

INTEGRATION OF CLIMATE RISKS AND OPPORTUNITIES IN CORPORATE REPORTING

**AN EXPLORATIVE STUDY ON THE TASK FORCE ON CLIMATE-
RELATED FINANCIAL DISCLOSURES IN THE EUROPEAN
FINANCIAL SECTOR**

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Integration of climate risks and opportunities in corporate reporting: An explorative study on the Task Force on Climate-related Financial Disclosures in the European financial sector

Abstract:

Motivated by the increased relevance of climate-related financial dependencies, this thesis examines the implementation of the Task Force on Climate-related Financial Disclosures (TCFD) in the European financial sector. It additionally explores the disclosure motivations, from the perspective of economics-based and socio-political theories. Through content analysis of company reports and computation of the Climate Compliance Index, we analyze climate-related disclosures of 49 financial firms, from 2016 to 2019. We further differentiate between hard and soft recommendations and examine internal and external characteristics driving TCFD disclosure. From these analyses, we find that despite a significant increase in climate-related disclosures after TCFD adoption, the level of reporting remains low, especially in areas where hard information is required. Overall, the extent of disclosure is positively associated with firm size, growth, existence of voluntary assurance, and a distinct TCFD report section. Moreover, we also present evidence of greater implementation and hard claims provision in the insurance industry, compared to banks. Notably, external pressures (listing status and country's characteristics) are not found to be significant determinants of reporting. While these results partially support the use of TCFD as a legitimacy tool, we also present limited evidence of the economics-based theories, especially when disclosure type is considered.

Keywords:

TCFD, climate-related risks, voluntary environmental disclosure, financial sector

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Introduction

Climate change poses significant challenges to most sectors, affecting both current and future prospects. Its potential impacts on companies are not only physical and are not expected to manifest in the long term only. Following the increasing concern on the topic, a transition to a climate-resilient society is deemed to be necessary by a multitude of global regulators, public authorities, and investors. It is estimated, however, that the expected shift to a lower-carbon economy requires the allocation of around \$1 trillion of investments a year to sustainable solutions (Task Force on Climate-Related Financial Disclosure [TCFD], 2017). Hence, worldwide regulators have assigned to the financial sector the responsibility of redirecting capital and incorporating climate-related information in financial decisions to ensure a smooth transition to a zero-carbon economy (European Commission, 2019). By being both providers and users of TCFD information, financial companies should provide consistent data that can be analyzed at a systemic level to facilitate authority assessment of risks posed to worldwide stability and sustainable economic growth by climate change (TCFD, 2017).

Given the existence of several voluntary frameworks, the international community recognized the need to guide companies to high-quality disclosure to overcome the lack of comparability and aggregability of data and allow for more informed investment decisions. As a result, in 2015, the Task Force was appointed to develop a comprehensive set of disclosure recommendations that:

“[...] could promote more informed investment, credit [or lending], and insurance underwriting decisions [and, in turn,] would enable stakeholders to understand better the concentrations of carbon-related assets in the financial sector and the financial system’s exposures to climate-related risks” (TCFD, 2017 p.4)

By addressing four different areas (governance, strategy, risk management and metrics and targets), TCFD aims to improve transparency and completeness of climate-related risks and opportunities (CROs) to ensure the understanding of the financial consequences of climate change. Such disclosures should encourage trust among actors and facilitate capital markets’ efficiency in transitioning to low-carbon investments. Transparent and comparable financial information on climate-related risks, indeed, helps to ensure that capital flows are more appropriately directed, and consequently actively managed. However, despite this wide awareness of climate change issues, companies are still failing to properly adopt TCFD, limiting its use for informed investment decisions.

Research on TCFD is still quite limited due to its recent introduction. Yet, together with empirical findings they confirm insufficient disclosure. Most existing studies aim to address the low level of climate-related information across different sectors, highlighting best practices and information content disclosed. Eccles and Krzus (2019), focusing on the 15 largest oil and gas companies, explore to what extent TCFD is implemented and the consequences of its adoption. Demaria and Rigot (2021), instead, analyze the

compliance of the French CAC 40 firms and the content reported for each CRO. Both of them show a still limited level of compliance. On the same line, O'Dwyer and Unerman (2020), problematize TCFD and its low implementation, by demonstrating areas in which research can actively contribute. They argue that more academic studies could bring evidence to support and expand the implementation of TCFD by assisting both companies and governments in moving corporate policies and actions towards the zero-carbon ambition.

Within such context, this thesis aims to expand the existing literature on TCFD reporting in the European financial sector. Particularly, we investigate to what extent European financial companies are implementing TCFD and, consequently, reflecting on CROs' impacts on their business models. Moreover, given the importance of this new framework, it is also crucial to understand what the internal and external characteristics of superior TCFD adopters are. To do so, we study 49 European financial companies from the banking and insurance industries. Firms belonging to these sub-sectors are among the most systemically important players in the financial sector and, therefore, their role and exposure to climate risks are particularly important to global financial stability. By applying content analysis on publicly available documents over the period 2016-2019, we are able to show that, although TCFD adoption results in an increasing amount of disclosed climate-related information, financial companies are still only partially complying with the recommendations. Furthermore, we also find relatively low levels of hard climate-related financial disclosure, which undermines the usefulness of TCFD for investment decisions. In addition, relying on economics-based and socio-political theories, we shed light on determinants of the extent of TCFD disclosure. In this regard, internal firm characteristics and modes of reporting are stronger drivers of TCFD compliance levels than external pressures.

The thesis contributes to the existing literature on TCFD in several ways. First, it complements the few academic studies on TCFD by focusing on the research gap in TCFD implementation in the European financial sector. Second, it investigates the value added by TCFD adoption in disclosing climate-related information as well as its informativeness level. Third, it outlines internal and external determinants of early TCFD adopters from the perspective of voluntary disclosure theories. Fourth, all the above findings contribute to the study of practical implementation of this new reporting style, assisting practitioners and policymakers in driving climate-related disclosure.

The remainder of the thesis is structured as follows. Chapter 1 considers the institutional background of environmental and TCFD disclosure, pointing out its importance and advantages. Chapter 2, reviewing previous academic literature on voluntary disclosure and its determinants, presents the hypotheses development. Chapter 3 focuses on sample selection and methodology, whereas Chapter 4 shows performed analyses and discussion of their results. Finally, Chapters 5 and 6 highlight the contributions and limitations of this thesis.

1. Institutional Background

1.1 Environmental Disclosure Regulations and Frameworks

A growing number of public authorities, including the European Union (EU), are promoting corporate social responsibility (CSR) through public policy, sustainability disclosure laws and regulations. These can lead to an enormous improvement in corporate accountability and mitigation of environmental issues, such as the pressing matter of climate change. Indeed, over the last two decades, companies have been increasingly pushed to go beyond their economic obligations and to be particularly meticulous in considering and accounting for their activities' impact on the environment (Bravo et al., 2012). The concern toward climate change-related issues was internationally addressed for the first time in 2015 when countries around the globe entered into the first-ever universal, legally binding agreement: the Paris Agreement. It aims to avoid dangerous climate change by limiting global warming to well below 2°C, preferably to 1.5°C, compared to pre-industrial levels (United Nations Framework Convention on Climate Change, 2015). This historical milestone represents the first powerful bridge between today's policies, countries' efforts, and climate-neutrality before the end of the century. Nowadays, the Paris Agreement together with the United Nation's Sustainable Development Goals and the Special Report of the Intergovernmental Panel on Climate Change (2018) push for immediate action to reduce greenhouse gas (GHG) emissions and to accelerate the shift to a low-carbon and climate-resilient economy (European Commission, 2019). On the same line, European public authorities have agreed on ambitious targets for cutting emissions by more than 50% from 1990s levels by 2030 and to transform the EU's economy for a more sustainable future by 2050 (European Commission, 2019).

As highlighted in the European Action Plan for Sustainable Finance (European Commission, 2018), there is the need to integrate environmental, social, and governance (ESG) considerations in financial policies and to mobilize finance for sustainable growth. Consequently, to shift to a greener economy and reach those fundamental environmental and social goals, financial institutions play a critical role. First, it is commonly recognized that the financial sector supports the economy by providing capital and funding for economic development, jobs' prosperity, innovation, and growth (King & Levine, 1993; Jeucken & Bouma, 1999; Wu and Schen, 2009). Second, financial players need to better understand and address the potential risks that climate change and environmental degradation pose to their businesses. Specifically, according to the European Commission, financial intermediaries have three main tasks: redirect capital to sustainable investments, integrate sustainability into risk management, and require transparency and long-term perspective in the activities of market participants (Nordic Council of Ministers, 2020). Therefore, companies need to disclose more transparent and

complete information on environmental activities to help drive sustainable financial markets and foster capital reallocation (Climate Disclosure Standard Board [CDSB] & Carbon Disclosure Project [CDP], 2018).

A great number of initiatives, both mandatory and voluntary, have arisen in the past decade to improve the quality, consistency, and transparency of non-financial corporate reporting. At the European level, there is the 2014/95/EU Directive, also called Non-Financial Reporting Directive (NFRD), which requires listed companies, banks, insurance companies, and public-interest companies to disclose CSR-related information from 2017 onward. Before NFRD, the European institutional setting regarding social and environmental disclosure highly differed with only a few countries requiring mandatory reporting. Among those, France introduced, already in 2012, a climate change disclosure in the financial reports of listed companies, and the United Kingdom (with the Companies Act 2006) mandated quoted companies to provide a report disclosing annual GHG emissions, diversity, and human rights. Other examples include Denmark and the Netherlands. Therefore, when at the time of its issuance, NFRD was transposed individually by EU members through national laws, the institutional setting became less fragmented across all European countries. It must be reminded, however, that countries voluntarily decided whether to maintain or increase its scope, thus, the relative number of companies subject to NFRD can highly vary from country to country. For example, in Sweden NFRD transposition has been further expanded compared to the EU requirements, meaning that the law is binding for a greater number of companies than mandated by the EU (Nordic Council of Ministers, 2020).

In addition to the above regulations, at an international level, there exist several voluntary sustainability reporting frameworks aimed at helping corporations, governments, and other organizations to understand and communicate the impact of their activities on ESG matters. The most common are the Global Reporting Initiative (GRI), Integrated Reporting (IR) by the International Integrated Reporting Council (IIRC) (KPMG, 2020; Demaria & Rigot, 2021), and the CDP and GHG Protocol for carbon-related environmental disclosure (Andrew & Cortese, 2011). These frameworks address a wide range of stakeholders and recommend the issuance of CSR or ESG information in the form of standalone or integrated reports.

In 2015, another international initiative emerged, the TCFD. Established by the G20's Financial Stability Board (FSB), TCFD is in line with the concern that the financial sector and financial investors do not have enough information to properly assess investment risks of the global economy and as a consequence, they could misprice or incorrectly value assets, misallocating capital and leading to financial instability (TCFD, 2017). This new reporting framework's objective is, indeed, to meet investors' increasing demand for transparency, comparability, and consistency by issuing voluntary, non-binding recommendations on CROs. Moreover, TCFD is the first framework focusing on the impact of climate change on the company and not vice versa. It takes a novel approach

by providing guidance for the integration of information on climate-dependencies-related financial risks a company has on different levels, or scenarios, of climate change in its mainstream annual financial filings (O'Dwyer & Unerman, 2020). This pushes companies to reflect on climate change impacts on their businesses and operations and what actions are needed to counteract them. Nonetheless, TCFD recommended disclosures have been mapped against NFRD as well as existing disclosure frameworks and thus, are aligned, for example, with GRI, IR, CDP, and CDBS Framework for Reporting Environmental Information. The Task Force has structured the recommendations around four main areas that represent the core elements of how a company operates: governance, strategy, risk management, and metrics and targets (see Table 1). Although TCFD asks companies to provide hard data on the financial impact of CROs, such as in the strategy and metrics and targets area, a large part of the recommendations relates to qualitative non-financial information (Demaria & Rigot, 2021). These recommendations can be adopted on a voluntary basis. Moreover, they remain flexible as the environmental and regulatory landscape is continuously changing and the needs of stakeholders can vary with time. However, for this reason, they can be applied to a wide variety of corporations across different sectors and institutional settings. Moreover, TCFD's recommendations provide additional guidance to financial sector organizations (see Appendix, Table A1), such as banks and insurance companies. These firms have been supplied with specific recommendations due to their key role in combating climate change (TCFD, 2017).

Table 1. TCFD recommendations

Governance	Strategy	Risk Management	Metrics and Targets
a) Describe the board's oversight on CROs	a) Describe CROs the organization has identified over the short, medium, and long term	a) Describe the organization's processes for identifying and assessing climate risks	a) Disclose the metrics used by the organization to assess CROs in line with its strategy and risk management process
b) Describe management's role in assessing and managing CROs	b) Describe the impact of CROs on the organization's businesses, strategy, and financial planning	b) Describe the organization's processes for managing climate risks	b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks
	c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenario, including a 2 °C or lower scenario	c) Describe how processes for identifying, assessing, and managing climate risks are integrated into the organization's overall risk management	c) Describe the targets used by the organization to manage CROs and performance against targets

1.2 Environmental and TCFD Disclosure in the European Financial Sector

Although European financial companies are subject to ESG mandatory regulations, recent reports on environmental disclosure show that the level of information is far from being sufficient and adequate for informed decision-making. In 2018, for example, Finansinspektionen studied Nordic financial firms' CSR disclosure, finding an ambiguous integration of policies into operations, weak transparency on CSR-related risks, and poor comparability of disclosed information. Accordingly, the European Banking Authority (EBA) (2020), in its high-level assessment on the state of European ESG disclosure, discovers that most institutions disclose information on ESG risks or sustainable finance briefly, distributing it through the reports rather than concentrating it into a specific section. The same results are confirmed by the European Financial Reporting Advisory Group (EFRAG) (2020) which shows that institutions still perceive environmental reporting as a compliance exercise and do not report some fundamental information for investors.

The same concerns are raised around CROs-related disclosures and proper implementation of TCFD recommendations. In its status report the Task Force states that even though disclosure has on average increased by 7% between 2017 and 2019 for banks and insurance firms, there is still low disclosure on the potential financial impacts of climate change on business and strategy (TCFD, 2020). The report shows that only 10% of financial companies studied properly report climate resilience of strategy and scenario analysis. Indeed, the majority of the companies address this type of reporting as a challenging exercise as it implies disclosing confidential information which could threaten future performance. CDBS & CDP (2018) in a cross-country empirical research on how TCFD is being implemented, find that over 50% of financial companies do not recognize the relevance of emissions from investments. The adoption of recommendations is found to be inconsistent, incomplete, and not well related to the business itself, indicating that the vast majority of companies only partially adopt TCFD. Lastly, a study performed by Autorité des Marchés Financiers (AMF) in 2020 confirms the same results, revealing low compliance with TCFD recommendations.

Due to the importance of climate change, governments have started to address this lack of information by discussing the possibility of including TCFD among mandatory requirements. The failure to integrate climate-related financial risks into investment decisions, indeed, is regarded by policymakers and regulators as a risk to the success of business models and the stability of the global financial system (O'Dwyer & Unerman, 2020). Whereas, as mentioned before, the financial actors can play an important role in contributing to an efficient transition to a greener economy, the ultimate responsibility to promote climate-related transparent activities and disclosures (e.g. TCFD-related information) lies within the political system. In this regard, the Nordic Council of Ministers (2020) argues that governments are responsible for achieving more transparent

disclosure, possibly with regulations. Previous literature supports this claim and deems regulations to be necessary to force firms to recognize the importance of climate-related disclosure to properly discuss climate change issues (Kouloukoui et al., 2019a). In addition, Sakhel (2017) finds that companies are willing to implement adequate responses and disclosure of climate risks only when regulatory threat is perceived to be high.

This has already been addressed in the United Kingdom, where the government has recently decided to enforce mandatory TCFD aligned disclosure for quoted companies and large private companies from 2025 (UK Department for Business, Energy & Industrial Strategy [BEIS], 2021). The regulation aims at significantly increasing the proportion of companies disclosing information on climate risks, ensuring a better understanding of climate-related financial risks, and pushing companies to reflect on what actions are needed to address climate change as a risk that could threaten their existence (BEIS, 2021). Within the financial sector, the Basel Committee on Banking Supervision has established a high-level Task Force on Climate-related Financial Risks intending to enhance risk disclosure among the financial institutions. In Europe, instead, financial public authorities, such as EBA, are pushing for the adoption of climate-related financial risk disclosure to increase the long-term view on environmental risks and opportunities. Moreover, mandatory disclosure on environmental and climate-related risks will come into effect in 2022 and become part of Pillar 3 under Basel III requirements for large financial institutions.

All the above reasons help to explain why TCFD is so distinctive and has been receiving much support and attention from policy circles, governments, and public authorities (O'Dwyer & Unerman, 2020). Consequently, companies worldwide have increasingly adopted these recommendations, going from 282 in 2017 to around 2,100 in May 2021 (TCFD, n.d.).

2. Literature Review and Hypotheses Development

2.1 Voluntary Disclosure Theories

A significant amount of research in the CSR field is dedicated to environmental reporting which is a way to communicate environmental strategies to stakeholders and the broader society (Brammer and Pavelin, 2006). Within the landscape of this type of reporting, TCFD is distinct due to its innovative orientation. However, there is limited literature focusing specifically on the disclosure of CROs. Kouloukoui et al. (2019a) and Kouloukoui et al. (2019b) study climate risk reporting of the world's largest emitters and listed Brazilian firms, respectively, to find low levels of disclosure. Moreover, they also study the motivation behind disclosure but do not find consistent drivers. The only TCFD-specific study, Demaria and Rigot (2021), does not further comment on the motivation behind the framework's adoption and degree of implementation from a theoretical perspective. Therefore, we rely on the more developed body of literature focusing on general environmental reporting practices, studied as a part of the wider CSR reporting (Deegan, 2002). This literature offers us theories to build an understanding of reasons for voluntary disclosure and enables us to comment on specific drivers of TCFD implementation.

Several theories have been developed over time in an attempt to explain why a firm would decide to voluntarily divulge information on its environmental performance. First, proprietary cost and voluntary disclosure theories, belonging to a group of economics-based theories, see disclosure as a practice driven by wealth maximization efforts (Clarkson et al., 2008). Proprietary cost theory is based on the argument that environmental disclosure exposes a lot of sensitive or proprietary information (Li et al., 1997). Therefore, such disclosure is predicted to be made only if it has value-enhancing potential (i.e. its benefits exceed the costs), and if the reporting firm can afford these costs in the first place (Cormier & Magnan, 2003; Verrecchia, 1983). Voluntary disclosure theory is also based on a similar logic. It argues that voluntary disclosure garners positive market reactions and is economically beneficial for firms, but only when it provides information that others, worse performers, are unable to mimic without incurring excessive costs (Clarkson et al., 2008; Mahoney et al., 2013; Prado-Lorenzo & Garcia-Sanchez, 2010).

Second, there is also significant research dedicated to socio-political theories of disclosure, namely stakeholder and legitimacy theories, which are based on the argument that organizational activities cannot be run in isolation from the social and political (Gray et al., 1996; Mateo-Márquez et al., 2020). Consequently, they attempt to explain disclosure practices in consideration of the external pressures faced by the reporting organization. They see disclosure as a mechanism of obtaining external support and approval (Cho & Patten, 2007; Patten, 2002). Both theories are very similar, but there are

some differences in the external pressures they focus on. While stakeholder theory sees corporate disclosure as driven by the firm's perception of stakeholder demands and attributes (Cormier et al., 2004), legitimacy theory is concerned with the approval of the society at large (Deegan, 2002).

In prior literature, there are contradicting findings regarding these theories and numerous attempts to reconcile their views (Gray et al., 1996). Several authors draw on the distinction between hard and soft disclosure. For instance, Clarkson et al. (2008) develop an index based on GRI, used extensively by further research, that differentiates between hard and soft disclosure items. Hard items include objective measures of performance, such as credible performance indicators and measures of spending. This type of information is more objective and informative for all stakeholders (Al-Tuwaijri et al., 2004). On the other hand, soft disclosures are claims that are not easily verifiable and include vision and strategy statements, environmental profiles, and initiatives. Utilizing this distinction, Clarkson et al. (2008), measuring the extent and content of disclosure, find that superior environmental performers disclose more hard information, supporting the economics-based theories. At the same time, worse performers are associated with a generally higher level of disclosure, suggesting its use as a legitimizing tool. Moreover, other academic studies state that firms that have their legitimacy questioned tend to make more soft claims, suggesting that socio-political theories can also be useful in predicting the type of information disclosed. Similar findings were discussed by Cho and Patten (2007), who also present evidence for worse environmental performers disclosing more soft data, thus supporting the legitimacy view. They argue that hard claims are more likely to be viewed by the management as having a high proprietary value and thereby are less preferred.

Therefore, based on a review of past research, it can be said that these different theories are not mutually exclusive. On the contrary, they can complement each other, and reporting practices can be explained by both voluntary disclosure and legitimizing motivations (Clarkson et al., 2008; Hummel & Schlick, 2016). In consequence, as a single theoretical view is inadequate to explain such disclosure, we adopt a multi-theoretical perspective to assist in understanding the motivations behind TCFD adoption. This is in line with previous literature that relies on multi-theoretical lenses to study a firm's decision to provide environmental disclosure (Cormier et al., 2005; Clarkson et al., 2008).

2.2 Voluntary Disclosure Framework Adoption

Governments and regulators' efforts to foster transparency and enhanced disclosure gave rise to several projects, among which TCFD is the latest development. Being built in 2017, TCFD reporting is a novel topic, both in practice and literature. In order to evaluate the usefulness of such a new framework, it is important to study whether TCFD adoption significantly impacts the climate risk information being reported.

TCFD covers four distinct topical areas, with disclosure requirements and types of information varying between and within these sections. Governance and risk management areas demand more discursive or soft information, for instance on CROs inclusion in organizational processes, highlighting responsibilities and policies towards these matters. On the other hand, strategy and metrics and targets expect, on average, more hard disclosures. Moreover, hard information content also varies. For example, in metrics and targets, it differs depending on whether the disclosure captures the impact of CROs on the business or own environmental performance of the reporting entity.

In its recommendations, the Task Force states that all four areas are equally important in providing a comprehensive view of CROs identification and management. However, literature commonly argues for soft disclosures to be less useful for investors in their decision-making (Al-Tuwaijri et al., 2004; Bertomeu & Marinovic, 2016). This is supported by publications on TCFD, which often highlight the topic of strategy as crucial for informed investor decisions (AMF, 2020; EFRAG, 2020). Therefore, to be useful for investment decision-making, soft information included in TCFD disclosures should be well-integrated and supported by quantitative data. However, most prior empirical studies find that the current state of TCFD disclosure is not sufficient to enable such informed evaluation (Nordic Council of Ministers, 2020). Consequently, we expect that this deemed absence of usefulness is due to a lack of hard disclosures, which leads to our first hypothesis:

H1: The extent of TCFD implementation is greater for soft disclosures than for hard disclosures.

Moreover, as a result of the unique orientation of TCFD, its adoption should lead to new topics being discussed. While it brings a different perspective on climate risk, its recommendations have been based on existing frameworks, leading to an overlap with these guidelines. For instance, disclosures on own resource consumption and Scope 1, 2, and 3 emissions are parts of several GRI standards and are also covered by CDP and CDSB Framework. Additionally, the board's oversight of CROs can be disclosed as part of IR, OECD Principles of Corporate Governance, or general disclosures of GRI (TCFD, 2017). As a result, companies adopting other frameworks might have already disclosed some of the recommendations even before TCFD finalization. Nevertheless, due to its innovative nature, proper adoption of TCFD should lead firms to disclose more climate risk-related information.

On the other hand, TCFD disclosure is done on a voluntary basis, which allows for flexibility in reporting. Thus, organizations could publicly declare TCFD adoption as a reaction to external pressure, but in reality, make no or very little change to the content being reported. In this regard, Westphal & Zajac (1994) discuss that organizations decouple their policies and practice, as a response to being subject to conflicting demands from a variety of parties and institutions. This concept is also applied to non-financial corporate disclosure, considering the issuance of reports with little information as a

reaction to conflicting logics that the reporting firm has to comply with (Luo et al., 2017). Consequently, TCFD might also be used as a decoupling mechanism, leading to little variation in climate disclosure after its adoption.

Therefore, based on these conflicting arguments, we cannot predict whether TCFD adoption is associated with the level of climate risk information reported by companies. Hence, we develop the following null hypothesis:

H2: The extent of climate risk disclosure is not associated with the adoption of TCFD.

2.3 Voluntary Disclosure Determinants

A significant body of environmental literature is dedicated to studying disclosure drivers, in light of the different theoretical perspectives. As discussed in the previous section, voluntary reporting can be seen by its adopters as either a way to signal superior climate risk management (Clarkson et al., 2008; Cormier & Magnan, 2003; Mahoney et al., 2013) or a legitimizing tool to gain stakeholder support (Patten, 2002; Cho & Patten, 2007; Branco & Rodriguez, 2008). However, it is challenging to provide a compelling argument for one strand of theories being more influential than the other. For this reason, we take a multi-theoretical perspective to determine and understand the various influences that a single organization faces. Indeed, previous research shows how both internal and external characteristics influence environmental disclosure practices across corporations. Given its recent introduction, there are limited academic studies on TCFD reporting drivers. The only prior study addressing determinants of TCFD disclosures is Demaria and Rigot (2021) that examines the application of TCFD recommendations in listed French companies. They find that firms belonging to industries with higher environmental impact and those whose main customers are consumers disclose more information, potentially to maintain their reputation. Additionally, Demaria and Rigot (2021) highlight an increasing trend in the extent of disclosures over time, due to increasing institutional pressures to improve environmental disclosures. Finally, they do not observe any variations in disclosure linked to size, as their sample companies are rather similar in this measure (Demaria & Rigot, 2021).

Regarding broader climate risk disclosure, Kouloukoui et al. (2019b) discuss that its extent is positively related to size, performance, and home country in a sample of listed Brazilian firms. On the other hand, Kouloukoui et al. (2019a) show that climate risk disclosure of the world's largest emitters is only associated with profitability and not with other common characteristics, such as size, performance, or country. In order to identify potential determinants, these academic papers rely mainly on the legitimacy theory. Due to the fundamental differences in the sample composition, we integrate this stream of literature with broader voluntary environmental disclosure research to identify TCFD's drivers in the European financial sector.

In this thesis, we focus on both internal firm characteristics and external pressures, leading to consideration of the following determinants of TCFD disclosure: financial performance, stakeholder pressure, CSR reporting practices, and industry.

Financial Performance

The financial characteristics of a firm are cited as influential for its CSR reporting by a great majority of the previous research (Branco & Rodrigues, 2008; Cho & Patten, 2007; Neu et al., 1998; Sethi et al., 2017a). In this thesis, we focus on three financial variables: size, asset growth, and profitability. These attributes are among the most commonly discussed determinants, yet they can be seen from multiple theoretical perspectives.

One view is that larger or financially stronger firms can afford to allocate more resources and subsequently can develop more comprehensive reporting processes than smaller organizations (Adams, 2002; Prado-Lorenzo & Garcia-Sanchez, 2010). On the other hand, however, a substantial portion of the disclosure literature considers especially size but also growth significant due to their socio-political influences. Size is discussed as a proxy for public visibility, which affects both the number of stakeholders a firm has and the degree of scrutiny it is under (Branco & Rodrigues, 2008; Mateo-Márquez et al., 2020). As a consequence, more visible firms face greater pressures to adapt to social expectations to avoid legitimacy problems (Cho & Patten, 2007). Branco and Rodrigues (2008) specifically discuss the visibility within the banking industry, arguing for the relevance of this viewpoint due to the role of the sub-sector in society, leading to increased scrutiny and a greater number of influential stakeholders. Moreover, firms experiencing more growth are argued to employ certain CSR practices, such as disclosure, to manage concerns about their growth rate risk and the long-term sustainability of this growth (Hannah et al., 2021). Concerning climate risk in the financial sector, this could be seen as an effort to obtain stakeholder support for capital growth in response to public discussion on its role in the transition to a greener economy.

Regarding firm profitability, there are some arguments for its relevance made in line with the socio-political theories. For instance, Frias-Aceituno et al. (2014) suggest that voluntary disclosure could be utilized by profitable firms to justify their high profits. However, the prevailing explanation appears to be economics-based. Profitable firms not only have more resources to dedicate to reporting, but they also have the ability to withstand the proprietary costs that come with voluntary disclosure (Cormier & Magnan, 2003).

The majority of existing literature finds a positive relationship between financial performance and voluntary environmental or CSR disclosure. In contrast, the only existing academic paper on TCFD drivers, Demaria and Rigot (2021), finds no association between TCFD implementation and size. However, as a consequence of their sample selection process, there is overall little variation in the size of their sample firms, which does not allow for further exploration of the effect on TCFD reporting. Therefore,

we rely, instead, on the body of prior literature focusing on environmental reporting, leading to the formulation of the following hypothesis:

H3: The extent of TCFD implementation is positively associated with financial performance.

Stakeholder Pressure

Another stream of literature focuses on how stakeholder pressure affects voluntary disclosure of social and environmental information across corporations. Stakeholder concerns are of particular importance for the financial sector both due to its relevance in society and its importance in ensuring financial and economic stability with respect to climate change (Jizi et al. 2014; TCFD, 2017). Especially this last reason brought the financial sector into the spotlight. Climate risk is gaining an increasing relevance among many of the sector's key stakeholders, such as investors, regulators, and customers, which resulted in increased attention to it. To cope with these stakeholders' changing needs and awareness of environmental issues, it could be expected that financial companies increase voluntary environmental disclosure.

This is consistent with socio-political theories that follow the idea that an organization relies on a wide array of stakeholders and on the broader society to grant them a "state of legitimacy". Such a view is linked to the concept of a social contract between an organization and the society that gives the organization the right to operate and the support to meet its goals (Deegan, 2002; Freeman & Reed, 1983). Since a breach of such a contract would be detrimental to the organization's survival (Deegan, 2002), disclosure is used as a defense mechanism. By voluntarily disclosing information, a company conveys the message to the society that it is conforming with expectations, which allows it to maintain or strengthen its legitimacy (Cho & Patten, 2007; Patten, 2002). Therefore, it becomes clear why stakeholder pressure is cited as one of the main drivers of increased sustainability reporting in the past decades (Comyns and Figge, 2015).

In this regard, stakeholder pressure assumes several measures according to previous literature (De Villiers & Marques, 2016; Liesen et al. 2015; Kolk et al. 2008). In this thesis, we use several proxies to capture differences in the degree of stakeholder pressure faced by individual firms: company listing status, the relevance of environmental and climate issues in a country's public agenda, and state pressure.

First, a higher degree of stakeholder pressure can be explained by a company's public status. Listed companies, usually, have more dispersed and less homogeneous ownership than private firms which results in having different types of stakeholders with non-convergent interests (Zeng et al., 2012). Moreover, quoted companies have greater exposure to the public and, consequently, need to answer to more stakeholders. This supports the idea that companies with public holdings tend to disclose more complete information to address a wider range of stakeholders and maintain an image of legitimacy.

The degree of stakeholder pressure can also be affected by the relevance of environmental and climate issues in the firm's country and its institutional setting. As identified by Freedman and Jaggi (2005), countries are pushing corporations for environmental information, reflecting society's concerns on climate change issues (Kolk et al., 2008). De Villiers and Marques (2016) study the relationship between the importance of sustainability and environmental issues on a country's public agenda and the likelihood of firm disclosure. To practically measure it, they rely on the Yale Law School's environmental performance index (EPI) which captures country law, policy, and scientific issues regarding the environment. On the same line, Liesen et al. (2015) examine the relationship between state pressure and GHG emission reporting, finding a positive association. The same results have been confirmed by Sethi et al. (2017) who find that financial companies headquartered in countries with more developed CSR environments are more likely to provide more complete information. In consequence, based on the previous literature and theories, we predict a positive association between stakeholder pressure and voluntary disclosure of climate-related information. This results in the following hypothesis:

H4: The extent of TCFD implementation is positively associated with stakeholder pressure.

CSR Reporting Practices

Environmental and climate-related information has also been widely studied in relation to CSR reporting practices (Cuadrado-Ballesteros et al., 2017; Michelon et al., 2015). Specifically, in our thesis, we explore in which way the adoption of an existing environmental disclosure framework, the position of climate-related information in a report, and the use of external assurance affect a company's extent of TCFD compliance.

As mentioned before, TCFD is designed and tailored to existing frameworks such as GRI, IR, and CDP (TCFD, 2017). Among all these frameworks, the one that mostly focuses on environmental and climate-related issues is CDP which is an independent project that helps a wide range of actors (e.g. investors, companies, states) to manage disclosure of their environmental outward impacts. Both the information collected, and the scoring methodology are widely used in previous literature studying environmental disclosure and performance (Mateo-Márquez et al., 2020; Lemma et al., 2020; Liao et al., 2015). CDP, using standardized and sector-specific questionnaires, collects company environmental information. Once all the data have been gathered, experts review the contents and assign a score that reflects both the extent of disclosure and organizational strategy in addressing climate change issues. Therefore, higher scores represent companies with more visible disclosure of their impacts and carbon-related strategies and actions (Lemma et al., 2020). In addition, the CDP score measures a company's understanding of climate-related issues, quality of management of those issues, and its transparency on climate change concerns (Lemma et al., 2020; Luo & Tang, 2014). Given these characteristics, it is interesting to study whether such companies are better

positioned to report on TCFD matters. As TCFD requires the integration of climate considerations with strategy and business model, this superior understanding and management of environmental issues could be vital for the successful implementation of this framework. However, as the orientation of the two frameworks is fundamentally different (outward versus inward), it might not necessarily be the case. Moreover, since there is no previous research on the TCFD's relationship with CDP score, we are unable to predict its existence.

It must be reminded, however, that the choice of reporting frameworks does not always reflect the principles of completeness and transparency pursued by the individual projects. Indeed, as Michelin et al. (2015) claim, companies may even adopt reporting practices that willingly reduce what is known about them and their environmental activity. Yet, how information is presented depends on its perceived importance to both report preparers and users. This results in environmental disclosure being influenced by the relevance of environmental and climate-related issues for the company, its stakeholders, and society as a whole. If those concerns are not seen as a core part of the business model or as a crucial business risk, the value added by this information in addressing both society and stakeholders is reduced (Marcia et al., 2015). Therefore, in terms of legitimacy and stakeholder theories, the extent of the disclosure will be reduced, or the information will be included in less visible and prominent sections of the corporate reports (Patten, 2002). On the opposite, if environmental considerations are seen as an essential part of the business model, disclosures would be included in a prominent section of corporate reports, reflecting possibly higher stakeholder concerns.

Lastly, according to some authors, external voluntary assurance has a concrete impact on the reporting, increasing information reported as well as reliability and credibility of the disclosure (Cuadrado-Ballesteros et al., 2017). These authors also discover an even greater positive relationship when assurance is provided by trustworthy accounting professionals, such as the Big4 companies. On the other hand, we also find papers such as the one of Michelin et al. (2015) that show that assurance of CSR information is not associated with either more quantity or quality of the disclosure provided. On the same line, Cho et al. (2014) argue that external assurance of reports provides benefits only to the environmental image of the company without influencing the reporting itself. In this case, assurance could be used as a tool to increase the legitimizing power of the disclosure, without significantly improving its quality or quantity. This argument is propelled by the criticism of non-financial assurance, as it is voluntary and more varied in scope and extent. Some literature further points to a lack of technical competencies and assurance-provider independence (Michelon et al. 2015). Also, many of the early-stage disclosures on TCFD's more advanced topics, such as scenario analysis, are highly subjective and qualitative, implying a lack of auditability (O'Dwyer & Unerman, 2020). Therefore, the role of assurance on such disclosures is highly uncertain.

Comprehensively, based on the aforementioned academic findings, we are unable to predict the existence of a relationship between TCFD and CSR reporting practices. For the purpose of this thesis, we develop the following null hypothesis:

H5: The extent of TCFD implementation is not associated with external assurance, CDP score, and the presence of a TCFD section.

Industry

The effects of sector and industry characteristics are examined by previous literature focusing on environmental disclosure, studying the amount of information disclosed using the sector in which a company operates as a control variable (Brammer and Pavelin 2006). Most of the prior studies identify that companies belonging to an environmentally sensitive sector are more likely to voluntarily disclose information regarding their impacts on the environment than companies in sectors with no visible impacts (Patten 2002, Cormier and Magnan 2003, Brammer and Pavelin 2006). Moreover, Rupley et al. (2012) find a positive association between sensitive sectors and the quality of environmental disclosure. Similarly, Lemma et al. (2020), in line with socio-political perspectives, argue that the more a company is exposed to climate risk, the greater the extent of its disclosure. In contrast, according to Comyns and Figge (2015), companies in environmentally sensitive sectors are able to maintain their legitimacy with their disclosure, without improvements in its quality.

In the case of this thesis, as we previously argued, banking and insurance industries are considered to be high stake sub-sectors due to the leading role assigned by TCFD in redirecting capital towards greener investments. Since no previous literature focuses on the differences in environmental disclosure across these two industries, it can be argued that both face the same pressure to disclose TCFD information. However, empirical reports find significant differences in the extent of reporting across banks and insurance companies. The TCFD status report (2020), for example, shows that insurance companies disclose above average while banks, on a general level, have below-average disclosure. Those differences could be driven by the fundamentally diverse business models of banks and insurance firms. According to the International Association of Insurance Supervisors (IAIS) and Sustainable Insurance Forum (SIF) (2020), the insurance industry may be the most experienced part of the financial sector in understanding climate risk's financial implications. Therefore, this suggests that insurance companies may be better positioned to adopt this newly introduced framework and its recommendations. Consequently, despite the lack of distinction between these sub-sectors in prior environmental disclosure literature, the differences observed in TCFD-specific empirical reports point to a positive relationship with being part of the insurance industry. Thus, the following hypothesis is formulated:

H6: The extent of TCFD implementation is positively associated with insurance industry membership.

3. Data and Research Method

3.1 Data Sources

In order to select our sample and retrieve the necessary information, we rely on different types of data sources. First, we utilize the TCFD database containing basic information (company name, sector, industry, location, region, and date of adoption) of its supporters. Successively, where applicable we proceed to collect annual documents from 2016 to 2019 from the different companies' official websites. Those documents represent an additional data source for the collection of information on company environmental disclosure and reporting style. Third, we start gathering internal company information on financials, corporate governance, and ownership using the database Capital IQ. Fourth, we retrieve additional firm information on environmental performance and climate-related activities from CDP. Finally, data regarding national and institutional settings are obtained using governmental sources, European databases, and official institutions issuing environmental country indexes.

3.2 Sample Selection

The initial sample consists of 88 companies from banks and insurance industries included in the TCFD supporter list as of February 2021 and located in Europe according to the TCFD database. To select a suitable sample, we perform some adjustments. The first step involves focusing on financial companies headquartered in Europe as they are subject to common regulations regarding environmental disclosure as suggested by the EU NFRD (2014) which is applicable, and therefore, mandatory to companies in the selected sample, excluding the Norwegian and Swiss ones. Nonetheless, those companies operate and, consequently, face competition in different countries across Europe where NFRD is applied. In this regard, Zeng et al. (2012) argue that the more firms in the same sector choose to disclose environmental information, the more likely a company is to disclose more environmental information. In addition, both Norway and Switzerland are on the path of transposing NFRD requirements in their countries as well. Thus, it can be said that Norwegian and Swiss companies are subject to similar levels of external pressure on the matter and, therefore, can be included in the sample selection. Moreover, we exclude 5 companies, listed on European stock exchanges but headquartered elsewhere outside Europe as we are interested in analyzing possible cultural and institutional factors on a European level.

In the sample selection process, we focus on the period of 2016 to 2019. With TCFD being finalized in 2017, this choice allows us to compare pre-TCFD disclosure levels (2016) with post-TCFD (2017-2019) ones and study the effect of adoption of TCFD on climate-related environmental disclosure. Therefore, 28 companies are excluded from our

sample since their adoption of TCFD recommendations starts from 2020 onward, and, thus, effects of TCFD adoption would not be captured. As the next step, we gather all publicly available annual documents issued from 2016 to 2019. The selection of those documents is consistent with previous studies of voluntary or mandatory disclosure as they are published annually and have more reliable, structured, and possibly comprehensive information (Cho & Patten, 2007; Wiseman, 1982, Beck et al., 2010). Finally, we exclude 6 more companies due to the public unavailability of annual reports or their financial data for one year or more. The final sample, therefore, consists of 49 financial companies from the banking and insurance industries across 12 European countries. Table 2 shows the sample selection and sample distribution by country, year of TCFD adoption, and industry group. A comprehensive list of names of selected companies is available in the Appendix (Table A2).

Table 2. Sample selection and distribution

Sample selection		n
Initial TCFD Supporter Bank & Insurance Industries		88
Less: Companies not headquartered in the EU		-5
		83
Less: Companies adopting TCFD in 2020 or later		-28
		55
Less: Companies with unavailable reports/financial data		-6
<i>Total sample</i>		49
By country		n
Denmark	1	
Finland	1	
France	4	
Germany	3	
Ireland	1	
Italy	2	
Netherlands	7	
Norway	3	
Spain	6	
Sweden	5	
Switzerland	6	
United Kingdom	10	
<i>Total</i>	49	
By industry		n
Banks		33
Insurance		16
<i>Total</i>		49
By year		n
2016		0
2017		25
2018		16
2019		8
<i>Total</i>		49

3.3 Research Method

Subsequently to sample selection and data collection, the gathered company reports are analyzed. The following sections outline the methods utilized in such analyses.

3.3.1 Measuring TCFD implementation: Climate Compliance Index

Starting from Wiseman (1982), who is among the first to propose a score to determine the level of environmental disclosure, several researchers have adopted the same method to study the determinants of reporting practices. Specifically, previous papers evaluating CSR disclosure can be divided into two major groups, according to the two main approaches used to practically measure its levels. Academic articles which belong to the first group generally use disclosure score provided by a third party, such as the CSR-R Monitor score (Sethi et al., 2017) or CDP questionnaire's answers (Mateo-Márquez et al., 2020). In the second group, the studies, instead, measure disclosure by creating scores based on content analysis of collected firm documents.

As a method used for systemic evaluation of communication contents, content analysis was initially applied to study messages in mass media (Lombard et al., 2002). Later on, this technique became widely used in social and environmental disclosure research due to the high presence of qualitative information (Branco & Rodrigues, 2008; Tingbani et al., 2020; Wiseman, 1982). Researchers utilize this approach to observe different perspectives of disclosure levels. For example, some authors, such as Patten (2002) or Cho et al. (2015) focus on disclosure breadth via the presence or absence of certain information in the reports, while others study the extent or quality of disclosure through various measures, such as the number of words or paragraphs (Kothari et al., 2009), comprehensiveness (Bouten et al., 2011) or information quality (Comyns & Figge, 2015; Michelon et al., 2015).

In this paper, we rely on the Climate Compliance Index (*CCI*) developed by Demaria and Rigot (2021). This index measures a firm's overall compliance with TCFD, analyzing information both from a quantitative and qualitative perspective. This innovative index is developed starting from the four areas of TCFD recommendations (governance, strategy, risk management, metrics and targets), their sub-areas (a, b, and c), and the associated questions developed by TCFD to facilitate the disclosure process. Demaria and Rigot (2021), following this approach, identify 38 questions (8 for governance, 13 for strategy, 7 for risk management, and 10 for metrics and targets) that, if adequately answered, lead to full compliance with TCFD recommendations (see Appendix, Table A3). Consequently, as questions can be answered both qualitatively or quantitatively, Demaria and Rigot (2021) transform them into closed ones allowing only for a positive or negative answer. In this way, it is possible to start coding and measuring the presence or absence of information in the annual documents.

Although TCFD issued supplemental guidance for the financial sector (TCFD, 2017), our methodological approach is not tailored to this additional document. This is done for the following reasons. As companies are still experiencing issues and difficulties in the implementation of TCFD (TCFD, 2020) and there is little research in this area, it is more relevant to study first how companies are adopting the general guidelines. Also, disclosure of information in line with the supplemental guidance is built on the main

recommendations and pushes for a greater degree of detail. Therefore, companies should first achieve quasi-complete compliance with TCFD's main recommendations to comply with additional ones.

As the next step, each question is assigned a value between 0 and 1 on a 3-step coding scale. Specifically, the value assigned is 1, 0.5, or 0 depending on the presence of information disclosed and the degree of detail used in answering a specific question. This technique of using a more precise coding scale is in line with several academic articles on disclosure of environmental and social issues (Cormier et al. 2004, Pistoni et al. 2018, Wiseman 1982). Our scoring process is as follows: a score of 0 corresponds to a lack of information or very limited information (no details), a score of 0.5 to partial compliance with the question (presence of details but not full disclosure), a score of 1 to full compliance (information present and in detail).

During the scoring process, we build a database where we store qualitative information, the position of information (e.g. main reports, additional reports), and assign a preliminary score to each of the 38 questions (see Appendix, Table A4). According to this method, in the end, each company has a sub-score for each area obtained by adding together points for each question in that area, and the total score is the sum of scores per area. This method is also consistent with previous literature (Al-Tuwajiri et al., 2004) stating that a disclosure measure should analyze each issue using a “yes/no” scoring method and then quantify the same issue with content analysis methodology and determine an aggregate score for each company. To ensure the reliability of our coding process and avoid risks of subjectivity and intra-rater reliability, the sample companies are randomly divided between two coders, and a preliminary score is assigned to each of the 38 questions. Every 5 companies, scores and qualitative information are reconsidered in conjunction. Whenever coding discrepancies arise, coding steps are re-analyzed, discussed, and scores, eventually, reconciled (Bouten et al. 2011, Milne & Adler, 1999).

The final compliance index is determined by calculating the ratio of the total score out of 38, the maximum score possible. Always in line with Demaria and Rigot (2021), the calculation of the score does not involve weights to avoid further subjectivity in identifying the relative importance of individual questions. This is in line with TCFD that states that individual recommendations are equally important and contribute as a whole to the creation of relevant and comprehensive information on CROs. Finally, the database containing companies' scores and sub-scores per year allows us to study and analyze the evolution of TCFD implementation in the European financial sector over the 2016 to 2019 time period, as well as perform an association study with pre-discussed firm factors.

3.3.2 Information classification

In addition to measuring the overall compliance with TCFD and its specific areas of recommendations, the aforementioned index can also be rearranged to classify disclosure areas into hard and soft. This division is performed by considering the core purpose of

TCFD which is to disclose financial information on corporation's climate dependencies. The questions identified as such require the disclosure of hard climate-related information to score the maximum points. This implies that some of the questions which require quantitative disclosure (e.g. GOV-Q1: how often is the board informed about climate issues?) are not considered to be hard questions for the purpose of this analysis. Indeed, they do not focus on the integration of climate risk considerations with financial information but indicate the efficiency of company internal processes in relation to CROs. For a similar reason, most of the questions from metrics and targets are not considered to be hard questions. In this case, indeed, data on GHG emissions and Scope 1, 2, and 3 focus on the outward impacts of a company's operations on the environment. Table 3 below, summarizes the hard questions identified.

As a result, 12 questions are classified as hard, while the remaining 26 are deemed as soft. In line with *CCI* methodology, the scores for hard and soft questions are calculated by adding together the points for each question identified as such. The final compliance index for each information type is obtained by dividing the respective score by the maximum points achievable (12 for hard and 26 for soft).

Table 3. Overview of hard questions

Area	n	Question details
<i>Strategy</i>	Q2 - 4 Q5 Q7 Q9 Q11-13	Details and costing of CROs by period Distribution of CRO at the sector and geographical levels Identification of impacts? Description of CAPEX and OPEX related to CRO Description of scenario analysis and conclusions
<i>Risk Management</i>	Q2	What is the materiality?
<i>Metrics and Targets</i>	Q2 Q3	Indicator similar to an indicator for managing business risks Assessment of an internal carbon price

4. Analyses and Results

4.1 Descriptive Analysis of Climate Compliance Index

The following chapter provides an overview of descriptive analyses of *CCI* development for our sample companies over time. By performing these analyses, we are able to study the level of TCFD implementation in the 2016-2019 period. In addition to the evolution of *CCI*, we expand our analysis even further by investigating potential country differences. Lastly, as TCFD is a newly introduced framework, it is also necessary to outline to what degree its supporters practically adopt it. For this last reason, a detailed descriptive analysis on the differences in implementation of the four recommendation areas is carried out.

4.1.1 Development of Climate Compliance Index

Figure 1 shows the development of the average *CCI* for the studied financial firms, alongside the increasing number of TCFD adopters. Out of the 49 companies included in the sample, 25 (51%) declared support for the TCFD recommendations already in 2017, when they were finalized. Another 16 (33%) have done so in 2018 and 8 (16%) in 2019. In addition, Table 4 presents a description of the *CCI* variable, showing a mean of 39% for the studied period and 48% for only observations after TCFD adoption, with the highest and lowest observed disclosure of 72% and 1%, respectively.

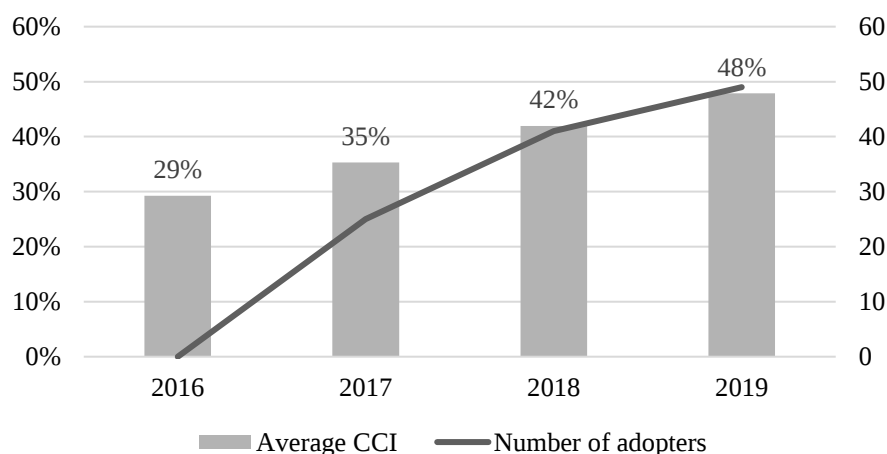


Figure 1. Development of *CCI* and number of adopters over time

Table 4. *CCI* descriptive analysis

Variable	n	Mean	Std. dev.	Min	Max
<i>CCI</i> (2016-2019)	196	39%	15%	1%	72%
<i>CCI</i> (after TCFD adoption)	115	48%	14%	1%	72%

As previously mentioned, the reporting in 2016 predates final TCFD publication and, thus serves as a basis to show the subsequent development in reporting practice. As can be seen in Figure 1, even before the finalization of these recommendations, the studied firms disclose some information, warranting an average *CCI* of 29%. This can be explained by several reasons. For instance, due to the heightened relevance of environmental matters in the past decade, companies have been increasingly pressured to report environmental and climate-related information to address their impacts on the planet. Moreover, besides being subject to mandatory reporting requirements, it is common for firms to adopt other reporting frameworks that overlap with TCFD. The Task Force also published progress reports before the final recommendations, so companies interested in the topic could have taken some reporting advice from such documents. Nonetheless, the yearly average has increased from 29% to 48%. Such a trend is in line with the findings of Demaria and Rigot (2021) as well as with the latest TCFD status report (2020), which also observe an increase in reporting over time.

The average score among TCFD adopters in 2019 is below 50%. This suggests that despite proclaiming support for the framework and adopting it in the annual filings, these firms have not practically embraced many of the recommendations. This claim can be supported by prior empirical studies conducted on various samples, each identifying several difficulties in practical TCFD implementation. For example, companies find the recommendations challenging, given the informational needs which could require the disclosure of sensitive information (TCFD, 2020; AMF, 2020).

4.1.2 Country differences

Figure 2 presents the evolution of *CCI* during 2016-2019 by country. Across all four years, French companies consistently show the highest level of implementation of the recommendations. A good level of disclosure can also be found among firms from Italy, Switzerland, and Germany. On the other hand, the lowest disclosure is found in Finland and Ireland, even though they visibly improve over time. However, it must be noted that each of these countries is represented by one firm only, which makes interpretation of results as country-representative problematic. Other countries that exhibit relatively low levels of disclosure include Norway, Sweden, and Spain. The highest relative improvement over the studied period can be observed in Norway, Sweden, the Netherlands, and Germany.

All countries and companies within the sample are under similar regulatory pressure, as a result of the work of the European Commission, as well as national standard setters. However, the regulations applicable before the introduction of the EU directive could potentially impact the level of compliance with TCFD. This is exemplified with France (scored as the best performer) that had a law in place, already in 2012, requiring the inclusion of climate change considerations in non-financial reporting of listed firms.

However, other countries with a form of a similar law in place before 2016 (e.g. United Kingdom, the Netherlands, Denmark) do not show significantly superior performance.

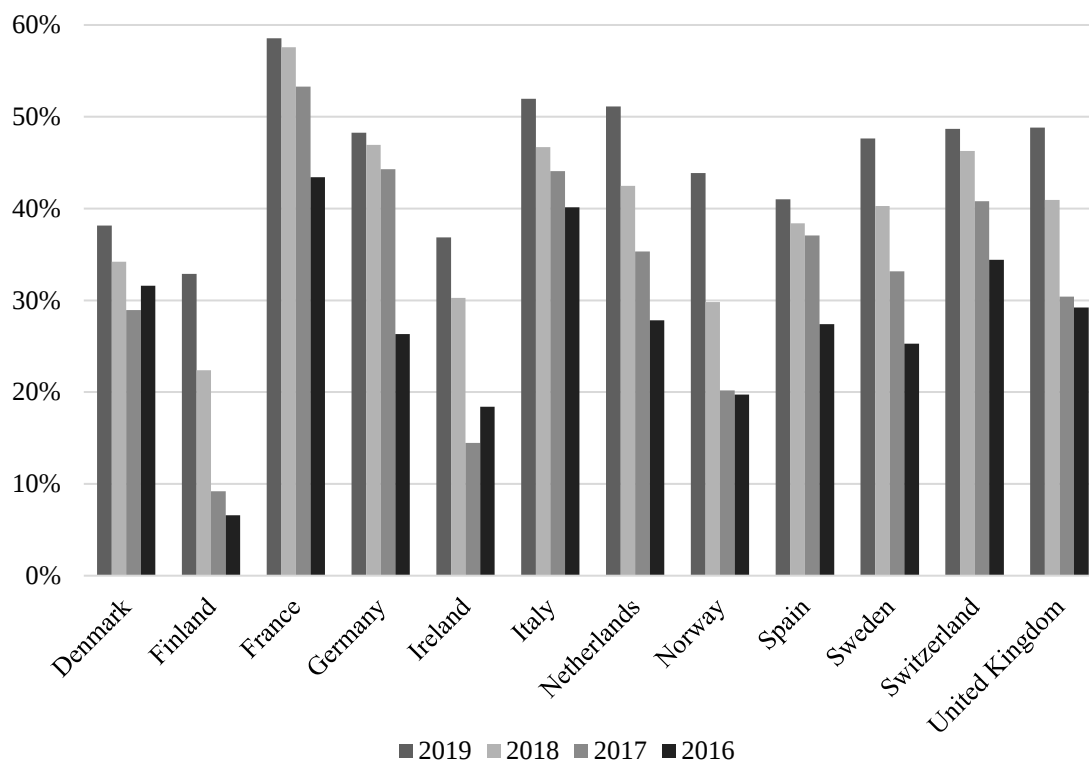


Figure 2. Development of *CCI* per country over time

4.1.3 TCFD reporting area differences

In 2019, the highest compliance with the reporting recommendations is found in the area of governance (60%), closely followed by metrics and targets (59%) and risk management (57%). While these categories show very similar scores, risk management has experienced the most improvement over the four years, from 28% to 57%, as seen in Figure 3. The fourth area, strategy, lags far behind the rest, with an average *CCI* of only 27% in 2019. Comparing these results to Demaria and Rigot (2021), we note that they find the highest scores for risk management and metrics and targets, with a lower score for governance and, similarly to our findings, the lowest compliance for the area of strategy. There is limited comparability between our findings and Demaria and Rigot's, since those authors have a different sample design, focusing on one country and multiple sectors. Nevertheless, the much lower score for strategy, in both cases, strongly indicates that this is a problem area for many firms when it comes to TCFD reporting in practice, which is in line with conclusions of many other empirical reports (AMF, 2020; TCFD, 2020; EFRAG, 2020).

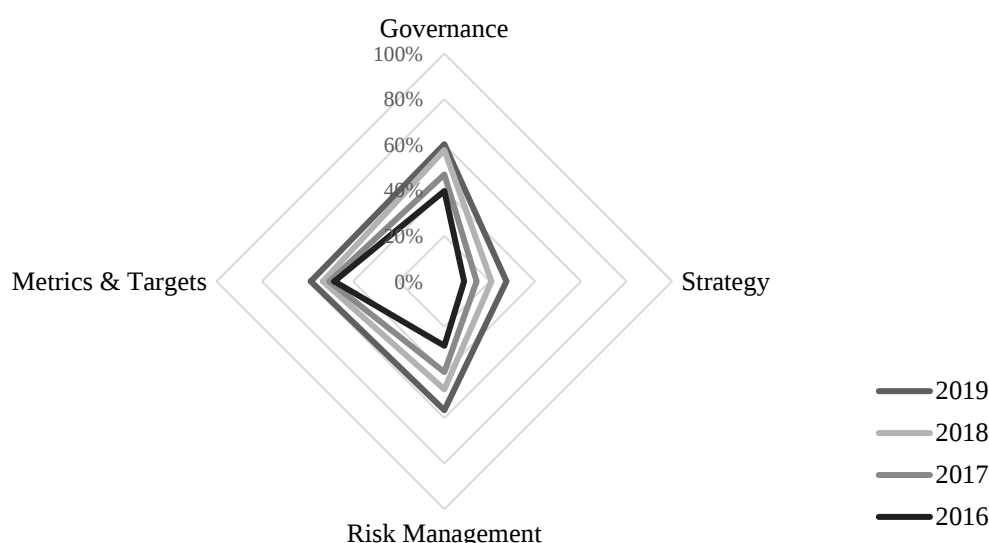


Figure 3. Development of TCFD areas of recommendations over time

Table 5 displays the development of *CCI* per question for each of the reporting areas. It can be seen that there are several well-reported questions. In governance, disclosure on most questions is quite high, especially on how the CROs are being communicated to the board and managed (GOV-Q1, Q6, and Q8). Moreover, most companies also report quite well on the integration of CROs into the business and strategy (STRAT-Q8), with these financial firms frequently describing their new products and services introduced as a response. There is also a relatively good level of disclosure on materiality study, the integration of climate risk identification and assessment into the overall risk management, and the current and potential regulations (RISKMAN-Q4, Q2, and Q3). For metrics and targets, reporting on Scope 1, 2, and 3 emissions, own consumption and its evolution is also comparatively high (METR-Q4, Q5, Q6, and Q8).

Among these best-addressed questions, most demand qualitative information. The ones requiring quantitative disclosure instead, are also covered by other frameworks, for example all scopes of emissions are a part of GRI (TCFD, 2017). In either case, they do not directly touch upon the integration with hard financial information.

From Table 5, it can further be seen that the questions with the lowest implementation require hard disclosure on climate-dependencies. In risk management, despite discussing a materiality analysis (RISKMAN-Q4), specific materiality of CROs is not being presented (RISKMAN-Q2). Another category where the disclosure is limited concerns the indicators linking CROs to the business, such as indicators similar to those for managing business risk and the internal carbon price (METR-Q2 and Q3). However, the highest level of hard data on financial dependencies is needed in the strategy part. While some firms identify details and CROs in the short term (STRAT-Q2), the details regarding the medium and long-term were found to be insufficient (STRAT-Q3 and Q4).

Table 5. Average *CCI* per question

Area	N	Question	2016	2017	2018	2019
Governance (GOV)	Q1	Board informed	66%	74%	84%	89%
	Q2	How often	28%	32%	49%	46%
	Q3	CROs included in strategy	48%	56%	66%	68%
	Q4	Board progress assessment	24%	26%	41%	44%
	Q5	Remuneration linked to CROs	7%	10%	13%	16%
	Q6	Managers responsibilities	65%	73%	80%	84%
	Q7	CROs feedback process	21%	33%	46%	52%
	Q8	Management of climate issue	57%	71%	83%	83%
	Total		40%	47%	58%	60%
Strategy (STRAT)	Q1	Accuracy of CROs periods	1%	8%	14%	18%
	Q2*	CROs short-term	4%	7%	11%	15%
	Q3*	CROs medium-term	0%	1%	2%	3%
	Q4*	CROs long-term	0%	1%	2%	4%
	Q5*	CROs by sectors and geography	7%	9%	12%	18%
	Q6	CROs impacts on strategy and business	15%	18%	22%	29%
	Q7*	Identification of impacts	11%	23%	38%	46%
	Q8	Integration of CROs	69%	87%	89%	96%
	Q9*	CROs-related CAPEX and OPEX	0%	0%	0%	0%
	Q10	Resilience of business model	1%	6%	14%	24%
	Q11*	Scenario analysis	2%	12%	30%	46%
	Q12*	Horizon of scenarios	0%	6%	16%	30%
	Q13*	Conclusion of scenarios	2%	5%	18%	28%
	Total		9%	14%	21%	27%
Risk Management (RISKMAN)	Q1	Process for CROs evaluation	34%	44%	54%	67%
	Q2*	Materiality	2%	1%	0%	2%
	Q3	Effects of regulations	18%	30%	50%	71%
	Q4	Existence of materiality study	61%	79%	84%	91%
	Q5	Management of climate risks	38%	52%	56%	64%
	Q6	Priorities	2%	10%	11%	18%
	Q7	Integration of CROs in risk management	43%	63%	77%	82%
	Total		28%	40%	47%	57%
Metrics and Targets (METR)	Q1	Consumption indicators	78%	74%	78%	77%
	Q2*	Indicator for business risk	13%	26%	27%	35%
	Q3*	Internal carbon price	2%	2%	1%	2%
	Q4	Evolution of Q1 to Q3	74%	70%	76%	76%
	Q5	Scope 1 and 2	73%	73%	78%	86%
	Q6	Scope 3	56%	56%	62%	74%
	Q7	Details of Scope 3	40%	42%	48%	56%
	Q8	Evolution of Q5 and Q6	81%	80%	80%	86%
	Q9	Objectives for Q1 and Q3	45%	51%	57%	62%
	Q10	Objectives for Q5 and Q6	20%	30%	28%	33%
	Total		48%	50%	53%	59%

Most of these scores come from firms being awarded 0.5 points, with no company reporting on these matters fully in line with the recommendations. Therefore, we can see that the areas demanding integration of CROs and financial information lack substantial disclosure. Even for questions where the score is higher, such as regarding scenario analysis in strategy (STRAT-Q11 and Q13), much of the disclosure in these categories is of qualitative or partial nature (more observations awarded 0.5 points than 1 point).

Based on these findings, given that TCFD aims at the integration of financial and non-financial information about the impact of climate change in order to support informed decision-making, low scores for the strategy area and other hard questions are troublesome. While the relatively good disclosure on risk management and governance increases the total level of information, the lack of quantitative and specific disclosures reduces its usefulness and novelty. Hence, we show that while the adoption of TCFD significantly increases the extent of reported information, TCFD adopters struggle to meet the purpose of the recommendations. Instead, they focus more on areas that provide more qualitative discussion (governance and risk management) or overlap with other frameworks (several questions of metrics and targets).

4.2 Univariate Analysis

In order to shed more light on the difference between hard and soft disclosure, we compare *CCI* for the two information types. In Table 6, we present tests of means for these two categories, using both a paired t-test and Wilcoxon signed-rank test. The latter test is added as it does not rely on the assumption of normal distribution and is less sensitive to outliers (Moore et al., 2016). The distribution of differences between the hard and soft questions' scores, presented in the Appendix (Figure A1), shows a lack of normality across the observations. For this reason, the Wilcoxon signed-rank test is more suitable.

Table 6. Comparison of means (hard and soft information)

	2016-2019	After TCFD Adoption
Mean (<i>HARD</i>)	10.9%	15.9%
Mean (<i>SOFT</i>)	51.4%	58.1%
t-test (diff = 0)	-42.442*** (0.000)	-36.381*** (0.000)
t-test (diff < 0)	(0.000)	(0.000)
Wilcoxon	-12.130*** (0.000)	-9.302*** (0.000)
Observations	196	115

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses.

From Table 6, it is possible to observe a significant difference between the compliance with hard and soft questions. When considering the whole period, the mean *CCI* for *HARD* is 10.9% while for *SOFT* it is 51.4%. This difference can also be noted for observations after TCFD adoption, where the mean *CCI* for *HARD* is 15.9% and 58.1% for *SOFT*. Thereby, these findings and test results in Table 6 confirm H1, in line with our expectations, showing that the extent of TCFD adoption is greater for soft questions than for hard ones. Consequently, companies disclose climate-related risk information mostly through soft information.

These observations are in line with the theory developed by Bertomeu and Marinovic (2016). The authors demonstrate that, in a voluntary setting, the aggregation of hard with soft information will turn all information into soft, leading to a lower level of informativeness. According to other literature, there are several reasons why companies might withhold hard information. For example, studies in line with legitimacy theory find that firms tend to make more soft claims when they have their legitimacy questioned, are bad environmental performers, or have more unfavorable information. Hence, they disclose less reliable and soft information that guarantees the minimum level of legitimacy required while avoiding exposure and potential consequences of hard data disclosure (Clarkson et al. 2008; Bertomeu & Marinovic, 2016).

In addition, Clarkson et al. (2008) associate a higher disclosure of hard claims with superior environmental performance, in support of economics-based theories. Thus, companies better addressing hard questions might also integrate climate considerations in their business to a greater extent, improving their performance. On the other hand, Cho and Patten (2007) also argue that this type of information tends to have more proprietary value and companies might decide not to disclose it to avoid potential costs. Accordingly, as previously mentioned, the TCFD status report (2020) shows that most of the companies find reporting of scenario analysis and climate financial implications challenging as it implies disclosing sensitive information. However, these companies also highlight limited capabilities and tools as further obstacles. Consequently, the lack of disclosure in these areas might indicate that companies either fear the potential consequences of reporting hard information or are not capable to do so.

4.3 Regression Analysis

The third part of the analysis focuses on determinants of TCFD reporting. In order to do so, we first run a regression with *CCI* as the dependent variable and the different determinants defined in the literature review as the independent variables. Moreover, we further run additional regressions with sub-scores of *CCI* (governance, strategy, risk management, metrics and targets) as the dependent variables in order to examine any differences among the four areas covered by TCFD. In the next paragraphs, we outline the exact specifications of the regressions and variables used, as well as provide an analysis of the findings.

4.3.1 Independent variables

Table 7. Independent variables

Variables	Predicted sign	Description	Data source
<i>TCFD</i>	+/-	TCFD adoption, equals 1 if firm adopted TCFD for the given reporting year, 0 otherwise	TCFD
<i>SIZE</i>	+	Firm size, measured as natural logarithm of total assets at year-end	Capital IQ
<i>ASSET_GROW</i>	+	Growth in total assets, measured as % change in total assets compared to prior year	Capital IQ
<i>ROA</i>	+	Return on assets, measured as net income relative to total assets at year-end	Capital IQ
<i>PUBLIC</i>	+	Company listing status, equals 1 for public firm, 0 otherwise	Capital IQ
<i>EPI</i>	+	Country environmental index, expressed by Environmental Performance Index obtained from an external source	Yale Law School
<i>STATE_PRESS</i>	+	Pressure from home country on environmental issues, equals 1 for above-average implicit tax level, 0 for below-average implicit tax level	Eurostat
<i>ASSUR</i>	+/-	Existence of external assurance of non-financial information, equals 1 for assurance, 0 otherwise	Company reports
<i>CDP_SCORE</i>	+/-	Firm environmental performance, measured on a scale of 0-2, based on the transformation of CDP letter score	CDP
<i>TCFD_SECT</i>	+/-	TCFD reporting style, equals 2 for a TCFD section in the standalone report, 1 for a TCFD section in the main financial report, 0 for no TCFD section	Company reports
<i>INDUSTRY</i>	+	Industry membership, equals 1 for insurance and 0 for bank	TCFD

Table 7 describes the independent variables used in the regression. To express TCFD adoption, we consult the list of adopters and their adoption year published on the TCFD

website. Next, we express firm size by total assets, as done in other research papers. As this measure is skewed, we compute a natural logarithm (Bouten et al., 2012; Liao et al., 2015; Sethi et al., 2017). Asset growth is the percentage change with respect to the year prior (Hannah et al., 2021). Profitability is expressed through return on assets (Jizi et al., 2014; Liao et al., 2015; Rupley et al., 2012).

Regarding stakeholder pressures, a dummy variable is created to demonstrate a firm's listing status. In order to measure the importance of environmental and climate change matters in a company's home country, the Yale Law School index used by De Villiers & Marques (2016) is included. State pressure is proxied with the implicit energy tax level, calculated as the energy tax revenues of a country in relation to its final energy consumption in Euro per ton of oil equivalent. As our sample does not provide many observations per country, to improve the robustness of the results, we divide the countries into those with high and low state pressure, based on their energy tax level compared to the average (Liesen et al., 2015). Subsequently, scores of 1 and 0 are assigned respectively for observations above and below average.

To account for the presence of external assurance, we create a binary variable with the value of 1 if any assurance is given to the non-financial reporting and a 0 otherwise (Hummel & Schlick, 2016). In our sample, we only observe limited assurance, thus, we do not make any distinction for the type of assurance. Moreover, all providers of assurance are one of the Big4 accounting firms, which is why we do not pursue further analysis in this direction. Next, a categorical variable is added to demonstrate the existence and location of a TCFD-specific section in the studied reports.

CDP score is also used. However, since it is expressed in the form of letters, F to A, it is necessary to transform it into numerical values for the purpose of regression analysis. Due to the limited number of observations in each of the grade categories, CDP scores are divided into 3 categories: low (grades F to D), medium (grades C- to B), and high (grades A- to A). This is done in order to distinguish the worst and the best-scored observations more clearly. Subsequently, these three categories are each assigned a respective numerical value, 0 for low, 1 for medium, and 2 for high. Finally, industry membership is initially determined by the classification of adopters by TCFD and confirmed during retrieval of the remainder of data from other sources.

4.3.2 Model specifications

In order to investigate information added by TCFD and determinants influencing the extent of climate-related disclosure and, so, the extent of TCFD implementation for the entire 2016-2019 time period, we employ the following specification:

$$(1) CCI_i = \alpha_i + \beta_1 TCFD_i + \beta_2 SIZE_i + \beta_3 ASSET_GROW_i + \beta_4 ROA_i + \beta_5 PUBLIC_i + \beta_6 EPI_i + \beta_7 STATE_PRESS_i + \beta_8 ASSUR_i + \beta_9 CDP_SCORE_i + \beta_{10} INDUSTRY_i + \varepsilon_i$$

All variables are defined in the above sections. Since we have a panel data structure, the equation is estimated using a linear regression which includes a careful estimation of degrees of freedom. It considers the nesting of fixed effects within clusters, represented by the individual companies, as well as many possible sources of collinearity within fixed effects. The model also accounts for heteroskedasticity. Including the *TCFD* dummy variable, we exclude yearly fixed effects due to collinearity. The regression does not include a country-fixed effect due to the sample composition. Moreover, cultural and institutional differences are incorporated by *EPI* and *STATE_PRESS* variables.

A second specification is implemented to study the effects of the same determinants on companies' extent of compliance with TCFD, only after adoption. In this case, we employ the following specification:

$$(2) CCI_i = \alpha_i + \beta_1 SIZE_i + \beta_2 ASSET_GROW_i + \beta_3 ROA_i + \beta_4 PUBLIC_i + \beta_5 EPI_i + \beta_6 STATE_PRESS_i + \beta_7 ASSUR_i + \beta_8 TCFD_SECT_i + \beta_9 CDP_SCORE_i + \beta_{10} INDUSTRY_i + \varepsilon_i$$

The second specification is estimated similarly to the first one. However, here we exclude the *TCFD* variable but include the *TCFD_SECT* variable, as this can be captured only after the adoption of TCFD. In addition, as the *TCFD* variable is excluded, we account for yearly fixed effects. The country-fixed effects are not considered.

Finally, both of the aforementioned specifications are tested for the four sub-scores of TCFD recommendations: governance, strategy, risk management, and metrics and targets. By doing so, we can observe any differences between the compliance for different scores as well as any changes in variables' behavior in these cases.

4.3.3 Descriptive analysis of independent variables

Tables 8 and 9 provide an overview of the descriptive statistics for the variables used in the regressions. Since *CCI* has been extensively described in 4.1, we focus on the independent variables in this section. In order to deal with extreme observations, we winsorize the data for *ASSET_GROW* and *ROA* at the 1st and 99th percentiles (Dyer et al., 2017; Hummel & Schlick, 2016). Moreover, for two variables (*STATE_PRESS* and *CDP_SCORE*), the number of observations is lower. First, the information for implicit energy tax level is available only for countries in the EU and Norway. Therefore, no value is recorded for the Swiss observations. Second, not all companies report their environmental information to CDP, thus their score is not available either.

During the studied period, around 59% of the firm-year observations are after their TCFD adoption. This is a consequence of companies adopting TCFD at different points in time throughout the four years. The average asset growth for all observations in this period is around 2.11% and the average return on assets is below 1%. Most of the sample firms are listed. The data also shows that approximately 77% of the studied reports have limited assurance on their non-financial disclosures, hinting at the popularity of such an auditing

approach among these firms. Lastly, around a third of the companies are insurance firms, while the rest belongs to the banking industry.

Table 8. Descriptive analysis for specification (1)

(1) 2016-2019					
Variables	n	Mean	Std. dev.	Min	Max
<i>CCI</i>	196	0.386	0.150	0.013	0.724
<i>TCFD</i>	196	0.587	0.494	0.000	1.000
<i>SIZE</i>	196	12.396	1.600	6.627	14.699
<i>ASSET_GROW</i>	196	0.021	0.076	-0.161	0.348
<i>ROA</i>	196	0.007	0.007	-0.001	0.049
<i>PUBLIC</i>	196	0.832	0.375	0.000	1.000
<i>EPI</i>	196	79.083	3.467	71.000	87.420
<i>STATE_PRESS</i>	172	0.558	0.498	0.000	1.000
<i>ASSUR</i>	196	0.765	0.425	0.000	1.000
<i>CDP_SCORE</i>	162	1.340	0.570	0.000	2.000
<i>INDUSTRY</i>	196	0.327	0.470	0.000	1.000

Table 9. Descriptive analysis for specification (2)

(2) After TCFD Adoption					
Variables	n	Mean	Std. dev.	Min	Max
<i>CCI</i>	115	0.448	0.138	0.132	0.724
<i>SIZE</i>	115	12.677	1.431	6.828	14.699
<i>ASSET_GROW</i>	115	0.027	0.080	-0.161	0.348
<i>ROA</i>	115	0.007	0.007	0.001	0.049
<i>PUBLIC</i>	115	0.870	0.338	0.000	1.000
<i>EPI</i>	115	78.720	3.480	71.000	87.420
<i>STATE_PRESS</i>	100	0.630	0.485	0.000	1.000
<i>ASSUR</i>	115	0.817	0.388	0.000	1.000
<i>CDP_SCORE</i>	102	1.412	0.495	1.000	2.000
<i>TCFD_SECT</i>	115	0.722	0.732	0.000	2.000
<i>INDUSTRY</i>	115	0.330	0.472	0.000	1.000

Table 9 allows us to observe any differences in the descriptive statistics for only observations of firms after their TCFD adoption. In this case, we find similar values to those in Table 8. However, it is important to note that after TCFD adoption, all observations show a positive return on assets and a higher level of CDP scores (low level not noted). This table also indicates the variability in firm reporting, as *TCFD_SECT* values range from 0 to 2, based on the presence and location of the TCFD-specific section. As this variable is categorical, the mean represented in Table 9 cannot be meaningfully interpreted. For this reason, we conduct another analysis (not tabulated). Our results show that around 56% of observations organize their TCFD disclosures into a separate section

and the location of this section varies between financial (17%) and standalone reports (39%). This indicates a lack of uniformity in reporting modes of TCFD information.

Table 10. Spearman's correlation

	CCI	TCFD	SIZE	ASSET_ GROW	ROA	PUBLIC	EPI	STATE_ PRESS	ASSUR	CDP_ SCORE	TCFD_ SECT	INDU -STRY
CCI	1.00											
TCFD	0.499***	1.000										
SIZE	0.495***	0.184**	1.000									
ASSET_ GROW	0.295***	0.076	-0.003	1.000								
ROA	-0.215**	-0.099	-0.401***	0.118	1.000							
PUBLIC	0.030	-0.044	0.118	0.081	-0.033	1.000						
EPI	0.087	-0.094	0.266***	-0.020	-0.216***	0.006	1.000					
STATE_ PRESS	0.186**	0.151*	0.284***	-0.058	-0.332***	-0.114	0.260***	1.000				
ASSUR	0.242***	0.150*	0.122	-0.109	-0.031	-0.103	0.008	-0.089	1.000			
CDP_ SCORE	0.217***	0.139*	0.327***	0.012	-0.273***	-0.154*	0.035	0.051	0.256***	1.000		
TCFD_ SECT	0.589***	0.459***	0.244***	0.178**	-0.041	0.058	0.091	0.229***	0.000	-0.017	1.000	
INDU- STRY	-0.006	-0.040	-0.265***	0.096	0.126	0.153*	-0.041	0.189*	-0.348***	-0.407***	0.214**	1.000

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses. All variables are defined in Table 7.

Furthermore, Table 10 presents Spearman's correlation of all variables included in the model. We use this analysis because it does not rely on a strict assumption of the variables' normal distribution (Knapp, 2018). Given the limited sample used for this study, it is more appropriate not to depend on such an assumption.

CCI shows a relatively high correlation with *TCFD*, *SIZE*, *ASSET_GROW*, *ROA*, *STATE_PRESS*, *ASSUR*, *CDP_SCORE*, and *TCFD_SECT*. In addition, some of the independent variables also appear correlated, with various levels of significance. Even though the correlation coefficients in the table do not indicate multicollinearity, we nevertheless check the variance inflation factors for these variables. The factors range from 1.09 to 1.74. Researchers use different cut-off points to discuss multicollinearity (Thompson et al., 2017), but even when a more conservative score of 3 is applied, our values are still below this point. Thus, there appears to be no multicollinearity problem.

4.3.4 Regression results

Table 11. Results of overall compliance index (model a and d)

Variables	(1) 2016-2019		(2) After TCFD Adoption	
	(a)	(d)	(a)	(d)
Dependent Variable: CCI				
<i>TCFD</i>	0.114*** (0.000)	0.096*** (0.000)		
<i>SIZE</i>	0.030*** (0.000)	0.032*** (0.000)	0.030*** (0.001)	0.036*** (0.007)
<i>ASSET_GROW</i>	0.004*** (0.000)	0.005*** (0.000)	0.004** (0.015)	0.003** (0.010)
<i>ROA</i>	-3.342 (0.190)	-2.869 (0.295)	-3.303 (0.247)	-3.083 (0.333)
<i>PUBLIC</i>	-0.008 (0.810)	-0.028 (0.672)	0.011 (0.757)	-0.022 (0.568)
<i>EPI</i>	0.003 (0.406)	0.001 (0.898)	0.004 (0.397)	0.004 (0.498)
<i>STATE_PRESS</i>		0.021 (0.581)		0.027 (0.656)
<i>ASSUR</i>	0.073*** (0.002)	0.089*** (0.004)	0.074*** (0.003)	0.087** (0.012)
<i>CDP_SCORE_{medium}</i>		0.070* (0.093)		
<i>CDP_SCORE_{high}</i>		0.093* (0.055)		0.039 (0.222)
<i>TCFD_SECT_{fin}</i>			0.087*** (0.001)	0.065* (0.056)
<i>TCFD_SECT_{stand}</i>			0.118*** (0.000)	0.113** (0.015)
<i>INDUSTRY</i>	0.032 (0.303)	0.054 (0.152)	0.059* (0.075)	0.079* (0.051)
Constant	-0.345 (0.228)	-0.252 (0.505)	-0.372 (0.283)	-0.445 (0.261)
Observations	196	142	115	88
R-squared	0.522	0.577	0.506	0.589

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses. All variables are defined in Table 7.

Table 12. Results for sub-scores (model d)

Variable	CCI_GOV		CCI_STRAT		CCI_RISKMAN		CCI_METR	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
TCFD	0.072** (0.040)		0.112*** (0.000)		0.161*** (0.000)		0.058* (0.088)	
SIZE	0.082*** (0.000)	0.087*** (0.001)	0.024*** (0.003)	0.024 (0.172)	0.055*** (0.000)	0.057*** (0.007)	-0.004 (0.874)	-0.004 (0.902)
ASSET_GROW	0.006*** (0.003)	0.004** (0.037)	0.006*** (0.001)	0.004** (0.018)	0.006*** (0.001)	0.003** (0.027)	0.003 (0.150)	0.002 (0.555)
ROA	-5.198 (0.218)	-6.909 (0.248)	0.032 (0.986)	-0.843 (0.719)	-3.164 (0.272)	-3.031 (0.392)	-5.553 (0.138)	-2.974 (0.457)
PUBLIC	0.018 (0.896)	0.058 (0.679)	0.022 (0.666)	-0.010 (0.865)	0.038 (0.566)	-0.014 (0.854)	-0.062 (0.547)	-0.109 (0.366)
EPI	0.019* (0.074)	0.020* (0.054)	-0.001 (0.850)	0.002 (0.738)	-0.010 (0.136)	-0.010 (0.131)	0.001 (0.898)	0.002 (0.857)
STATE_PRESS	0.039 (0.622)	0.106 (0.257)	0.039 (0.237)	0.052 (0.314)	0.022 (0.647)	-0.068 (0.182)	0.014 (0.873)	-0.004 (0.978)
ASSUR	0.100 (0.246)	0.063 (0.617)	0.084*** (0.001)	0.076*** (0.010)	0.121*** (0.003)	0.085** (0.020)	0.049 (0.505)	0.123* (0.097)
CDP_SCORE _{Emedium}	0.112 (0.127)		-0.020 (0.576)		0.038 (0.638)		0.178* (0.061)	
CDP_SCORE _{high}	0.083 (0.376)	-0.015 (0.808)	0.022 (0.566)	0.054 (0.133)	0.067 (0.433)	0.048 (0.258)	0.180 (0.132)	0.057 (0.433)
TCFD_SECT _{fin}		0.069 (0.301)		0.050 (0.223)		0.131*** (0.006)		0.034 (0.646)
TCFD_SECT _{stand}		0.084 (0.296)		0.123** (0.043)		0.165** (0.011)		0.086 (0.324)
INDUSTRY	0.111* (0.058)	0.138* (0.086)	0.113*** (0.003)	0.136*** (0.008)	0.059 (0.296)	0.080 (0.239)	-0.024 (0.731)	-0.045 (0.541)
Constant	-2.274*** (0.004)	-2.376*** (0.008)	-0.265 (0.488)	-0.432 (0.414)	0.239 (0.657)	0.470 (0.427)	0.320 (0.701)	0.444 (0.588)
Observation	142	88	142	88	142	88	142	88
R-squared	0.474	0.520	0.478	0.526	0.568	0.550	0.203	0.201

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses. All variables are defined in Table 7.

The results of the regression analysis are divided into two categories: overall *CCI* and sub-scores for the four areas of recommendations. As we have previously mentioned, *STATE_PRESS* and *CDP_SCORE* variables present fewer observations than our sample size. In order to deal with these missing values, we run several regression models for each of the two specifications. First, we run a regression specification excluding *STATE_PRESS* and *CDP_SCORE* (model a), then two additional models adding each variable (models b and c), and finally a last regression (model d) including all variables. This allows us to observe the behavior of coefficients and significance as a result of some missing observations. However, as we do not observe any significant differences in the coefficients and p-values across the last three models (b, c, and d), we present model a, which excludes the aforementioned variables, and model d, which includes both variables. For sub-scores, only model d is presented for both specifications, as, similarly to the models for the total score, the significance of coefficients and p-values does not change. Moreover, we are mainly interested in observing the combined effects of all chosen variables.

4.3.5 Discussion of regression results

Table 11 presents the results of our estimation of equations (1) and (2) with specification adjustments for *STATE_PRESS* and *CDP_SCORE*. Table 12, instead, shows the results for regressions (1) and (2) for the four different areas of TCFD recommendations.

The following variables emerge with a statistical significance across the different regression specifications: *TCFD*, *SIZE*, *ASSET_GROW*, *ASSUR*, *TCFD_SECT* and *INDUSTRY*. Moreover, as identified in Tables 11 and 12, most of the variables behave similarly for the first three individual *CCI* sub-scores but not for *CCI_METR*. From the results, indeed, it is possible to observe that besides *TCFD*, no other variable is significant in this last regression. It should be noted, however, that R-squared levels highly differ across the regressions, analyzing the sub-scores. While for *CCI_GOV*, *CCI_STRAT*, and *CCI_RISKMAN*, we observe R-squared between 0.400 and 0.500, for *CCI_METR* the maximum R-squared is 0.203. This indicates that for metrics and targets, the chosen independent variables weakly explain the variation in the *CCI*.

Our findings reject H2, that predicts no association between the extent of disclosure of climate-related information and the adoption of TCFD. This is supported by the *TCFD* variable which is shown to be significant and positive at the 1% level in Table 11. Therefore, we argue that the adoption of TCFD results in a higher extent of CROs disclosure which underlines its innovative nature and novel orientation on climate-related financial dependencies. Moreover, this positive association does not support the view of TCFD reporting as a pure decoupling mechanism. This claim can also be supported by the regressions performed on the sub-scores (Table 12). While we observe a highly significant (1% and 5% levels) and positive association with the *TFCD* variable for the areas of governance, strategy, and risk management, for metrics and targets the

significance is lower (10% level). In this last area, the *TCFD* coefficient is lower for *CCI_METR* than for other sub-scores. As previously shown in the descriptive analysis, indeed, information recommended in metrics and targets mostly focuses on outward impacts and is already widely covered even before the adoption of TCFD (*CCI_METR*₂₀₁₆ is 48%).

Financial characteristics also stand out as significant determinants of the extent of TCFD implementation. *SIZE* and *ASSET_GROW* are, indeed, highly significant (1% and 5% levels) and positively associated with *CCI*. However, such relationships can be subject to various alternative explanations. On one hand, this positive association supports the resource orientation of economics-based theories, suggesting that more extensive disclosure is a consequence of having the means to do so. However, this is not supported by the consistent non-significant effect of *ROA* across all the regressions run. Looking at its coefficient, it is possible to observe that it is mostly negative, implying that more profitable firms do not disclose more on their CROs. This finding could be a result of the inherent tensions between short-term profitability and long-term focus of climate change (Ullmann, 1985). On the other hand, the observed significance of size and growth also supports the socio-political theories. High-growth firms could disclose more TCFD information to justify the long-term sustainability of their business strategy. In addition, the more extensive disclosure of larger firms could also be a response to more external pressure and scrutiny, in consequence of their higher visibility (Branco & Rodrigues, 2008).

However, the argument that greater external pressure is associated with higher *CCI* is not supported by other findings, especially by the lack of a significant relationship with proxies of stakeholder pressures. Indeed, Tables 11 and 12 show that *PUBLIC*, *EPI*, and *STATE_PRESS* are consistently not significant. These results do not support H4 and suggest that external drivers do not influence the extent of reporting, contrary to expectations of legitimacy and stakeholder theories. The only exception found is *EPI* which is positive and significant for *CCI_GOV*, possibly indicating that companies in more environmentally sensitive countries disclose more information on their governance processes related to climate issues. However, in this case, the *EPI* coefficient is significant only at a 10% level, so interpretation of this result is limited, especially if analyzed along with the other external pressure proxies.

Moreover, these findings should be interpreted in light of the nature of our sample. First, the European financial sector is highly interconnected, due to common markets and regulatory bodies. This could explain why country-specific characteristics do not act as significant determinants of reporting. Second, it could be argued that this sector is distinct when it comes to stakeholder pressures. Given their high-impact status, all these firms are subject to relatively high pressures since they operate in a tightly regulated environment and need to address the demands of a plethora of stakeholders. Moreover, due to the role of the sector in society (facilitating growth and prosperity), the listing status of these firms

might not be as strong of a determinant of pressure as in other sectors. In contrast, the size of financial institutions is often mentioned as a relevant indicator of their importance. For instance, size is among the criteria used by the FSB to define systemically important financial institutions (FSB, 2011). Therefore, in this context, size could be seen as more influential since it reflects the level of society's concern regarding firm's operations.

Furthermore, the regression results allow us to connect TCFD implementation with other reporting practices, testing H5. In the case of overall *CCI*, we see a positive and significant association (1% level) with *ASSUR*. However, the results are not so straightforward when testing its association with the sub-scores. We find *ASSUR* to be highly significant (1% and 5% levels) just for *CCI_RISKMAN* and *CCI_STRAT*. Its positive association with TCFD implementation could suggest that this practice is not just used for legitimization. Instead, there seems to be a relationship with the overall extent of reporting as well as with strategy and risk management areas which contain the majority of the climate risk disclosures introduced by TCFD. However, despite such association, it needs to be reminded that all external assurance practices observed in our sample are limited and previous academic research suggests that, nowadays, several TCFD topics lack auditability (O'Dwyer & Unerman, 2020). Therefore, the interpretation of such association remains unclear.

Another significant determinant is the presence of a TCFD section. Considered only for observations after adoption, *TCFD_SECT* is positively associated with *CCI*, indicating that companies which include TCFD information in prominent parts of the report achieve a greater compliance level. Moreover, the results show a stronger association with information being included in the additional report (*TCFD_SECT_{stand}*). In line with previous literature, this suggests that these companies want to direct attention to such disclosure through its inclusion in a distinct section of reference documents. Indeed, presenting information in a prominent part of corporate reports is done when environmental issues are considered to be relevant and important for the business (Patten, 2002). Thus, a TCFD section is also used to address possibly higher stakeholders and society's concerns on the matter, supporting socio-political theories.

The above considerations on H5 are not supported by the findings related to *CDP_SCORE* as we observe a positive association with a low level of statistical significance only for overall *CCI* for equation (1). Our results suggest that being a leader in environmental performance, as defined by CDP, might not facilitate better reporting on financial climate-related disclosures. In particular, there is no association with reporting on strategy and risk management, areas where such information is concentrated. Therefore, these findings show that TCFD's inward orientation might be substantially different from CDP's outward focus and being a leader in managing and disclosing own impact is not a predisposition for superior TCFD reporting. Instead, the determinants previously discussed are more influential.

Finally, the coefficient of *INDUSTRY* is not consistently significant across the regressions included in Tables 11 and 12, providing mixed results for H6. Our findings show that this variable is positive and significant at 1% for *CCI_STRAT*, positive and significant at 10% level for overall *CCI* and *CCI_GOV*, and non-significant for *CCI_RISKMAN* and *CCI_METR*. This association is especially pronounced for strategy, showing that insurance firms, on average, tend to have greater compliance with this part of the framework. Such fundamental differences between the sub-sectors could be driven by different exposure to CROs that banks and insurance firms face (TCFD, 2017). Most banks are only directly exposed to CROs through their investment activities. However, their main business (lending and intermediary activities) is indirectly affected by CROs, as the degree of exposure depends on the risk faced by their customers. In contrast, insurance companies are subject to climate risks mostly through their core businesses (e.g. weather-related risk transfer business). Therefore, the findings of greater *CCI* in insurance are consistent with Lemma et al. (2020) who find a positive association between environmental risk exposure and the extent of a firm's environmental disclosure, in support of the socio-political theories.

4.4 Additional Analyses

4.4.1 Analyses specifications

The regression analysis provides an identification of significant determinants of *CCI* which includes both hard and soft disclosures. As previously argued, however, the hard information required by TCFD is particularly interesting, due to its innovative orientation and usefulness for decision-making. Therefore, we conduct supplemental analysis to compare whether the proportion of hard disclosure significantly differs between groups of observations, categorized based on their value for each of the variables significant in the regressions (*SIZE*, *ASSET_GROW*, *ASSUR*, *TCFD_SECT* and *INDUSTRY*). Two sets of tests are carried out to compare the relative hard disclosure scores, a t-test of means and a Wilcoxon rank-sum test, in case of a potential lack of normality (Neuhäuser, 2015; Moore et al., 2016). Since the proportion of hard disclosure is not normally distributed (see Appendix, Figure A2), we rely predominantly on the results of the Wilcoxon rank-sum test.

Some adjustments are made before performing the analyses. For continuous variables, *SIZE* and *ASSET_GROW*, we identify top and bottom quartiles based on their values. The quartiles are depicted in Table 13 respectively with 1 and 0. Moreover, for the only non-binary categorical variable, *TCFD_SECT*, we carry out two analyses. The first compares observations corresponding to either non-existence (indicated as 0) or existence (indicated as 1) of a TCFD section. In the second, we exclude companies' year observations that do not include this reporting practice and only compare the level of hard information depending on where the TCFD section is located. Therefore, in this case, *TCFD_SECT_{fin}* corresponds to its presence in the main report, while *TCFD_SECT_{stand}* to

a TCFD section in the additional report. Finally, for *ASSUR* and *INDUSTRY*, no adjustments are made.

4.4.2 Results

The results shown in Table 13 indicate that firms in the top and bottom quartiles of both *SIZE* and *ASSET_GROW* do not provide significantly different relative hard information.

Table 13. Comparison of means (*SIZE* and *ASSET_GROW*)

	2016-2019	After TCFD Adoption
Mean (<i>SIZE</i> 0)	10.4%	11.2%
Mean (<i>SIZE</i> 1)	10.4%	11.8%
t-test (diff = 0)	0.011 (0.991)	-0.157 (0.876)
t-test (diff < 0)	(0.504)	(0.438)
Wilcoxon	-3.780*** (0.000)	0.985 (0.325)
Observations	88	56
Mean (<i>ASSET_GROW</i> 0)	7.3%	11.9%
Mean (<i>ASSET_GROW</i> 1)	9.1%	8.9%
t-test (diff = 0)	-1.061 (0.291)	1.974* (0.054)
t-test (diff < 0)	(0.146)	(0.973)
Wilcoxon	-1.557 (0.120)	1.919* (0.055)
Observations	98	56

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses.

Moreover, observing Table 14, it is possible to note that there is also no significant difference depending on the existence of external assurance (*ASSUR*). This provides further evidence on the role of this practice already discussed in 4.3.4. Specifically, the results suggest that having external assurance is not associated with more hard disclosure which would improve decision usefulness and completeness of TCFD information. According to previous literature and academic findings, hard information is necessary for informed investment decisions (Al-Tuwaijiri et al., 2004).

Furthermore, our findings (Table 14) highlight that reports with a separate TCFD section contain more hard disclosures. In addition, more hard information can be found when there is a TCFD section in a standalone report than when it is included in the financial filing. This does not support the view of TCFD reporting as a legitimacy tool as if disclosure were purely implemented for legitimizing purposes, the extent of hard

information would not be significantly different. Instead, past literature, in line with economics-based theories, states that hard information is proprietary and would only be divulged if its benefits exceed costs. Therefore, we can argue that these TCFD sections are used to signal superior performance (Clarkson et al., 2008; Cormier & Magnan, 2003).

Table 14. Comparison of means (*ASSUR* and *TCFD_SECT*)

	2016-2019	After TCFD Adoption
Mean (<i>ASSUR</i> 0)	10.6%	14.1%
Mean (<i>ASSUR</i> 1)	7.7%	10.0%
t-test (diff = 0)	0.920 (0.362)	0.899 (0.379)
t-test (diff < 0)	(0.819)	(0.811)
Wilcoxon	-1.246 (0.213)	0.141 (0.888)
Observations	196	115
Mean (<i>TCFD_SECT</i> 0)		8.6%
Mean (<i>TCFD_SECT</i> 1)		12.5%
t-test (diff = 0)		-1.855* (0.068)
t-test (diff < 0)		(0.034)
Wilcoxon		-4.320*** (0.000)
Observations		115
Mean (<i>TCFD_SECT_{fin}</i>)		11.2%
Mean (<i>TCFD_SECT_{stand}</i>)		15.5%
t-test (diff = 0)		-2.601** (0.014)
t-test (diff < 0)		(0.007)
Wilcoxon		-2.888*** (0.004)
Observations		64

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses.

Finally, an industry comparison (Table 15) shows a significant difference in means between banks and insurance firms, with a greater relative provision of hard information in the insurance sub-sector. Such finding could be interpreted in light of many empirical reports attributing insufficient TCFD disclosure to a lack of tools and methods (AMF, 2020; EFRAG, 2020). Due to the previously mentioned differences in the role of climate

risk in financial firms' business models, insurance companies might have, over time, developed better capabilities to integrate climate considerations into their business and operations and to disclose on topics such as climate scenarios or CROs costing. Moreover, as a result of their actuarial business, they are considered to be by far the most experienced part of the financial sector in understanding and managing this new type of risk (IAIS & SIF, 2020). In this perspective, the extent of TCFD implementation would be influenced by competencies and capabilities rather than by the specific motivations discussed by the socio-political or economics-based theories.

Table 15. Comparison of means (*INDUSTRY*)

	2016-2019	After TCFD Adoption
Mean (<i>INDUSTRY Banks</i>)	6.5%	8.9%
Mean (<i>INDUSTRY Insurance</i>)	12.3%	14.6%
t-test (diff = 0)	-2.467** (0.016)	-2.125** (0.040)
t-test (diff < 0)	(0.008)	(0.020)
Wilcoxon	-1.986** (0.047)	-2.476** (0.013)
Observations	196	115

*, **, *** Indicate that the estimated coefficients are statistically significant at the 10%, 5%, and 1% levels, with p-values in parentheses.

5. Conclusion

This thesis provides evidence that European financial companies are increasingly reporting climate-related information, but their aggregate level of TCFD disclosure is still rather low (less than 50% in 2019). In addition, our findings suggest that the information provided by the selected firms may not be sufficient for informed investment decisions. For example, the strategy area, deemed by investors and practitioners to be crucial in evaluating a firm's climate exposure, is implemented only at a 27% level. Moreover, we find a pronounced disparity between soft and hard disclosure which may reduce the completeness and informativeness of TCFD-related information.

Furthermore, TCFD's usability for financial decision-making is also undermined by the low comparability of cross-firm reports. From our analyses, indeed, we show that TCFD information can be found across several reports and is presented in different ways. Such differences further increase variability in reporting practices and reduce their decision-usefulness (Demaria & Rigot, 2021).

Utilizing a multi-theoretical approach, we show that the motivation behind TCFD adoption and the extent of its implementation could be driven by several purposes. First, the TCFD reporting could be used for legitimizing objectives. This view is supported by the positive association of *CCI* with firm size, its growth, and disclosure of more soft information. Accordingly, companies seek support and legitimacy for their operations by disclosing more information but in a qualitative way. By doing so, they can meet stakeholders and society's needs without exposing themselves through the disclosure of hard information. This perspective is also limitedly supported by the positive association of industry with the overall extent of implementation and two of the four sub-scores. Companies belonging to the insurance sector provide a higher quantity of information than banks. As climate risk is crucial for their core business model, they need to address greater external pressures to disclose environmental considerations.

On the other hand, our findings also show the association of the extent of TCFD implementation with external assurance and the presence of a TCFD section, either in the main financial report or in the additional ones. Indeed, according to existing literature, a positive association between the extent of disclosure and external assurance suggests that companies do not use environmental reporting for legitimacy purposes. However, given the limited assurance practices observed as well as the lack of prior specific studies on the role of assurance in TCFD reporting (O'Dwyer & Unerman, 2020), this might not be the case. Moreover, we show that the presence of assurance does not lead to a higher level of quantitative information, further limiting the refutation of the legitimacy theory. Existing literature also links the inclusion of non-financial information in a specific section as a way to emphasize its presence and address stakeholders' concerns. The inclusion of more hard information in reports with a TCFD section suggests not only that companies want to bring attention to content disclosed, but also that they disclose

relatively more useful and complete data. In line with economics-based theories, this could indicate that firms adopt this mode of reporting to shed light on their superior environmental performance.

Lastly, TCFD's innovative nature may require the development of new competencies and capabilities to properly implement its recommendations. This issue is specifically relevant for hard disclosures. Therefore, even though firms recognize the importance of climate change impacts on their business, they may not be able to fully comply with the information required by TCFD. The insurance industry, which is considered to be the best-prepared part of the financial sector, in terms of required skills, to face challenges related to global warming, does still not achieve a considerable level of integration of climate-related considerations with financial information. Nonetheless, insurance companies provide on average relatively more hard information on CROs than banks, possibly confirming that they might be relatively better prepared to integrate climate risk considerations in their financial disclosure.

Given the crucial role of the financial sector in ensuring a smooth transition to a climate-resilient economy, the observed limited disclosure could present a risk to global financial stability. Policymakers and regulators have classified the integration of climate considerations into investment decisions as essential to achieve reallocation of capital and a sustainable future. In this view, our findings point out the two potential practical challenges of TCFD: its voluntary nature and innovative orientation. First, we show how TCFD's voluntary setting allows for flexibility in reporting. As in precedent studies on this type of disclosure, this may result in the merger of soft and hard information, underestimation, or avoidance of disclosure on CROs as well as fragmented reporting modes. Second, TCFD's limited disclosure may occur due to its recent introduction and innovativeness. These characteristics, indeed, can affect companies' ability to disclose general information but in particular hard items. Therefore, there needs to be a significant improvement made in TCFD reporting practices in the European financial sector to achieve useful, informative, and comparable climate-related disclosure.

6. Limitations and Future Research

We acknowledge that this study is subject to several limitations. Nonetheless, they represent possible avenues for future research on TCFD. First, although this study provides a valuable insight into the extent of climate disclosure and its determinants, it is based on a limited sample which bounds its scope. Future academic studies could analyze a larger panel of data including organizations from different financial sub-sectors, such as asset owners and asset managers. However, extending the scope to a larger sample size implies systematically scoring the reports through the 38 identified questions which results in a time-consuming activity. Large scope empirical reports, indeed, can deploy AI to analyze documents (e.g. TCFD status report).

Second, even though this thesis sheds light on different determinants of TCFD implementation, it does not consider the actual climate performance of our sample companies. Therefore, we are not able to comment on the integration of CROs in the business model and strategies pursued by those firms. Environmental performance measures used in other sectors, such as GHG emissions, are less relevant for financial institutions since they mostly consider direct effects, which are relatively small for these firms. Moreover, comprehensive reporting of indirect emissions is still limited. This lack of environmental performance data prevents us from identifying with clarity the reasons why companies might decide to adopt TCFD and the consequent decision to withhold some information. Academic research could, therefore, investigate further the motivation behind these choices, utilizing alternative measures of financial institutions' environmental performance.

Moreover, in light of recent and potentially mandatory TCFD regulations, future studies could explore the implications of this new institutional setting. In this regard, another possible academic direction would be to further study the differences in competencies between banks and insurance companies. As we have shown, firms belonging to the insurance industry disclose more hard information than banks. Therefore, identifying the underlying capabilities of those organizations could be vital for practitioners, policymakers, and governments in developing further guidelines to support climate-related disclosure.

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Appendix

Table A2. Additional TCFD recommendations for banks and insurance industries

	Sub-area	Banks	Insurance
Governance	<i>a) Describe the board's oversight on CROs</i>		
	<i>b) Describe management's role in assessing and managing CROs</i>		
Strategy	<i>a) Describe CROs the organization has identified over the short, medium, and long term</i>	Describe concentrations of exposure to CROs in lending and intermediary activities	Provide quant. info on core business: info at business division, sector, level; potential impacts influence client, cedent, broker selection; if products or competencies related to climate are being developed
	<i>b) Describe the impact of CROs on the organization's businesses, strategy, and financial planning</i>		In scenario analysis: input parameters, assumption and considerations and analytical choices; if exposed to weather-related perils consider a scenario higher of 2 °C; short, medium, long-term milestones as time frames
	<i>c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenario, including a 2 °C or lower scenario</i>		
Risk Management	<i>a) Describe the organization's processes for identifying and assessing climate risks</i>	Characterize climate risks in traditional banking risks (credit, market, liquidity, and operational risks)	Describe the process of identification and assessment of risks on portfolio by geography, business division, and product segments, including physical, transition, and liability risk
	<i>b) Describe the organization's processes for managing climate risks</i>		Describe key tools or instruments (risk models) to develop and price products, range of climate events considered, and how the risk of rising frequency and intensity are managed
	<i>c) Describe how processes for identifying, assessing, and managing climate risks are integrated into the organization's overall risk management</i>		
Metrics and Targets	<i>a) Disclose the metrics used by the organization to assess CROs in line with its strategy and risk management process</i>	Metrics to assess impacts on activities in periods broken down by type, industry, geography, credit quality, tenor credit. Provide amount and % of carbon assets and the amount of lending or other products connected to CROs	Provide aggregated risk exposure to weather-related catastrophes of their property business by the relevant jurisdiction
	<i>b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 GHG emission, and the related risks</i>		
	<i>c) Describe the targets used by the organization to manage CROs and performance against targets</i>		

Table A2. Final sample composition

N	Name	Country	Industry	TCFD Year
1	Danske Bank A/S	Denmark	Banks	2018
2	Evli Bank	Finland	Banks	2019
3	AXA Group	France	Insurance	2017
4	BNP Paribas	France	Banks	2017
5	Crédit Agricole S.A.	France	Banks	2017
6	Société Générale	France	Banks	2017
7	Allianz SE	Germany	Insurance	2018
8	Bayerische Landesbank	Germany	Banks	2019
9	KfW Bankengruppe	Germany	Banks	2018
10	AIB Group plc	Ireland	Banks	2019
11	Assicurazioni Generali S.p.A.	Italy	Insurance	2018
12	Intesa San Paolo	Italy	Banks	2018
13	ABN AMRO Bank N.V.	Netherlands	Banks	2017
14	Aegon N.V.	Netherlands	Insurance	2017
15	ASR Nederland NV	Netherlands	Insurance	2018
16	ING Group	Netherlands	Banks	2017
17	NN Group	Netherlands	Insurance	2017
18	Rabobank	Netherlands	Banks	2017
19	Van Lanschot Kempen	Netherlands	Banks	2018
20	DNB ASA	Norway	Banks	2017
21	Sparebank 1 Forsikring AS	Norway	Insurance	2019
22	Storebrand ASA	Norway	Insurance	2017
23	Banco Santander	Spain	Banks	2017
24	Bankia	Spain	Banks	2018
25	Bankinter	Spain	Banks	2019
26	BBVA	Spain	Banks	2017
27	CaixaBank	Spain	Banks	2017
28	Ibercaja Banco	Spain	Banks	2019
29	Handelsbanken	Sweden	Banks	2018
30	Länsförsäkringar AB	Sweden	Insurance	2018
31	Nordea Bank Abp	Sweden	Banks	2018
32	SEB	Sweden	Banks	2018
33	Swedbank	Sweden	Banks	2018
34	Bank J. Safra Sarasin Ltd.	Switzerland	Banks	2019
35	Credit Suisse Group AG	Switzerland	Banks	2017
36	Swiss Life Holding AG	Switzerland	Insurance	2018
37	Swiss Re Ltd.	Switzerland	Insurance	2017
38	UBS Group	Switzerland	Banks	2017
39	Zurich Insurance Group	Switzerland	Insurance	2017
40	Aon	United Kingdom	Insurance	2018
41	Aviva plc	United Kingdom	Insurance	2017
42	Barclays	United Kingdom	Banks	2017
43	EBRD*	United Kingdom	Banks	2018
44	HSBC Holdings plc	United Kingdom	Banks	2017
45	Legal & General Group PLC	United Kingdom	Insurance	2019
46	Lloyds Banking Group	United Kingdom	Banks	2017
47	RBS	United Kingdom	Banks	2017
48	Standard Chartered	United Kingdom	Banks	2017
49	Standard Life Aberdeen plc	United Kingdom	Insurance	2017

*EBRD = European Bank for Reconstruction and Development

Table A3. Questions used to build the Compliance Climate Index

Governance	Strategy	Risk Management	Metrics and Targets
<i>a) Describe the board's oversight on CROs</i>	<i>a) Describe CROs the organization has identified over the short, medium, and long term</i>	<i>a) Describe the organization's processes for identifying and assessing climate risks</i>	<i>a) Disclose the metrics used by the organization to assess CROs in line with its strategy and risk management process</i>
1) Is the board informed about climate issues?	1) Accuracy of CRO periods	1) Are the processes for identification and evaluation of CRO presented?	1) Indicators related to energy consumption, water, waste management, etc.
2) How often?	2 - 4) Details and costing of CROs by period*	2) What is the materiality?*	2) Indicator similar to an indicator for managing business risks*
3) Are climate topics taken into account in the evaluation and orientation of strategy?	5) Distribution of CRO at the sector and geographical levels*	3) Are current and potential regulations taken into account?	3) Assessment of an internal carbon price*
4) How does the board assess the progress?	6) Impact of CRO on the company's business and strategy	4) Existence of a materiality study	4) Evolution of the above indicators
Total: 4 points	Total: 4 points	Total: 4 points	Total: 4 points
<i>b) Describe management's role in assessing and managing CROs</i>	<i>b) Describe the impact of CROs on the organization's businesses, strategy, and financial planning</i>	<i>b) Describe the organization's processes for managing climate risks</i>	<i>b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 GHG emission, and the related risks</i>
5) Variable management remuneration linked to climate indicators?	7) Identification of impacts?*	5) Description of management of climate-related risks	5) Carbon footprint, GHG emission - Scope 1 and 2
6) What are the responsibilities of managers related to climate change?	8) How are they integrated?	6) What are the priorities identified?	6 - 7) GHG emissions of Scope 3 and details of significant elements
7) Climate information feedback process	9) Description of CAPEX and OPEX related to CRO*		8) Evolution of Scope 1, 2, and 3 indicators
8) How does the management manage climate issues?			
Total: 4 points	Total: 3 points	Total: 2 points	Total: 4 points
	<i>c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenario, including a 2 °C or lower scenario</i>	<i>c) Describe how processes for identifying, assessing, and managing climate risks are integrated into the organization's overall risk management</i>	<i>c) Describe the targets used by the organization to manage CROs and performance against targets</i>
	10) Study of the resilience of the business model		9) Are objectives posted for - consumption and carbon price indicators?
	11) Analysis of different scenarios*		10) Are objectives posted for - Scope 1, 2, and 3 indicators?
	12) Horizon of these scenarios*		
	13) Conclusion of the scenario analysis*		
	Total: 4 points	Total: 1 point	Total: 2 points

*, indicates hard questions

Table A4. Extract of database built during coding process (Swedbank, year 2019)

Area	Question details	Info included	Page	Report	Suggested points
Governance	<i>Q1. Is the board informed about climate issues?</i>	Board is ultimately responsible for sustainability by adopting policies	194	M	1
	<i>Q2. How often?</i>				0
	<i>Q3. Are climate topics taken into account in the evaluation and orientation of strategy?</i>	Implementation of sustainability issues in the main processes (fund management, payments, lending, and procurement) identified as one of the major issues discussed by the board throughout the year	39	M	1
	<i>Q4. How does the board assess the progress?</i>				0
	<i>Q5. Variable management remuneration linked to climate indicators?</i>				0
	<i>Q6. What are the responsibilities of managers related to climate change?</i>	Have separate business areas are responsible for integrating sustainability into their processes and work Indicate the presence of a sustainability group on the senior management level define the policies and oversee the work of the business	44, 197	M	1
	<i>Q7. Climate information feedback process</i>	Sustainability function responsible for reporting and monitoring on sustainability issues (including climate change-related risks)	197	M	0.5
	<i>Q8. How does the management manage climate issues?</i>	Sustainability group - coordinates work in business areas with expertise and support from group functions, such as Risk, Credit, and Finance	21	M	1
Abbreviations: M, main financial report					4.5

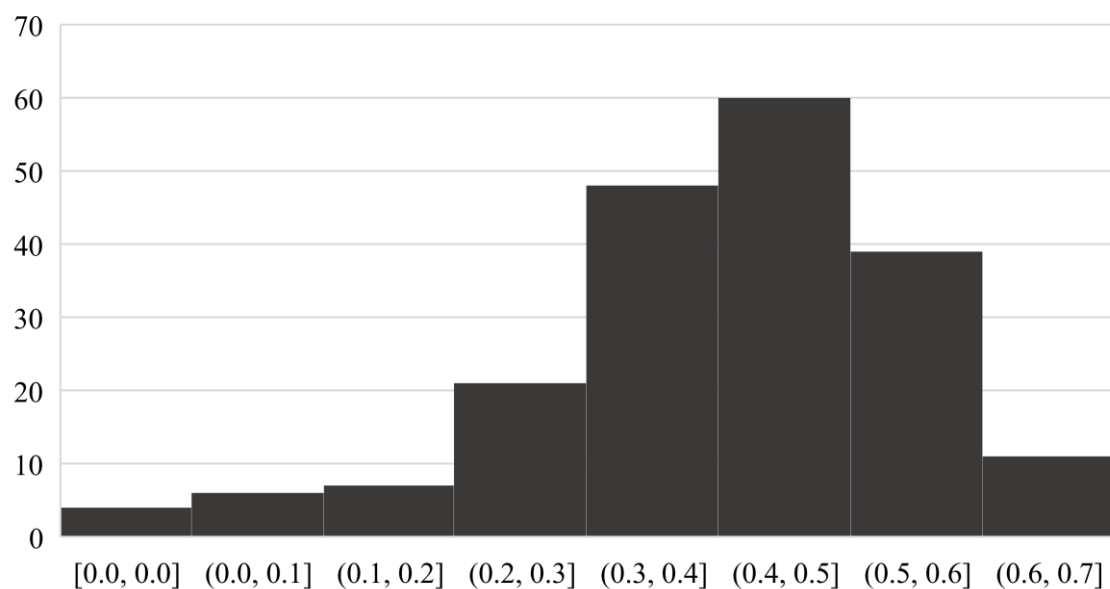


Figure A1. Distribution of differences of total hard and soft disclosures

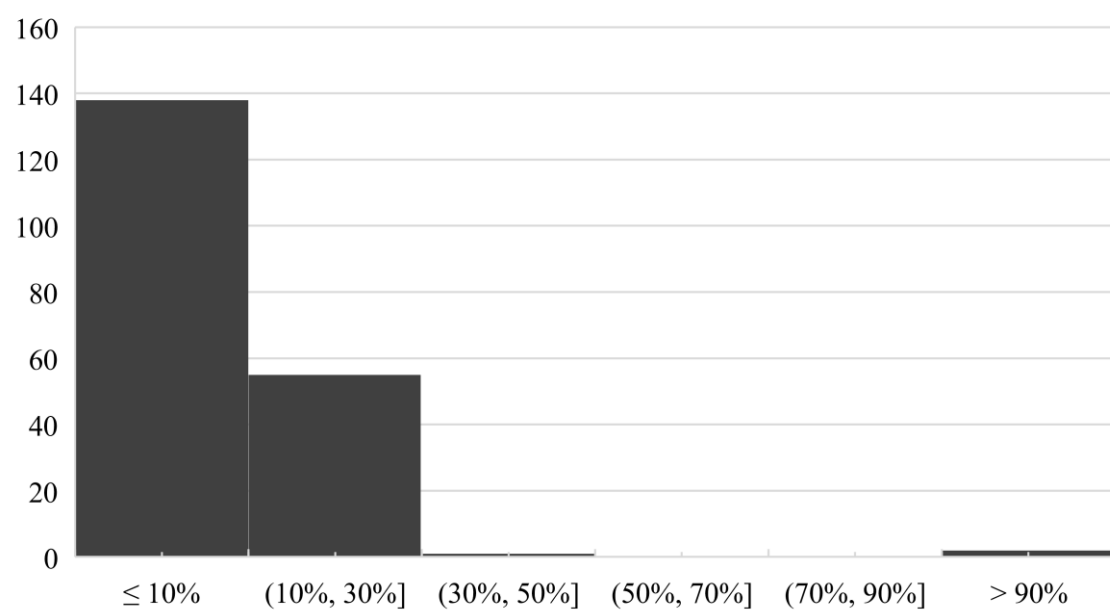


Figure A2. Distribution of hard information