG performance and default risk. However, most discussed studies have reported a negative association between sustainability performance and CDS spreads. Therefore, the first hypothesis is formulated as follows:

$Null_1$: ESG scores do not have an impact on CDS spreads.
H_1: ESG scores are negatively associated with CDS spreads.

The second part of this study examines whether US government expenditures on ESG-related activities are associated with industry CDS indexes. Exploring government expenditures allows focusing more on the political side of sustainability. Since the sample period includes spending shock, the effects of debt expansions can be estimated with novel data. Intuitively, some companies or industries might benefit more from government expenditures than others. This could be one factor driving the results of the first hypothesis. Furthermore, if the correlation appears to be positive, the rationality behind ESG spending raises questions. However, despite the received results, at least some expenditures on ESG-related budget functions are required, e.g. education and healthcare. To the best of my knowledge, the relationship between government ESG spending and CDS spreads (or prices of other assets) has not been studied before, emphasising the academic contribution of this thesis. In contrast, other government spending and financial markets have received academic attention. For example, it has been found that defence industry stock performance has been driven by defence budget announcements (Gurdgiev et al., 2022). Furthermore, the presidency of the US has also impacted stock

returns (Belo et al., 2013). More broadly, Wisniewski and Jackson (2021) report a negative association between debt to GDP (Gross Domestic Product)-ratio and stock returns.

In the long run, government expenditures seem to be associated with higher country-level default risk (see Reinhart and Rogoff, 2009). However, in the short horizon the effect can be negative or positive. This thesis focuses on mid-term (5-year) effects on CDS spreads. Additionally, the information flows from CDS to bonds (Blanco, 2005) impedes making an intuitive assumption of the coefficient´s sign. Considering the previous and the absence of related literature, the effect of ESG spending on CDS spreads is expected to be positive or negative. Thus, the second hypothesis is formulated as follows:

$Null_2$: Government ESG expenditures do not affect CDS spreads.
H_{2A}: Government ESG expenditures are negatively associated with CDS spreads.
H_{2B}: Government ESG expenditures are positively associated with CDS spreads.

1.2 Structure of the study

The second chapter discusses ESG and sustainability, including criticism that has emerged towards ESG and ESG scoring. It is followed by a chapter delving into derivatives markets and CDS. The third chapter comprehensively explains the nature, valuation, and practicality of a CDS as an investment. Since CDS is fundamentally an insurance contract against default risk, the fourth chapter discusses default correlations and popular methods utilised in credit risk modelling. The fifth chapter includes a literature review section focusing on existing studies on both hypotheses. The sixth chapter discusses the data and methodologies applied in the research. Aligning with the fifth chapter, the two hypotheses are discussed separately to avoid misunderstandings. After the sixth chapter, the hypotheses' results are interpreted. The chapter also specifies possible limitations of the results. The eighth and last chapter concludes the study by presenting the main findings and relevant concepts. Furthermore, suggestions for future research and practical implications are presented in the eighth chapter.

2 History of ESG and CSR

This chapter begins with a summary of the history of corporate sustainability, followed by a discussion of its relevance to financial markets. Furthermore, the ESG rating and scoring process is defined comprehensively. The final part includes a discussion of the sustainability concept's challenges and criticisms.

2.1 Definition of ESG

Corporate sustainability has been a subject of study for nearly a century. Until the last two decades, academics have focused predominantly on CSR. Despite remarkable attention, it does not have one comprehensive definition. CSR activities encompass various categories. According to Dahlsrud (2008, p. 1), the challenge in defining CSR is that the existing methodologies do not suggest an unbiased verification. Dahlsrud (p. 5) continues that based on the previous literature, CSR can be viewed as a concept that includes environmental, economic, social, and stakeholder dimensions. Nonetheless, it should be noted that the definition of socially responsible behaviour evolves over time (Campbell, 2007). Dahlsrud concludes that the challenge for a corporation is the consideration of CSR in business strategy rather than the definition of CSR.

The concept of ESG was introduced in 2005 through the United Nations (UN) report titled "Who Cares Wins." The report includes recommendations suggested by the financial industry for integrating the three pillars in decision-making processes. Issues related to the three pillars are described in the report (p. 6). The first pillar is the *Environment*, which addresses concerns such as climate change, emissions, and environmentally friendly production. The second pillar, *Social*, includes workplace health, human rights, and government relations. The third pillar is *Governance*, which consists of e.g. executive compensation, bribery, and accounting practices. Kiesel and Lücke (2019) define ESG as a group of non-financial information affecting an entity´s predisposition on topics included in the three pillars.

Companies can be divided into subgroups based on their sustainability activities. Pástor et al. (2021) propose two classifications of companies: “green” and “brown”. As could be expected, green companies have a positive influence on society, whereas the impact of brown companies is negative. However, a company's willingness to act responsibly might depend on economic conditions. A better financial performance of a company is more likely to result in socially responsible behaviour (Campbell, 2007). Therefore, it can be argued that companies with better financial positions may invest more in ESG activities and thus have higher ESG scores.

Stakeholder theory describes the behaviour of companies affected by the desires of different internal and external parties. According to Mitchell et al. (1997), the stakeholders encompass owners, contractors, employees, suppliers, etc. More broadly, it can be stated that stakeholders can be viewed as a group of all parties that are affected by a particular entity. Pressure from stakeholders is one of the drivers of a company´s sustainability actions. Based on stakeholder theory, higher-level corporate responsibility may decrease the pressure from external parties (Lian et al., 2023). Mitchell et al. continue that some stakeholders are more influential than others, which should be considered in managerial decision-making. In addition to stakeholder influence, companies are also subject to the influence of surrounding society. This relationship is examined in institutional theory. According to Campbell (2007), corporations are, for instance, affected by the regulation and monitoring of external parties such as nongovernmental organisations and institutions. Thus, the companies in this thesis's sample are likely to be influenced by external parties. Therefore, regional and industry-wide differences in the results and ESG scores might emerge.

The perceptions and values of managers influence their responsiveness to ESG issues (Kiesel & Lücke, 2019). Thus, behavioural aspects are likely part of the companies’ ESG activities, potentially driving variance among ESG scores utilised in this thesis. According to Pedersen et al. (2021), investors can be divided into three categories based on their investment behaviour related to ESG factors. Pedersen et al. describe U, A, and M-type

of investors. They state that ESG-unaware (Type-U) do not consider ESG scores in their investment process. ESG scores are discussed in the following chapter. Pedersen et al. state that Type-U investors solely focus on maximising their mean-variance utility. Mean-variance maximisation stands for maximising returns at a given risk, or the inverse, minimising risk at a given level of return.

Furthermore, Pedersen et al. (2021) suggest that Type-A (Aware) investors modify their perceptions of ex-ante returns and risk based on ESG scores. According to Pedersen et al., ESG-motivated (Type-M) investors are the most interested in ESG issues. They explain that ESG-motivated investors make a trade-off between three factors: expected return, ESG scores, and risk. Furthermore, the optimisation process of Type-M investors can be simplified to trade-off between the Sharpe ratio and ESG performance (Pedersen et al., 2021). Pástor et al. (2021) state that the higher the ESG preferences an investor has, the lower the expected returns are. They explain that this results from capital flows from "brown" assets to "green" assets. Consequently, green companies become more valuable relative to brown, and the market portfolio approaches the portfolio of ESG investors (Pástor et al., 2021, p.2). On the one hand, the previous suggests that some investors holding ESG investments might benefit from increased asset prices due to capital flows to green assets. On the other hand, the decreased value of brown assets, relative to green, might offer higher risk-adjusted returns.

2.2 ESG scores

Although several ESG rating agencies exist, this study focuses on ratings by LSEG (London Stock Exchange Group). These ratings are known previously as Refinitiv and Thomson Reuters ESG scores. Therefore, it is meaningful to delve into the rating process of that particular entity. Other well-known ESG raters are MSCI, ISS Oekom, and Bloomberg (Billio et al., 2021). LSEG (2023) measures ESG performance with both numerical and letter scales. Both measurements are based on percentiles. Therefore, the numerical ratings vary between 0 and 100, and letters from D- to A+.

LSEG (2024) states that ESG and sustainability conceptually differ. According to LSEG, both concepts are regulated differently. They define sustainability as a broader, longer-term objective balancing economic and non-economic well-being. In contrast, ESG is defined as a framework addressing the three pillars. Furthermore, LSEG explains that there is not a standardised framework for ESG. Considering the pillar scores, they state that the environmental pillar is the most challenging to report. Practically, it could be argued that the absence of a standardised definition of ESG likely complicates managing the ESG issues and incorporating ESG into corporations´ business activities. On the other hand, the absence potentially drives inconsistencies in reporting sustainability actions. Furthermore, greenwashing, where companies exaggerate their positive sustainability actions, might be more tempting without a comprehensive definition.

According to LSEG (2023), the ESG ratings are a sum of over 630 different metrics related to sustainability and responsibility. Those metrics are rearranged into ten categories. The three ESG pillars are calculated separately based on the categories and later combined to produce the overall ESG score. However, different weights for environmental and social pillars are utilised based on the industry in which a company operates. LSEG continues that the weight for corporate governance is the same in all industries. The following picture illustrates the formulation of LSEG ESG scores and the ten categories employed in the rating process.

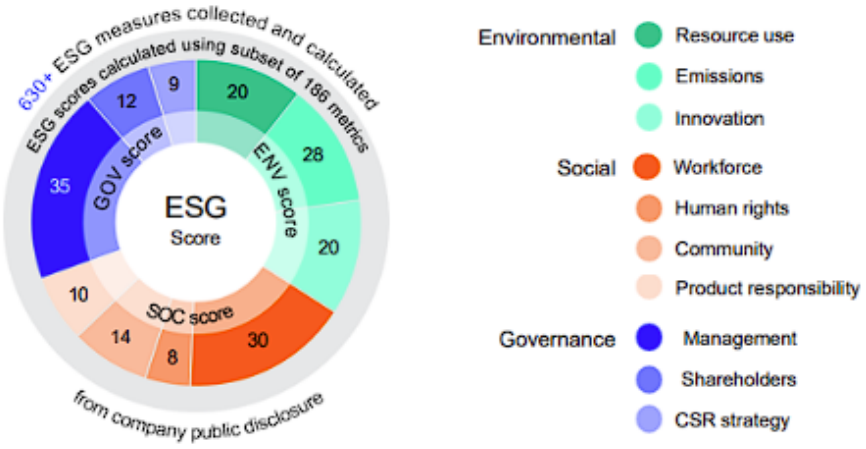

Figure 1 The structure of LSEG ESG scores

LSEG (2023) suggests that their data is continuously updated to embed new information. However, the majority of data is refreshed on an annual basis, depending on the company's ESG disclosure. It should be noted that LSEG sometimes updates the ESG scores afterwards. This might influence the results of this thesis. LSEG clarifies that the corrections are made, for example, if new information that would have impacted the ESG score emerges. However, scores older than five years are "definitive". In other words, they remain unchanged whether new information emerges or not.

What follows is a comparison of the ESG scores of two Finnish companies in this thesis´s sample. Nokia´s ESG score in 2022 was 83,73. The pillar scores were environment 70,28; social 83,62; and governance 91,47. In comparison, Stora Enso had an ESG score of 81,67 in 2022. The three pillar scores were environment 85,97; social 87,83; and governance 65,05. Although both companies had ESG scores relatively close to each other, there are existing differences. Stora Enso had a significantly higher environmental score than Nokia. In contrast, Nokia´s governance score was higher than Stora Enso´s. This example highlights the reasoning for regressing the effect of pillar scores on the CDS spreads.

2.3 Criticism towards ESG

Given the significant attention that ESG has received, there is also criticism towards the concept of sustainability. Perhaps the most well-known criticism was made by Milton Friedman, who stated, "*The Social Responsibility of Business Is to Increase Its Profits*" (The NY Times, 1970). Furthermore, more recently in June 2023, the CEO of BlackRock, Larry Fink, criticised the term "ESG" by stating that "*I don't use the word ESG any more, because it's been entirely weaponised ... by the far left and weaponised by the far right*" (Reuters, 2023). Additionally, ESG has received political attention. For example, North Dakota has restricted investing state funds for social purposes, and the state of Idaho prohibited public entities from weighing ESG issues over "prudent investor rule" (Harward Law School, 2023). In January 2023, it was reported that BlackRock had lost approximately four billion dollars in assets under management due to a political campaign against ESG investing (Reuters, 2023). As a speculation, the previously mentioned statement of Larry Fink might be related to BlackRock losing money due to capital outflows from their funds.

Based on fundamental economic theories, investments should have diminishing marginal returns. Diminishing marginal returns indicates that increasing input by one unit has an effect of under one on output. At a corporate level, there is a trade-off between ESG investments and other investment opportunities (Lian et al., 2023). Thus, investment decisions should be made based on expected marginal utilities derived from the investments. It could be argued that by following legislation, companies behave responsibly, and efforts above that are investments facing diminishing marginal returns. On the other hand, it might be possible for companies to positively affect ESG scores without extra investments, for example, by utilising more cost-efficient and environmentally friendly production methodologies.

Since corporate sustainability in academic literature is usually proxied with ESG ratings or scores, their critical evaluation is justified. According to Billio et al. (2021), there is a

deviation in the definitions of ESG pillars. They state that the disagreement in the definitions causes contradictory ratings between rating agencies. They suggest that disagreement leads to difficulty in deciding the correct benchmarks in ESG investing. As a result of the disagreement, the results of Billio et al. indicate that once there is agreement in the ESG ratings, it does not impact the performance of ESG portfolios. They report that the average agreement in ESG scores is approximately 24%. In conclusion, there is an urgent need for commonality in ESG reporting (Billio et al., 2021). These results illustrate that the findings of this thesis are also subject to at least some rating disagreement. In credit ratings, it is often assumed that there is positive rating drift during economic booms (Altman & Kao, 1992, p. 4). Regarding ESG scores, positive drift could also be expected during booms since companies might have more resources to spend on ESG activities aligning with Campbell (2007).

Christensen et al. (2022) examine the potential drivers of ESG rating disagreement. They find that ESG disclosure is one of the factors. The higher the disclosure is, the higher the disagreement is. Based on Christensen et al., ESG rating agencies must evaluate whether the disclosure indicates positive or negative performance. They find that the disagreement is more robust with environmental and social pillars. Furthermore, disagreement is higher with ESG outcomes than inputs. Christensen et al. define the inputs as actions that a company is making and outcomes as the results of the inputs. Perhaps the results of Christensen et al. explain some of the results of Billio et al. (2021). In a European context, the CSRD might diminish the disagreement between rating agencies, potentially affecting the results of future research.

Market sentiment may drive the effects of ESG on financial markets (Anand et al., 2023). Thus, it can be argued that investors' behavioural biases, such as herding, are the leading factors affecting the performance of sustainability concepts. Hwang and Salmon (2004, p. 1) explain herding as a behavioural bias where investors adapt their personal beliefs to the average belief among other market participants. Therefore, individuals dismiss

their judgment. Investors´ herding behaviour potentially drives companies to make decisions that appear unprofitable in the long term. The previous applies also to actions other than those that are ESG-related. On the other hand, herding might also have positive impacts, such as encouraging companies to have more transparent governance. Additionally, investor behaviour is influenced by topics receiving more attention, e.g. news coverage (Barber & Odean, 2008). Hwang and Salmon obtained results indicating that investors herd "towards the market portfolio". In contrast, Pástor et al. (2021) state that the market portfolio moves towards the portfolios of ESG investors. Given the tendency of investors to make irrational decisions, time variation in the results of this thesis can be expected, depending on the market sentiment.

3 Derivatives and CDS

This chapter includes an overview of the derivatives market followed by a comprehensive discussion of CDS's structure, purpose, and nature. Furthermore, valuation and other relevant concepts, including a real-world example of arbitrage opportunity, are presented.[1]

3.1 Derivatives market

The derivatives market is the most important financial market, at least measured in notional size. Therefore, several types of products are traded in the derivatives market, such as options, swaps, futures, and forwards. According to Hull (2022, p. 23), a derivative contract is a contract between two market participants on a future transaction. As the term "derivative" suggests, derivatives are products whose values should be proportional to the value of an underlying asset. However, this might not always be the case (Blanco et al., 2005). Derivatives are traded in both exchanges and over-the-counter (OTC) markets. The Chicago Board of Trade and the Chicago Mercantile Exchange are two well-known exchanges in which companies and institutions implement trading (Hull, 2022, p. 24).

In contrast to exchanges, traders in the OTC markets are larger entities such as financial institutions (Hull, 2022, p. 25). Hull describes that there are two alternative ways to complete a trade. It can be completed as a bilateral trade or through a central counterparty (CC). According to Hull (p. 25), in bilateral trading, there is a risk that the other party of the trade will default. However, if the trade is completed through a CC, the CC will bear the risk that one of the participants defaults. The derivatives market is constantly evolving. The global financial crisis can be viewed as one of the dividers between the past and present in the derivatives market. The Dodd-Frank Act was one regulatory response in

[1] The theoretical background of CDS, derivatives market and credit risk modelling follow my bachelor´s thesis "The divers of CDS spreads". Thus, similarities exist especially in the mathematical parts.

the US to the financial crisis by promoting transparency in the OTC market and increasing the responsibilities of the CC (Loon & Zhong, 2016).

3.2 Definition of CDS

Based on the Bank for International Settlements (BIS) (2024) survey, CDSs are the most essential credit derivatives. CDS typically includes three entities: CDS seller, CDS buyer (lender), and debt issuer, referred to as a reference entity (Longstaff et al., 2005). By entering a CDS contract, the lender can transfer the reference entity's default risk to the CDS seller. Therefore, CDSs are fundamentally insurance contracts against default risk (Bai & Collin-Dufresne, 2019). Since the value of CDS depends on the default risk, it can be categorised as a contingent claim (Longstaff et al., 2005). However, CDS buyers are not protected from other risks besides default risk. They are subject to i.e. interest rate, reinvestment, and liquidity risks (Fabozzi et al., 2021). There is a conceptual difference between “credit risk” and “default risk”. Fabozzi et al. (2021, p. 65) define the risk that the borrower cannot deliver the contractual payments as a default risk. They continue that credit risk encompasses the default risk, and the risk of the bond´s value relative to others will deteriorate.

If a credit event occurs, the seller of the CDS is obligated to compensate the losses for the buyer of the CDS. Therefore, a CDS is a legally binding contract. There is not one comprehensive definition for a credit event. However, a credit event might occur, for example, when the reference entity goes bankrupt, fails to pay interest or the debt is restructured (Blanco et al., 2005, p. 3). Naturally, the buyer of the CDS compensates the seller of the CDS for bearing the default risk. This periodic payment is referred to as a CDS premia (Longstaff et al., 2005) or spread (Bai & Collin-Dufresne, 2019). This thesis uses exclusively the term “spread”. Usually, spreads are measured in basis points (BPs), a hundred BPs equal to one per cent. Since CDS spreads represent default risk (Gao et al., 2021), a higher default risk should be associated with a higher CDS spread. Vise versa,

lower CDS spreads should indicate lower default risk. Furthermore, the spreads provide a continuous measurement of credit risk instead of discrete metrics such as credit ratings.

However, the definition of credit events has evolved over time. During the European sovereign crisis, Greece's debt was restructured with a 50% write-down, also known as a "haircut." According to Augustin et al. (2014, p. 12), there was uncertainty among "European officials" about whether voluntary debt restructuring would be perceived as a credit event. They continue (p. 103) that over two-thirds of bondholders eventually agreed to the voluntary restructuring, which was considered a credit event. Afterwards, in 2014, the contractual design of CDS was altered, e.g. in terms of the definition of a credit event and settlement of a CDS contract (Augustin et al., 2014). The previous example emphasises the political risks related to CDS. Since the devil lies in the details, playing word games around definitions of defaults and credit events is possible.

For example, a company's 5-year CDS spread per annum is 120 BPs, and the notional principal is 10 million dollars. Thus, the quarterly cost for the buyer of the CDS to hedge against default risk is 30 000 dollars. The following figure illustrates the structure of the CDS.

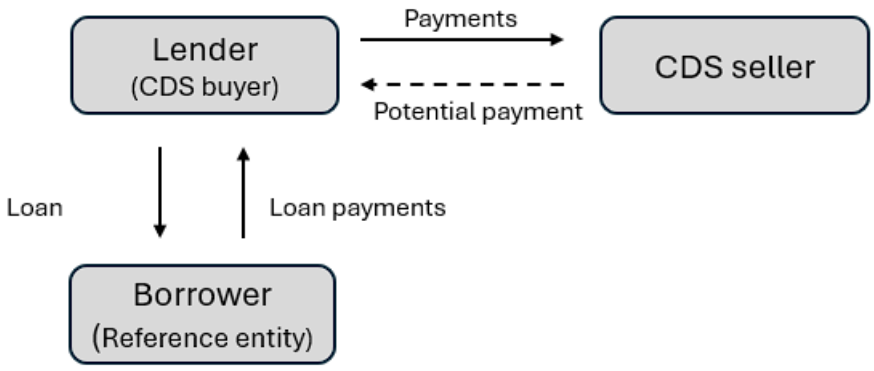

Figure 2 Structure of a CDS

While comparing the size of the CDS market to the derivatives market, it might appear they are just a marginal sideshow. However, the outstanding notional amount of CDS is

substantial. The notional amount of CDS has steadily increased during the last few years, up to 10 trillion US dollars (BIS, 2024). The notional amount witnessed a dramatic increase before the financial crisis and almost as dramatic decrease after the crisis. The notional amount peaked at 60 trillion US dollars (BIS, 2018). However, this development might result from other aspects of CDS, such as speculation and basis trade, in addition to the nature of insurance.

3.3 Hedging vs Speculation vs Arbitrage

According to the trade-off theory, companies balance the pros and cons of debt financing before issuing debt. Pros include receiving tax shields and lowering the required rate of returns. On the other hand, issuing debt may result in costs of financial distress and an increased probability of default. However, according to Modigliani and Miller (1958), capital structure should not affect the company's riskiness. The results of Oehmke and Zawadowski (2017) indicate the hedging nature of CDS. They suggest that the higher the amount of outstanding debt a company has, the higher the net notional CDS positions are. Thus, it seems that markets perceive that increased debt increases the probability of default. Furthermore, higher CDS positions are associated with higher amounts of accounts payable and for companies providing credit guarantees (Oehmke & Zawadowski, 2017). However, it has been found that initiating CDS trading increases a company's default probability, driven by, for example, an increased number of lenders (Subrahmanyam et al., 2014).

Alternatively, the CDS market provides a trading platform for speculation. Speculation with CDS is appealing since the speculator does not have to hold the underlying debt instrument. The speculation approach can be viewed from the perspectives of CDS buyers and CDS sellers. On one hand, CDS buyers may speculate on the possibility of a credit event. On the other hand, CDS sellers speculate that the reference entities will not default on their debt or that the received spreads compensate for the expected losses. This emphasises the role of default risk estimation, which will be discussed later in this thesis.

Several factors exist as to why some investors prefer trading CDSs over bonds. Oehmke and Zawadowski (2017) state that CDSs have a standardisation advantage over bonds. They explain that corporate bonds include e.g. coupons, restrictive covenants, and call-optionality. In practice, those embedded contractual terms prevent implementing pure arbitrage trade as discussed later. Longstaff et al. (2005) provide an additional battery of explanations. Longstaff et al. suggest that the CDS market adapts to changes in supply and demand since there is no limit to the amount outstanding. According to Longstaff et al., hedgers will likely hold their positions to maturity. Entering a new CDS contract may be more economical than liquidating the existing position. Also, selling CDS may be easier than shorting a bond (Longstaff et al., 2005). These fundamental differences between the CDS and the bond market highlight the reasoning for estimating the effect of ESG performance on default risk with CDS spreads rather than bond yield spreads.

3.4 Counterparty risk

Until this chapter, the introduction of CDS has solely focused on CDS buyers transferring the default risk to the sellers of the CDSs. Nevertheless, CDS buyers are exposed to default risk, which is referenced as a counterparty risk. Bai and Collin-Dufresne (2019) define counterparty risk as a risk that a CDS seller cannot fulfil obligations if a reference entity defaults on debt. They state that there should be a negative association between CDS spreads and counterparty risk. A methodology assessing the impact of counterparty risk on spreads was proposed by Hull and White (2001), which is discussed more precisely in the following chapter. According to Bai and Collin-Dufresne, the counterparty risk depends on the default correlation between the CDS seller and the reference entity. Default correlations are presented in the credit risk modelling chapter.

Loon and Zhong (2016) investigated whether the Dodd-Frank Act in the US impacted the CDS market. Their evidence suggests that the reform, including central clearing, en-

hanced the liquidity of the CDS index market and reduced counterparty risk. More specifically, they found that the reform was associated with lower transaction costs if the trades were cleared through CCs. Currently, most CDS trading flows through CCs (BIS, 2024). On the other hand, it can be argued that the counterparty risk has not vanished. Instead, the CC bears it (Hull, 2022, p. 25). Therefore, a question arises whether introducing centrally cleared trades in reality solved the problem. Furthermore, the existence of transaction costs indicates that the spreads of this thesis sample might include some amount of "premiums" to compensate for the costs. Thus also affecting the obtained results.

3.5 Valuation of CDS spreads

There are alternative approaches to estimating "correct" CDS spreads. Some are more intuitive than others, requiring more assumptions and approximations. However, despite being rules of thumb, they can still be practical tools for an investor. Given the efficient market hypothesis (EMH) and the "strong form market efficiency", all available information should be fully embedded into asset prices (Fama, 1970). Thus, there should not be any arbitrage opportunities. The EMH assumes, for example, that there is no information asymmetry, no transaction costs, and investors have rational expectations. If arbitrage opportunities exist, rational investors should exploit those theoretically "risk-free" opportunities and push the asset prices to their "correct" level. Some market participants are better informed than others or have access to private information. Therefore, there are information asymmetries. Furthermore, transaction fees occur, for example, if a broker is involved in trading. Thus, the EMH is a theoretical framework rather than reality. The following part of this subchapter discusses the effects of deviations from market efficiency on the valuation of CDS spreads.

Assuming perfect capital markets, the CDS spread should equal the corporate yield spread. More precisely, according to Blanco et al. (2005), the n-year CDS spread of a reference entity is the difference between the n-year bond yield issued by the reference

entity and the n-year "risk-free" rate. This relation is illustrated in equation 1, where *s* is the spread, *y* is the yield, and *rf* is the risk-free rate.

$$s = y - rf \tag{1}$$

Equation 1 emphasises why CDS spreads and corporate yield spreads can be theoretically compared. Usually, risk-free rates are approximated with government bond yields. The risk-free rate for European (US) companies can be approximated with the German (US) government bond yield. It should be noted that since truly risk-free rates do not exist, there is always some amount of risk included. Practically, investors can estimate market perceptions of the "risk-free rate" by subtracting the CDS spread from corporate bond yield. According to equation one, since CDS spread valuation is relative to the values of other assets, they cannot be valued absolutely. Therefore, the theoretical valuation of CDS assumes that the underlying is correctly valued.

According to the EMH, CDS and corporate yield spreads should move in tandem. However, they do not. Evidence exists that the CDS market leads the bond market in the price discovery process (Blanco, 2005). In addition to contradicting the EMH, the findings of Blanco et al. also contradict the fundamental assumption that the values of derivatives should be proportional to the value of the underlying, not vice versa. With more recent data, Gadgil (2024) also reports the leading role of the CDS market in price discovery. However, the effect has declined due to regulative changes after the financial crisis (Gadgil, 2024). As speculation, if CDS spreads drive yields, an investor can wag the underlying by purchasing CDSs in large quantities, leading to an increased amount of CDS outstanding. Thus, market participants might consider that the company´s default risk has increased due to increased CDS positions. These findings indicate that the relationship between CDS spreads and yield spreads in equation 1 cannot hold in reality. Furthermore, in the absence of related literature, this deviation from efficiency justifies why the effect of government ESG spending on CDS spreads in hypothesis two is assumed to be positive or negative.

However, the previous equation does not describe what drives the yield or CDS spreads. CDS spreads can be estimated using the probability of default and recovery rate. The recovery rate is the rate that can be recovered if a loan defaults. Common practice assumes that the recovery rate is 40% (Hull, 2022, p. 564). Following Hull (2022, p. 565), the spread is estimated with equation 2, where R is the recovery rate for the corporate bond, P is the probability of default and s is the CDS spread.

$$s = (1 - R)P \tag{2}$$

Interpretation of equation 2 suggests that an increase in the recovery rate decreases the spreads, and an increase in the probability of default increases the spreads, ceteris paribus. This intuitive equation has several beneficial contributions. For example, if two variables are known, it is straightforward to calculate the third variable. The estimated probability of the reference entity´s default can be derived since the market determines the CDS spread and if the recovery rate is assumed to be 40%.

The recovery rates have a significant variance (Duffie & Singleton, 1999). Between 2013 and 2023, the average recovery rate of bonds in the US varied between approximately 45% and 65%, exceeding the longer-term average of 40% (S&P, 2023). Excess returns can be gained if an investor assumes that market participants constantly estimate the recovery rate as 40% and believes that he or she can estimate the recovery rate more precisely than the markets. For instance, if the investor believes the "correct" recovery rate is over 40%, excess returns can be obtained by selling the CDS. The assumptions of a recovery rate of 40% and the leading role of CDS over bonds suggest that bond yields tend to be more or less incorrectly valued. It can be argued that the assumptions of recovery rates might explain evidence of the CDS market leading the bond market. Furthermore, the deviations from "correct" values potentially explain the results of this thesis and the presented studies in the literature review section.

According to Hull and White (2001), valuing a plain vanilla CDS contract without a counterparty risk is a two-phase process. The first phase derives the risk-neutral default probability from the reference entity´s bond yields. Historical default probabilities and expectations of future default probabilities are embedded in risk-neutral probabilities. Hull and White continue that expected present values of future payments and future payoffs on the CDS are calculated in the second phase. However, this method does not consider the risk of the counterparty´s default.

Given the importance of the counterparty risk, Hull and White (2001, p. 6) propose an alternative method, including the counterparty risk. Perhaps the most important aspect in their model is whether the reference entity or the counterparty defaults and, in case of default, which one defaults first. However, their model includes assumptions that may contradict the "real-world" circumstances. For example, mutual independence is assumed in risk-free rates, recovery rates, and default events (Hull & White, 2001, p. 5). However, assuming mutual independence of default events suggests that there are no default correlations, which, on average, biases the estimation results. Default correlations are discussed in more detail in the following chapter. According to Hull and White (2001), the effect of counterparty risk on CDS spreads can be approximated with equation 3.

$$s = \frac{\int_0^T [1-\hat{R}-A(t)\hat{R}]\theta(t)v(t)dt}{\int_0^T [\theta(t)u(t)+\theta(t)e(t)+\phi(t)u(t)]dt+\pi u(T)} \qquad (3)$$

Where T is the maturity of the CDS, $\hat{R}$ is the expected recovery rate on the CDS in case of default, and s is the spread. $\phi(t)$ represents the risk-neutral probability of the counterparty´s default before the reference entity. Similarly, $\theta(t)$ is the risk-neutral default probability of the reference entity if the counterparty does not default earlier. $v(t)$, $u(t)$, and $e(t)$ are the present value of one dollar received at time t, the present value of annual CDS payments between time zero and t, and the present value of accrual payment on the CDS, respectively. The possibility that neither the reference entity nor the coun-

terparty defaults during the CDS contract is expressed with π. $A(t)$ indicates the percentual accrued interest from the underlying bond at time t. As an interpretation of the equation, if the $\theta(t)$ or $v(t)$ is zero, the value of the s should also be zero.

Hull and White (2001) explain that the equation's numerator and denominator are estimated with Monte Carlo simulation. Furthermore, they state that regardless of which one defaults first, continue the CDS payments until the default. However, if the reference entity defaults first, there will be a pay-off in contrast to the counterparty's default. Despite being a mathematical approximation, equation 3 also has practical implications. It can be utilised to estimate the values of all credit derivatives whose payoffs are derived from the default probabilities of a company (Hull & White, 2001). According to Li (1999), there is a negative association between CDS spreads and counterparty risk.

3.6 Arbitrage with CDS-Bond basis

CDS-bond basis stands for the difference between CDS spread and corporate yield over the "risk-free" rate (Oehmke & Zawadowski, 2017). Thus, the basis can be negative or positive if there is deviation. Oehmke and Zawadowski explain that the basis is negative if the yield spread exceeds the CDS spread. Inversely, the basis is positive when CDS spreads exceed yield spreads. The basis relationship holds only with certain assumptions. Assumptions in the following relations are, for example, that the "risky" and "risk-free" bonds have the same maturities and embedded optionality. The following relationships illustrate how arbitrage is implemented with a positive and a negative basis, respectively.

$$IF\ YTM^{Risky} - CDS\ Spread < risk - free \quad (4)$$
$$\Rightarrow\ Long{:}risk - free\ debt$$
$$\Rightarrow\ Short{:}(A)\ risky\ debt\ and\ (B)CDS$$

$$IF\ YTM^{Risky} - CDS\ Spread > risk - free \quad (5)$$
$$\Rightarrow Long{:}\ (A)\ risky\ debt\ and\ B\ (CDS)$$
$$\Rightarrow Short{:}risk - free\ debt$$

The YTM in relationships 4 and 5 is the yield-to-maturity (YTM) of the risky corporate bond. Given the EMH, the difference between the risky debt and CDS spread should equal the “risk-free” rate. Arbitrage with a positive basis (relationship 4) is implemented by a long position in the “risk-free” debt and shorting the “risky” debt and CDS. Furthermore, a negative basis arbitrage is executed by shorting the “risk-free” debt and taking a long position in the “risky” debt and CDS. These relationships explain why CDS spreads and corporate yield spreads are both discussed in the literature review chapter. However, relationships cannot hold if, i.e. the underlying is not correctly valued, or the derivative drives the underlying.

What follows is an example of a possible real-world arbitrage opportunity. The data in the example was obtained from Bloomberg on 04/2024. The CDS spread of Goldman Sachs (GS) maturing in 06/2025 was 30,65 BPs (0,31%). A debt instrument issued by the GS with no call-optionality maturing 06/2025 traded with a yield of 4,43%. Furthermore, the US government's debt instrument maturing also 06/2025 traded with a yield of 4,95%. Thus, the difference between the yield to maturity of “risky” debt and the CDS spread was approximately 4,12%. This indicates an existing positive basis arbitrage opportunity. Therefore, arbitrage is implemented by selling the “risky” debt and the CDS and by taking a long position in the “risk-free” debt. However, since the example includes some frictions, it is not a “pure arbitrage”. For instance, the three assets have slightly different maturities. Furthermore, both debt instruments have semi-annual coupon payments with slightly different coupon rates and schedules. On the other hand, the relationship requires that CDS spreads are proportional to yield spreads, which might not be the case. Nevertheless, this illustrates the challenges or, more accurately, the impossibility of creating “risk-free” trades.

According to Oehmke and Zawadowski (2017), the amount of outstanding CDSs is driven by a negative basis arbitrage since it requires purchasing a CDS. They state that the effect of the negative basis on outstanding CDS is more robust when arbitrageurs receive more favourable funding. However, some investors do not completely cover their long position

in the “risky” debt. Instead, they purchase less protection to enhance the carry component of the trade (Bai & Collin-Dufresne, 2019, p. 6). Thus, the cost of the trade should be decreased due to lower payments for the seller of the CDS. However, increasing the risk exposure distances the trade from a “pure arbitrage”. Bai and Collin-Dufresne find that the CDS bond basis was highly negative during the financial crisis. They suggest that it was caused by, e.g. funding, liquidity, and counterparty risks.

Since a positive basis arbitrage requires selling a CDS, it may also be associated with a higher net notional CDS outstanding (Oehmke & Zawadowski, 2017). Bai and Collin-Dufresne (2019) explain that one trading friction in the positive basis arbitrage is the possible challenge of shorting a bond. Oehmke and Zawadowski (p. 29) continue that in addition to difficulties in short selling, shorting a bond may also be costly. Given the number of assumptions that do not hold, trading frictions, and the absence of a truly risk-free rate, it is justified to argue that there is at least some amount of speculation in arbitrage.

4 Credit risk modelling

Since CDSs are insurances against default risk, this chapter discusses the fundamental concepts related to credit risk modelling. There are two significant approaches to credit risk modelling: structural models and reduced-form models. According to Jarrow (2011), the considerable difference between the models is the assumptions of information symmetries. Jarrow (p. 2) describes that structural models assume the information to be symmetric and the absence of adverse selection, whereas the reduced-form models are *"consistent with asymmetric information in the credit markets*". The chapter begins with a definition of default correlations. Default correlations are followed by examples of structural models and reduced-form models, respectively.

4.1 Default correlations

Given the fundamental purpose of CDSs as protections against the risk of default, investors should consider that default events might not be independent. In other words, default events tend to correlate (Das et al., 2007). Li (1999) states that the CDS buyer is exposed to the default correlation between the reference entity and the CDS seller. Vice versa, if an investor holds a portfolio of sold CDS contracts, the seller is exposed to the default correlations of the reference entities. These interpretations highlight why understanding default correlations is essential for participants in the CDS market.

Defaults can cluster, e.g., by industry, time, and space. Das et al. (2007, p. 1) explain why defaults tend to cluster rather than be independent. They state that companies may be exposed to similar factors that drive the default probabilities. Furthermore, Das et al. explain that market participants may adapt their decision-making based on earlier default events. Also, they suggest that the default of one entity may trigger other default events. For example, a defaulting company might be an important buyer for several companies, leading to increased default probabilities for the suppliers. The default events are more likely if companies have bilateral dependence or operate in the same industry (Hull & White, 2001).

The financial crisis demonstrated the effect of default contagions in the banking industry. A more recent event in the banking sector was the collapse of Silicon Valley Bank in March 2023. From a CDS buyer´s perspective, if the trade has not been cleared through a CC, the importance of default correlations increases substantially. In case the CDS seller and the reference entity are both e.g. financial institutions, the CDS buyer should carefully consider the risk of default contagions while making the investment decision. A positive association between economic conditions and recovery rates has also been captured (Altman et al., 2005). Thus, the economic distress, causing higher default correlations, decreases the recovery rates. This sets another limit to deriving CDS spreads from default probabilities and recovery rates.

Li (1999) suggests that in addition to the previously mentioned explanations, the default probability of a bond is also driven by maturity and the business cycle. Interestingly, based on Moody´s historical data on B-rated bonds, Li (p. 5) finds that the conditional default probabilities decrease as time passes. According to Li (p.5), the term structure of default rates can be derived from physical probabilities of default calculated by credit rating agencies, from CDS spreads, and by the Merton model. The Merton model is introduced in the following chapter. Given the results of Li (1999) and Das et al. (2007), it can be stated that at some level, investors in the CDS market trade the default correlations between companies rather than independent default probabilities. Assuming the relationship between the economic cycle and default clustering holds, investors can try to time the market (contradicting the EMH) by taking positions that align with their expectations on future correlations or economic conditions. This is known as correlation trading.

4.2 Merton model

Although the foundation of structural credit risk models, the Merton model, was introduced approximately five decades ago, it is still a relevant framework among academics and practitioners (Afik et al., 2016). Afik et al. continue that several extensions of the Merton model exist, such as the Moody´s-KMV. The relatively intuitive approach of the Merton model makes it appealing.

According to Merton (1974), the model is an extension of the Black-Scholes model. In the model, Merton examines the default probability derived from the value of a company´s assets and liabilities. More precisely, a company´s equity value is measured with a European call option. Merton assumed a company has a homogenous debt that has to be paid at the time *T*. Debt is homogenous if it has, e.g., the same maturity, seniority, and embedded optionality. Furthermore, the model includes several assumptions, such as that transaction costs do not exist, lending and borrowing have the same interest rate, and the term structure of interest rates is "*known with certainty*" (Merton, 1974, p. 3). Intuitively, it is more likely that a company does not have debt compared to the "homogeneity of debt" -assumption; therefore, the model is a framework rather than an interpretation of reality. Also, assuming that the default event occurs at the maturity *T* usually contradicts "real-world" circumstances. It is probable that companies will have a bunch of other debt, triggering default before the *T* is reached.

Merton states that if a company has more debt than assets at the time T, managers acting for the best of equity owners should default on the debt; in this case, the bondholders take over the company. Thus, the put option that the equity owners have is exercised. In terms of CDSs, if assets fall below liabilities a credit event should be triggered at the maturity. Therefore, CDS sellers should be worried only about the probability that assets are lower than liabilities at the time T. Vice versa, according to Merton, if the assets at time T are more valuable than the debt, the debt should be paid. This theoretical relation is illustrated in the following equation, where E_T is the value of the company´s equity at the time T, V_T is the value of assets and D is the value of debt.

$$E_T = \max(V_T - D, 0), \quad (6)$$

Compared to the "traditional" European call option notation, V_T is the value of the stock and D is the option's exercise price (Merton, 1974, p. 7). According to Hull (2022, p. 570), the present value of the equity is calculated with equation 7, where E_0 and V_0 are the present values of the company´s equity and assets, respectively. Furthermore, σ_v is the volatility of the assets, r is the "risk-free" rate, and $N(d_2)$ risk-neutral probability of default (Hull, 2022).

$$E_0 = V_0 N(d_1) - De^{-rT} N(d_2) \quad (7)$$

$$\text{where } d_1 = \frac{\ln(V_0/D) + (r + \sigma_v^2/2)T}{\sigma_v \sqrt{T}} \quad (8)$$

$$\text{and } d_2 = d_1 - \sigma_v \sqrt{T} \quad (9)$$

Afik et al. (2016) explain that the value of assets follows a geometric Brownian motion and that equations 7-9 are from the Black-Scholes model, illustrating the distance to default (call option is not exercised). They describe (pp. 3–4) common theoretical assumptions in the model, such as normal distributions, the assumption that T is usually one year, a company has issued a zero-coupon bond, and the "risk-free" rate and asset volatility are constant. Thus, the model is inaccurate if, for example, asset values are skewed due to seasonality in volatility.

Afik et al. (2016) find that defaulting companies tend to have lower asset volatility than non-defaulting, resulting in underestimating correct asset volatility. If a company is publicly traded, the value of E_0 can be obtained from the value of stock Hull (2022, p. 570). However, utilising ex-post volatilities, such as equity volatility, rather than ex-ante diminishes the prediction accuracy of the model (Afik et al., 2016). The practice of deriving future values based on past values seems counterintuitive, considering that, e.g., stock

prices are assumed to contain all future cash flows. Furthermore, based on the random walk assumption, future events should not depend on past events.

Theoretically, the most important variables in the Merton model are the values of assets and liabilities. If the value of assets increases, the distance to default should increase since a company is more likely to be able to cover its liabilities at maturity. Vice versa, increasing liabilities decreases the distance to default, ceteris paribus. Also, an increase in maturity, "risk-free" rate, and volatility should be associated with lower default probabilities. The distance to default assumptions requires that managers make a "rational" decision at the time T based on the "fundamental" value of the equity and that the company has not defaulted before the T is reached. Since the Merton model does not explicitly capture default correlations, it is reasonable to assume it works best when default correlations are below the long-term average. In contrast, during systemic crises, the model's predictive power is likely lowest.

However, there is existing evidence regarding information flows in the markets potentially lowering the predictive power of the Merton model. Acharya and Johnson (2007) report that the CDS market has been leading equity markets under certain market conditions. The effect has been more pronounced for negative credit events for companies with more bank relationships. They explain the results as potential insider trading. Their findings have two major implications regarding this thesis. First, the existence of insider trading suggests that markets are not efficient.

The second requires more assumptions. According to the Merton model, the equity value can be utilised to estimate the distance to default. If one uses the Merton model to estimate default probabilities, which are assumed to drive CDS spreads, the value of E at the time T is the variable of interest. In this scenario, if CDS spreads drive the E, the estimation will likely be biased. However, it should be noted that the results of Acharya and Johnson hold in explained conditions. In addition, the leading role of the CDS market over equities might have also decreased in line with bond markets (see Gadgil, 2024).

On the other hand, it has been captured that the sovereign CDS market has led bond and stock markets (Xiao et al., 2024). Hasan et al. (2023) also capture the leading role of the CDS market in price discovery. They explain that stock markets generally consider news regarding cash flows, whereas the CDS market captures more default-specific information.

4.3 Duffie-Singleton approach

Duffie and Singleton (1999) propose a reduced-form credit risk modelling and contingent claim valuation method. Perhaps one of the most significant differences in their model, compared to the Merton model, is the measure of fractional losses in the market value of defaultable bonds in the event of default rather than assets falling under a certain threshold. Duffie and Singleton explain that their model relies on risk-neutral hazard rates. According to Hull and White (2001, p.2), default probabilities of reduced-form models can be made comparable to default probabilities derived from CDS spreads or yield spreads. Duffie and Singleton (p. 3) continue that assuming independence of fractional recovery and hazard rates from the value of contingent claims is typical for reduced-form models. Furthermore, they describe (p. 20) the effects exogeneity assumptions, i.e. hazard rates, on the values of bonds. However, they emphasise (p. 8) that the exogeneity assumption does not hold in all circumstances.

According to Duffie and Singleton, assuming exogeneity, a corporate bond with no call-optionality should have a value of the sum of expected cash-flows from the bond. On the other hand, they suggest assuming that fractional recovery and hazard rates are exogenous diminishes the prediction accuracy in some cases. For example, the market value of fractional recovery is not exogenous if it is fixed. Furthermore, endogeneity problems may arise with certain OTC derivatives (Duffie & Singleton, 1999).

Hull and White (2001, p. 2) state that the dependence of variables in reduced-form models on macroeconomic conditions allows them to capture default correlations. Thus, a

default probability is conditional on macroeconomic circumstances instead of being independent. Evidence of cyclicality in recovery and hazard rates exists, conditional on the business cycle (Duffie & Singleton, 1999, p. 7). However, Hull and White continue that reduced-form models do not completely capture default correlations, even in the case of perfect correlation. This limits the model's prediction accuracy since defaults will likely occur during financial distress when default correlations between companies approach one. As discussed earlier, defaults tend to cluster in industry, space and time. Duffie and Singleton (p. 7) state that default rates are usually higher for companies with lower credit quality during financial distress, as could be expected. Thus, default events among the population of companies and time periods seem not to be random. Speculative investors can utilise those captured patterns in their investment decisions.

5 Literature review

The literature review chapter is divided into two subchapters based on the hypothesis. The first subchapter delves into ESG performance and default risk. Furthermore, the second subchapter discusses the existing literature and economic theories related to government spending and financial markets. The key findings of previous literature are presented in the tables at the end of both subchapters. It should be noted that the literature review more or less assumes that assets are "correctly" priced. However, as discussed earlier, it might not be the case, especially regarding CDS spreads.

5.1 ESG scores and CDS spreads

Although academic literature on ESG factors has mainly focused on the correlation between ESG and equity markets, a growing number of studies have paid attention to ESG and debt markets. Given the relationship between yield spreads and CDS spreads, it is justified to assume that, theoretically, CDS and yield spreads should be driven by similar factors. As discussed earlier, the CDS spread should equal the difference between corporate bond yield and the "risk-free" rate. Therefore, the literature review discusses studies focusing on CDS and yield spreads. Since most companies with active CDS trading are from the US and Europe, the literature review mainly includes studies with samples from those areas.

Caiazza et al. (2023) research the relationship between corporate sustainability, proxied with ESG scores, and CDS spreads. Their sample includes S&P500 companies and a sample period from 2002 to 2019. In addition to the overall ESG score, all three components of ESG are studied separately to capture the effects of each pillar. Caiazza et al. find a negative relation between ESG scores and CDS spreads, aligning with hypothesis one. In other words, ESG scores are associated with a lower probability of default. The results are also robust during the financial crisis, indicating that better ESG performance might be valued during systemic crises. Furthermore, Caiazza et al. provide evidence that each of the three pillars is negatively associated with spreads. Industry-wide analysis reveals

that the findings hold in all industries except technology and Oil&Gas (Caiazza et al., 2023).

The impact of corporate sustainability practices on default risk with different time horizons has also been studied. Gao et al. (2021) focus on the effect of CSR ratings on the term structure of CDS spreads. They measure the slope of the CDS spread curve to determine the difference between long- and short-term spreads. Their data includes US companies between 2002 and 2013. Gao et al. find that better CSR performance results in a negative term structure. This finding has an interesting interpretation: strong CSR performance increases the short-term risk and decreases the long-term risk. The differences between CSR strengths and concerns are taken into account. According to Gao et al. (p. 2), strengths measure "the best corporate practices" and concerns "the most serious challenges" in a variety of different categories. Based on market reactions, strengths decrease the slope, and concerns vice versa increase the slope. In contrast to Caiazza et al. (2023), Gao et al. made a robustness check for their results by excluding the financial crisis period from the data. Despite the exclusion, their results remain both statistically and economically significant. Furthermore, it has been captured that better CSR performance mitigated the effect of the pandemic period on corporate CDS spreads (Hasan et al., 2023).

Kanno (2023) obtains similar results as Gao et al. (2021) on the relation between sustainability and long-term default risk. However, instead of utilising CDS spreads to measure credit risk, Kanno estimates the risk with a firm-level physical probability of default. The effect of ESG performance is evaluated with different metrics representing the three pillars. Those metrics include, e.g., emissions, human rights, and shareholders scores. Kanno finds that ESG factors decrease, especially long-term default probabilities in all three categories. The results of Gao et al. and Kanno support each other since both of the studies estimate long-term risk with a 5-year horizon. Furthermore, based on these two studies, the negative impact of ESG has been captured during two decades since the Kanno (2023) sample included firm-level observations from 2017 to 2020. However, this

does not indicate that the relationship has held in all circumstances or will hold in the future.

Given the role of Europe as a leader in sustainable finance, it is reasonable to delve into the differences between Europe and the US. Barth et al. (2022) suggest existing geographical differences in the risk mitigation effect of ESG. Risk mitigation can be defined, e.g., as actions of an individual or the effect of certain concepts potentially leading to lower risk. Barth et al. include a sample of companies between 2007-2019. The results provide evidence that the effect of ESG on CDS spreads is more robust in Europe than in the US. Furthermore, considering the disagreement between ESG rating agencies, Barth et al. find similar results by utilising the ratings of two different agencies. However, it should be noted that most companies in their sample are located in the US, which might affect the results.

Since there is a deviation in the ESG ratings and CDS spreads, the effect of ESG performance on spreads may not be linear. Interestingly, Barth et al. (2022) find that the relation appears to be U-shaped instead of linear. They interpret this result as that companies from both extreme ends of the curve face higher default risk. In other words, companies with modest ratings have the lowest default risk. Based on previous studies, it might appear counter-intuitive that companies with extremely high ESG ratings have a higher default risk. However, Barth et al. provide an explanation for the phenomenon that aligns with fundamental economic theories. They suggest that the association between high ESG performance and high default risk is driven by diminishing marginal returns. If the theory of diminishing marginal returns holds, Barth et al.'s results indicate that an optimal level of investment in ESG should exist, indicating that companies should not aim for excessively high or low ESG scores. The relationship between ESG performance and CDS spreads appears more significant in Europe than in the US (Barth et al., 2022).

Although previous studies have mainly focused on European and US markets, there are a number of studies examining Asian markets. Lian et al. (2023) researched the impact of ESG performance on Chinese bond credit spreads between 2009 and 2020. The importance of the Chinese bond market has been growing. According to Lian et al., only the US bond market is bigger. Their main finding indicates a negative correlation between ESG factors and bond credit spreads. Furthermore, their results suggest that better ESG performance is related to corporate information transparency, lower agency costs, and financial performance. For example, they find that a higher ESG rating harmonises analysts´ forecasts. Thus, the transparency driven by ESG may cause lower bond spreads (Lian et al., 2023). If ESG performance increases the transparency of corporate information, activities driving the transparency should be focused on. Intuitively, the governance pillar has the most significant role in enhancing transparency. Thus, it may benefit companies to participate in ESG activities requiring fewer resources. For example, increasing transparency through good governance requires fewer resources than transformations in production methodologies.

Aligning with Lian et al. (2023), Okimoto and Takaoka (2024) find a negative correlation between ESG scores and credit spreads. Their sample includes Japanese companies from 2007 to 2018. The negative correlation is more robust for companies with a lower credit rating. This finding is in line with the assumption that ESG performance is valued during low trust periods. Companies with lower credit ratings are likely to be less trusted than their peers with higher credit ratings. Okimoto and Takaoka provide a time-varying graphic indicating that the impact of all three pillars rose during the sample period for both lowly and highly rated companies. This result indicates that there has been time variation in the risk mitigation effect of ESG performance. Therefore, this study also researches potential time-variation in the relationship.

In completely efficient capital markets, all currently available relevant information should be embedded in the price of an asset. Therefore, there should not be any reactions to the rating announcements since they should not provide new information. More

precisely, the information related to the ESG factors should already be considered. Kiesel and Lücke (2019) examine whether the ESG consideration in rating announcements affects CDS spreads. Their sample includes both European and US companies from 2004-2015. They find that a higher ESG integration in the rating announcement reports triggers more robust abnormal CDS spread changes. Kiesel and Lücke suggest that ESG components are more related to downside risk than upside potential. Furthermore, the governance pillar is the most significant driver of abnormal spread changes.

In addition to Kiesel and Lücke (2019), Drago et al. (2019) research rating actions as a driver of spread changes. Contradicting Kiesel and Lücke, they measure the effect of a pure CSR rating action rather than disclosure. Drago et al. obtained a sample of European companies between 2007 and 2017. On the one hand, their results suggest that CSR rating upgrades significantly decrease the spreads. In other words, a higher CSR rating decreases a company's default risk. On the other hand, there is no statistically significant abnormal change for the CSR downgrade event. Furthermore, they test the impact of CSR rating announcements on CDS spreads 30 days after the announcement by utilising the three ESG pillars as independent variables. Drago et al. find that both environmental and social pillars negatively affect spreads. However, contradicting Kiesel and Lücke (2019), they do not find a statistically significant correlation between spreads and the governance pillar. One explanation for the contradictory result might be that their sample did not include US companies. Furthermore, ESG factors are possibly more important factors affecting default risk in the US than in Europe (Kiesel & Lücke, 2019).

In addition to CSR or ESG factors, the effect of pure credit rating events has been widely studied in academic literature. Interestingly, evidence suggests that sustainability factors might have a contrary effect on CDS spreads compared to rating events. Finnerty et al. (2013) find that negative rating events have a more pronounced effect on CDS spreads than positive if the anticipation period is included. In contrast, Drago et al. (2019) obtained significant abnormal changes for positive events but not negative. Thus, markets might not perceive deteriorating sustainability performance as important as improving

performance. In contrast, negative ESG news decreases companies' stock values, whereas positive ESG news does not have a positive impact (Capelle-Blancard & Petit, 2019).

However, measuring abnormal changes might be subject to modelling errors. Estimating abnormal changes requires a benchmark to which the CDS spread changes of a particular entity are compared. Thus, abnormal changes might be driven by an inaccurate model. According to Fama (1991), estimating market efficiency is practically impossible, resulting from the joint hypothesis problem. Modelling errors do not affect only studies focusing on abnormal changes. Instead, basically, all studies discussed are subject to those errors. Models can include, for example, unsuited variables or necessary variables might be omitted. Therefore, the regressions of this thesis most likely do not capture all relevant factors perfectly, which may bias the results obtained. Therefore, models are more or less approximations rather than exact.

Despite the agreement among previously presented studies, there are also contradictory findings. Amiraslani et al. (2023) studied whether social capital affected bond credit spreads between 2008 and 2019. The social capital was proxied with Refinitiv´s environmental and social pillar scores, referred to as E&S. They found that E&S did not explain bond credit spreads during the whole sample period. However, during the financial crisis, E&S became a significant driver of bond spreads. According to Amiraslani et al., it results from declining trust among market participants. Furthermore, based on the results, the effect of E&S on pure default probabilities is more robust for companies with higher default probabilities. Aligning with Lücke (2019), Amiraslani et al. (2023) find that the governance pillar does not explain bond credit spreads. They carried out additional tests to examine the impact of trust during industry-specific shocks. They measure the impact of E&S on bond spreads during the BP Deepwater Horizon oil spill and the Wells Fargo cross-selling scandal. The trust explained industry-specific spreads during the incidents. It can be hypothesised that the environmental pillar was more pronounced during the oil spill and vice versa, the social pillar during the cross-selling scandal.

The relationship between ESG scores and CDS may be reversed. Zhao and Zhu (2024) investigated whether CDS trading impacts ESG performance. According to Zhao and Zhu, for example, monitoring incentives for lenders are lower if a company has CDS trading. They explain that the monitoring incentives decrease since the default risk is transferred to the CDS seller after entering into a CDS contract. Thus, the seller should have the incentive to monitor. Zhao and Zhu found that corporate ESG performance significantly increased after the CDS trading began. Furthermore, their evidence suggests that several factors enhance the relationship. For example, higher institutional ownership, higher debt financing, bank relationships, and covenants drive a more robust impact (Zhao & Zhu, 2024, p. 2). However, these previous factors might correlate with each other. Since lenders utilise covenants to reduce the riskiness of lending, the incentive to use covenants may be higher, with companies depending more on debt financing. Furthermore, it is possible that banks, in lending roles, use more covenants than other market participants.

Although many of the previous studies solely focus on corporate-level factors affecting CDS spreads. Country-specific factors also affect the robustness of the relation between ESG and CDS spreads. Abdul Razak et al. (2023) have a sample of global corporations between 2013 and 2016. They find that better country-level ESG performance reduces corporate CDS spreads. Furthermore, the effect is more pronounced in countries with a higher level of sustainability. The country-level sustainability might be one factor explaining some of the differences between samples from US and European corporations. Aligning with Kiesel and Lücke (2019) and contradicting Drago et al. (2019), Abdul Razak et al. find that from the three pillars, governance has the highest risk mitigation effect even after controlling country-level sustainability.

Hübel (2022) examines whether country-level ESG performance affects sovereign CDS spreads. The study data expanded from 2007 to 2017. Hübel finds that better ESG performance drives lower sovereign CDS spreads, indicating that ESG factors also have a

risk-mitigating effect on spreads at the country level. All three pillars have a risk-reducing effect. However, environmental and governance pillars remain significant after credit rating is controlled. Moreover, Hübel finds that ESG performance has a flattening effect on the term structure of spreads. According to Hübel, environmental and social pillars drive the term structure. Logically determined, the findings of Abdul Razak et al. (2023) support the findings of Hübel. If country-level sustainability drives corporate CDS spreads, it would be illogical if it does not drive sovereign spreads. For example, companies operate in the regulatory environment of a respective country. Additionally, a country and companies located are subject to similar factors, such as political risk, macroeconomy, and investor sentiment.

Authors	Sample period	Sample area	Key findings
Caiazza et al. (2023)	2002-2019	US	a) Higher ESG scores are associated with lower CDS spreads. b) Each of the pillars are negatively associated with spreads. c) The effect is industry-wide
Gao et al. (2021)	2003-2013	US	CSR performance increases short-term risk and reduces long-term credit risk.
Kanno (2023)	2017-2020	Japan	ESG performance predicts long-term default risk
Barth et al. (2022)	2007-2019	Europe and US	a) Higher ESG scores are associated with lower CDS spreads. b) The effect is stronger in Europe than in the US. c) The relationship is U-shaped rather than linear.
Lian et al. (2023)	2009-2020	China	ESG performance lowers bond credit spreads.
Okimoto & Takaoka (2024)	2007-2018	Japan	a) Negative correlation between ESG performance and credit spreads. b) The negative correlation is more robust for companies
Kiesel & Lücke (2019)	2004-2015	Europe and US	Higher ESG integration in the rating announcement reports triggers more robust ab-normal CDS spread changes.
Drago et al. (2019)	2007-2017	Europe	a) CSR rating upgrades decrease CDS spreads. b) Rating downgrades don´t have immediate effect.
Amiraslani et al. (2023)	2006-2019	US	E&S performance drives lower bond spreads during low-trust period.
Zhao & Zhu (2024)	2002-2018	Unknown	CDS trading increases company´s ESG performance.
Abdul Razak et al. (2023)	2013-2016	Global	Risk mitigation effect of ESG is more pronounced in higher level sustainability countries.
Hübel (2022)	2007-2017	Global	Better ESG performance drives lower sovereign CDS spreads.

Table 1 Literature review on ESG and default risk

5.2 Government expenditures

Given the previously discussed political dilemmas around the concept of ESG, a question arises of whether political decisions are associated with CDS spreads. Perhaps the most influential way for a government to impact society is through budgeting decisions. For example, the government can focus on sustainability issues over military spending or tax cuts. Thus, government decisions might drive economic phenomena. If a company or industry benefits from government expenditures, lower CDS spreads could be expected. Furthermore, the effect may be more pronounced for some industries. Since government budget deficits have become common, the effects of debt financing on financial markets are discussed in this literature review.

Defaults can be divided into two categories: implicit and explicit. Implicit default occurs, for example, when the default is not directly expressed, such as paying a debt with a currency other than predetermined. An explicit default event is more straightforward. The borrower may announce that it will not pay or be able to pay the debt. Reinhart and Rogoff (2009) provide comprehensive statistics on government debt and sovereign defaults from the beginning of the 19th century. Their study (p. 44) suggests that the number of countries that have not directly defaulted on their external debt is relatively small. For example, non-defaulters include Scandinavian countries and the US. They add (p. 44) that if defaults on domestic public debt or debt restructuring are considered, the US has defaulted on its debt. Reinhart and Rogoff clarify that in 1933, a restructuring event led the US not to pay its public debts with gold. Instead, the payments would be made in fiat currency, aligning with the implicit default definition. In terms of CDS, debt restructuring is one of the events that may trigger a credit event (see Blanco et al., 2005). Thus, it can be argued that also wealthy developed countries may default on their debt justifying the research on the effects of US government spending.

Reinhart and Rogoff also analyse the thresholds above which default events are likely to occur. They find (p. 24) that from 1970 to 2008, around 50 percent of middle-income

countries' defaults occurred when external debt to the gross national product (GNP) ratio was lower than 60 percent. GNP measures the economic output of a country´s economy and its citizens. Although the US does not belong to those studied countries, the ratio can be considered as a “benchmark” number. Based on the Federal Reserve of St. Louis and the U.S. Department of the Treasury statistics, the US gross external debt to GNP ratio at the end of quarter two in 2024 was around 90%. Thus, there is at least some risk of the US defaulting on its debt somewhere in the future. Therefore, the effect of government expenditures on CDS spreads can differ depending on the time horizon. In the long run, expenditures might increase the country's default risk, increasing the default probabilities of companies. In the short run, the effect can be positive or negative. The previous discussion indicates that investors should demand risk premiums depending on the financial health of the country where the investment will be made.

The academic literature on government expenditures and firm performance (or industry-level) is relatively limited. Existing literature focuses more on the relationship between government expenditures and macroeconomic effects. One industry receiving academic attention is the defense industry. A possible explanation is that changes in government spending have historically been driven chiefly by changes in defense spending (Nekarda & Ramey, 2011, p. 41). According to Gurdgiev et al. (2022), defense budget announcements drive a significant positive stock performance of major US defense industry companies. In this context, it could be argued that, as a rule of thumb, stock returns are negatively correlated with CDS spreads. Thus, it is likely that market participants perceive those companies as less risky.

Furthermore, Gurdgiev et al. (2022) found that the current president's party impacted excess returns. The effect of announcements has been more pronounced with Republican presidents. Applying their results to ESG, the effect of ESG expenditures on CDS spreads might have been more pronounced during a Democratic president rather than a Republican. Furthermore, if military companies benefitted more from Republican presidents regarding stock returns, companies focusing on ESG issues might benefit from a

Democratic president. For example, companies with a Democratic background and location in a Democratic state have, on average, higher CSR scores than companies with a Republican background (Di Giuli & Kostovetsky, 2014).

Aligning with Gurdgiev et al. (2022), Belo et al. (2013) report an existing correlation between stock returns, profitability, cash flows, and political cycles. Their results indicate that companies in industries with higher exposure to government expenditures during Democratic presidencies are rewarded with, i.e., better cash flows. Vice versa, their results suggest that the positive relation turns negative during Republican presidencies. Thus, industry-wide variability based on government exposure can be expected regarding CDS spreads. An industry with high government exposure is, e.g., oil and gas extraction, whereas an example of a low exposure industry is breweries (Belo et al., 2013). Given the results of Belo et al., a question arises about the reasons for the obtained results. There are many potential reasons; for example, the results can be caused by modelling biases. Second, Democratic presidencies might have higher total expenditures than Republicans. Third, Democratic presidencies might be more favourable toward industries benefitting from government decisions.

Differences between the spending practices of different governments might emerge. Interestingly, according to Chien and Bennet (2021), at the US state level, there seems not to be significant differences between the spending policies of Democratic and Republican states. Furthermore, they report moderate differences in spending related to ESG factors such as education and environment. As reported in the descriptive statistics, the proportion of government ESG expenditures remained relatively similar during the sample period, including Democratic and Republican presidencies.

More general studies of fiscal expansions and stock prices have also been conducted. Blanchard (1981) suggests that, theoretically, under rational expectations, the effect of an expansion announcement depends on whether the announcement was expected or not. Expansions do not directly drive stock prices; they are driven by “anticipated profits

and discount rates" (Blanchard, 1981, p. 11). Thus, financial valuation is a composition of cash flows, rates and time. Mumtaz and Theodoridis (2020) found that before 1980, stock prices had reacted positively to fiscal shocks. By contrast, the effect has been negative since 1980. Their results indicate that the negative effect on stock prices after 1980 has been industry-wide.

Aligning with Mumtaz and Theodoridis (2020), Wisniewski and Jackson (2021) find a negative association between government debt-to-GDP ratio increases and stock returns. Their study includes a comprehensive global sample from 1990 to 2014. They argue that interest rate pressures and future tax burdens cause the results. In economics, this phenomenon is referred to as "Ricardian equivalence". Ricardian equivalence proposes that rational agents assume that increased debt results in higher taxation in the future. Thus, debt expansion would not affect economic activity (Seater, 1993). However, in reality, there is a tendency among "rational" agents to behave more or less irrationally. Furthermore, it has been found that government debt drives sovereign CDS spreads (Aizenman et al., 2013). If government debt financing increases its default risk, higher default risk for the companies (i.e. higher CDS spreads) in that particular country can be expected.

Since the sample of this thesis includes an economic shock during the COVID period, it is reasonable to discuss its possible outcomes. Klein and Linnemann (2019) studied the effects of government spending shocks on a battery of economic variables after the financial crisis. Their results suggest that spending shocks decreased the spread between corporate and government bond yields during the recession period after the crisis. They explain the results with the decreased private sector default risk. Thus, theoretically, the CDS spreads should have also declined due to a spending shock. However, as discussed earlier these results might be driven by the short-term impact of government spending. On average, the spreads seem to increase after a fiscal shock (Mumtaz & Theodoridis, 2020). The findings of Klein and Linnemann indicate increased consumer confidence after spending shocks. However, their results applied only to the financial crisis and its

aftermath. Perhaps consumer confidence has increased the expectations of future aggregate demand, declining the spreads. Based on Klein and Linnemann, it could be argued that government expenditures might affect CDS spreads only during specific periods.

Although the existing research on CDS spreads and fiscal policy is limited, there is evidence that they have an association. Oumayma and Driss (2022) research the effects of fiscal policy on emerging countries' sovereign CDS spreads during pre-COVID and COVID pandemic. They find that the fiscal environment explained spreads during the pandemic period in contrast to the pre-pandemic period. Their results suggest that government announcements of fiscal expansions significantly drove CDS spread changes. Thus, it can be expected that increases in US debt impacted CDS spreads during this thesis's sample period. This underlines the decision to examine the government spending policies, especially during economic shocks. On the other hand, the absence of related literature highlights this thesis's novelty and academic contribution.

Based on previously discussed theories, the funding source of ESG expenditures may affect the relationship between expenditures and CDS spreads. For example, expenditures discussed might substitute for other spending functions, or debt expansions might finance them. Under the Ricardian equivalence, no association between spending and spreads could be expected if agents modify their consumption decisions to the point where the effect of debt expansions does not affect aggregate demand. On the other hand, ESG expenditures that serve as substitutes for other spending might drive lower spreads. Cyclicality in the relationship might emerge due to the politicisation of the ESG concept.

Although the sample period of this thesis is relatively short, it includes relevant factors proposed by discussed studies related to the practice and theories of government spending. Those factors include the presidencies of different parties and high government debt expansions during the pandemic. Given the disagreement among studies and potential

differences between the effects of government´s short- and long-term spending, the effect of government ESG expenditures on industry CDS spreads is expected to be positive or negative. Furthermore, the information flows between a derivative and the underlying increases the uncertainty of whether a positive or negative impact should be expected.

Authors	Sample period	Sample area	Key findings
Rheinhart & Rogoff (2009)	n/a	Global	Government spending is associated with higher country-level default probability.
Gurdgiev et al. (2022)	1990-2019	US	Defence budget announcements drive positive stock performance of US defence industry companies.
Belo et al. (2013)	1947-2002	US	Government exposure affects stock returns of companies.
Mumtaz & Theodoridis (2020)	1955-2015	US	After 1980 fiscal shocks have negatively affected stock returns.
Wisniewski & Jackson (2021)	1990-2014	Worldwide	Government debt-to-GDP ratio is negatively associated with stock returns.
Oymayma & Driss (2021)	2019-2021	Emerging market	Spending shock during COVID was associated with CDS spread changes.
Klein & Linnemann (2019)	1960-2015	US	Government spending shocks decrease the spread between corporate and government bond yields

Table 2 Literature review on government spending

6 Data and methodology

The sample of this thesis includes quarterly corporate CDS spreads from two leading markets: the US and Europe. Since the number of companies in the sample is relatively low, quarterly data is used instead of annual to obtain more sample observations. On the other hand, monthly data would include short-term volatility. Thus, quarterly data represents longer-term trends. The geographical division allows for the examination and comparison of the effects of ESG scores in two different markets. Also, the relatively low number of companies with active CDS trading justifies the expansion of the sample to two different markets.

This study's data spans from 2015 to the end of 2023. More precisely, the first hypothesis examines the years 2015-2022 and the second years between 2017 and 2023. Given the differences between the two hypotheses, the data and methodology subchapters discuss the hypotheses separately. The reasoning for sample periods is primarily practical. The contribution of the first hypothesis, relative to existing literature, is to provide results with more recent data. The year 2023 was excluded from the sample since, when the data for this thesis was collected, ESG scores of 2023 were not sufficiently updated. Regarding the second hypothesis, government spending data is reported from 2017 onwards. The following chapter introduces the data utilised in this thesis and describes the research methods applied. Appendix One includes industries examined in hypothesis two.

6.1 Data

The two hypotheses of this thesis include more or less similar data. The following table includes all variables used in both regressions and their sources.

Variable	Source
CDS spread	LSEG
ESG scores	LSEG
ESG expenditures	US Government
Total assets	LSEG
Leverage	LSEG
ROA	LSEG
Stock return	LSEG
Inflation	Eurostat
Slope of yield curve	LSEG (German), Federal Reserve Bank of St. Louis (US)
Market excess	Kenneth R. French Data Library
SMB	Kenneth R. French Data Library
HML	Kenneth R. French Data Library
GDP per capita growth	OECD
Debt to GDP	Federal Reserve Bank of St. Louis (US)
Change in debt	Federal Reserve Bank of St. Louis (US)
Unemployment	Federal Reserve Bank of St. Louis (US)
Consumer confidence	OECD

Table 3 Sources of data

The dependent variable of hypothesis one is an end-of-quarter 5-year CDS spread for a company in line with previous research. CDS contracts with different maturities, such as 1-year, 3-year, and 10-year, exist. However, 5-year contracts are the most liquid (Pereira et al., 2018). To have a sample of companies with active CDS trading, companies with less than ten quarters of available CDS trading data during the sample period are excluded. Naturally, this will have some biasing effect on the obtained results. Also, CDS spreads exceeding 4000BPs are excluded to control outliers, in line with Barth et al. (2021). Furthermore, resulting from skewed data, natural logarithms are taken from CDS spreads following Barth et al. (2021). A common practice in the literature has been excluding the financial industry due to its unique characteristics (see, e.g. Belo et al., 2013). For example, banks must follow regulations that control their leverage ratios. On the other hand, by excluding the financial industry, the results of this thesis are more comparable to other studies. Additionally, if the financial industry were included, it would cover a relatively large proportion of the sample companies. Thus, companies with SIC

codes between 6000-6999 are removed from the sample. Therefore, the data of this study includes 420 companies and 11 189 firm-quarter observations.

The independent variable of interest is the ESG score of a specific company. The formation and processes related to ESG scoring are presented in subchapter 2.2. Additionally, the effect of each of the pillars of ESG is examined separately. ESG and pillar scores are obtained from one of the leading raters, LSEG. ESG scores from LSEG, or predecessors, have been utilised in CDS research by i.e. Drago et al. (2019). Because ESG scores are usually updated annually, the ESG score is assumed to be constant until there is an update. Since ESG scores are derived from pillar scores, the effect of pillars on CDS spreads is expected to be negative, in line with hypothesis one.

Following Caiazza et al. (2023), control variables are divided into firm-level, market-level, and macroeconomic variables. Some companies in the European sample report financial information semi-annually. Thus, the accounting variables are assumed constant in those cases before new information emerges. Total assets represent an accounting variable used to proxy firm size that might influence CDS spreads. Based on the findings of Di Febo and Angelini (2018), Pereira et al. (2018), and Abdul Razak et al. (2023), the size of a company is assumed to be negatively associated with CDS spreads. Natural logarithms are taken from the total assets to moderate the skewness of the data. Return on assets (ROA) indicates a company´s capability of generating profit, increasing the distance to default. Thus, it is expected that ROA negatively impacts CDS spreads. In the literature, for example, ROA has been used by Caiazza et al. (2023) and Longstaff et al. (2005).

Based on Merton (1974), higher leverage ratios decrease the distance to default. Therefore, leverage is assumed to be positively associated with CDS spreads. Leverage is interpreted as short-term and long-term debt over total assets. Stock returns are theoretically an interpretation of market participants´ prospects of a company. Therefore, a given

company's stock return is expected to be associated with lower CDS spreads. For example, stock returns are used in literature by Galil et al. (2014). This thesis applies quarterly stock returns.

Market-level variables are based on the Fama and French Three Factor Model, an extension of CAPM (Capital Asset Pricing Model), applied in estimating stock returns. Fundamentally, the Three Factor Model estimates excess returns. The extension is chosen since characteristics affecting CDS spreads might not be captured with the market excess return. Other extensions, such as four or five-factor models, are not chosen to avoid overfitting the regression. Overfitting emerges, for example, when the regression is too complex relative to the amount of data. SMB is the return of a portfolio of companies with small market capitalisation minus big market cap. Similarly, HML indicates the difference between the returns of high-book-to-market and low-book-to-market companies. The return of the market index over the “risk-free” rate is referred to as market excess return. Negative associations between the Three Factor Model and CDS spreads are expected. These three factors have been used, i.e. by Caiazza et al. (2023). The market return is estimated as a value-weighted market portfolio of a given region (Kenneth R. French, 2024). The “risk-free” rate is the US one-month T-bill rate.

Macroeconomic variables include the slope of the yield curve and inflation. The slope of the yield curve indicates the estimations of future interest rates and economic activity. The higher the market estimates the future interest rates, the steeper the yield curve's slope should be. Following Galil et al. (2014), the slope is calculated as the difference between 10-year and two-year constant maturity rates. For US companies, the slope is calculated using US government debt instruments. The slope for the European sample is approximated with German government debt instruments. The correlation with CDS spreads can be positive or negative, depending on the slope. Inflation is estimated with an annual change of harmonised consumer price indexes in the US and European Union at the end of the quarter. Previously, inflation has been utilised in research by i.e. Caiazza et al. (2023).

The second hypothesis includes same and different control variables as the first one. Most importantly, the ESG score or its pillars are replaced by the share of quarterly ESG expenditures in the US from quarterly GDP. Since one undisputed definition for ESG or CSR does not exist, selecting expenditures related to ESG and the sustainability concept is relatively challenging. In defining "correct" expenditures, this thesis more or less follows the article published by a think tank, The Brookings Institution (2019). The selected expenditures are a sum of the following six US budget functions: Health, Social security, Education, training, employment and social services, Agriculture, Administration of Justice, and Natural resources and environment. The data on government expenditures is available from 2017, which sets a hard boundary for the sample period. The sample consists of 1269 industry-quarter observations. The industries included are reported in appendix one.

The explained variable in the second hypothesis is the natural logarithm of the quarterly industry-level 5-year North American CDS index spread. Control variables include inflation, market excess return, slope of the US yield curve, SMB, and HML. New variables compared to the first hypothesis are the change in government debt, debt to GDP -ratio, GDP growth rate, unemployment rate and consumer confidence index (CCI). As discussed in the literature review, government debt expansions have become relatively common, and results indicate that some companies or industries might benefit from it (see Gurdgiev et al., 2022 and Belo et al., 2013). Thus, a negative or positive coefficient for change in debt is expected. Debt-to-GDP measures the ratio between the output of an economy and outstanding debt. Wisniewski et al. (2018) reported a negative association between stock returns and increases in debt-to-GDP ratios. Therefore, increasing debt-to-GDP ratio is expected to correlate positively with industry CDS spreads. In CDS research, the debt-to-GDP ratio has been utilised, i.e. by Caiazza et al. (2023).

Furthermore, following Wisniewski et al. (2018), GDP growth and unemployment rate are included as control variables. GDP growth and unemployment are intuitive indicators

of economic growth and the financial health of companies. Therefore, a negative coefficient for GDP growth and a positive coefficient for the unemployment rate are expected. GDP growth has been used in CDS literature by i.e. Hasan et al. (2023). Since the majority of the variables represent macroeconomic and market-level factors, CCI is included to express consumers' prospects. CCI captures the economic sentiment and expectations of households for the future. The higher the index is, the more confident consumers, on average, are. Thus, households are likely to be more willing to consume. Therefore, the CCI index is assumed to be negatively associated with CDS spreads. The following two tables include descriptive statistics for regressions one and two.

	CDS spread	ESG score	Environment	Social	Governance	Total assets	Leverage	ROA	Stock return	Inflation	Slope	Mkt-rf	SMB	HML
Mean	135,36	67,16	65,53	69,83	65,02	47067179	0,35	0,06	0,03	0,02	0,01	0,02	0,00	0,00
Median	74,87	70,53	70,34	73,87	69,17	22823000	0,32	0,06	0,03	0,02	0,01	0,03	0,00	-0,01
Maximum	3671,33	95,58	98,87	98,26	99,45	675000000	2,56	1,34	3,16	0,11	0,02	0,23	0,16	0,19
Minimum	5,24	0,91	0,00	0,44	1,21	127	0,00	-3,33	-1,00	-0,01	0,00	-0,25	-0,08	-0,22
Std. Dev.	210,54	16,74	21,84	19,74	19,65	68559179	0,18	0,11	0,18	0,03	0,00	0,09	0,04	0,07
Skewness	6,58	-0,92	-0,81	-0,83	-0,73	3,56	2,63	-5,83	1,55	1,51	-0,01	-0,64	0,88	0,25
Kurtosis	67,74	3,61	2,97	3,10	2,96	20,09	24,24	161,72	21,12	4,17	2,39	4,02	4,39	4,74

Table 4 Descriptive statistics regression one

	Industry CDS spread	ESG expend	Change in debt	Debt-to-GDP	GDP growth	Inflation	Slope	Unemployment	Mkt-rf	SMB	HML	CCI
Mean	162,90	0,11	0,02	1,13	0,005	0,03	0,003	0,05	0,03	-0,003	-0,01	99,52
Median	121,39	0,11	0,02	1,18	0,01	0,02	0,003	0,04	0,06	-0,01	-0,02	99,26
Maximum	1593,81	0,18	0,14	1,33	0,08	0,10	0,016	0,15	0,23	0,16	0,19	101,60
Minimum	19,88	0,09	-0,01	1,02	-0,08	0,00	-0,011	0,03	-0,21	-0,08	-0,22	96,22
Std. Dev.	133,59	0,02	0,03	0,09	0,02	0,03	0,006	0,02	0,09	0,05	0,08	1,77
Skewness	3,28	2,07	3,40	0,13	-0,79	1,21	-0,139	3,00	-0,77	1,22	-0,01	-0,25
Kurtosis	22,37	7,71	16,30	1,57	12,33	3,13	2,691	11,92	3,78	4,66	3,69	1,58

Table 5 Descriptive statistics regression two

Table 4 includes descriptive statistics for the variables in the first regression. The median values for the two main variables of the first regression, CDS spread and ESG score, are 74,87 and 70,53, respectively. Excluding CDS spreads over 4000BPs decreases the maximum spread to 3671BPs. The CDS spread data is skewed with a skewness of 6,58. The reported skewness in total assets is 3,56. Each pillar score's median and maximum values are approximately 70 and 98, respectively. Median leverage in the sample is moderate at 35%. Perhaps the most important macroeconomic variable, the slope of the yield curve, has a maximum value of 2%.

Table 5 includes descriptive statistics for regression 2. The median industry CDS spread is around 121BPs with a maximum of 1594BPs. The data suggests that the industry-wide maximum spreads were during 2020, especially in the year's first quarter. However, logarithmic values of CDS spreads moderate the difference. The variable of interest, ESG expenditures, was approximately 11% of the quarterly GDP on average. Furthermore, the standard deviation of expenditures is around 2%. The maximum US debt-to-GDP ratio and inflation during the sample period were 133% and 10%, respectively. Altogether, the maximum and minimum values of the variables have been driven more or less by the outburst of the COVID pandemic.

In addition to modelling biases, this thesis is also subject to errors in measuring included variables. The variable of interest, ESG expenditures to GDP, depends on the accuracy of reporting government spending and estimation of quarterly GDP. Intuitively, it is likely that there are some estimation errors that bias the results of this thesis. Since the variation in the expenditures is relatively low, the effect of ESG expenditures might not be captured correctly. Therefore, an additional test, reported in Appendix 2, redefining the variable of interest is conducted. The ESG expenditures are the same, however, the expenditures are divided by total quarterly US government expenditures. This approach allows the variable of interest to have a higher standard deviation. Nevertheless, the results obtained are surprisingly similar to those of the original model.

	CDS spread	ESG score	Environment	Social	Governance	Total assets	Leverage	ROA	Stock return	Inflation	Slope	Mkt-rf	SMB	HML
CDS spread	1													
ESG score	-0,19	1												
Environment	-0,20	0,83	1											
Social	-0,21	0,89	0,71	1										
Governance	-0,02	0,57	0,20	0,26	1									
Total assets	-0,13	0,28	0,28	0,27	0,07	1								
Leverage	0,21	-0,07	-0,05	-0,06	-0,07	-0,07	1							
ROA	-0,22	0,04	0,05	0,06	-0,02	-0,08	0,07	1						
Stock return	-0,08	-0,01	0,00	-0,01	0,01	-0,01	0,01	0,00	1					
Inflation	0,06	0,10	0,08	0,10	0,03	0,06	0,02	0,09	-0,06	1				
Slope	-0,05	-0,13	-0,10	-0,13	-0,07	-0,04	-0,04	-0,04	0,00	-0,34	1			
Mkt-rf	-0,06	-0,02	-0,02	-0,02	0,00	0,00	0,03	-0,04	0,52	-0,20	0,03	1		
SMB	-0,03	0,02	0,02	0,02	0,00	0,00	0,00	-0,06	0,29	-0,26	0,10	0,52	1	
HML	-0,03	0,01	0,01	0,02	-0,01	0,01	-0,01	0,03	0,18	0,35	0,10	0,07	0,05	1

Table 6 Correlation matrix regression one

	Industry CDS spread	ESG expend	Change in debt	Debt-to-GDP	GDP growth	Inflation	Slope	Unemployment	Mkt-rf	SMB	HML	CCI
Ind. CDS spread	1											
ESG expend	0,00	1										
Change in debt	0,03	0,13	1									
Debt-to-GDP	0,01	0,55	0,49	1								
GDP growth	-0,04	0,21	-0,60	-0,09	1							
Inflation	-0,01	0,27	-0,17	0,36	0,06	1						
Slope	-0,08	-0,07	-0,05	-0,07	0,07	-0,09	1					
Unemployment	0,09	0,03	0,31	0,22	-0,33	-0,31	0,29	1				
Mkt-rf	-0,08	0,29	0,43	0,26	-0,05	-0,35	0,14	-0,11	1			
SMB	-0,02	-0,02	0,29	0,31	-0,20	-0,22	0,16	0,08	0,54	1		
HML	-0,08	0,26	0,02	0,32	0,14	0,43	0,12	-0,45	-0,02	0,08	1	
CCI	-0,05	-0,43	-0,15	-0,77	0,09	-0,69	0,41	-0,04	0,20	0,07	-0,22	1

Table 7 Correlation matrix regression two

Table 6 reports a correlation matrix for the variables of hypothesis one. Overall, the correlations are moderate. Therefore, high multicollinearity does not exist. The highest reported correlations are between the excess return and SMB, and stock return and excess return at 0,52. High correlations between stock and market returns are expected. Ideally, the correlation among independent variables should be as low as possible to maintain reliable results from the regression.

The correlations between ESG score and its pillars with CDS spreads are negative. However, correlations do not take into account, e.g. the effect of other variables, lagged effects, and possible fixed effects. The highest correlations with CDS spreads appear to be ROA and leverage with absolute values of around 0,2. The correlations between pillar scores and ESG scores are naturally high. It should be noted that avoiding multicollinearity, for example, in accounting-based variables is nearly impossible. Similar correlations are likely to occur in the studies presented in the literature review. Therefore, it could be argued that having some amount of multicollinearity makes the results more comparable to other studies with similar variables.

Following regression one, the correlations among variables of regression two are also moderate (table 7). The highest correlation -0,69 is between inflation and CCI. This result is somewhat expected since inflation relatively straightforwardly affects consumers' confidence. If inflation is higher than the average salary increases, the purchasing power of consumers declines, potentially leading to lower household confidence. As well as in regression one, the correlation between excess returns and SMB is relatively high at 0,54. The dependent variable correlates lowly with independents. For example, the correlation between industry CDS spreads and government ESG expenditures is nearly zero. Thus, the correlations do not suggest whether a positive or negative association between them should be expected from the results. Additionally, the other expenditure-based variables, change in debt and debt-to-GDP -ratio, have positive correlations. As could be expected, GDP growth, excess return and CCI have negative correlations with CDS spreads.

6.2 Methodology

The effect of ESG scores on CDS spreads is measured with panel data and ordinary least squares (OLS) regression, minimising the sum of squared residuals, following earlier studies (i.e. Caiazza et al., 2023 and Barth et al., 2022). Based on the Gauss-Markov theorem, the OLS estimator is the best linear unbiased estimator (BLUE) if five assumptions hold. Equation 10 should represent the population and random sample; no perfect collinearity exists among variables, the error term *u* has a conditional mean of zero, and the error term has a constant variance given explanatory variable (Wooldridge, 2012, p. 105). Factually, the Gauss-Markov assumptions are violated. For example, multicollinearity exists among independent variables. Also, it should be noted that the sample of the thesis does not represent the population of existing companies in the US and Europe. Most of the entities are large and represent all existing companies matching the criteria of this study, i.e., publicly traded, have a sufficient number of CDS data, and have ESG scores. Thus, the sample is not completely random. Hence, the model is formulated as follows:

$$\ln\left(CDS\ spread\right)_{i,t} = a_i + \beta ESG_{i,t-1} + \beta Controls_{i,t-1} + \delta Fixed\ effects + u_{i,t} \quad (10)$$

The dependent variable of the equation is the natural logarithm of a 5-year CDS spread for a given firm i at quarter t. The a_i is the intercept of the equation, and the variable of interest is the ESG score of a company or one of its components. Furthermore, controls include size, leverage, ROA, stock return, inflation, slope, market excess return, SMB, and HML. The time-varying error term is represented with u, where the value changes over time (Wooldridge, 2012, p.460). Following Caiazza et al. (2023), the regression includes one period lagged effects. The sum of a_i and $u_{i,t}$ is usually referred to as a composite error (Wooldridge, 2012, p.460). Lagged effects indicate that the CDS spread at the time t is explained by the value of independent variables at the time $t-1$. Based on previous academic research, the model incorporates fixed effects that capture firm and time-specific variation. The quarterly macro and market-level control variables are time variant but firm invariant, causing collinearity if estimated with time-fixed effects. Thus,

time-fixed effects are estimated with year dummies akin to Di Giuli and Kostovetsky (2014).

Additionally, the Hausman test can evaluate the necessity of incorporating fixed effects. The Hausmann test indicates whether a random or fixed-effects model should be used. The null hypothesis of the Hausman test suggests that random effects are the preferred model. In case the null hypothesis is rejected, fixed-effect estimates should be used (Wooldridge, 2012, p. 496). The Hausman test provides a p-value of 0,005. Thus, a fixed-effects model is preferable.

To the best of my knowledge, this thesis is the first to estimate the relationship between expenditures on ESG and corporate CDS spreads. Thus, "benchmark models" do not exist. Furthermore, the model incorporates only the US. This geographical decision is driven mainly by available data. The data should include similar budget functions in all estimated areas to estimate differences between two or more geographical areas as precisely as possible. Unfortunately, different countries have different reporting practices. Also, the CDS index data covers only the US sufficiently. The utilised model partly follows the study conducted by Wisniewski et al. (2018). Similarly to hypothesis one, the second hypothesis includes fixed-effect OLS regression.

The effect of government ESG expenditures on CDS spreads is estimated with industry-level CDS indexes. The panel data consists of all available industries provided by the LSEG. In contrast to hypothesis one, indexes of financial companies are not excluded from the sample since i.e. the unique capital structure of financial companies should not be an issue with industry indexes. Furthermore, the short sample period increases the necessity for additional data. On the other hand, in the absence of related literature, it is not necessary to make the results comparable to other studies. However, a robustness check without the financial industry will be conducted. Hence, the regression for the second hypothesis is as follows:

$$\ln\left(CDS\ index\ spread\right)_{i,t} = a_i + \beta ESG\ Expend\ _{i,t-1} + \beta Controls_{i,t-1} + \delta FE + u_{i,t}, \quad (11)$$

where $ESG\ Expend$ is the amount of quarterly US government expenditures on ESG from quarterly GDP. Aligning with the model of hypothesis one, fixed effects (FE) are included in the regression. Controls include inflation, slope, market excess return, SMB, HML, GDP growth, debt-to-GDP, change in debt, unemployment, and CCI. Government decisions might not have an immediate impact on the economy. In contrast, the effect appears to be prolonged, as discussed earlier (see Reinhart & Rogoff, 2009). Therefore, the regression includes one-period lagged effects. Some studies, e.g., Mumtaz and Theodoridis (2020) and Blanchard (1981), have estimated the effects of spending with the vector autoregressive model. Generally, the model requires more data than OLS. In this case, OLS is the preferred model since the sample period is short and the amount of data is limited.

7 Results

This chapter presents the results of the two regressions, beginning with hypothesis one and followed by hypothesis two. The first subchapter begins with results for the combined and whole sample period. Later, geographical and time-varying effects are estimated. Similarly, the second subchapter begins with an analysis of the relationship between ESG expenditures and CDS spreads, followed by an industry-level analysis. However, it should be noted that the discussed results assume that CDS spreads are correctly priced, which might not be the case.

7.1 Hypothesis one

Hypothesis one estimates whether high ESG performance companies are rewarded by lower default risk. The following table includes a combined sample of US and European companies from 2015 to 2022. The first model estimates the effect of ESG score on CDS spreads. Furthermore, models 2-4 estimate the impact of each pillar score on CDS spreads separately.

Variable	1	2	3	4
ESG score	0,001			
	(1,635)			
Environmental		0,001***		
		(3,284)		
Social			0,000	
			(-0,591)	
Governance				0,000
				(1,170)
Size	-0,040**	-0,025	-0,039**	-0,038**
	(-2,248)	(-1,383)	(-2,185)	(-2,150)
Leverage	0,699***	0,683***	0,699***	0,696***
	(14,506)	(14,114)	(14,502)	(14,431)
ROA	-1,003***	-1,017***	-1,000***	-1,000***
	(-17,858)	(-18,085)	(-17,773)	(-17,780)
Stock return	-0,251***	-0,253***	-0,251***	-0,251***
	(-11,335)	(-11,413)	(-11,325)	(-11,333)
Inflation	3,812***	3,794***	3,857***	3,858***
	(10,653)	(10,589)	(10,761)	(10,785)
Slope	-0,754	-0,658	-0,840	-0,813
	(-0,697)	(-0,607)	(-0,777)	(-0,752)
Mkt-rf	-0,046	-0,044	-0,045	-0,044
	(-0,869)	(-0,838)	(-0,853)	(-0,839)
SMB	0,401***	0,405***	0,406***	0,405***
	(4,103)	(4,137)	(4,149)	(4,141)
HML	0,723***	0,727***	0,719***	0,721***
	(11,512)	(11,565)	(11,456)	(11,499)
Intercept	4,924***	4,645***	4,990***	4,936***
	(16,202)	(15,064)	(16,486)	(16,223)
R-squared	0,84	0,84	0,84	0,84

Table 8 The effect of ESG scores on CDS spreads

The *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively. The model includes fixed effects. T-statistics are reported in parenthesis. To save space, the results for year dummies are not reported.

The results indicate that ESG score does not have a statistically significant effect on CDS spreads. Precisely, the ESG score´s p-value is 0,1022. Thus, it can be argued that a weak positive effect might exist since the p-value is close to the 10% confidence level threshold. Whether the effect is significant, the results indicate that companies, on average, have not benefited from higher ESG scores. In contrast, the credit markets might have perceived companies with better ESG scores as riskier than their peers with lower ESG scores. High statistical significance in the control variables is captured except for the yield

curve's slope and market excess return. The results indicate, in line with the Merton model, that more leveraged companies are riskier. Based on the results, managers of companies should focus on the company's capital structure. In other words, maintaining leverage at a moderate level to avoid high default risk. On the other hand, investors should require higher returns from their high-leverage investments. Also, lenders should consider the necessity of utilising e.g. restrictive covenants in terms of high-leverage companies.

Furthermore, a company's size is negatively associated with CDS spreads. As expected, a company's profitability, ROA, has a negative coefficient. Moreover, stock returns and CDS spreads have a negative relation. The R-squared of the models is relatively high at around 0,84. Since most variation is captured with fixed effects and controls, the impact of ESG or pillar scores, whether significant or not, on the R-squared of the model is relatively low. Models 2-4 indicate that the environmental pillar is the only pillar score statistically significantly associated with CDS spreads. In contrast to hypothesis one, environmental performance increases a company's default risk with a high statistical significance. Similarly, the governance pillar has a positive coefficient, albeit not significant. Consistent with the results of the ESG score, the control variables remain highly significant estimated with each pillar score.

Several factors may drive unexpected results. For example, the drivers might be the sample size, the ESG scoring methodology, geographical differences, and the sample period. The number of companies not belonging to the financial industry with active CDS trading has decreased rather than increased, resulting in a lower sample size. Also, the previously discussed differences between rating agencies may drive differences between existing results. On one hand, to the best of my knowledge, this thesis includes the most recent data. Thus, the association between spreads and ESG might have reversed over the last few years. Decreasing marginal utilities derived from a company´s ESG spending may drive higher default risk perceived by credit markets. On the other hand, compliance

with existing regulations and socially responsible behaviour aligning with generally accepted practices might be sufficient for the markets. Thus, additional efforts to maximise ESG performance are not rewarded.

The previously discussed results are probably more or less affected by geographical differences. Given the differences between Europe and the US, for example, in terms of market and political environment, it is reasonable to divide the sample into two geographical areas. Furthermore, there are legislative differences between the areas, i.e. CSRD, that become into effect onwards from 2024. Also, market sentiment as a whole is potentially more favourable towards sustainability in Europe than in the US. Other potential differences between areas are, e.g., access to capital and shareholder activism. The following table reports results for the effect of ESG and pillar scores on CDS spreads in both areas separately. The table's left (right) side reports the European (US) sample results.

Varibale	Europe				US			
	1	2	3	4	1	2	3	4
ESG score	0,003*** (2,629)				0,001 (0,760)			
Environmental		-0,002*** (-2,6109)				0,002*** (3,437)		
Social			0,000 (0,207)				-0,001 (-1,498)	
Governance				0,003*** (4,938)				0,001 (1,215)
Size	0,008 (-0,288)	0,018 (0,686)	0,013 (0,488)	0,010 (0,361)	-0,117*** (-5,178)	-0,091*** (-3,898)	-0,117*** (-5,168)	-0,115*** (-5,057)
Leverage	0,618*** (7,371)	0,619*** (7,386)	0,616*** (7,345)	0,628*** (7,516)	3,411** (2,363)	3,253** (2,258)	3,410** (2,363)	3,419** (2,369)
ROA	-0,585*** (-8,165)	-0,593*** -8,274	-0,589*** (-8,217)	-0,577*** (-8,070)	-1,547*** (-19,122)	-1,577*** (-19,484)	-1,537*** (-18,956)	-1,543*** (-19,081)
Stock return	-0,315*** (-8,699)	-0,317*** (-8,753)	-0,314*** (-8,690)	-0,318*** (-8,825)	-0,243*** (-8,661)	-0,246*** (-8,747)	-0,243*** (-8,666)	-0,243*** (-8,670)
Inflation	4,593*** (7,836)	4,536*** (7,741)	4,549*** -7,756	4,665*** (7,973)	1,625*** (2,835)	1,603*** (2,793)	1,643*** (2,867)	1,628*** (2,841)
Slope	24,666*** (8,800)	24,681*** (8,805)	24,667*** (8,788)	24,382*** (8,715)	-13,122*** (-5,050)	-12,974*** (-4,982)	-13,115*** (-5,045)	-13,080*** (-5,033)
Mkt-rf	0,102 (1,153)	0,106 (1,207)	0,102 (1,160)	0,107 (1,211)	0,093 (1,241)	0,094 (1,261)	0,093 (1,247)	0,093 (1,254)
SMB	-0,234 (-0,859)	-0,241 (-0,887)	-0,232 (-0,852)	-0,240 (-0,886)	-0,121 (-0,844)	-0,118 (-0,819)	-0,119 (-0,835)	-0,120 (-0,841)
HML	1,717*** -14,185	1,700*** (-14,052)	1,703*** (14,068)	1,731*** (14,327)	0,625*** (8,028)	0,632*** (8,103)	0,618*** (7,944)	0,624*** (8,017)
Intercept	3,797*** (8,196)	3,994*** (8,640)	3,905*** (8,439)	3,813*** (8,279)	6,716*** (17,407)	6,196*** (15,691)	6,797*** (17,717)	6,676*** (17,208)
R-squared	0,83	0,83	0,82	0,83	0,84	0,84	0,84	0,84

Table 9 The effect of ESG scores in the US and Europe

The model's dependent variable is CDS spread. The *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively. The model includes fixed effects. T-statistics are reported in parenthesis. To save space, the results for year dummies are not reported.

As could be expected, differences exist between US and European companies. Most interestingly, the ESG score explains European CDS spreads statistically significantly. Contradicting to hypothesis one, the effect is positive. A similar statistical difference is not captured in the US sample. That noted, the European sample is the primary driver of the obtained positive coefficient near statistical significance in the combined sample. Additionally, differences in pillar scores exist. The environmental pillar explains CDS spreads in both areas. However, the coefficient is negative in the European sample, whereas a positive association is captured in the US sample. This result should be interpreted as European companies being rewarded from higher environmental scores. In contrast, US

companies are “punished” for participating in activities creating higher environmental scores. As speculation, given the difference in the number of European companies (153) versus US companies (267), the effect of ESG scores on CDS spreads in the combined model would probably be significant if the numbers between areas were more balanced.

What follows is speculation of possible contributors to previously discussed findings. First, considering hypothesis one, negative coefficients in ESG scores are not captured. The positive, albeit insignificant, effect might suggest that US markets do not consider ESG scores or performance an important contributor to lower default risk. On the other hand, the momentum of ESG in the US might have diminished to the point where companies are not overinvesting in ESG practices other than the environmental pillar. Therefore, they might not be subject to diminishing marginal returns. Second, European markets might also not perceive ESG activities as risk-reducing, potentially driving the statistically significant coefficient.

Compared to the US companies, European companies might be investing more, leading to diminishing marginal returns and increased default risk. If European companies invest more than their US peers, one possible cause of the phenomenon is the CSRD that has not yet come into effect. The credit market might expect companies to use more resources in the longer term. Therefore, it could have an effect on 5-year CDS spreads. Greenwashing is potentially also captured with higher CDS spreads. At the country level, the European government's expenditures on ESG may be associated with higher country-level risk, driving corporate default risk. Third, the results are less accurate if the CDS spreads are not “correctly” valued, as discussed earlier.

Social pillar scores in table 9 are not associated with CDS spreads in both areas. However, the governance pillar score has a significant positive coefficient in the European subsample. Given the relatively high correlations between pillar scores and ESG scores, reported in the correlation matrix, the positive effect of ESG scores in the European sample is

probably driven by the governance score having higher t-statistics than the environmental score. Furthermore, the effect of the social pillar is positive, although not significant. Statistically significant effect of the governance score in the US is not captured.

The controls in both areas are relatively similar in terms of significance. However, there are two exceptions. First, the size factor does not explain variation in European companies' CDS spreads, whereas the negative effect in the US is highly significant. Second, the slope of the yield curve explained significantly CDS spreads in both areas. However, the sign is different. In the US, the slope is associated with lower CDS spreads, whereas the effect in Europe is positive. One explanation is that the slope in the US is estimated with Treasury yield, and German government bonds serve as a proxy for all European countries. This finding might explain why the slope does not significantly impact the CDS spreads of the combined sample. As speculation, since the slope of the yield curve is utilised in forecasting future economic output, dramatic changes in the yield curve may indicate a recession in the future.

Since variation between the geographical areas is captured, it is reasonable to research whether time variability exists. The following table includes geographical and time-based divisions. Since the sample includes eight years, dividing the period into two four-year periods is intuitive. Thus, the effect of ESG score is estimated between 2015-2018 and 2019-2022.

	Europe		US	
	2015-2018	2019-2022	2015-2018	2019-2022
ESG score	0,000	0,003*	0,001	-0,001
	(0,185)	(1,780)	(0,781)	(-0,447)
Size	0,109***	0,000	0,085**	-0,200***
	(2,807)	(0,009)	(2,466)	(-5,070)
Leverage	0,864***	0,277**	2,233*	0,933***
	(6,239)	(2,449)	(1,787)	(8,195)
ROA	-0,040	-0,392***	-1,019***	-0,880***
	(-0,505)	-4,016	(-8,010)	(-8,256)
Stock return	-0,286***	-0,302***	-0,384***	-0,200***
	(-6,500)	(-7,381)	(-9,227)	(-6,502)
Inflation	-0,366	4,856***	-2,4435	9,692***
	(-0,140)	(8,848)	(-1,123)	(13,269)
Slope	18,171***	40,287***	1,956	10,301***
	(4,687)	(13,696)	(0,466)	(3,120)
Mkt-rf	-0,776***	0,245**	0,841***	-0,428***
	(-4,932)	(2,423)	(4,064)	(-5,147)
SMB	-0,439	0,265	-0,960***	2,714***
	(-1,495)	(0,633)	(-4,889)	(10,949)
HML	1,150***	1,582***	0,424***	0,303***
	(6,267)	(10,306)	(3,901)	(3,337)
Intercept	2,192***	3,511***	3,003***	7,518***
	(3,312)	(4,832)	(5,080)	(11,063)
R-squared	0,87	0,90	0,88	0,98

Table 10 Time variation in ESG scores and CDS spreads

The *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively. The model includes fixed effects. T-statistics are reported in parenthesis. To save space, the results for year dummies are not reported.

The results indicate existing time variability in the markets. Most importantly, the ESG scores have explained CDS spreads significantly only between 2019 and 2022 in Europe. ESG score did not explain CDS spreads in the US in either of the periods. There are possible explanations for the time variation. Firstly, the second period includes a substantially different market environment compared to the previous period or compared to the US. Secondly, the beginning of 2020 includes the outburst of the COVID pandemic, which increased market risk and caused fears of default contagions. Also, the war in Ukraine, beginning in 2022, probably affected more European than US companies. However, the previous does not explain why the association between ESG scores and European CDS spreads turned positive. Based on existing studies, higher corporate sustainability should

be rewarded during low-trust periods. Additionally, year-specific variation should be captured by the year dummies included in the regression. The result obtained might be potentially driven by fund flows from high ESG score assets to others.

Time variation exists also in control variables. The size factor was significant in Europe during the first period but not in the second one. In the US sample, size is statistically significant during both of the periods. However, in the first period, the coefficient is positive and negative during the second period. This indicates that larger companies were perceived as riskier before the financial turmoil. In contrast, during the crisis period, the results suggest that the size of a company served as protection against the risk of default. This signals that allocating investments to larger companies during a crisis might be a profitable investment strategy for an investor. In the US, the significance of leverage increased during the second period. Also, the inflation explained CDS spreads in both areas only during the second period. Inflation was relatively low, if not negative, during the first years of the sample and reached record levels of the last decades in Europe and the US during the last sample years. This suggests for future research that the control variables chosen, i.e. inflation, should describe the researched sample period. Thus, samples that include only years with low inflation should use other metrics, such as shadow rates, if nominal rates are close to zero.

In conclusion, the hypothesis one suggesting ESG performance is associated with lower default risk is rejected. Additionally, the null hypothesis stating that ESG scores do not affect CDS spreads can be partly accepted. In the combined sample, ESG scores did not contribute statistically significantly to CDS spreads. However, the results indicate existing geographical differences. In contrast to hypothesis one, a positive contribution to CDS spreads in the European sample is captured. Additionally, pillar scores in both areas are more or less associated with CDS spreads. Interestingly, the results of the US and Europe are contradictory. For example, the effect of environmental pillar score is negative in Europe but positive in the US. It is not surprising that the environmental pillar score has the highest explanatory power from the pillar scores since, intuitively, sustainability is

often compared to environmental issues. Furthermore, as the correlation matrix suggests, environmental and social pillars correlate highest with the ESG score. It should be noted that the sample includes primarily large companies, causing biased results towards large companies. Therefore, the results do not apply to all public companies.

7.2 Hypothesis two

The following table includes results for the second regression, in which government ESG expenditures explain the industry CDS spread levels. To capture lagged effects, all explanatory variables are one period lagged during 2017-2023.

Variable	Coefficient	t-Statistic	P-value
ESG expend	2,250**	2,279	0,023
Change in debt	-4,571***	-3,736	0,000
Debt-to-GDP	1,332**	2,023	0,043
GDP growth	-6,043***	-5,537	0,000
Inflation	-1,467	-0,867	0,386
Slope	-16,476***	-2,841	0,005
Unemployment	-2,294*	-1,787	0,074
Mkt-rf	-0,376	-1,529	0,127
SMB	-0,473	-1,346	0,179
HML	0,079	0,341	0,733
CCI	0,086**	2,278	0,023
Intercept	-5,203	-1,187	0,236

Table 11 The effect of ESG expenditures on CDS spreads

The *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively. The regression's R-squared is 0.75. The model includes fixed effects. To save space, the results for year dummies are not reported.

The results indicate that, on average, the US government's ESG expenditures are associated with higher CDS spreads. As expected, the quarterly GDP growth rate is the most significant control variable. Another representation of economic activity, the unemployment rate, has a statistically significant negative coefficient. Interestingly, an increase in debt generally lowers companies' default risk. Thus, companies seem to benefit from government debt expansion in terms of decreased probabilities of default. As discussed

earlier, the impact may be negative in the short run but likely positive with a longer time horizon. However, the debt-to-GDP ratio is positively associated with industry CDS spreads, which aligns with the findings of Wisniewski and Jackson (2021) on stocks. It could be argued that the positive coefficient of debt-to-GDP disproves the assumption of Ricardian equivalence. However, making definite assumptions from the results of a short sample period is difficult, if not impossible. Also, CCI, which could be expected to be negatively associated with CDS spreads, has a positive coefficient. Based on the captured results, the null hypothesis stating that government ESG spending is not associated with CDS spreads can be rejected. Appendix Two includes an additional test redefining the variable of interest.

However, the government ESG expenditure might not actually be the key driver of the spreads in the long run. Based on Reinhart and Rogoff (2009), theoretically, the effect could be similarly estimated with any other government expenditures. As speculation, ESG may be an excuse for the government to overspend. Since the results indicate that ESG expenditures and other government spending are associated with CDS spreads, it is meaningful to delve into the existing differences between industries. Given that the regressed data includes 47 industry indexes, the results are reported for some sectors only. Although it is assumed that the CDS index spreads of the financial industry are comparable to others, an additional test is conducted by excluding it. Therefore, the last column in the following table includes a robustness check without the financial industry. Excluding financials decreases the number of cross-sections to 42.

Variable	Chemicals	Banking	Transportation	Airline	Manufacturing	Robustness check
ESG expend	4,296*	4,031*	2,883	5,496*	3,038	2,283**
	(1,987)	(2,021)	(1,459)	(1,833)	(1,715)	(2,095)
Change in debt	-11,321**	-8,666***	-3,334	-4,507	-7,325***	-4,532***
	(-4,220)	(-3,505)	(-1,361)	(-1,212)	(-3,336)	(-3,354)
Debt-to-GDP	2,739*	2,120	2,707*	3,926*	1,410	1,299*
	(1,897)	(1,593)	(2,054)	(1,962)	(1,193)'	(1,787)
GDP growth	-11,932***	-10,536***	-6,219**	-7,976**	-8,753***	-6,086***
	(-4,986)	(-4,778)	(-2,847)	(-2,405)	(-4,470)	(-5,050)
Inflation	-3,053	-5,970	-2,129	-1,464	-1,859	-1,333
	(-0,823)	(-1,746)	(-0,629)	(-0,285)	(-0,612)	(-0,713)
Slope	-47,423***	-19,654	-11,431	-8,562	-18,280	-16,550***
	(-3,729)	(-1,677)	(-0,985)	(-0,486)	(-1,756)	(-2,584)
Unemployment	-3,018	-6,676**	-2,363	-2,536	-2,244	-2,429*
	(-1,072)	(-2,574)	(-0,920)	(-0,650)	(-0,974)	(-1,713)
Mkt-rf	-0,735	-0,651	-1,152**	-1,679*	-0,305	-0,407
	(-1,364)	(-1,310)	(-2,340)	(-2,248)	(-0,692)	(-1,499)
SMB	-0,770	-1,354*	-0,544	-0,269	-0,416	-0,422
	(-0,999)	(-1,906)	(-0,773)	(-0,252)	(-0,659)	(-1,086)
HML	-0,005	0,114	-0,435	-0,726	0,134	0,079
	(-0,010)	(0,243)	(-0,934)	(-1,026)	(0,320)	(0,307)
CCI	0,170*	0,118	0,100	0,170	0,090	0,085**
	(2,052)	(1,546)	(1,325)	(1,473)	(1,319)	(2,037)
Intercept	-15,441	-9,883	-8,669	-16,692	-5,789	-5,074
	(-1,607)	(-1,116)	(-0,988)	(-1,253)	(-0,736)	(-1,048)

Table 12 Industry-variation in expenditures and CDS spreads.

The *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively. The last column includes a robustness check for the original model, excluding financial industries. T-statistics are reported in parenthesis. To save space, the results for year dummies are not reported.

The results suggest industry-wide variability in the explanatory power of ESG expenditures on industry CDS indexes. Furthermore, a similar recognisable pattern exists in terms of control variables. Whether the coefficient for ESG expenditures is significant or not, the coefficient is positive. This indicates an industry-wide relationship where, on average, companies do not benefit from government ESG spending practices. From reported industries, ESG spending has a statistically significant impact on chemicals, banking, and airlines. On the other hand, expenditures did not explain variability in transportation and manufacturing industries. Overall, the effect of control variables on manufacturing industry spreads was the least significant. Thus, the only significant control variables were the change in debt and GDP growth. Based on the model, which includes all

industries and industry-specific results, GDP growth and change in debt have the highest explanatory power on CDS index spreads from the included controls.

The robustness check in the last column of the previous table indicates that the financial industry does not solely drive the results of the combined sample. That might have been the case in hypothesis one if the financial industry was included due to its high sample proportion. On the other hand, the robustness check enhances the comparability of obtained results relative to the results of hypothesis one. Excluding the financial industry increases the p-value for ESG expenditures from 0,023 to 0,036. However, the results remain significant at a 5% confidence level. In conclusion, government expenditures on ESG are associated with higher industry CDS spreads. Similar effects are captured with industry-specific observations. From another perspective, the results of the study suggest that in terms of default risk mitigation and enhancing prospects of the economy, political decisions should focus, for example, on increasing GDP growth. In other words, policies that aim for higher economic activity. Making unconditional conclusions from a relatively short sample period is not desirable.

8 Conclusions

ESG and sustainability have received significant attention among the public and academics. The general focus appears to have moved from CSR to ESG during the last two decades. Many individuals, companies, and governments have adapted their attitudes and beliefs toward a sustainable future. However, contradicting beliefs also exist. Opposing consensus does not necessarily indicate that one is wrong or has a distorted view. Given the opposing views and the pros and cons of ESG, this thesis begins by critically evaluating and discussing the dilemmas surrounding the concept. Some studies suggest, e.g., a positive correlation between stock returns and firm performance, whereas some indicate that ESG portfolios do not provide abnormal returns. On the other hand, the political environment has affected the sustainability concept more or less. The previous reasons highlight the importance of understanding how ESG might affect the financial markets.

The first hypothesis examines the relationship between corporate ESG scores and CDS spreads in the US and Europe between 2015 and 2022. The obtained results contradict what could be expected based on existing literature. The ESG score in the combined sample is weakly, if at all, correlated with CDS spreads. Interestingly, the coefficient is positive, although negative was expected. Furthermore, the environmental pillar is the only significant pillar with a positive coefficient. Thus, the results indicate that, on average, companies are not rewarded for their ESG-enhancing activities.

However, the geographical division provides more academically and practically interesting findings. ESG score is associated with higher CDS spreads in Europe. However, the effect of the environmental pillar is negative, whereas governance has a positive impact on spreads. The social pillar is not associated with spreads. Furthermore, the environmental pillar score positively impacts CDS spreads in the US. Division of the sample period reveals that the effect of ESG score on CDS spreads was positive during 2019-2022 in Europe. The ESG score did not explain US CDS spreads during either subperiod. One explanation is that the success of ESG in the US has ended. The results suggest that the

credit markets have not rewarded companies with higher ESG scores regarding default risk reduction. As an academic contribution, this thesis includes the most recent data in the field of this study to the best of my knowledge.

The results of hypothesis one have several practical implications. The results indicate that European companies should not invest excessively in ESG activities since markets seem to perceive that higher ESG scores are associated with a higher default risk. On the other hand, actions towards better ESG scores in the US are not also rewarded. The positive, albeit not significant, coefficient of ESG score indicates that US companies should not also use extra resources for ESG activities. From an individual investor´s perspective, investing in companies with moderate ESG ratings might be more profitable than focusing on companies with high ESG scores. Also, ESG-motivated investors should probably observe their portfolios´ ex-ante risk-adjusted returns. If higher ESG scores are associated with higher default risk, large funds focusing on high ESG score companies are potentially a risk for market stability. This risk should be noted by market regulators. Given the results, lenders should re-assess the riskiness of companies with high ESG scores. The variation in the pillar scores suggests that investors and lenders should consider them in the decision-making in addition to total scores. In terms of European companies, the obtained results indicate that mandatory standards encouraging companies to spend more money on their ESG activities might harm the economy in the long run.

Given the discussed political dimensions of ESG, the second hypothesis of this thesis focused on the effect of US government ESG expenditures on industry CDS spreads between 2017 and 2023. Existing literature does not provide a model or benchmark for the research of this hypothesis. Academics have focused more on sovereigns rather than companies. Thus, perhaps this thesis's most important academic contribution is introducing an applicable and repeatable approach to estimate, i.e. the effect of government spending on CDS spreads. The effect is expected to be agnostic in the absence of existing literature. The results indicate that the US government's ESG spending on industry CDS spreads is positive. Interpretation of the previous suggests that ESG expenditures have

increased the default risk of companies with active CDS trading. The effect is also examined with different industries. According to the obtained results, if the effect is significant, it is positive. For example, a positive association is captured in chemicals, banking and airlines. On the other hand, ESG expenditures do not, on average, affect the spreads of transportation and manufacturing industries.

Practically, the results of the second hypothesis suggest to US policymakers that the funds channelled into ESG spending have not been beneficial for companies on average in terms of default risk. This could, in the longer horizon, lead to circumstances where the government needs to bail out defaulting firms. Therefore, the government should perhaps focus on the amount of spending on ESG-related budget functions. It could be argued that increasing spending is politically easier than cutting expenses. Naturally, some of the estimated budget functions, such as the legal system and social security, require some expenditures. As discussed earlier, the effect might have been similar to any other budget function. According to the results, government debt increases might boost the economy in the short time horizon. However, a similar effect should probably not be expected in the future. Excluding debt expansions, government activities that increase GDP growth are likely beneficial for companies and the economy.

There are several possible venues for future research. For example, as discussed in the thesis, the existing differences between ESG rating agencies might drive the results. Thus, the ESG scores provided by a different rating agency could be used to capture the existing differences. Furthermore, studies estimating the effects of ESG scores on CDS spreads should include data after 2022. Another approach could be how the ownership of large asset managers, i.e. BlackRock, affects the relationship between ESG scores and CDS spreads. Regarding the second hypothesis, significant differences might be obtained by defining the ESG expenditures differently or focusing, for example, only on environmental spending. Also, comparing different countries could reveal country-wide variation. Given the relatively short sample period, future research should expand the sample period.

In conclusion, the results suggest that higher ESG scores do not decrease a company's default risk, and government ESG expenditures drive higher default risk on average. However, the results should not be interpreted as an invitation for companies to act irresponsibly. Perhaps a top-down approach where decisions of sustainability actions are made at the highest level of a company is not efficient. Consequently, the focus could be on whether individuals within the company act responsibly. It can be expected that if most employees behave responsibly, the company will become more sustainable and positive effects on the surrounding society can be captured.

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Appendices

Appendix 1. List of industries

AIRLINE	MNFG
BANKING	MTLS/MNG
BEV/BT	OIL & GAS
BLDG PRDS	OILF MCH/SVCS
CABLE/MDA	OTHER FIN
CGM/DIVR MFG	PHARMS
CHEMICALS	PROP/CLTY INS
CONTAINERS	PUBLISHING
CSM GOODS	RAILROADS
CSM PRDS	REITS
ELEC POWER	RET STR FD/DRG
ELEC UTL M.QLT	RET STRS OTH
ELTN	RSTR
ENERGY CO	SERVICE CO
FOOD PRC	SVS OTHER
HLTHCR FACS	TELECOMS
HLTHCR SUPP	TELEPHONE
HOME BLDRS	TEXT/APRL/SHO
INDLS OTH	TOBACCO
INFO/DATA TECH	TRSP
LEISURE	TRSP OTHER
LIFE INS	UTL OTHER
LODGING	VEH PARTS
MACHINERY	

Appendix 2. Additional test for hypothesis two

Variable	Coefficient	t-Statistic	P-value
ESG expend	0,910**	2,258	0,024
Change in debt	-4,313***	-3,575	0,000
Debt-to-GDP	1,735**	2,516	0,012
GDP growth	-4,415***	-4,508	0,000
Inflation	-0,085	-0,061	0,952
Slope	-20,502***	-3,676	0,000
Unemployment	-1,561	-1,374	0,170
Mkt-rf	-0,239	-1,077	0,282
SMB	-0,639*	-1,786	0,074
HML	-0,021	-0,085	0,933
CCI	0,087**	2,306	0,021
Intercept	-5,824	-1,326	0,185

Table 13 Additional test on ESG expenditures and CDS spreads

The *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively. The model includes fixed effects. T-statistics are reported in parenthesis. The R-squared of the model is approximately 0,75. To save space, the results for year dummies are not reported. In comparison to the primary model, the ESG expenditures are divided by total government expenditures instead of GDP.