

DO TCFD SUPPORTERS OBTAIN BETTER DEBT FINANCING TERMS?

**A GLOBAL STUDY ON HOW COMPANY BOND YIELDS ARE
AFFECTED BY THE DECISION TO SUPPORT THE TCFD**

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Do TCFD supporters obtain better debt financing terms? A global study on how company bond yields are affected by the decision to support the TCFD.

Abstract:

This thesis analyzes the impact of companies supporting the Task Force on Climate-related Financial Disclosures (TCFD), more specifically, the impact on their bond yields. As prior literature suggests that higher quality disclosures decrease companies' cost of capital and the TCFD aims to help companies provide relevant climate-related disclosures to the financial market, this thesis aims to test if firms supporting the TCFD will obtain similar financial benefits. Moreover, supporting firms can choose whether to only support or to disclose in accordance with the TCFD recommendations. Consequently, a distinction was made between these firms, resulting in two data samples. Using a linear regression test controlling for fixed effects, this thesis cannot find support to the claim that firms that sign the TCFD supporting agreement receive better debt financing terms, regardless of whether they disclose according to the guidelines or not.

Keywords:

TCFD, Asymmetric Information, Disclosure, Signaling, Yield

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1. Introduction

“Climate-related financial disclosure is of paramount importance for transparent and sustainable capital markets” - Laura M Cha, Chairman, Hong Kong Exchanges

A concept formally known as "ESG" has been widely discussed in companies worldwide over the past decade and is now a factor influencing key operational and investment decisions. ESG stands for environmental, social, and governance, and investors pay attention to how companies consider these three pillars when evaluating material risks and growth opportunities in potential investments (CFA Institute, 2022).

ESG issues came to light in 2006 when the United Nations Principles for Responsible Investment (PRI) initiative mandated the inclusion of ESG criteria in corporate valuation (Atkins, 2020). As of March 2021, 3,826 investment companies with \$121 trillion in assets under management (AUM) have signed on to these principles, incorporating ESG issues into their investment decisions (PRI Annual Report, 2021). To enable this, a natural demand for companies to disclose ESG-related information has seen a similar evolution. To support and guide companies in providing such information, several voluntary standards and frameworks have emerged over the years. Voluntary standards include the Sustainability Accounting Standards Board (SASB) and the Global Reporting Initiative (GRI), while frameworks include the EU Taxonomy and the Task Force on Climate-related Financial Disclosures (TCFD). The standards provide detailed instructions on the ESG-related topics that should be reported on, while the frameworks provide information on how the topics should be organized. Thus, they should be combined. (VinciWorks, 2021)

To narrow the gap between financial market demand for ESG information and corporate supply, legislative initiatives have been launched to require companies of a certain size to disclose ESG information either in stand-alone reports or in their regular financial reports. By 2017, 25 countries, including the United Kingdom, China, and Australia, had mandated disclosure of ESG information for certain types of companies. However, these disclosures became localized over the years and lacked a common structure that all countries and companies could adhere to. That is, companies did not report in accordance

with a specific framework or similar (Nelson, 2021). Recently, progress has been made in this area as the Task Force on Climate-related Financial Disclosures (TCFD) framework is becoming mandatory in some cases. The TCFD is a working group established by the Financial Stability Board to help public companies and other organizations to disclose climate-related risks and opportunities. To help companies in an efficient manner, the working group has created a framework, the TCFD framework, which provides guidelines for disclosure. (TCFD, 2022)

In 2021, New Zealand became the first country to implement mandatory TCFD reporting, and several countries have committed to join by 2022, including the United Kingdom, Japan, and Hong Kong (WorldFavor, 2022). In addition, TCFD reporting became mandatory for all PRI signatories in 2020 (PRI, 2021). One reason the TCFD framework has a significantly growing number of supporters and legislative progress compared to other ESG-related disclosure frameworks may be due in part to its recent introduction, but also to the framework's alternative perspective of providing financially relevant climate-related company disclosures to the financial market. (TCFD, 2022)

As the TCFD framework has grown in popularity, studies and analyzes have naturally been conducted on the benefits and pitfalls of the framework, its impact on business performance, and how best to use it. Perhaps due to the newness of the framework, there is a lack of literature on the potential financial impact that companies experience when they become TCFD supporters. It is in this area that the main contribution of this thesis lies. Researchers such as Barry & Brown (1985), Botosan (1997), and Sengupta (1998) have conducted studies that show a negative relationship between corporate disclosure and their cost of capital. Thus, there is reason to believe that the decision to become a TCFD supporter should also have an impact on a firm's cost of capital. Ultimately, this thesis aims to fill this theoretical gap by answering the following research question:

Do TCFD supporters obtain better debt financing terms?

Furthermore, the partially voluntary nature of the TCFD framework leads some companies to disclose in accordance with the guidelines, while others do not. For example, companies may sign the agreement to become TCFD supporters but not disclose according to the guidelines. The purpose of this thesis is also to examine whether the results differ between these two groups of companies. Since the TCFD itself does not

make such a categorization of supporting companies, this thesis has done so based on certain criteria, which are explained in more detail in Section 6.1. Companies that support the TCFD are referred to as “supporters”, while only the supporting firms that disclose information in accordance with the TCFD framework, are referred to as “adopters”. Consequently, all firms are supporters but not all firms are adopters, only the ones that disclose according to the TCFD recommended guidelines. In addition, there is another dimension related to the quality of disclosure, as how and what they disclose varies significantly across companies, regardless of whether TCFD reporting is voluntary or mandatory, despite the TCFD's recommended guidelines. Consequently, this thesis also aims to analyze the impact on the financial market by choosing to support or adopt and for which quality.

In this thesis, linear regression tests were conducted with the aim to analyze the impact of bond yields from firms becoming TCFD supporters and adopters. Thus, tests were conducted on bonds issued by companies before they became TCFD supporters or adopters and after. The bonds were tested because their yield serves as a proxy for the issuing companies' cost of debt. Two different data samples were created to test the difference between TCFD supporters and adopters. Of the 2,819 companies that supported TCFD at the end of 2021, 203 companies were included in the first data sample, resulting in 3,569 bonds used for the test. The second data sample, which includes only firms adopting the TCFD, included 167 firms with a corresponding 3,127 bonds used for testing. Firms were excluded from the data samples because values were missing, because they operated in irrelevant industries, and because they had not issued bonds before and after supporting the TCFD. In addition to answering the research question, a cross-sectional test, focusing on asset size, was conducted to further synthesize the results. Additional empirical testing was also conducted to assess the validity of the tests.

The results of this thesis do not suggest that signing the TCFD agreement leads to better terms for debt financing, regardless of whether firms support or adopt the framework. The test for firm size also yielded the same result, as the test did not find statistical significance.

The remainder of this thesis is organized as follows: Section 2 introduces and details TCFD, followed by introductory theory related to the financial market, bonds, asymmetric information, and signaling. Section 3 begins with a review of prior research, which includes previous relevant literature, and ends with hypothesis development along with the hypotheses of the thesis. Section 4 presents the methodology of the thesis, followed by a description of the data processing in Section 5. Section 6 presents the results of the various tests. In Section 7, the results are discussed, debated, and the contributions of this work are presented. Section 8 concludes the thesis and finally, Section 9 presents the limitations of the thesis and suggestions for future research.

2. Institutional and theoretical background

This section introduces and details the Task Force on Climate-Related Financial Disclosures and the theoretical background of this thesis, which includes sections on the financial market, bonds, asymmetric information and signaling.

2.1. Introducing the TCFD

As a result of increasing stakeholder demand for ESG information by companies, various ESG-related reporting frameworks have emerged in recent years. As noted above, one framework has recently experienced a growing number of adherents - the Task Force on Climate-Related Financial Disclosures (TCFD) framework. In 2017, the Financial Stability Board established the TCFD to make recommendations to help companies make more effective climate-related disclosures so that stakeholders can better understand the financial system's exposure to climate-related risks. The assumption is that without trustworthy climate-related financial information, financial markets will not be able to properly assess climate-related risks and opportunities. Therefore, companies should report in line with these recommendations to help financial markets avoid the risk of sudden shifts in value when certain industries are forced to quickly adapt to a new situation caused by a climate-related event. (TCFD, 2022)

Figure 1. TCFD recommendations (TCFD, 2022)

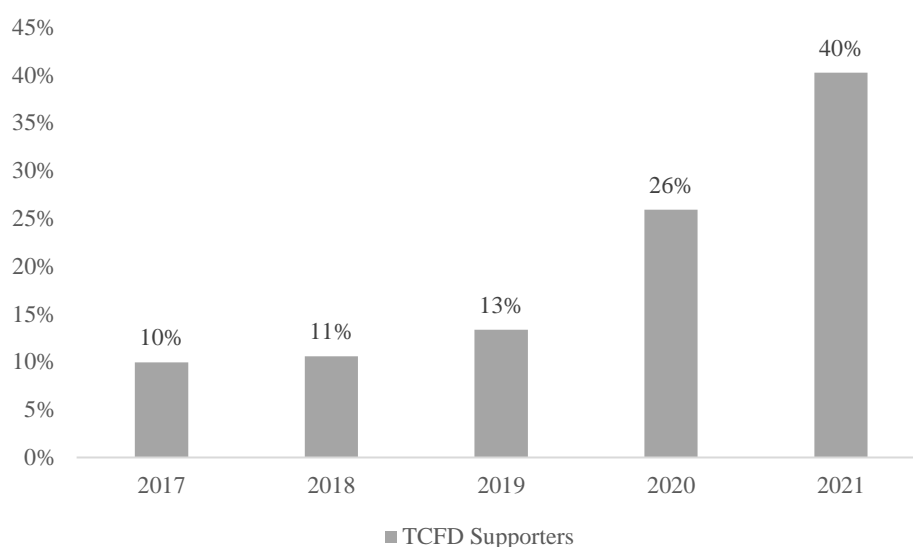
Governance	Strategy	Risk Management	Metrics & Targets
Disclose the organization's governance around climate-related risks and opportunities.	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.	Disclose how the organization identifies, assesses, and manages climate-related risks.	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

To avoid similar corporate disclosure problems as in the past and instead ensure that the financial market receives relevant and necessary information, the TCFD provides its supporters with a specific structure for what to report and how. It is recommended that companies disclose information on four topics, as visualized in Figure 1 - governance,

strategy, risk management, and metrics and targets. Within each of these topic areas, there are additional recommendations for further disclosure to provide guidance to reporting companies. Finally, the TCFD recommends that supporting companies disclose a scenario analysis that shows how the four topic areas are affected by various climate-related scenarios. This is intended to provide reporting companies with a tool to plan for different outcomes. Disclosing information according to this structure provides the financial market with a comprehensive overview of how a reporting entity assesses its climate-related risks and opportunities (TCFD Report, 2017).

By the end of 2021, 2,819 companies had announced their support for the TCFD framework and were therefore registered on the TCFD supporter list (TCFD, 2022). As visualized in Graph 1, the TCFD has experienced a significant growth in supporters since its establishment and the majority of supporting companies have registered in the last two years. However, there are also companies that have announced their support for the framework but have not yet disclosed information in line with the TCFD recommendations. To test the hypotheses presented in Section 3.5, a distinction was made between companies that have disclosed such information and those that have not. In this thesis, companies that support the TCFD have been referred to as “supporters”, while only the supporting firms that disclose information in accordance with the TCFD framework, have been referred to as “adopters”

Graph 1. Distribution of firms becoming TCFD supporters (TCFD, 2022)



2.2. Financial market, debt financing and bonds

Since bonds are the basis for the tests in this thesis, it is important to understand how they work. To obtain external financing, companies must turn to the financial market, a concept that has many definitions. In this thesis, the financial market is defined following Teplova's (2000) definition, which states that it is a system of supply and demand for financial assets, cash, and investment sources. Companies in need of capital turn to creditors and investors for equity and debt financing. Debt financing includes bank loans, government bonds, corporate bonds, and more. Thus, corporate bonds are debt instruments that can be purchased on the financial market.

A corporate bond is a debt instrument that includes a collection of cash flows because it generally pays a fixed rate of interest over a fixed period of time. There are four main characteristics of bonds: the type of issuer, the maturity, the principal and coupon. Obviously, corporations are the issuers of corporate bonds, and the maturity of a bond is the number of years after which the issuer is obligated to repay the bond. Principal refers to the amount the issuer must repay on the maturity date, while coupon is the additional amount of interest the issuer pays between the issue date and the maturity date. For some bonds, there are no regular interest payments, these are called zero coupon bonds. The key measure of return for bondholders, i.e., bond investors, is the yield to maturity (YTM), i.e., the current bond price in the market, which is equal to the internal rate of

return required for the present value of all future cash flows (Choudhry, 2004). The YTM captures the risk premium required by bondholders and is therefore an excellent measure of the return that bondholders require from a company for their investment (Sengupta, 1998).

2.3. Asymmetric Information

Asymmetric information occurs when there is imperfect knowledge because one party has more information than the other party in a situation (Stiglitz, 2002). It often occurs in situations where one party, called the agent, provides services on behalf of another party, called the principal, and the agent has no information about the agent's behavior or intentions. Situations may arise where the agent exploits its knowledge advantage at the expense of the principal when the principal and the agent have different attitudes toward risk or completely different objectives. This situation arises from agency theory, and it is expected that the associated problems will be mitigated by the exchange of information between the two parties, thereby reducing the information asymmetry. (Eisenhardt, 1989)

Companies looking for funds usually face a problem known as the "lemon problem." Here, the company has an incentive to withhold unpleasant information and highlight the positive information to raise funds (Healy & Palepu, 2000). According to existing theory, insiders have better information about the company's historical and future potential than outsiders, such as investors, so there is an inherent information asymmetry between the two parts. Information asymmetry creates uncertainty for investors and causes them to pay for information risk, i.e., a risk premium. That is, if a firm's managers can reduce information asymmetry, and thus the risk premium for investors, managers should have a lower cost of capital as information risk decreases. Consequently, firms and their managers have an incentive to disclose information, which could lower their cost of capital, i.e., the financing terms for the firm.

2.4. Signaling

One type of information exchange that reduces information asymmetry between two parties is the signaling strategy (Spence, 2002). Connelly et al. (2011) describe signaling theory as a process that includes four parts that contribute to a signaling environment.

The signaler (1) is the insider with inside information who decides how much and what information to send as a signal (2) to the receiver (3), who ultimately sends feedback (4) in the form of counter signals to enable more efficient signaling. The signaling environment, which may exist between people, organizations, or other parties, aims to reduce information asymmetry (Rynes et al., 1991). Consequently, the reduction of information asymmetry ultimately depends on the type of signals that the signaler sends and how well they are received by the receiver. In addition, there is the signal cost, i.e., the cost associated with achieving certain outcomes that are ultimately mediated by signals (Bird & Smith, 2005). The receiver is likely to send positive feedback, i.e., inform the signaler that the received signal is considered reliable and well received, if there is a cost associated with the signal (Connelly et al., 2011).

It is worth understanding whether the receivers, i.e., the financial market considers the signaling costs for the companies that become TCFD supporters to be equivalent to the costs of adopting the framework, as for TCFD adopters. In other words, is the announcement to support the TCFD sufficient to obtain the benefits of debt financing from the financial market? Or do companies need to disclose TCFD-related information to obtain these benefits? According to the signaling theory, there should be a clear difference between TCFD supporters and adopters, as the financial market should interpret signaling costs differently for the two options. Becoming a TCFD supporter requires little work, while becoming a TCFD adopter requires the efforts of an entire firm. However, due to the novelty of the framework, the financial market might not notice this effort, so the signal cost for the options might be misinterpreted. One of the objectives of this thesis is to analyze the signal value of supporting or adopting the TCFD.

3. Prior Research & Hypothesis Development

This section discusses previous literature on general sustainability reporting and relevant literature on TCFD and its disclosure recommendations. In addition, the previous literature on the impact of corporate disclosure on corporate financing terms is presented. It then discusses the theoretical gaps that emerge from the examination of the existing literature. Finally, the section ends with the development of two hypotheses that will be discussed and tested throughout the thesis.

3.1. Previous literature on sustainability disclosures

Disclosure of sustainability information has evolved rapidly in recent years as reporting requirements on environmental, social and governance (ESG) issues have increased significantly, especially for financial services firms. Consequently, the EU Corporate Sustainability Reporting Directive is successively adding new sustainability reporting requirements that mainly large companies must follow, while expanding the scope of companies subject to these requirements. However, disclosure of sustainability data is not only required and demanded by regulators, but also by investors and consumers as public pressure on companies to operate sustainably increases (KPMG, 2021).

The literature on the value of sustainable corporate management, both in terms of financial and non-financial measures, is more established than the impact of sustainability disclosure itself. Henderson (2015) discusses the business case for environmental sustainability, arguing that several business models have emerged that offer particularly good opportunities to make money from running a sustainable operation. Similarly, Kuehn (2014) illustrates how companies are using the momentum of their sustainability efforts to create value by leveraging their strengths to accelerate positive change. Benefits such as these are well known in large companies today, so the focus has naturally shifted to examining the impact of disclosure rather than the actual sustainable actions companies are taking. As a result, literature has emerged over the years on general sustainability disclosures and, more importantly, on the impact that sustainability disclosures have on companies.

The European Commission (2019) stated the benefits of sustainability reporting in the implementation of the new guidelines in 2019. The benefits stated by the European Commission include attracting a more diverse investor base, improving understanding of climate opportunities, and fostering a more constructive dialog with stakeholders. Deloitte (2021) also published a report on the value drivers associated with sustainability disclosure. In addition to the benefits stated by the European Commission, Deloitte stated benefits such as risk mitigation, operational efficiency, brand differentiation and more.

The process of disclosing sustainability information has also been studied to some degree. Adams et al. (2006) focus on understanding the corporate processes for preparing a sustainability report and the challenges associated with the processes and how they may affect sustainability performance. They conducted a case study in which they observed company meetings, conducted individual interviews, and obtained feedback from stakeholders. They concluded that corporate ownership played an important role and that the biggest challenge was the lack of internal structures in the preparation of the sustainability report. Although the findings are interesting, their study also had its pitfalls, as it examined only one company and the date of the study (2006) could be considered outdated. In addition, Buallay and Hawaj (2021) conducted a sectoral analysis of sustainability reporting and its impact on company performance. By analyzing data from about 3,000 companies, they concluded that sustainability reporting not only has a financial impact, but also that there are significant differences among seven different sectors. By conducting regression analysis using return on assets, return on equity, and Tobin's Q as dependent variables, they found that some sectors benefited to a greater extent from disclosure of sustainability efforts as operational, financial, and market performance varied after implementation. The study is comprehensive and highly relevant to companies planning sustainability reporting.

3.2. Previous literature on the TCFD

Following the introduction of the TCFD framework, several articles have appeared on the subject to highlight its benefits, pitfalls, and areas for development. Shortly after the launch of the TCFD, Eccles and Krzus (2018) published an article outlining why companies should become supporters, the benefits of doing so, and how to best leverage it. They note that companies should use the framework because (1) investors need the information, (2) investors will be less inclined to invest without it, (3) companies that adhere to the framework are better able to adapt to potential climate changes and explain those changes to financial markets, and finally that (4) the recommendations could eventually lead to regulation and laggards will be negatively affected. They also conducted an analysis of the largest oil and gas companies by market capitalization listed on the New York Stock Exchange and concluded that disclosures recommended by the TCFD can be made in existing reporting formats, suggesting that they are not a barrier that would prevent companies from using them. Both companies' annual reports and their sustainability reports were analyzed for the analysis. The article published by Eccles and Krzus (2018) states positive aspects of supporting the TCFD, but also highlights potential concerns related to the framework.

Nevertheless, not all the literature on TCFD and its disclosure recommendations is as favorably highlighted as the article published by Eccles and Krzus (2018). Chua and Fiedler (2020) studied the Australian market, interviewed 48 stakeholders, and collected 66 annual and sustainability reports and came to less positive conclusions. They find that there is strong demand for climate-related financial reports and that demand is growing rapidly. However, they conclude that the ability to disclose such information is limited by three problems: (1) lack of guidance, resulting in companies not knowing what to disclose, (2) the measurements to be used are too complex, and finally that (3) the information required by investors is too uncertain, as some of the metrics are difficult to quantify. In summary, they note that there is strong demand, but implementation is not yet fully developed. There is other evidence to support this finding, which is appropriate given the novel nature of the framework. For example, O'Dwyer and Unerman (2020) conducted a similar study in which they problematized the TCFD recommended disclosures to explore the transformative potential of the framework. In addition to Chua

and Fiedler's (2020) findings, they also highlight the problems with climate-related scenario planning, both for companies and investors, the difficulty of aligning TCFD recommended disclosures with other reporting frameworks, and other challenges.

In summary, the relevance of the TCFD framework should not be questioned. However, many researchers point out that the framework is not yet fully developed in certain areas. In their article, Ameli et al. (2019) conclude that transparency of corporate climate-related risks through TCFD recommended disclosures alone is not sufficient for financial markets to respond rationally and in line with the public interest, as assumed by the efficient market hypothesis (EHM). Based on empirical evidence from surveys sent to institutional investors, they argue that transparency from TCFD recommended disclosures is helpful, but not nearly sufficient to be consistent with the EMH, and thus cannot yet be considered a comprehensive response to the challenges of "aligning institutional climate finance."

Conclusively, by analyzing TCFD recommended disclosures through the lens of previous literature, it is evident that the framework is demanded and popular, yet it is still newly established and thus comes with challenges that have not been fully solved at this point in time.

3.3. Previous literature on corporate disclosure's impact on corporate financing terms

The implications of increased disclosure are frequently debated both in academia and among creators and users of the information. Previous research such as Barry & Brown (1985), Botosan (1997), Sengupta (1998) presents a negative relationship between increased disclosure of corporate information and the cost of capital, which in turn leads to lower financing costs for companies. Practitioners, on the other hand, tend to question whether the time, effort, and cost put into these disclosures are really commensurate with the benefits to users.

Previous research on the impact on the cost of equity suggests that increased disclosure can reduce the cost of equity (1) through increased liquidity as a result of disclosure by (a) reducing transaction costs and (b) increasing demand for the firm's stock price, or (2) through increased disclosure reducing the information asymmetry associated with

forecasts and estimates, which means that the risk that important information will be omitted decreases, and thus the risk premium decreases (Healy et al., 1999, Botosan, 1997). Sengupta (1998) extends this research and finds that firms have lower effective interest costs when they disclose high quality, i.e., detailed, and consistent, information. Underwriters and lenders tend to focus on a firm's potential default risk, and Sengupta finds that their assessment of default decreases when quality disclosures are made. Thus, the importance of disclosure is not limited to debt or equity financing. Note that Sengupta's results are based on financial analysts' disclosure assessments and not whether a company disclose according to a particular framework, such as the TCFD.

Similar results have been found with respect to corporate social responsibility (CSR) disclosure. Attig et al. (2013) find that a company's non-financial disclosures, such as CSR information, are honored by rating agencies when assessing the company's creditworthiness. Rating agencies such as S&P and Moody's often serve as a guide for underwriters, and thus investors, in assessing the creditworthiness of companies. In addition, investments in CSR that go beyond requirements and benefit society can lead to better financing terms, i.e., lower costs due to a better rating by the rating agencies. In contrast, a study by Menz (2010) suggests that there is a positive but weak relationship between CSR and European corporate bond yields. However, this relationship focuses on CSR performance rather than sustainability disclosure.

Conclusively, the literature to date suggests that it is beneficial for companies to improve their disclosure. Besides doing what might be called "the right thing," companies can also improve their financing terms by reducing information asymmetry and, consequently, their cost of capital, both for debt and equity.

3.4. Theoretical gaps

As mentioned earlier, there is a clear demand and several benefits for companies to adopt and report on sustainability measures. This is both out of self-interest, such as risk mitigation and operational efficiency, and to external parties, such as customers, the environment, and investors. Given the increasing demand from investors to "do the right thing" and make better risk assessments, TCFD was created to provide a framework that companies can prepare, and the financial market can use. Although the initiative is

welcomed by investors and companies, there are still some pitfalls for both sides that make it difficult for investors to interpret and use the information currently available.

Nonetheless, the literature to date suggests that improved disclosures overall and ESG disclosures can benefit companies in financing, so it is plausible that companies supporting the TCFD could benefit despite current pitfalls. However, studies on ESG information and better financing terms suggest that financial analysts tend to interpret corporate ESG performance subjectively rather than if a company discloses in accordance with a standardized framework or not. Consequently, it is relevant and novel to examine whether there are financial benefits as a result of becoming a TCFD supporter. If such a link can be demonstrated, it would be of great benefit in developing further growth in corporate disclosure and sustainability disclosure.

3.5. Hypothesis Development

Given the significant increase in relevance, awareness, and advocacy of the TCFD framework, the financial implications of specifically supporting the TCFD are analyzed in this thesis. Previous research suggests that ESG-related disclosures should lead to better terms for equity and debt financing. However, this thesis only examines the impact on debt financing, as it is the most important source of external financing for listed companies and is the most advanced in terms of sustainability branding (Sengupta, 1998). This thesis hypothesizes that supporters of the TCFD will be able to obtain debt financing at more favorable terms, so the first hypothesis is as follows:

H1: *TCFD supporters will obtain funds at more preferable debt financing terms.*

Given the partially voluntary nature of the TCFD framework, companies can decide for themselves whether to solely support or to adopt the TCFD's disclosure recommendations. Since the organizational burden differs significantly between the two options, it is interesting to examine whether financing terms are affected by the decision to support or adopt the framework. According to the theory, the asymmetric information

between the financial market and debt issuing firms should further decrease when firms choose to adopt the framework, as adoption leads to higher signaling costs and disclosures. Consequently, this thesis hypothesizes that firms adopting the TCFD will obtain better debt financing terms. The second hypothesis is therefore as follows:

H2: *TCFD recommended disclosures result in more preferable debt financing terms.*

4. Methodology

This section outlines and describes the methodology used to answer the research question of this thesis. The purpose of this section is for the reader to understand the basis and framework for the findings and analysis of this thesis.

4.1. Model for Cost of Debt

To examine the impact on borrowing terms for companies becoming TCFD supporters/adopters, tests were conducted on bonds issued by companies before they became TCFD supporters or adopters and after. Two models were created to explain the cost of debt for corporate bonds. The formulas and consequently the analyses are performed at the bond level, i.e., the unit of analysis. The two models are:

$$COD_t = f(TCFD(S)_t, Control\ Variables, Fixed\ Effects) \quad (1)$$

$$COD_t = f(TCFD(A)_t, Control\ Variables, Fixed\ Effects) \quad (2)$$

(S): represent firms which have been identified as TCFD supporters.

(A): represent firms which have been identified as also TCFD adopters.

Formula 1 is applied to the dataset of bonds issued by TCFD supporters and formula 2 is applied to an adjusted dataset which only includes bonds issued by companies before they became TCFD adopters and after:

4.2. Cost of debt measurement (COD)

Yield to maturity (YTM) represents the effective interest rate on the bond, i.e., the rate at which future interest and principal payments on the bond equal the current value of the bond. YTM is an indicator of the cost of debt as it includes the risk premium charged to bondholders, i.e., investors.

4.3. TCFD

Data on the global companies that are supporting the TCFD were taken from the TCFD homepage (TCFD, 2022), where the number of companies supporting the TCFD is continuously updated. The level of participation and "performance" of companies in relation to their TCFD recommended disclosures were not considered in this thesis, only the distinction between supporters and adopters. Two dummy variables were created to determine the companies' level of TCFD engagement with the bond issue, with 0 indicating that the bond issue occurred before the corresponding company became a TCFD supporter/adopter, and 1 indicating that the company was a supporter/adopter at the time of the bond issue.

4.4. Sample period

This thesis studies global bonds issued by TCFD supporters and adopters in the last 10 years, from 2012 to 2022. The first company to become a TCFD supporter signed the agreement in July 2017. Thus, by using a 10-year sample period, the data sample captures an approximately equal period before and after the first companies signed the TCFD agreement. In addition, a 10-year sample period allows for an examination of periods near the date of interest, i.e., the date that the companies became TCFD supporters.

4.5. Control variables

When companies issue bonds, their cost of debt may be affected by several factors other than the decision to support or adopt the TCFD recommended disclosures, and these other factors should be considered. Previous research on the impact of corporate disclosures on corporate returns and cost of capital shows that researchers tend to form three categories when interpreting firms' cost of debt, namely: issue characteristics, market conditions, and issuer characteristics. The relationship between the cost of debt and the control variable are based on the same prior research. (Gong et al., 2018; Sengupta, 1998; Botosan, 1997; Francis et al. 2006)

4.5.1. Issue Characteristics

LSIZE: Logarithm of amount issued in bond (USD millions) +1 i.e. $\text{LOG}(\text{BondSize}+1)$.

LSIZE is expected to have a negative relationship with COD

MATUR: Maturity of each bond measured in number of years. The longer a bond's maturity is, the higher the expected COD due to i) higher credit risk exposure the further a future payment is planned to be paid out and ii) higher interest risk exposure

CALL: Callable bonds issued, presented as 1 if callable and 0 if not callable. Callability expected to have a negative impact on COD, due to the callability's provision penalty element

4.5.2. Market Conditions

TBILL: U.S. Treasury bill yield at constant maturity matched to the approximate maturity of the bond's maturity at time t . The following maturities for Treasury bill yields were used to approximately match with comparable maturities of the bond: 1 month, 3 months, 6 months, 1 year, 2 years, 3 years, 5 years, 7 years, 10 years, 20 years and 30 years. U.S. Treasury bills serve as a proxy for the overall interest rate levels globally and thus indicate investors' available risk-free rate. TBILL is expected to have a positive association with COD. (U.S. Department of Treasury, 2022)

4.5.3. Issuer Characteristics

DE: Quota between book value of long-term debt and the book value of equity at year $t-1$. Higher DE is expected to be positively associated with COD

Margin: Operating profit year $t-1$ (Earnings before tax and interest, "EBIT") divided by net sales year $t-1$. Higher margin expected to be negatively associated with COD

LASSET: Logarithm of issuer's total assets year $t-1$. Higher LASSET is expected to be negatively associated with COD, as larger firms sometimes are perceived to have lower market risk. Moreover, asset size has a positive relationship with disclosure (Eskandari et al., 2012)

4.6. Fixed Effects

To control for time-invariant variable effects across different firms, fixed effects are added in the form of year, firm and country.

Firm fixed effects: Allows the regression to absorb all changes that do not occur within a specific firm. Given that the data sample consists of firms which have issued bonds before and after becoming TCFD supporters/adopters, controlling for time-invariant effects for different firms is needed.

Year fixed effects: Allows the regression to absorb all changes that do not occur within a specific year. Given that the data is retrieved over a 10 year sample period, controlling for time-invariant effects for different years is needed.

Country fixed effects: Allows the regression to absorb all changes that do not occur within a specific country. Given that the data sample is a global one, controlling for time-invariant effects for different countries is needed.

Lastly, standard errors are clustered at firm level when running the regressions, which is in line with prior research. (Petersen, 2009)

4.7. Regression

Based upon the dependent variable, independent variable, controlling variables and fixed effects above, the regression below is estimated:

$$COD = \alpha_1 TCFD(S) + \alpha_2 DE + \alpha_3 Margin + \alpha_4 LASSET + \alpha_5 LSIZE + \alpha_6 MATUR + \alpha_7 CALL + \alpha_8 TBILL + FE_{firm, year, country} + \varepsilon \quad (3)$$

$$COD = YIELD$$

Given the control variables and the estimated regression above, the coefficients are expected to display the following signs:

$$\alpha_0 ?, \alpha_1 < 0, \alpha_2 > 0, \alpha_3 < 0, \alpha_4 < 0, \alpha_5 < 0, \alpha_6 > 0, \alpha_7 < 0, \alpha_8 > 0$$

In investigating the relationship between firms adopting the TCFD recommended disclosures and their cost of debt, i.e., narrowing down the dataset to only adopters' bonds, a similar model was used. However, instead of using a variable for identifying whether the bond was issued before or after the firm became a supporter, a variable for identifying the adopters is used, generating the following regression:

$$COD = \alpha_1 TCFD(A) + \alpha_2 DE + \alpha_3 Margin + \alpha_4 LASSET + \alpha_5 LSIZE + \alpha_6 MATUR + \alpha_7 CALL + \alpha_8 TBILL + FE_{firm, year, country} + \varepsilon \quad (4)$$

$$COD = YIELD$$

Given the control variables and the estimated regression above, the coefficients are expected to display the following signs:

$$\alpha_0 ?, \alpha_1 < 0, \alpha_2 > 0, \alpha_3 < 0, \alpha_4 < 0, \alpha_5 < 0, \alpha_6 > 0, \alpha_7 < 0, \alpha_8 > 0$$

Both regressions are run on a bond level, for variables such as TCFD (S/A), LSIZE, MATUR, CALL and TBILL to be more accurate and properly matched when running the regression. Rather than conducting a test on a company yearly average level, which would decrease the accuracy of the regression.

5. Data Sample & Process

This section outlines the process of data collection. This includes the rationale for why certain data was collected, as well as where and how. Finally, the section ends with a description of the data.

5.1. Data Sample and processing

Since this thesis was conducted on a global scale, the original dataset was not narrowed down in terms of geographic scope. Consequently, all TCFD supporters (as of December 2021) were initially included, representing 2,819. To enable a search for issuer characteristics in Compustat, Global Company Keys (GVKEY) were identified for 929 companies, which reduced the size of the dataset. Financial companies, defined as bank- and insurance-related companies, were excluded from this dataset because their financing decisions are influenced by different factors than the financing decisions of traditional non-financial companies. Originally, both bonds and loans were to be analyzed, but due to the lack of data on loans, only bonds were included.

Bonds issued by companies and bond issue characteristics were retrieved from Refinitiv Eikon using company tickers obtained from International Securities Identification Numbers (ISIN) in Compustat. 41 company tickers and 6 ISIN codes were missing from Compustat and were collected manually. In this way, 8,856 bonds were obtained, which was then filtered out to 220 companies and then to 6,336 bonds, considering only companies that issued bonds before and after supporting the TCFD. Next, the bond sample was filtered by excluding bonds with missing values for issue characteristics (e.g., yield, LSIZE, LMATUR, and LCALL). In addition, issuer characteristics (e.g., DE, Margin, and LASSET) for the bond issuer were matched to each bond and consequently bond issuers with missing values were excluded. This procedure resulted in a final sample of 203 TCFD-supporting firms that had issued bonds before and after joining, totaling 3,569 bonds. Finally, the control variable for market conditions, i.e., TBILL, was matched to the comparable maturity of each bond.

To test the second hypothesis, a distinction had to be made between TCFD supporters and adopters. Since there is no formal distinction on the TCFD website or by the companies

themselves, this was done manually by analyzing the information provided by the companies. Companies were classified as "adopters" if they included any of the following parts in their disclosure: The Four Themes (Governance, Strategy, Risk Management, and Metrics and Targets), Climate Change Scenario Analyzes, or Transition and Physical Risks. Consequently, companies that did not include any of the above areas were considered solely "supporters." By applying this distinction to the analysis of the original 203 TCFD-supporting companies that issued bonds before and after signing the TCFD agreement, the data sample yielded 36 (18%) firms which were considered solely supporters and 167 (82%) adopters. Of the 167 adopters, 3,127 bonds remained to be analyzed for the second hypothesis. This is illustrated in Table 1.

Table 1. Data selection process

Selection Criteria	
TCFD Supporters	2,819
Less:	
Firms which did not have GVKEYs	-1,890
Financial institutions	-66
Firms which did not issue bonds before and after becoming TCFD supporters	-643
Firms lacking Compustat and relevant bond data	-17
Final sample for TCFD supporters	203
Less:	
Firms identified as solely supporters	-36
Final sample for TCFD adopters	167

5.2. Data Description

Two data samples were created, one with bonds issued by TCFD supporters and another data sample with bonds issued by entities identified as TCFD adopters. These two data samples were created to test the two separate hypotheses.

To provide an overview of the two data samples, Tables 2 and 3 were created to show the number of companies per country, the number of bonds issued per country, the number of bonds issued before and after the company signed the TCFD agreement per country, and the average yield per country.

Table 2 illustrates that Japan stands out as the country with the most TCFD-supporting companies. The noteworthy presence of Japan in the data sample, about 41% of all companies, is also related to the fact that Japan is the country with the highest number of TCFD-supporting companies. Japanese firms account for about 21% of the total number

of TCFD-supporting firms worldwide. The data also illustrates the split between bonds issued before and after corresponding firms became TCFD supporters. About 59% of bonds were issued before and 41% of bonds were issued after. This shows that there is a sufficient number of observations, i.e., bonds, to investigate before and after firms became TCFD supporters. Finally, the average yield in the whole dataset is about 2.01%, and the average range between countries is 0.39% and 6.35%. The range of yields between countries is large and is partly explained by the fact that some countries are represented by only a few companies, which has a strong impact on the yield of the corresponding country in the dataset.

As shown in Table 3, the number of TCFD adopters present in each country ranges from 1 to 75, with Japan again showing the largest presence. The number of bonds issued before and after TCFD adoption by the companies corresponds to 57% and 43%, respectively. Finally, the average yield across the dataset is about 2.08% and the average yield per country ranges from 0.39% to 6.39%.

Table 2. Description of data sample for TCFD supporters

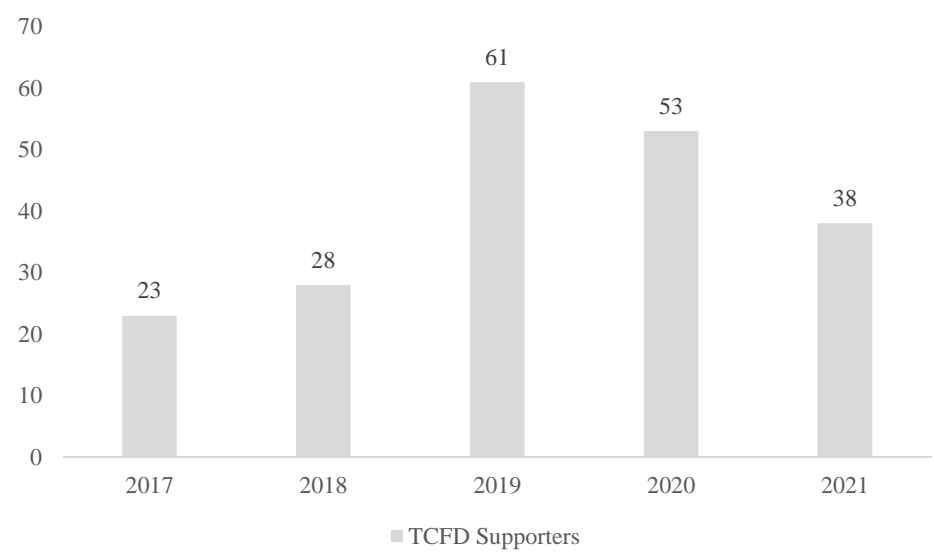
Country	Number of firms	Number of bonds	Number of bonds issued before joining TCFD	Number of bonds issued after joining TCFD	Average yield %
Japan	90	1,396	804	592	0.66
USA	26	661	404	257	3.52
France	12	279	141	138	1.41
Canada	9	239	171	68	3.85
Germany	6	171	61	110	1.47
South Korea	6	139	104	35	2.99
UK	6	120	49	71	3.28
Taiwan	6	99	43	56	0.79
Thailand	5	82	67	15	2.89
Mexico	4	34	21	13	5.47
Spain	4	14	7	7	3.56
India	3	46	29	17	6.35
Italy	3	44	16	28	2.42
Netherlands	3	38	10	28	0.39
Switzerland	2	59	28	31	2.27
Sweden	2	32	29	3	2.48
Norway	2	23	18	5	2.88
Philippines	2	14	8	6	4.06
Singapore	2	14	8	6	3.18
Australia	2	10	6	4	3.68
Finland	2	12	6	6	1.66
Portugal	2	11	4	7	2.30
Austria	1	17	12	5	1.37
Belgium	1	5	4	1	2.22
Brazil	1	6	4	2	5.50
Turkey	1	4	2	2	5.32
Total	203	3,569	2,056	1,513	2.03

Table 3. Description of data sample for TCFD adopters

Country	Number of firms	Number of bonds	Number of bonds issued before joining TCFD	Number of bonds issued after joining TCFD	Average yield %
Japan	75	1,161	651	510	0.64
USA	23	632	384	248	3.59
Canada	8	262	194	68	3.85
France	6	191	81	110	1.37
UK	6	120	49	71	3.28
Germany	6	171	61	110	1.47
Taiwan	6	99	43	56	0.79
South Korea	5	133	102	31	2.96
Spain	4	14	7	7	3.56
Italy	3	44	16	28	2.42
Mexico	3	26	14	12	4.74
Netherlands	3	38	10	28	0.39
Australia	2	10	6	4	3.68
Finland	2	12	6	6	1.66
India	2	41	27	14	6.39
Singapore	2	14	8	6	3.18
Switzerland	2	59	28	31	2.27
Thailand	2	29	23	6	3.01
Austria	1	17	12	5	1.37
Belgium	1	5	4	1	2.22
Brazil	1	6	4	2	5.50
Norway	1	9	6	3	2.36
Portugal	1	3	2	1	0.95
Sweden	1	27	26	1	2.74
Turkey	1	4	2	2	5.32
Total	167	3,127	1,766	1,361	2.08

Graph 2 illustrates when the 203 companies investigated in this thesis became TCFD supporters. The chart shows that most of the issuers included in the data sample became TCFD supporters during 2019, 61 issuers or about 30% of the total number of issuers. Of the total TCFD supporters, i.e., the unfiltered data set, comprising 2,819 firms, most firms signed the TCFD agreement in 2021, about 40% of TCFD supporters. The difference between the dataset used in this thesis and the unfiltered dataset of TCFD supporters is due to the smaller number of companies in the original dataset that issued bonds before and after they became TCFD supporters, as well as missing values.

Graph 2. Distribution of firms becoming TCFD supporters in dataset



6. Results

In this section, the results of the thesis are presented using tables and described with corresponding text. The section begins with descriptive statistics and correlation analyzes and concludes with results related to the impact of firms supporting or adopting the TCFD recommended disclosures on the cost of debt.

6.1. Descriptive Statistics and Correlation Analysis

6.1.1. Issuer Summary Statistics

To understand the issuer characteristics of both TCFD supporters and adopters, two summary tables (Tables 4 and 5) were created to illustrate the number of observations, the average D/E over the sample period, the average profitability margin over the sample period, and the average asset size in millions of US dollars over the sample period.

Table 4 shows that the median firm size for TCFD supporters, measured in assets, is \$21.6 billion for the firms included in the data sample, indicating that the sample consists of larger firms. However, it is also important to note that there is a wide range of sizes, as the smallest company is \$1.5 billion and the largest is \$488.1 billion. For TCFD adopters, as presented in table 5, the median asset size was \$22.5 billion and the range between the smallest and the largest firm was \$2.3 billion to \$488.1 billion.

Table 4. Issuer characteristics for TCFD supporters

Variable	Obs.	Mean	Std. Dev.	Min	Max	Median
DE	203	0.96	0.94	0.00	5.65	0.66
Margin	203	0.09	0.10	-0.34	0.50	0.07
Asset	203	41,823	60,113	1,459	488,138	21,596

Values refer to averages per firm over the sample period. Asset is in USD millions.

Table 5. Issuer Characteristics for TCFD adopters

Variable	Obs.	Mean	Std. Dev.	Min	Max	Median
DE	167	0.93	0.89	0.00	5.65	0.65
Margin	167	0.08	0.10	-0.34	0.50	0.07
Asset	167	45,898	64,717	2,341	488,138	22,495

Values refer to averages per firm over the sample period. Asset is in USD millions.

6.1.2. Data Summary Statistics

To understand the underlying bond data for TCFD supporters and adopters, issue characteristics, issuer characteristics, and market conditions, i.e., the variables used in the two regressions for the bonds, two additional summary statistical tables were created (Tables 6 and 7). These two additional tables show a summary of each bond issued and its control variables. The summary includes the number of observations, means, standard deviations, minimum value, maximum value, and median value.

Table 6. Descriptive statistics of TCFD supporter data, on bond level

Variable	Obs.	Mean	Std. Dev.	Min	Max	Median
Yield	3,569	2.01	1.985	-13.247	18.727	1.351
TCFDS	3,569	.412	.492	0	1	0
DE	3,569	1.332	1.217	0	8.833	0.975
Margin	3,569	.105	.122	-1.089	.567	0.085
Assets	3,569	71,133	81,850	902	586,204	42,056
BondSize	3,569	11,623	30,367	.002	400,000	1,250
MATUR	3,569	13.222	11.21	.019	61.29	10.005
CALL	3,569	.364	.481	0	1	0
TBILL	3,569	1.811	.899	.01	3.88	1.880

Assets and BondSize presented in USD million. The values are absolute values and not logarithmic, to provide a more coherent view of the sample at hand. The logarithmic values are used in the regressions

Table 7. Descriptive statistics of TCFD adopter data, on bond level

Variable	Obs.	Mean	Std. Dev.	Min	Max	Median
Yield	3,127	2.068	2.024	-13.247	18.727	1.476
TCFDA	3,127	.435	.496	0	1	0
DE	3,127	1.316	1.171	0	8.833	0.990
Margin	3,127	.108	.125	-1.089	.557	0.087
Assets	3,127	76,548	85,767	902	586,203	43,587
BondSize	3,127	11,619	31,797	.002	400,000	1,000
MATUR	3,127	13.419	11.482	.019	61.29	10.005
CALL	3,127	.382	.486	0	1	0
TBILL	3,127	1.819	.904	.01	3.88	1.900

Assets and BondSize presented in USD million. The values are absolute values and not logarithmic, to provide a more coherent view of the sample at hand. The logarithmic values are used in the regressions

Table 6 shows that the median value of the bonds is \$ 1.3 billion, the largest bond issued is \$400 billion, and the smallest is \$2 thousand. The average yield for TCFD supporters (Table 6) is about 2.01% with a range of -13.3% and 18.7% and a standard deviation of 1.99.

Table 7 shows that TCFD adopters have a slightly smaller median bond size of \$1 billion with the same minimum and maximum value as in Table 6. Furthermore, the range in

yield showed similar results for TCFD adopters as supporters, but with a slightly higher average yield of 2.07%. In terms of bond maturity, the median maturity for both samples is 10 years.

6.1.3. Correlation Matrix

Two correlation matrices (Table 8 & 9) were created for each variable used in both the TCFD supporter and adopter regressions to examine any correlation between the variables.

Table 8. Correlation Matrix for TCFD supporter variables

Pearson's Correlations Coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Yield	1.000								
(2) TCFDS	-0.059	1.000							
(3) DE	0.072	-0.032	1.000						
(4) Margin	0.299	-0.129	-0.070	1.000					
(5) LASSET	0.115	0.130	0.120	0.090	1.000				
(6) LSIZE	-0.394	-0.054	-0.050	-0.278	-0.323	1.000			
(7) MATUR	0.316	-0.134	0.098	0.142	0.136	-0.052	1.000		
(8) CALL	0.543	0.028	0.055	0.255	0.216	-0.474	0.302	1.000	
(9) TBILL	0.183	-0.559	0.081	0.145	-0.010	0.032	0.491	0.117	1.000

Values that are insignificant on a 1%, 5% or 10% level are presented in bold.

Table 9. Correlation Matrix for TCFD adopter variables

Pearson's Correlations Coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Yield	1.000								
(2) TCFDA	-0.071	1.000							
(3) DE	0.133	-0.033	1.000						
(4) Margin	0.290	-0.113	-0.045	1.000					
(5) LASSET	0.149	0.116	0.156	0.106	1.000				
(6) LSIZE	-0.385	-0.056	-0.098	-0.265	-0.324	1.000			
(7) MATUR	0.344	-0.139	0.118	0.159	0.132	-0.051	1.000		
(8) CALL	0.572	0.016	0.114	0.255	0.197	-0.458	0.339	1.000	
(9) TBILL	0.216	-0.559	0.080	0.161	-0.011	0.043	0.500	0.146	1.000

Values that are insignificant on a 1%, 5% or 10% level are presented in bold.

Both Table 8 and Table 9 show a negative correlation between the dependent variable yield and the respective TCFD dummy variables. That is, bond yields are lower when firms issue bonds as TCFD supporters and adopters. These results are consistent with previous studies on debt financing and disclosure, however, no conclusion can be drawn from these correlations.

6.2. Effect of TCFD on Cost of Debt

The test for the first hypothesis is performed using formula 3, the results of which are shown in Table 10. The regression results indicate a positive relationship between companies becoming TCFD supporters and their bond yield. However, the relationship cannot be demonstrated with statistical significance, so the results do not support the hypothesis that the cost of debt decreases when firms become TCFD supporters. Moreover, the potential impact of a significant result would be a higher yield by 23 basis points. For the control variables in the regression, five out of seven control variables had the sign expected before running the regression; this result is comparable to previous studies (Sengupta, 1998).

Table 10. Linear regression for firms becoming TCFD supporters' impact on their bond yield

Yield	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
TCFDS	0.23	0.12	1.32	0.187	-0.15	0.47
DE	0.05	0.04	1.21	0.229	-0.03	0.14
Margin	-0.87	0.57	-1.52	0.131	-1.99	0.26
LASSET	0.25	0.17	1.45	0.149	-0.09	0.58
LSIZE	-0.23***	0.09	-2.66	0.009	-0.40	-0.06
MATUR	0.04***	0.00	6.70	0.000	0.02	0.03
CALL	0.96***	0.18	5.47	0.000	0.61	1.31
TBILL	0.34***	0.08	4.01	0.000	0.17	0.51
Constant	0.25	0.81	0.31	0.754	-1.35	1.86
Firm-fixed effects: Included						
Year-fixed effects: Included						
Country-fixed effects: Included						
adj. R-squared: 0.6232						
Number of obs.: 3,569						

*** $p < .01$, ** $p < .05$, * $p < .1$

To test the impact of TCFD adopters on the cost of debt, and thus the second hypothesis formula 4 is regressed and presented in Table 11. The regression generates a result with a negative TCFD coefficient of -0.26 for the association of TCFD adopters on their bond yield, but not a statistically significant coefficient. In addition, the potential impact of a significant result would lower the yield by 26 basis points. In the regression to test the second hypothesis, six of the seven control variables had the expected sign.

Table 11. Linear regression for firms becoming TCFD adopters' impact on their bond yield

Yield	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
TCFDA	-0.26	0.22	-1.21	0.229	-0.69	0.17
DE	0.13	0.10	1.29	0.198	-0.07	0.32
Margin	1.84*	1.11	1.66	0.098	-0.35	4.02
LASSET	-0.22	0.24	-0.89	0.374	-0.69	0.26
LSIZE	-0.36***	0.13	-2.87	0.005	-0.61	-0.11
MATUR	0.01**	0.01	2.36	0.019	0.00	0.02
CALL	1.56***	0.16	9.97	0.000	1.25	1.87
TBILL	0.54***	0.11	4.74	0.000	0.32	0.77
Constant	2.24*	1.25	1.79	0.075	-0.23	4.7
Firm-fixed effects: Included						
Year-fixed effects: Included						
Country-fixed effects: Included						
adj. R-squared: 0.4348						
Number of obs.: 3,127						

*** $p < .01$, ** $p < .05$, * $p < .1$

6.3. Validating tests

In addition to the main test, additional empirical tests were performed to evaluate the validity of the tests. The computed tests involved issues common to empirical regression models.

Heteroscedasticity

From initial regressions run without fixed effects, the results indicate heteroskedasticity, meaning that the standard errors in the estimates could be biased, leading to inaccurate conclusions. Heteroscedasticity implies that the standard errors of the regression are not constant. However, given the usage of fixed effects and clustering of standard errors on a firm level, heteroscedasticity is not present across firms, and not considered a problem for the regressions (Petersen, 2009).

Multicollinearity

The correlation matrix presented in Tables 8 and 9 can be used as a support to show potential problems related to multicollinearity. Problems associated with multicollinearity would mean that independent control variables used in the model are correlated with each other and thus do not serve the purpose of being independent variables, and consequently render the model and its results uninterpretable.

Table 8 and 9 shows that the highest correlation coefficient is just below 0.6, which is within proximity of multicollinearity issues, according to Belsley et al. (1980). To ensure that multicollinearity was not a problem, a variance inflation factor (VIF) test was performed and presented (Table 12) to further investigate a potential multicollinearity problem, which is consistent with previous research (Botosan, 1997, Gong et al, 2018). When tested for multicollinearity, the variables, as shown in Table 12, resulted in an average value of 1.4 for the variables included in both the supporter and the adopter data samples, with a maximum value of just below 2 originating from the variable TBILL. The values of the variables range from 1 to 2, indicating that there is a limited correlation between the variables considered. Consequently, the effects of multicollinearity in the regressions and their results should not have a major impact on the interpretation of the results and should not invalidate the results.

Table 12. Variance inflation factor

TCFD supporter variables		TCFD adopter variables	
Variables	VIF	Variables	VIF
TBILL	1.964	TBILL	1.997
TCFDS	1.552	MATUR	1.554
MATUR	1.506	TCFDA	1.542
LSIZE	1.465	CALL	1.477
CALL	1.458	LSIZE	1.451
LASSET	1.17	LASSET	1.17
Margin	1.155	Margin	1.148
DE	1.037	DE	1.054
Mean VIF	1.413	Mean VIF	1.424

6.4. Cross-section tests

In addition to testing the main hypotheses, further cross-sectional analysis was conducted from the perspective of issuer characteristics to investigate whether additional insights and conclusions can be drawn. The same regression as the main test was run with controls for the same fixed effects.

Asset size

The two samples of TCFD supporting and adopting firms was divided into companies with small and large assets, which was done based on the median of the average asset size of the present sample. Large companies for TCFD supporters were considered to have average total assets above the median of the average asset size, i.e., greater than \$21.6 billion, and smaller companies were consequently considered to have average assets smaller than \$21.6 billion. Similarly, large companies for TCFD adopters were considered to have average assets above the median of the average asset size, i.e., greater than \$22.5 billion, and smaller companies were consequently considered to have average assets smaller than \$22.5 billion. Two separate regressions were run for TCFD supporters, one for small asset firm bonds and one for large asset firm bonds, which are presented in table 13 and table 14 respectively.

As shown in Table 13, there is a negative relationship between TCFD and yield with a coefficient of -0.59, but it is not statistically significant. Consequently, there is no evidence that smaller companies receive better debt financing terms when issuing bonds as TCFD supporters. For companies with large assets, a negative relationship between TCFD and yield can be found, as shown in Table 14, but this relationship cannot be shown to be statistically significant either.

Table 13. Linear regression for small asset firms becoming TCFD supporters' impact on their bond yield

Yield	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
TCFDS	-0.59	0.38	-1.55	0.125	-1.34	0.17
DE	0.09	0.15	0.61	0.540	-0.20	0.38
Margin	4.14*	2.20	1.88	0.063	-0.23	8.51
LASSET	0.26	0.82	0.32	0.749	-1.36	1.89
LSIZE	-0.61**	0.27	-2.21	0.029	-1.15	-0.06
MATUR	0.02	0.02	1.38	0.171	-0.01	0.05
CALL	1.77***	0.40	4.40	0.000	0.97	2.57
TBILL	0.09	0.28	0.32	0.748	-0.47	0.65
Constant	1.95	3.86	0.51	0.614	-5.70	9.60
Firm-fixed effects: Included						
Year-fixed effects: Included						
Country-fixed effects: Included						
adj. R-squared: 0.4033						
Number of obs.: 898						

*** $p < .01$, ** $p < .05$, * $p < .1$

Table 14. Linear regression for large asset firms becoming TCFD supporters' impact on their bond yield

Yield	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
TCFDS	-0.18	0.20	-0.89	0.379	-0.59	0.22
DE	0.06	0.11	0.57	0.571	-0.15	0.28
Margin	0.97	0.77	1.27	0.207	-0.55	2.49
LASSET	-0.22	0.30	-0.74	0.459	-0.81	0.37
LSIZE	-0.40***	0.13	-3.13	0.002	-0.65	-0.15
MATUR	0.02***	0.01	3.00	0.003	0.01	0.03
CALL	1.40***	0.16	8.68	0.000	1.08	1.72
TBILL	0.57***	0.10	5.60	0.000	0.37	0.77
Constant	2.43	1.48	1.64	0.105	-0.51	5.38
Firm-fixed effects: Included						
Year-fixed effects: Included						
Country-fixed effects: Included						
adj. R-squared: 0.4731						
Number of obs.: 2,671						

*** $p < .01$, ** $p < .05$, * $p < .1$.

Similarly, for TCFD adopters two regressions were run on small and large asset firm bonds and presented in table 15 and 16. Table 15 illustrates TCFD impact from adoption on yield for small asset firm bonds, indicating a positive association between TCFD and their bond yields, however these results are insignificant. Moreover, table 16 illustrates TCFD impact from adoption on yield for large asset firm bonds, and similar to small asset firm bonds, the TCFD coefficient was positive and insignificant.

Table 15. Linear regression for small asset firms becoming TCFD adopters' impact on their bond yield

Yield	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
TCFDA	0.19	0.11	1.64	0.105	-0.04	0.41
DE	-0.12	0.20	-0.59	0.558	-0.53	0.29
Margin	0.93	0.96	-0.97	0.335	-2.83	0.97
LASSET	0.58	1.04	-0.55	0.582	-2.65	1.50
LSIZE	0.09	0.26	0.36	0.720	-0.42	0.60
MATUR	0.04***	0.01	5.51	0.000	-0.02	0.05
CALL	-0.11	0.45	-0.23	0.815	-1.00	0.79
TBILL	0.23*	0.13	1.75	0.084	-0.03	0.48
Constant	3.18	4.30	0.74	0.462	-5.37	11.7
Firm-fixed effects: Included						
Year-fixed effects: Included						
Country-fixed effects: Included						
adj. R-squared: 0.8303						
Number of obs.: 766						

*** $p < .01$, ** $p < .05$, * $p < .1$.

Table 16. Linear regression for large asset firms becoming TCFD supporters' impact on their bond yield

Yield	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
TCFDA	0.24	0.16	1.50	0.138	-0.08	0.56
DE	0.06	0.06	1.02	0.311	-0.06	0.17
Margin	-0.64	0.51	-1.27	0.206	-1.65	0.36
LASSET	0.41	0.27	1.52	0.132	-0.13	0.94
LSIZE	-0.19**	0.08	2.25	0.027	-0.36	-0.02
MATUR	0.02***	0.00	5.57	0.000	0.02	0.03
CALL	0.98***	0.16	6.03	0.000	0.66	1.30
TBILL	0.41***	0.11	3.89	0.000	0.20	0.62
Constant	-0.84	1.27	-0.66	0.510	-3.36	1.68
Firm-fixed effects: Included						
Year-fixed effects: Included						
Country-fixed effects: Included						
adj. R-squared: 0.6018						
Number of obs.: 3,261						

*** $p < .01$, ** $p < .05$, * $p < .1$

7. Discussion

This section aims to provide a synthesized discussion based on the results presented in the prior section. Linkages and comparisons will be made to theory, prior research and the section ends with a clarification of how this thesis closes existing theoretical gaps.

7.1. Discussing summarized results

The goal of this thesis was to find out whether supporters of TCFD obtain better debt financing terms. However, a definite answer to this question could not be given. Nonetheless, the multiple tests conducted have provided some clues that motivate further research on this topic.

As shown in the correlation matrix for both TCFD supporters and adopters, a negative correlation was found between TCFD and the corresponding bond yield. These results were expected and are consistent with prior literature (Barry and Brown, 1985; Botosan, 1997; Sengupta, 1997), however, no conclusions could be drawn based on this correlation alone.

Despite a negative correlation between TCFD supporters/adopters and the corresponding bond yields, the regression tests resulted in neither null hypothesis being rejected. The test for TCFD supporters yielded a positive coefficient, while the results for TCFD adopters yielded a negative coefficient, but without statistical significance. Thus, to answer the research question of this thesis, it cannot be concluded that companies receive better debt financing terms when they become TCFD supporters. These results are not in accordance with existing theories and most previous research on the subject and raise the question of why this might be the case.

That the regression tests for TCFD adopters resulted in insignificant results could be considered somewhat surprising as Connelly et al. (2011), suggest that the financial market is expected to respond more positively to signals from firms that are associated with costs. Adopting TCFD recommendations is associated with significantly higher costs, which should speak in favor of significant negative association. Additionally, Attig et al. (2013) find that disclosure of nonfinancial information increases creditworthiness, which should yield significant results. Furthermore, prior research (Barry and Brown,

1985; Botosan, 1997; Sengupta, 1997) speaks in favor of higher disclosure quality having a negative association with cost of debt, which should suggest that TCFD adopters should obtain better financing terms.

7.2. Potential explanations to rejected hypotheses

As discussed in Section 3.2, researchers in several studies have discussed TCFD and its benefits and pitfalls from a more qualitative perspective. Chua and Fiedler (2020) concluded in their study that companies lack reporting guidelines and that the information required from investors is too uncertain, as some of the metrics are difficult to quantify. This could possibly partially explain the insignificant results in this thesis, as the financial market may view TCFD recommended disclosures as irrelevant and uncertain in some cases. In addition, Chau and Fiedler (2020) point out that the measurements to be used for disclosure are too complex. This could lead to companies mainly disclosing information that is accessible and easy to provide without much effort, which is insufficient for the financial market. Moreover, although Sengupta (1998) and Botosan (1997) conclude that there is a negative relationship between increasing corporate disclosure and the cost of capital, this result is based on responses to disclosure ratings provided by financial analysts. One explanation for why the same relationship cannot be demonstrated with significance for TCFD recommended disclosures could be that there are no similar scoring systems. It would be interesting to see if the analysts' scoring could help TCFD adopters and provide them with guidance on what to disclose to the financial market. This would decrease the information asymmetry and give TCFD adopters advantages in debt financing in the future.

The above analysis referred to TCFD recommended disclosures, i.e., information provided by adopters. One of the reasons this thesis distinguished between TCFD supporters and adopters was, in part, to test the signaling effect of the announcement to sign the TCFD supporting agreement. Although there was evidence of a negative coefficient between TCFD adopters and bond yields compared to a positive coefficient for TCFD supporters, it was not demonstrated with significance. This result suggests that the financial market does not consider published TCFD information to be more valuable than a firm's decision to support. This reasoning is similar to what is commonly known as "greenwashing," i.e., the dissemination of disinformation to project an environmentally

conscious image to the public (Phyper and Maclean, 2009). This would imply that simply signing the support list would be sufficient to potentially receive benefits. However, since neither the first nor the second hypothesis could be proven with significance, the "greenwashing" argument is invalid.

Before making the greenwashing argument or scrutinizing existing studies and theories, one must consider the novel nature of TCFD. Considering that 40% of all current TCFD supporters have not signed the TCFD agreement until 2021, the framework may not yet be established enough to illustrate potential financial benefits. Existing theory suggests that information asymmetry leads to uncertainty among borrowers, which causes firms to pay for information risk, i.e., a risk premium when issuing bonds. One theory could be that the financial market lacks knowledge about climate-related disclosures and how much they can affect a company's financial position. Thus, if companies disclose such information, it could be that the financial market does not see it as valuable and the information asymmetry is not reduced as a result, which could explain why there are no proven financial benefits for supporting or adopting it to date.

7.3. Analysis of additional tests

As shown in 6.4, no significant relationship was found between TCFD supporters/adopters and corresponding bond yields, for either small or large firms.

Considering that larger companies are expected to have a higher quality of disclosure compared to smaller companies (Eskandari et al., 2012) and consequently have better financing conditions, as presented for example by Sengupta (1998), the results could be interpreted as indicating that larger companies already have a relatively well-established disclosure policy. This implies that the hurdle of reporting in line with the TCFD recommended disclosures is not seen as valuable by the market and could be one reason why larger companies' supporting TCFD does not have a significant impact on their bond yields. To date, no studies have been published showing a negative relationship between size and disclosure levels, only a positive one.

Consequently, it could be argued that smaller companies signing the TCFD agreement should have a larger impact on their bond yields because the step required for them to report in compliance with TCFD is larger than for larger companies that have higher disclosure quality. However, given the non-significant results in Table 15, this cannot be concluded.

7.4. Closing theoretical gaps

As described in the previous sections of this thesis, the literature on the financial implications associated with the disclosure of ESG-related information in financial markets is growing. However, most of the literature relates to qualitative aspects, such as implementation issues and general organizational benefits. Due to the novel nature of the TCFD framework, there has been no literature on the potential financial impacts that companies experience once they become TCFD supporters. This thesis fills this theoretical gap. The thesis concludes that there is no evidence to support the claim that firms that become TCFD supporters obtain better debt financing terms. Moreover, it does not appear to matter whether a firm chooses to support or adopt the framework, i.e., disclosure itself does not provide any benefits. Similarly, with respect to firm size, there is no evidence in this thesis that smaller or larger firms have lower borrowing costs when they become TCFD supporters or adopters. The conclusion is that companies attempting to obtain cheaper financing by becoming TCFD supporters, regardless of whether they disclose according to the guidelines or not, do not have statistical support for such a decision from this thesis.

8. Concluding remarks

ESG information is increasingly in demand by the financial market, as evidenced by the numerous disclosure standards and frameworks that have appeared over the past decade. The TCFD framework has grown significantly in importance and has led to several countries adopting the framework by law. The growth demonstrates not only the relevance of ESG information, but climate-related financial information. Clearly, the financial market has recognized the importance of a framework that provides an alternative perspective that enables financially relevant climate disclosure. As a result of the growing importance of the TCFD, several studies have been conducted on the qualitative nature of the framework. However, the quantitative impact on companies that choose to support the framework has been neglected in previous literature, not least in terms of the cost impact on debt. Therefore, the objective of this thesis was to fill an existing gap in the literature by answering the following research question: Do TCFD supporters obtain better debt financing terms?

Based on previous literature on the impact of corporate disclosure in general and ESG disclosure, combined with asymmetry and signaling theory, the following two hypotheses were formulated: TCFD supporters will obtain funds at more preferable debt financing terms (H1) and TCFD recommended disclosures result in more preferable debt financing terms (H2). Performing linear regression tests revealed that neither of the null hypotheses could be rejected. Cross-sectional tests also showed similar results, with non-significant TCFD coefficients. Consequently, this thesis concludes that there is no evidence to support the claim that firms that become TCFD supporters receive better debt financing terms, regardless of whether they disclose according to the guidelines or not.

To explain why the null hypothesis could not be rejected, reference was made to qualitative studies of the TCFD, which indicate that the framework lacks guidance and contains uncertain information. In addition, given the insignificant difference between TCFD supporters' and adopters' results, the disclosure effect does not seem to affect the financial market response. These conclusions could be partly explained by the novel nature of the framework, as the financial market may not yet be able to interpret signals from TCFD-supporting firms aimed at reducing information asymmetry.

9. Limitations and suggestion for further research

There are some limitations to this thesis that are detailed in this section. The section ends with a discussion of the various areas of interest that should be further explored in relation to the subject of this thesis. This section forms the conclusion of this thesis.

9.1. Limitations

In the course of the work, three main limitations were noted. The first two refer to the novelty of the framework, but in two different aspects, while the third refers to the data processing.

The first and perhaps most obvious limitation is the novel nature of the TCFD framework, which naturally affects the results of the work. The TCFD released its climate-related disclosure recommendations in 2017 (TCFD, 2022), and given the lag effect that occurs after the introduction of new voluntary frameworks, the absolute majority of all TCFD supporters have joined in the last three years. As shown in Graph 1, 40% of all current TCFD supporters signed the TCFD agreement in 2021. Consequently, the sample size is limited, but there is also a potential limitation in terms of supporter implementation. Are TCFD supporters who reportedly joined in 2021 disclosing enough to reduce information asymmetry with the financial market to obtain better financing terms? Or is the framework too new for participants to know what to disclose?

The second limitation also refers to the novelty of the TCFD framework, but instead focuses on the quality of the disclosures. As mentioned in the introduction, the purpose of this thesis was also to examine how the quality of TCFD recommended disclosures might affect corporate financing conditions. However, due to the lack of an official "scorecard" for how best to disclose TCFD-related information, combined with a lack of expertise and knowledge on the part of the authors of this thesis regarding disclosure scoring, this conclusion could not be reached. Moreover, the lack of such knowledge also requires a review of the distinction between supporters and adopters. This distinction was based on a set of criteria established by the authors. In the absence of guidance from the TCFD, perhaps other criteria should have been used to make the distinction? This could have potentially affected the data samples.

The third limitation relates to data processing, as many companies supporting TCFD were excluded for several reasons. First, about half of all TCFD-supporting firms (as of the end of 2021) were missing identifiers (GVKEYs) and therefore could not be included in the dataset. In addition, only firms that had issued bonds before and after the date they became TCFD supporters could be included, further reducing the size of the dataset. Finally, some firms lacked information on some of the relevant control variables, so these were also excluded. In summary, given the large initial data sample of TCFD-supporting companies, the method used in this thesis combined with missing bond data resulted in limitations in the data processing.

9.2. Suggestion for further research

During the process of writing this paper, some interesting areas for further research were identified. First, other financing aspects could be explored in terms of whether a company receives better financing terms when it supports/adopts the TCFD. In this work, bond yield was used as a benchmark. It would be interesting to see if other financing aspects such as bond maturities, debt obligations, or borrowing rates would be affected by such a decision instead. Second, it would be interesting to categorize by industry and test whether the yield effect is more significant depending on which industry a company operates in. Third, 22% of all TCFD supporters were Japanese companies at the end of 2021 (TCFD, 2022). Consequently, given the high level of interest, it would be intriguing to analyze TCFD recommended disclosures specifically for Japanese companies. Do they provide TCFD recommended disclosures of better quality? What has led so many companies to join? How has the Japanese market responded?

10. References

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11. Appendix

Descriptive data TCFD supporters by sector

Country	Number of firms	Number of bonds	Number of bonds issued before joining TCFD	Number of bonds issued after joining TCFD	Average yield %
Communication services	8	411	297	114	3.34
Consumer discretionary	19	205	103	102	1.64
Consumer staples	22	313	166	147	2.05
Energy	15	238	161	77	3.27
Health Care	3	71	40	31	1.84
Industrials	43	548	331	217	1.40
Information technology	11	135	50	85	1.31
Materials	37	419	230	189	1.59
Other	4	59	50	9	2.50
Real estate	2	30	17	13	1.39
Transportation	10	151	122	29	1.56
Utilities	29	989	530	459	1.90
Total	203	3,569	2,056	1,513	2.03

Descriptive data TCFD adopters by sector

Country	Number of firms	Number of bonds	Number of bonds issued before joining TCFD	Number of bonds issued after joining TCFD	Average yield %
Communication services	6	393	265	128	3.51
Consumer discretionary	16	192	96	96	1.56
Consumer staples	15	188	79	109	1.95
Energy	13	227	150	77	3.37
Health Care	2	45	20	25	1.48
Industrials	36	476	279	197	1.45
Information technology	9	125	46	79	1.27
Materials	33	392	209	183	1.58
Other	3	53	48	5	2.38
Real estate	2	30	17	13	1.39
Transportation	6	74	61	13	1.62
Utilities	26	932	496	436	1.97
Total	167	3,127	1,766	1,361	2.08