Thesis:

“Climate Change Disclosures in Family Firms”

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ABSTRACT

Global warming imposes significant physical, regulatory and reputational risks to listed corporations. Consequently, climate-related issues have recently received increased attention from investors, creditors and stock market regulators. In February 2010, The United States (US) Securities and Exchange Commission (SEC) issued an interpretative guidance requiring publicly listed firms to disclose material climate change risks (CCR) in their annual securities filings (10Ks). However, considering the level of enforcement and managerial discretion in the definition of materiality, market participants raised concerns about the lack and quality of CCR disclosure. This research explores the effects of family control as an important determinant of CCR disclosure strategies. Family firms are the world's most common form of economic organizations, dominating the global economy. The socioemotional wealth (SEW) theoretical perspective argues that family firms behave differently from their nonfamily counterparts and exhibit significant heterogeneity depending on the level of family control and involvement. Using a sample of S&P 500 companies, I examine whether family firms differ from their non-family peers in their climate change disclosure strategies. Additionally, I further explore the effects of two dimensions (i.e. family control and influence, family identity) of socioemotional wealth on CCR disclosures. Overall, I find that family ownership has no impact on CCR disclosure decisions, but is negatively related to CCR disclosure quality. Moreover, I find a positive relationship between family firms prioritizing family identity and CCR disclosure quality. The findings of this research have implications for regulators, investors, and academic researchers.

1. Introduction

This paper focuses on climate change disclosures in family firms. Climate change problems call for extra attention from investors, creditors and regulators since global warming poses a tremendous threat to human society. This sustainability issue exerts a great influence on the accounting field, leading to increased carbon management practices, climate-related risks assessment and investors' demand for enhanced disclosures about these risks (Solomon et al., 2011).

In February 2010, The US Securities and Exchange Commission (SEC) issued a guidance requiring publicly listed firms to disclose climate change risks (CCR) in their annual securities filings (10Ks) if they are material to their operations. However, managers still enjoy significant discretion in the definition of materiality, which makes climate change disclosures a more complex decision. Further, in the absence of enforcement of climate change disclosures by the SEC, it is hard to judge whether such disclosure is voluntary or mandatory (Matsumura et al., 2017). Therefore, it is important to examine the determinants of climate change disclosures in 10Ks.

This research focuses on family ownership and control as a potential determinant of CCR disclosures for several reasons. Family firms are the world's most common form of economic organizations, dominating the global economic landscape (La Porta et al., 1999). Nearly 70 percent of all firms worldwide are family-owned or family-managed (Prencipe et al., 2014). Due to this high importance, there is an increasing interest in conducting family firm research. The emergence of this field of research lies in the fundamental assumption that family firms behave differently from nonfamily firms, and that behaviors of different family firms also vary from each other (Chrisman et al., 2006). It is argued that family firms differ from nonfamily firms in terms of ownership structure, agency problem, etc. More importantly, the heterogeneity among family firms exists, which reflects in different dimensions of the socioemotional wealth (SEW) (Berrone et al., 2012; Gomez-Mejia et al., 2014).

Using a sample of S&P 500 companies, I first examine whether family ownership exerts an influence on climate change disclosures. Next, relying on the SEW approach, I focus on two dimensions of SEW (i.e. family control and

influence, family identity) to see whether different dimensions of SEW impact climate change disclosure decisions. Overall, I find that family ownership has no impact on CCR disclosure decisions, but is negatively related to CCR disclosure quality. Moreover, I find a positive relationship between family firms prioritizing family identity and CCR disclosure quality.

This paper makes several contributions to the extant literature on climate change disclosures and family firms. First, prior literature examines the determinants of climate change disclosures but does not consider the family ownership as a potential determinant (Cotter and Najah, 2012; Jira and Toffel, 2013; Comyns, 2016). This paper extends the literature on climate change disclosures by assessing whether family firms differ from nonfamily firms in terms of climate change disclosures. Studying family ownership is of great significance, given that family firms dominate the global economy and have distinctive characteristics. These family firm characteristics are argued to affect risk management and reporting practices (Chen et al., 2008; Cabeza-García et al., 2017).

Second, to the best of my knowledge, this paper is the first to investigate climate change disclosures in family firms. Previous studies on reporting practices in family firms focus on financial reporting (Gomez-Mejia et al., 2014), CSR disclosure (Campopiano and Massis, 2015; Cabeza-García et al., 2017), etc. I intend to investigate climate change disclosures because GHG emissions impose a threat on human lives (Luo et al., 2012) and climate change-related risks may have economic consequences.

Third, following Matsumura et al., (2017), I study the CCR in 10-K filings after the issue of SEC 2010 guidance, rather than the voluntary climate change disclosures in the Carbon Disclosure Project (CDP) annual questionnaire (Luo et al., 2012; Ben-Amar et al., 2017). This paper contributes to the discussion about whether CCR disclosure is mandatory or voluntary, and understanding family members' disclosure decisions. In addition, it provides insights for regulators about how to enhance the guidance to better serve the needs of companies and investors.

Finally, this paper not only explores the difference between family firms and nonfamily firms, but also sheds light on the heterogeneity among family

firms. I select family control and influence and family identity in SEW to capture the heterogeneity because these two dimensions are most sensitive to stakeholder claims (Gomez-Mejia et al., 2014; Arena and Michelon, 2018).

The remainder of this paper unfolds as follows. First, I review the extant research on family control and climate-related disclosures, and put forward my hypotheses. Next, I present my research design, including sample, variables, and regression models. Then, I discuss the empirical results and additional tests. Lastly, I draw conclusions and implications, as well as pointing out the limitations of this paper.

2. Literature Review and Hypothesis Development

In this section, I first review the literature on family firms, especially family firm characteristics, family firm performance, and corporate disclosure in family firms. Second, I summarize accounting research on climate change disclosure, with a focus on determinants and economic outcomes. Finally, I put forward my research hypotheses.

2.1 Research on Family Firms

Defined as firms managed or controlled by founding families, family firms exist worldwide and play a prominent role in the global economy (Prencipe et al., 2014). In US, they represent over 35 percent of the S&P 500 Industrials (Anderson and Reeb, 2003). While in European countries, family firms are far more prevalent. For instance, In France, family firms account for 83% of all the businesses. The percentage is around 79% in German businesses (Prencipe et al., 2014). Despite the prevalence and significance of family firms, they didn't receive substantial attention from researchers until last few decades.

2.1.1 Family Firm Characteristics

Previous literature summarizes some main features that characterize family firms. First, family owners can make firms pursue their own interests due to their sufficient power (Anderson and Reeb, 2003).

The second feature that separates family firms from non-family firms is the role of non-economic factors, such as the strong emotional overtone. Families

share a wide variety of emotions, including intimacy, love, and happiness. These emotions gradually permeate a firm's daily affairs. Therefore, the identity of family members is closely tied to the firm, which suggests that external perception of the firm greatly affects family members' reputation. (Gomez-Mejia et al., 2011; Chen et al., 2010). Owing to this strong emotional attachment, the preservation of family control and firm reputation becomes the main reference point in decision-making (Prencipe et al., 2014). Furthermore, succession is another distinguishing non-economic factor between family and nonfamily firms. It refers to families' desire to preserve the business in the long term and thereby, pass it to the next generation (Anderson and Reeb, 2003; Gomez-Mejia et al., 2011). Consequently, instead of maximizing economic profits, family firms are more inclined to focus on these noneconomic factors.

The final feature is the relationship between owners and managers in family firms. Typically, managers in family firms are family members, or someone who is in close personal relationship with family members (Prencipe et al., 2014). As Miller and Le Breton-Miller (2006) argued, family managers have longer job tenure compared with managers in nonfamily firms. Hence, in order to maintain the position for the long-term, family managers are more devoted to the firm and work for the continuity of the enterprise even at the sacrifice of short-term benefits. Moreover, in terms of corporate governance in family firms, family owners have more incentives to monitor managers since their interests are closely associated with the firm. They are also actively involved in firm's activities and consequently, possess superior knowledge about the firm which enables them to better monitor managers (Anderson and Reeb, 2003).

In accordance with the above-mentioned features of family firms, four theoretical frameworks are widely adopted in extant literature to study family firms: agency theory, stewardship theory, the resource-based view (RBV), and socioemotional wealth (SEW) theory. According to the review paper written by Prencipe et al. (2014), researchers show preference for agency theory while explaining accounting and reporting issues in family firms.

Agency theory deals with conflicting interests and the information asymmetry problem between principals (shareholders) and agents (managers). This theory particularly focuses on the risk of manager's opportunistic behaviors,

which could bring about moral hazard and adverse selection problems. Subsequently, agency costs increase. Two types of agency problems are identified by Ali et al. (2007): separation between management and ownership (Type l agency problem) and conflicts between large shareholders and other owners (Type II agency problem).

It is generally recognized that family firms are exposed to less severe Type I agency problem because family managers have lower risk of opportunistic behaviors. Further, given their excellent knowledge of the firm, family owners are able to monitor the managers more efficiently (Prencipe et al., 2014; Ali et al., 2007). This phenomenon complies with the 'alignment effect' put forward by Wang (2006). However, the dominant position of family members in both board and management enables family owners to pursue their own interests at the cost of other shareholders' benefits, which gives rise to more severe Type II agency problem. This issue is described as 'entrenchment effect' by Wang (2006).

An emerging theory that is frequently employed to study family firms is called socioemotional wealth approach (Gomez-Mejia et al., 2007; 2011). This concept derives from behavioral agency theory and assumes that decision-making in family firms is mostly driven by the preservation of socioemotional wealth (Gomez-Mejia et al., 2011; Prencipe et al., 2014). Socioemotional wealth theory, initially developed by Gomez-Mejia et al. (2007), places emphasis on noneconomic factors such as strong emotional overtone, family value, and altruism. Recently, an increasing number of articles incorporate this theoretical framework, providing support for the applicability of this concept in family firms (Prencipe et al., 2014).

2.1.2 The Effect of Family Control on Firm Performance

Given the prevalence and importance of family firms, Anderson and Reeb (2003) examine the relationship between family ownership and firm performance. Previous literature provides two insights about the influence of family ownership. On one hand, founding families have the power and incentives to pursue their own interests at the expense of firm performance. On the other hand, family ownership is likely to bring about some advantages to the firm because founding families possess better monitoring power and are motivated to

maximize the firm value. Results show that family firms perform better than non-family firms, in favor of the second insight which gives prominence to the benefits of family ownership. Anderson and Reeb (2003) further suggest that family firms have greater profitability if a family member holds the post of the CEO.

Focusing on public family firms in Taiwan, Chu (2011) finds results consistent with Anderson and Reeb (2003). As shown in this paper, family ownership is positively related to firm performance. This relationship becomes stronger when family members hold positions in top management teams (TMTs) or on board of directors. Moreover, this positive relationship between family ownership and firm performance is weaker in large firms than in small-and medium-sized enterprises (SMEs).

2.1.3 The Effect of Family Control on the Adoption of CSR Practices

2.1.3.1 Concept of CSR

The booming development of globalization and the constant deterioration of the environment bring about tremendous challenges to modern organizations. In face of such challenges, firms are supposed to meet expectations from the society and stakeholders with a long-term horizon, instead of focusing on short-term benefits.

In 1979, Carroll defined four-part obligations that firms are expected to fulfill: economic responsibility, legal responsibility, ethical responsibility, and discretionary responsibility. The first two responsibilities imply that organizations should obtain economic goals within the legal framework. Ethical responsibility refers to behaviors and ethical norms that organizations are expected to follow but not required by law. Finally, discretionary responsibility represents obligations that are decided by corporate and managers' judgement.

2.1.3.2 CSP in Family Firms

Carrol (1999) points out that alternative themes such as corporate social performance (CSP), corporate social responsiveness, business ethics, etc., attracted researchers' attention in the 1980s, and took center stage in the 1990s.

In the 2000s, research on CSR entered a relatively mature phase (Wang and Gao, 2016). During this period, CSR is well combined with various disciplines,

such as accounting, marketing, and management. As one of the well-researched topics in accounting literature, several studies have documented that corporate governance is associated with CSR (Young and Thyil, 2012). Considering family firms' unique characteristics in management and governance, it is worth examining whether family firms differ from nonfamily firms in terms of CSR-related themes.

Among the extant literature on CSP, a limited number of articles investigate the CSP in family firms (Dyer and Whetten, 2006; Bingham et al., 2011). The extant results are mixed as pointed out by Labelle et al. (2018). For example, Dyer and Whetten hold the view that S&P family firms are no more likely than nonfamily firms to undertake positive CSR activities, whereas they avoid activities that could do damage to their firm image.

But Bingham et al. (2011) document notable differences between family and nonfamily firms in both social initiatives and social concerns on the basis of organizational identity theory. Organizational identity is described by the authors as 'the organization's self-conception or self-definition as characterized by organization-specific attributes' (Bingham et al., 2011, p.567). Following organizational identity theory, firms can be labeled with one, or a combination, of three identity orientations: individualistic, relational, and collectivistic.

Firms with individualistic orientation are self-interested. They undertake social responsibility to gain legitimacy and to distinguish from other entities, which provide them with competitive advantages. Whereas, firms that are relation-oriented care more about the interactions between firms and particular stakeholders. Finally, firms that adopt collectivistic orientation view their relationships with stakeholders as interdependent. These firms take the collective interests of stakeholders into account when making strategic decisions.

Nonfamily firms are generally considered to have an individualistic identity orientation while family firms are more inclined to take a more relational identity orientation. Therefore, family firms are as likely as nonfamily firms to avoid social concerns, but more likely to maintain a favorable relationship with particular stakeholders through positive social initiatives. The authors further argue that the greater family involvement within a family firm, the higher the level of CSP towards certain stakeholders such as community,

which is due to the fact that family firms may turn to collectivistic orientation in pace with the increase of family involvement.

Apart from mixed results, another existing problem regarding CSP in family firms is that this line of research is too general and does not go deeper into the SEW theory. Therefore, Labelle et al. (2018) utilize two widely accepted perspectives to explore the relationship between family firms and CSP. These two theoretical perspectives are agency theory and socioemotional wealth theory respectively. Borrowing arguments from agency theory, Labelle et al. (2018) hypothesize that family firms are more inclined to invest in costly CSR activities and family members need to assume a large proportion of this cost. In contrast, within the SEW approach, there should be a positive relationship between family firms and CSP since family members are supposed to meet stakeholders' expectations about CSP and preserve SEW for the long-term benefits. In the end, the authors find that family firms exhibit lower CSP than nonfamily firms, which is in agreement with agency theory. Furthermore, while concentrating on the heterogeneity in family firms, Labelle et al. (2018) discover a curvilinear relationship between family control and CSP. This is because when family control increases, family owners face less pressures from stakeholders and are reluctant to bear the huge investment in CSR. In addition, Labelle et al. (2018) extend this relationship into the international setting and conclude that family firms in stakeholder-oriented countries pay more attention to social concerns than those in shareholder-oriented countries.

2.1.4 The Effect of Family Control on Corporate Reporting Practices

2.1.4.1 Financial Reporting Practices

In modern society, investors are commonly faced with two problems when making their investment decisions, which hinders the effective allocation of resources in the capital market. The first problem is information asymmetry between managers and investors. Realizing managers' incentives to raise capital, investors are inclined to treat both good and bad investment equally. Accordingly, good investment will be undervalued, whereas bad investment will be overvalued in capital market. The second problem refers to agency problem, which stems from the separation between ownership and management. As

mentioned before, managers are self-interested and intend to expropriate investors' funds in pursuit of their own interests.

Several solutions identified by Healy and Palepu (2001) to deal with information asymmetry and agency problem: optimal contracts between investors and managers, board of directors, information intermediaries, and disclosure. Disclosure is considered to play an essential role in mitigating these problems and maintaining an efficient capital market by conveying information between managers and investors. That's why corporate disclosure has been a hot issue for a long period of time.

Research on financial reporting in family firms primarily focuses on three issues: earnings quality, earnings management, and voluntary disclosure.

2.1.4.1.1 Earnings Quality in Family Firms

Users of financial reporting care about not only the financial numbers but also the quality of financial statements. Salvato and Moores (2010) define earnings quality as: 'the relevance of earnings in measuring firm performance, and is generally gauged by assessing the informativeness of reported numbers, the level of disclosure, and the degree of compliance with accepted accounting standards' (p.196).

As discussed earlier, an array of theoretical frameworks (e.g. agency theory) are employed by researchers to explain the difference in accounting practices between family and nonfamily firms. Research on earnings quality in family firms typically focuses on agency theory. It has been documented that family firms have less severe Type l agency problem compared with nonfamily firms. Therefore, nonfamily firms will compensate their managers according to corporate earnings-performance to mitigate this problem. However, family owners are more informed of managers' individual performance by direct monitoring. As a result, family owners are more likely to remunerate their managers based on managers' efforts. Additionally, family owners have a better knowledge about their business, which lowers the risk of managers' opportunistic behaviors.

The arguments above indicate that the earnings quality is lower in nonfamily firms than in family firms (Ali et al., 2007). Similarly, Wang (2006)

also argues that family firms should have higher earnings quality. In light of alignment effect, family owners are equipped with better monitoring power, which accelerates decision making process and creates long-term employee loyalty. And family firms attach more importance to long-term benefits and firm reputation, so they are less likely to involve in manipulating corporate earnings.

When it comes to the Type II agency problem, it implies a totally different conclusion that earnings are more likely to be manipulated in family firms, which is consistent with the perspective of the entrenchment effect. Accounting for a large proportion of corporate shares, family owners have the opportunity to easily manipulate earnings for their own interests. For example, they may do so to hide the bad consequence of a transaction with related parties. It is also possible that family owners do the manipulation to maintain family members' position in management position (Ali et al., 2007). In addition, according to the entrenchment effect, the monitoring is ineffective in family firms since family members hold crucial positions both in management team and on board of directors. This monitoring problem along with the information asymmetry between family owners and other shareholders raises the risk of earnings manipulation (Wang et al., 2006).

Taking advantage of SEW model, Gomez-Mejia et al. (2014) examine how two dimensions of SEW influence financial reporting decisions in family firms. As discussed earlier, SEW theory assumes that preservation of socioemotional wealth is the main reference point when family members make strategic decisions. More importantly, family firms oriented by different dimensions of SEW are supposed to respond differently to financial reporting decisions (Berrone et al., 2012; Gomez-Mejia et al., 2014). Gomez-Mejia et al. (2014) document that when family control and influence dimension is more salient, family members are more likely to manipulate earnings to preserve their controlling position. However, if family firms are oriented by family identity dimension, in order to protect the firm reputation, they are more willing to disclose accounting information of higher quality.

To conclude, different theories provide different perspectives for earnings quality. Even though most evidence is in favor of the positive relationship between family involvement and earnings quality (Ali et al., 2007; Wang, 2006),

some articles argue that earnings quality in family firms is lower compared with nonfamily firms (Ho and Wong, 2001; Prencipe et al., 2008; Yang, 2010). Therefore, earnings quality in family firms is not a simple 'either/or' question. Considering different reference points of family firms is of great significance. (Gomez-Mejia et al., 2014).

2.1.4.1.2 Voluntary Disclosure

Due to the existence of information asymmetry and agency problem, extant literature on voluntary disclosure assumes that shareholders prefer more voluntary disclosure. However, not all shareholders have the same preference (Chen et al., 2008). As the most common type of large shareholders, family ownership is supposed to have an impact on voluntary disclosure.

Ali et al. (2007) conclude that family firms are more willing to disclose bad news through earnings forecasts but less likely to provide voluntary information about corporate governance practices. Hence, following this line of research, Chen et al., (2008) further explore this relationship between family firms and voluntary disclosure.

Considering some distinguishing features of family firms, such as long-term investment horizon, less severe Type l problem, and more effective monitoring, Chen et al. (2008) hypothesize that family firms prefer less voluntary disclosure. However, the benefits of voluntary disclosure (e.g., reduce the cost of capital, lower information risk) and the cost of withholding bad news motivate family owners to voluntarily disclose more information. After the empirical analysis, the authors find that family firms disclose more about earnings warnings but less about earnings forecasts and conference calls.

The emergence of SEW theory provides new insights on voluntary disclosure in family firms. Gomez-Mejia et al. (2014) focus on two specific dimensions of SEW to explain the heterogeneity among family firms in terms of financial reporting decisions. When 'family control and influence' dimension is more salient, family owners will avoid disclosure of extra information to reduce the risk of threatening family controlling status. Whereas, if firms are more oriented with 'family identity' dimension, they would prefer more voluntary disclosure in order to preserve firm's reputation and image. Besides, litigation

concerns will arise because of failure to warn for bad news, which is more detrimental to family firms that regard 'family identity' as the main reference point.

2.1.4.2 Non-financial Reporting Practices

2.1.4.2.1 CSR Disclosure in Family Firms

In recent years, instead of merely focusing on corporate financial information, stakeholders nowadays also attach great importance to a firm's environmental and social performance. The mounting interest in CSR increases the demand for CSR disclosure. CSR reporting is mostly voluntary in most countries, whereas it has become mandatory especially in European countries. For instance, all public firms in France were enforced to issue CSR reports in 2003 (Tschopp and Huefner, 2015). CSR reporting was mandated in Spain in 2014 after the implement of Directive 2014/95/EU (Cabeza-Garcia et al., 2017).

Some of the extant studies explore the antecedents of CSR disclosure, including firm characteristics, contextual factors, and internal factors (Campopiano and Massis, 2015; Cabeza-Garcia et al., 2017). Among firm characteristics, shareholder structure is identified as one potential antecedent. Therefore, as the most common type of large shareholders, family owners are expected to exert an influence on firm's CSR reporting. However, literature on family involvement and CSR reporting is very scarce (Cabeza-Garcia et al., 2017), which leaves much room for future work.

Based on the above-mentioned features, family firms have less severe information asymmetry problem and more effective monitoring power. Besides, in light of discussions regarding voluntary disclosure in family firms, there is no need for family firms to issue CSR reports unless the benefits of disclosure outweigh the costs of doing so. But from the perspective of SEW theory, family firms are more likely to disclose CSR efforts in order to build the firm's reputation and be recognized by stakeholders (Cabeza-Garcia et al., 2017; Campopiano and Massis, 2015; Berrone et al., 2010; Chen et al., 2008; Bingham et al., 2011).

Cabeza-Garcia et al. (2017) reach three conclusions in terms of family involvement and CSR reporting. First, family ownership/governances reduce

CSR disclosure. Further, their results indicate that other family members as second-largest shareholder strengthens this negative relationship, while foreign investors as second-largest shareholder can reduce the negative effect of family control on CSR disclosure.

2.1.4.2.2 Environmental Disclosure in Family Firms

As discussed before, the distinguishing features of family firms exert a significant influence on corporate disclosure decisions, including earnings quality, voluntary disclosure, CSR disclosure, etc. However, to the best of my knowledge, there is scarce research on the environmental disclosure in family firms.

Until recently, Arena and Michelon (2018) focus on the association between family firms and their environmental disclosure practices based on socioemotional wealth perspective. Besides, they also explore whether firm's life cycle stage moderates this relationship. Results show that family firms disclose less environmental information than nonfamily firms when family control and influence SEW dimension is the main reference point. This relationship is moderated throughout the firm's life cycle stage. Yet, if family identity SEW dimension is more salient, which typically appears in middle-aged stage, family firms would disclose more information about their environmental commitment than nonfamily firms.

In terms of environmental performance in family firms, Berrone et al. (2010) suggest that firms have diverse environmental performance in response to homogenous pressures from institutions. This variation in responses can be attributed to the considerations of firm's controlling party. Furthermore, as pointed out by the authors, adopting an environment-friendly policy could incur higher economic risk. That is to say, except from economic benefits, non-economic advantages help explain firm's environmental performance. Accordingly, building on socioemotional wealth perspective, the authors find that family firms have a better environmental performance than nonfamily firms for the protection of SEW. In addition, Berrone et al. (2010) demonstrate that firm's environmental policy is also affected by the association between top executives and dominant controllers. More specifically, CEO's stock ownership is

negatively related to environmental performance in nonfamily firms, but not in family firms.

Samara et al. (2018) recognize an increasing research interest on this topic. However, the arguments and results are mixed, and no article ever considers how heterogeneity among family firms impacts this relationship. By conducting qualitative comparative analysis, Samara et al. (2018) figure out two governance configurations that can accelerate the environmental social performance of family firms regardless of institutional changes: 1) the combination of 100% family ownership, first generation leadership, high family presence on the board, and low family involvement in management; and 2) the combination of 100% family ownership, first generation leadership, high family involvement in management, and the presence of outside directors on the board.

2.2 Research on Climate Change Disclosures

Human activities put tremendous pressures on natural environment, bringing about an array of detrimental outcomes, including climate change, water scarcity, air pollution, etc. (Solomon et al., 2011). Among these environmental problems, extra attention is given to climate change issues as global warming is threatening regular operations of companies. Climate change has been studied in various areas, such as agriculture, tourism, energy, human health and so on. However, there is limited research on climate change issues in accounting (Guo and Yang, 2017).

Hahn et al. (2015) reviewed prior research on carbon disclosures. They summarized the related papers into three areas: determinants, outcomes, and regulations of carbon disclosures. Among these three areas, more than half of the chosen articles focus on the determinants of climate change reporting.

2.2.1 Determinants of Climate Change Disclosures

The determinants of climate change disclosures could be mainly divided into four categories: economic, ecological, regulatory, and disclosure determinants (Hahn et al., 2015). Besides these categories, other factors such as environmental management systems (EMS), ownership structure, and board of directors are also found to have an influence on carbon disclosure.

[Insert Table 1]

Table 1 (adapted from Hahn et al., 2015) presents the literature on the determinants of carbon disclosure. In terms of economic determinants, which are often applied as control variables, we can find that most of the studies report insignificant findings about the relationship between financial performance and carbon disclosure (Choi et al., 2013; Cotter and Najah, 2012). In the same vein, the relationship between leverage and carbon disclosure is demonstrated by most researchers to be insignificant (Choi et al., 2013; Freeman and Jaggi, 2005). While a majority of articles show a significantly positive relationship between size and carbon disclosure (Luo et al., 2012; Cotter and Najah, 2012; Ben-Amar et al., 2017).

Ecological determinants include measures of emissions and the membership in a carbon-intensive industry. Previous studies report a positive relationship between carbon emissions and carbon disclosure (Apergis et al., 2013), namely, the greater the carbon emissions, the higher possibility of carbon disclosure. However, some researchers find this relationship insignificant (Jira and Toffel, 2013). These mixed results can be explained by the difference in research contexts and industries, or by the disparate measures of carbon emissions. The other ecological determinant is the membership in a carbon-intensive industry. Carbon-intensive industry largely relies on carbon emissions, and is more directly and significantly affected by climate change issues. The results are mixed as all possible results (negative, positive, and insignificant) are found (Yu and Ting, 2012; Jira and Toffel, 2013; Amran et al., 2014). As pointed out by Hahn et al., (2015), this can be explained by the methodological issues. For example, Choi et al., (2013) discover a positive relationship between carbon-intensive industry and carbon disclosure by using a self-created index from a content analysis of corporate reports. Whereas, Yu and Ting (2012) find a negative relationship because they rely on the disclosure score calculated by CDP based on how thoroughly these firms respond to the CDP questionnaire. Moreover, Jira and Toffel (2013) utilize a binary variable that describes whether a firm answers the CDP questionnaire or not to measure the carbon disclosure, and contend that there is no significant relationship between carbon-intensive industry and carbon disclosure.

The third category of determinants refers to the regulatory determinants. Based on the review paper by Hahn et al., (2015), a large number of articles focus on the influence of Kyoto Protocol (Freeman and Jaggi, 2005; Jira and Toffel, 2013). Kyoto Protocol is an international treaty that commits state parties to reduce GHG emissions in face of the increasingly serious global warming problem. First adopted in Kyoto, Japan, this treaty currently has 192 parties involved[1]. From Table 1 we can find that these articles provide evidence supporting that firms headquartered in signatories of the Kyoto Protocol disclose more carbon-related information. Aside from Kyoto Protocol, other regulations and projects also play an essential role in shaping the decision on carbon disclosure.

Carbon Disclosure Project (CDP), initiated by institutional investors, is one of the world's largest channels to exercise pressure on corporations to issue climate related information through a questionnaire. Carbon information disclosed in the CDP is voluntary but highly structured, compared with carbon disclosure in the corporate reports (Depoers et al., 2016). Rankin et al. (2011) examine a list of determinants of voluntary carbon disclosure, among which are corporate governance, environmental management systems (EMS), and the CDP. Based on the sample of Australian firms, the authors find that firms which make public reporting to the CDP are more likely to disclose GHG emissions information. Furthermore, the extent and credibility of GHG emissions disclosures are positively related to the reporting decision to the CDP.

Another influential GHG disclosure guideline is Global Reporting Initiative (GRI). In 2000, GRI's sustainability reporting framework was launched to help firms communicate their economic, social, and governance impacts. It is thereby widely adopted by various organizations and regarded as the most authoritative sustainability reporting framework all over the world (GRI-Facts and Features; Moneva et al., 2006). Extant literature demonstrates a significantly positive relationship between carbon disclosure and use of GRI guidelines. More importantly, relying on GRI guidelines improves the quality, extent, and

1 7.a Kyoto Protocol to the United Nations Framework Convention on Climate Change". UN Treaty Database. Retrieved 27 November 2014

credibility of carbon disclosure (Rankin et al., 2011; Comyns, 2016).

However, due to the lack of standards regarding climate change disclosure, investors are unable to acquire consistent and sufficient data for evaluations (Solomon et al., 2011). Subsequently, in response to the urgent demand for standardized climate change disclosure and increasing public interest in climate change problem, Securities and Exchange Committee (SEC) released a guidance on February 8, 2010, under which firms are required to disclose material information associated with climate change risks (CCR) in Form 10-K. And SEC 2010 is the exclusive guidance that standardizes climate change reporting in the U.S. (Guo and Yang, 2017). Climate change risks refer to 'those related to the transition to a lower carbon economy (e.g., policy, legal, technology, reputation, and market changes to address mitigation and adaptation requirements related to climate change); and risks related to the physical impacts of climate change (e.g., due to floods, rising sea levels, and water availability, with direct damage to assets and indirect impacts from supply chain disruption)' (Matsumura et al., 2017, p9).

Although SEC 2010 specified some mandatory rules, as a matter of fact, managers' final decisions regarding whether to disclose climate change risks are generally affected by three factors. First, it is hard to define whether CCR is a material risk to the firm. Second, the consistency of the enforcement of SEC 2010 plays an important role in managers' decision-making process. The last factor is managers' cost-and-benefit analysis about disclosing CCR (Matsumura et al., 2017). Similar to SEC 2010, CSA 2010 was issued as a guidance on environmental disclosures. Given that there is no clear threshold for the materiality, CCR disclosure is likely to be affected by corporate governance and executives' characteristics (Ben-Amar and McIlkenny,2015). Therefore, it is still uncertain whether CCR disclosure is mandatory or voluntary.

The final category is about disclosure determinants. According to Hahn et al., (2015), these disclosure determinants refer to prior carbon disclosures and other related disclosures, such as environmental disclosures and CSR disclosures. From Table 1 we can find that 3 papers report a significantly positive relationship (Brouhle and Harrington, 2010; Cotter and Najah, 2012; Jira and

Toffel, 2013). This result indicates that firms with related disclosures are more likely to engage in carbon disclosures.

More recently, additional determinants have been investigated, among which are EMS (Rankin et al., 2011), government ownership, environmental performance (Giannarakis et al.,2018), stakeholder pressure (Liesen et al., 2015), women percentage on boards (Ben-Amar et al., 2017), and board effectiveness (Ben-Amar and McIlkenny, 2015). Positive relationships are reported for these additional determinants.

2.2.2 Consequences of Climate Change Disclosures

The outcomes of carbon disclosure are under-researched, compared with the determinants of carbon disclosure (Hahn et al., 2015).

[Insert Table 2]

In terms of economic effects, Matsumura et al. (2014) find that firms' value decreases by $212,000 for emitting every additional thousand metric tons of GHG, and that the median value of firms that disclose carbon emissions is much higher than that of non-disclosers. These findings indicate that the market penalizes firms not only for carbon emissions, but also for not disclosing such information. In the same vein, Saka and Oshika (2014) report that carbon emissions are negatively related to the market value of equity, while carbon disclosure is positively related to the market value of equity. The latter relationship is even stronger along with an increasing volume of carbon emissions. More recently, Griffin et al. (2017) find that S&P firms' disclosures about their GHG emissions impose a market-implied equity discount of $79 per ton.

Cost of capital is another economic consequence of carbon disclosure. Matsumura et al. (2017) focus on climate-related disclosures in annual filings. Starting from 2010, the SEC required firms to disclose climate change risk (CCR) if it is material to the firm. In the setting of the SEC 2010, the authors examine the relationship between CCR disclosure and the cost of equity (COE). Results show that the COE of non-disclosers is much higher than that of disclosers, suggesting that investors generally regard CCR as a material risk and put a risk

premium on non-disclosers. Furthermore, relying on SASB's Materiality Map, Matsumura et al., (2017) find the same relationship between CCR disclosure and the cost of equity for firms where investors judge CCR as material. Whereas, such a relationship is not significant if investors view CCR as not material.

Using a sample of Australian companies, Li et al. (2014) find that both the cost of debt and the cost of equity will be affected by the emissions reduction. Results also show that emission intensity is positively related to the cost of debt, but this relationship is not substantiated between emission intensity and the cost of equity. Chen and Gao (2012) report that climate change risk is positively associated with the cost of capital, specifically the cost of debt and the cost of equity in the context of U.S. Additionally, they find that debt investors differ from equity investors in evaluating the climate change risk. Consistent with Chen and Gao (2012), Jung et al. (2018) reveal a significantly positive association between the cost of debt and carbon risks based on Australian companies. Furthermore, they point out a firm's awareness of carbon risks could mitigate this association; in other words, improving carbon risk management such as disclosing more carbon-related information and actively responding to CDP survey could help firms reduce the potential penalty imposed by the market.

In addition, Liesen et al., (2017) evaluate the relevance of climate change disclosure and performance to asset prices in order to see whether this information is priced appropriately. Results indicate that the information concerning climate change disclosure and performance is value relevant. This article calls for investors to consider carbon disclosure and performance when making investment decisions. Moreover, it suggests that more GHG-related regulations are imperative to make carbon disclosure mandatory and standardized, thereby increasing the market efficiency.

The last consequence of carbon disclosure in Table 1 refers to other related disclosures. Carbon disclosure is positively linked with CSR strengths/concerns, and the overall CSR disclosure (Guo and Yang, 2017).

2.3 Hypothesis Development

As stated before, although the SEC 2010 requires firms to disclose climate change risk (CCR) if it is material to the firm operations, corporate governance

and managers' characteristic may largely impact disclosure decisions (Ben-Amar and McIlkenny, 2015; Matsumura et al., 2017). Therefore, it is uncertain whether climate change reporting is a mandatory or voluntary managerial decision.

[Insert Figure 1]

Figure 1 presents the decision tree of managers' CCR disclosure decisions put forward by Matsumura et al., (2017). On one hand, given the ambiguity about CCR materiality, if managers are unwilling to disclose CCR, then they will judge CCR as not material to the firm. On the other hand, if CCR is assessed as a material risk, we can see that CCR disclosure largely depends on managers' perceptions of the regulatory enforcement. Therefore, managers still enjoy significant discretion in the decision-making process of CCR disclosure, which makes CCR disclosure a more complex decision. As discussed before, managers in family firms are likely to be family members, or individuals who are in close personal relationship with family members (Prencipe et al., 2014). They have longer job tenure compared with those in nonfamily firms. In order to maintain the position for the long-term, managers in family firms are committed to the continuity of the firm even at the sacrifice of short-term benefits, and exhibit their loyalty and ability to gain the trust of family members (Miller and Le Breton-Miller, 2006). In addition, from the perspective of SEW, family firms regard the preservation of socioemotional wealth as the main reference point when making strategic decisions (Gomez-Mejia et al., 2011), and they have sufficient power to perpetuate SEW regardless of financial considerations (Gomez-Mejia et al., 2007). Considering these above-mentioned features, family firms are more likely to acknowledge CCR as a material risk, perceive regulatory enforcement as strong, and even issue CCR disclosure at the sacrifice of economic benefits. Hence, I assume that family firms are more willing to disclose CCR and thereby have better disclosure quality. Because family members desire to avoid litigation risks and to impress stakeholders with a good firm image.

The arguments above lead to my first hypothesis:

Hypothesis 1. Compared with nonfamily firms, family firms are more likely to engage in climate change disclosures and have higher quality of disclosure.

After examining the difference between family firms and nonfamily firms in terms of climate change disclosures, I further explore whether the heterogeneity among family firms impacts the CCR disclosure. It is well acknowledged that SEW is a multidimensional concept. There are five dimensions of SEW: family control and influence, family members' identification with the firm, binding social ties, emotional attachment, and renewal of family bonds to the firm through dynastic succession (Berrone et al., 2012). Among these five dimensions, family control and influence and family members' identification with the firm are most sensitive to stakeholder claims (Arena and Michelon, 2018). Family firms which prioritize family control and influence dimension are dedicated to maintaining control of the firm even at the sacrifice of economic interests (Gomez-Mejia et al., 2014). Family firms in which family identity is more salient usually carry the name of family members. Hence, the identity of family members is closely tied to the firm. In order to impress stakeholders with a positive family image, family firms would regard family identity as the main reference point, regardless of financial considerations (Berrone et al., 2012).

The complexity of SEW leads to the heterogeneity among family firms. As indicated by Berrone et al., (2012), this heterogeneity among family firms may impact their strategic decisions. Building on SEW dimensions, Gomez-Mejia et al. (2014) study the financial reporting decisions in family firms. They find that when family control and influence is more salient, family principals are more willing to manipulate earnings but less prone to disclose voluntary information, for the purpose of control preservation. By contrast, family firms which give priority to family identity are less likely to manipulate earnings but more inclined to issue voluntary disclosure. These arguments reveal the bright and dark sides of family ownership in terms of financial reporting decisions. More recently, Arena and Michelon (2018) employ the same theoretical framework to investigate the environmental disclosure (ED) in family firms and whether this relationship is moderated by the firm's life cycle stage. The results show that family firms in which family control and influence prevails are less involved in ED than nonfamily firms, while family firms which prioritize family identity provide more ED than nonfamily firms do.

These two papers offer me insights on studying climate change disclosures in family firms. For family firms in which family members prioritize the family control and influence dimension of SEW, disclosing climate change risks would threaten the family controlling status (Arena and Michelon, 2018). For instance, climate change disclosures may contain proprietary information that will incur proprietary costs on family firms (Dye, 1990). Moreover, additional disclosures will decrease the information asymmetry and increase the transparency, therefore, attracting more external investors. With more external investors involved, the level of scrutiny from regulators and external stakeholders will be enhanced (Healy and Palepu, 2001). Besides, if the firm decides to issue climate change disclosures, any interruption in the future will expose this firm to a negative market reaction (Diamond & Verrecchia, 1991), and family owners have to undertake a large part of this loss (Labelle et al., 2018). The instances cited above are detrimental to the family control and influence, therefore, I propose that family firms in which family control and influence dimension is more salient are less likely to disclose climate change information, and have lower quality of climate change disclosures.

While family firms, in which family identity prevails, intend to engage in climate change reporting and have higher quality of disclosure because family members desire to preserve the firm's reputation and image by meeting the demand of stakeholders. Based on the arguments above, I formulate the following hypotheses dealing with the heterogeneity among family firms.

Hypothesis 2: Family firms in which family control and influence dimension is more salient are less likely than other family firms to disclose climate change information, and tend to have lower quality of climate change reporting than other family firms.

Hypothesis 3: Family firms in which family identity dimension is more salient are more likely than other family firms to disclose climate change information, and tend to have higher disclosure quality than other family firms.

3. Research Design

3.1 Data Selection

The sample is selected from firms listed in S&P 500. I focus on S&P 500 index for two reasons. First, climate change disclosure in U.S. firms becomes a complex decision after the issue of SEC 2010 guidance. It is important to examine the determinants of climate change disclosures in 10-Ks. Second, S&P 500 is an American stock market index and considered as a good representative of U.S. stock market. The period of the selected sample is from 2011 to 2016. I collect the data of climate change disclosures from CERES Sustainability Disclosure Tool [2] and CookESG Research [3]. All the financial data is gathered from Bloomberg Platforms. The software for conducting multivariate analyses is Stata.

3.2 Definition of Variables

3.2.1 Dependent Variables

I use different proxies to assess the extent of climate change-related disclosures. First, I use a binary variable (CCD) to measure the disclosure decision of sample firms. Variable CCD equals to 1 if the firm discloses climate change information in 10-K filings in year t and 0 otherwise. Second, to capture the quality of climate change disclosure, I rely on two variables: disclosure specificity (DSpecificity) and disclosure rank (DRank), provided by CookESG. Disclosure specificity refers to four types of climate change disclosure, which are general climate disclosure, regulatory risks, physical risks and renewable & clean energy. By reading the excerpts from the original SEC filings, I find that general climate disclosure lacks substantive information compared with other three types of disclosure.

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2 CERES Sustainability Disclosure Tool provides information about company's material risks and opportunities resulting from sustainability issues, in collaboration with CookESG Research. (see https://www.ceres.org/resources/tools)

3 CookESG Research focuses on the climate risk disclosure analysis, aiming to promote the transparency about the risks and impacts of climate change. Disclosures in annual securities reports about climate change, water, hydraulic fracturing and carbon asset risk are available at: https://cookesg.com/

Therefore, one way to measure the quality of climate change disclosures is to assess the level of disclosure specificity as the total of the proportions of disclosures devoted to physical and regulatory risks as well as the disclosures about investments in clean and renewable energy. Figure 2 provides a breakdown of CCR disclosures of EXXON MOBIL in 2016. We can see from the figure that 20% of the disclosure is considered as a general and boilerplate, while 80% are specific disclosures about climate change risks. Given that investors are likely to prefer specific rather than general disclosures, I assume that the greater the disclosure specificity, the higher is the disclosure quality.

[Insert Figure 2]

My final measure of CCR disclosure quality is the disclosure rank provided in CookESG Research. This score ranges from 0 to 100 and refers to the rank percentiles listed in the CooESG database.

3.2.2 Independent Variables

There are various operational definitions of family firms in empirical research (Prencipe et al., 2014). Anderson and Reeb (2003) and Chen et al., (2008) define family firms as those in which the founder or descendant or family member is director or officer or block shareholder. However, this definition of family firms incorporates lone founder firms in which an individual is one of the firm's founders with no other family members involved, and is an insider or a large shareholder. According to Miller et al., (2007), lone founder firms cannot be identified as family firms because only firms where the founder along with other family members is present are classified as family firms. Therefore, in order to remove the influence of lone founder firms on climate change disclosures and disclosure quality, I exclude these firms from family firm category. My first independent variable is a dummy variable FF which takes 1 if the firm is identified as a family firm, and 0 otherwise. Family ownership, control and involvement will be gathered from NRG Metrics[4], a database providing

4 NRG Metrics is a database that provides accurate data about corporate governance (http://nrgmetrics.com/).

information about corporate governance and ownership.

To investigate the heterogeneity among family firms based on the SEW model, I employ two independent variables CI and ID. Following Arena and Michelon (2018), I use variable CI to define family firms in which family control and influence dimension is more salient. CI is equal to 1 if single family holds more than 50% of the shares. To define family firms which prioritize family identity dimension, I use a binary variable ID, which equals to 1 if the family name is part of the firm name, 0 otherwise.

3.2.3 Control Variables

As stated before, economic determinants of carbon disclosure are often applied as control variables (Hahn et al., 2015). Therefore, I control for financial performance, firm size, market-to-book and leverage. I also incorporate board independence in my models to control for the potential influence of board of directors.

In addition, extant literature suggests that industry may impact carbon disclosures (Choi et al., 2013; Yu and Ting, 2012). Moreover, Matsumura et al., (2017) imply that certain industries affect the judgement of CCR materiality and, to a further extent, disclosure decisions. Hence, following Matsumura et al., (2017), I use SASB's Materiality Map [5] to identify the materiality of industries by matching SIC codes to Sustainable Industry Classification System (SICS) industries [6]. I will focus on (1) GHG emissions, and (2) physical impacts of climate change, among a list of sustainability issues. Variable SASB_MT is coded 1 if at least one of the two issues is classified as material in the Map, and 0 otherwise.

Detailed measures of all the variables are provided below:

[Insert Table 3]

5 The Materiality Map is available at: https://materiality.sasb.org/

6 The SICS Look-up Tool is used to determine the SICS industry for S&P 500 firms. (see https://www.sasb.org/find-your-industry/)

3.3 Models

To empirically test the difference between family firms and nonfamily firms in terms of climate change disclosures, I establish the following regression models [7]. To avoid the endogeneity issue, I use one-year lag for control variables except SASB_MT.

The sample consists of all S&P 500 firms. β_1 in three models are coefficients of interest for Hypothesis 1.

$$CCD_t = \beta_0 + \beta_1 FF_t + \beta_2 IND\_BOD_{t-1} + \beta_3 SIZE_{t-1} + \beta_4 LEV_{t-1} + \beta_5 ROA_{t-1} + \beta_6 MT\_BK_{t-1} + \beta_7 SASB\_MT_t + \varepsilon \quad (1)$$

$$DSpecificity_t = \beta_0 + \beta_1 FF_t + \beta_2 IND\_BOD_{t-1} + \beta_3 SIZE_{t-1} + \beta_4 LEV_{t-1} + \beta_5 ROA_{t-1} + \beta_6 MT\_BK_{t-1} + \beta_7 SASB\_MT_t + \varepsilon \quad (2)$$

$$DRank_t = \beta_0 + \beta_1 FF_t + \beta_2 IND\_BOD_{t-1} + \beta_3 SIZE_{t-1} + \beta_4 LEV_{t-1} + \beta_5 ROA_{t-1} + \beta_6 MT\_BK_{t-1} + \beta_7 SASB\_MT_t + \varepsilon \quad (3)$$

To further explore the impact of the heterogeneity among family firms on climate change disclosures, I use the following regression models. The sample consists of all S&P 500 family firms. β_1 and β_2 in these models are coefficients of interest for Hypothesis 2 and Hypothesis 3.

$$CCD_t = \beta_0 + \beta_1 CI_t + \beta_2 ID_t + \beta_3 IND\_BOD_{t-1} + \beta_4 SIZE_{t-1} + \beta_5 LEV_{t-1} + \beta_6 ROA_{t-1} + \beta_7 MT\_BK_{t-1} + \beta_8 SASB\_MT_t + \varepsilon \quad (4)$$

$$DSpecificity_t = \beta_0 + \beta_1 CI_t + \beta_2 ID_t + \beta_3 IND\_BOD_{t-1} + \beta_4 SIZE_{t-1} + \beta_5 LEV_{t-1} + \beta_6 ROA_{t-1} + \beta_7 MT\_BK_{t-1} + \beta_8 SASB\_MT_t + \varepsilon \quad (5)$$

$$DRank_t = \beta_0 + \beta_1 CI_t + \beta_2 ID_t + \beta_3 IND\_BOD_{t-1} + \beta_4 SIZE_{t-1} + \beta_5 LEV_{t-1} + \beta_6 ROA_{t-1} + \beta_7 MT\_BK_{t-1} + \beta_8 SASB\_MT_t + \varepsilon \quad (6)$$

Note. CCD is climate change disclosure decision; DSpecificity is disclosure specificity; DRank is disclosure rank; FF is a binary variable that equals to 1 if the firm is a family firm; CI is a binary variable that equals to 1 if single family holds more than 50% of the shares; ID is a binary variable that equals to 1 if the family name is part of the firm name; IND_BOD is the percentage of independent directors sitting on board; SIZE is the natural algorithm of total assets; LEV is total liabilities divided by total assets; ROA is net income divided by total assets; MT_BK is market value of assets divided by the book value; SASB_MT is equal to 1 if at least one of the two issues (i.e. GHG emissions and physical impacts of climate change) is classified as material.

7 My sample is panel data, it consists of multiple observations from the same firm over the sample period (2011-2016). Therefore, I control for year effects and cluster standard errors at the firm level in all the regression models.

4. Empirical Results

4.1 Descriptive Statistics and Correlation Matrix

Table 4 provides descriptive statistics of all the sample firms. As shown in panel A, nonfamily firms have 1671 firm-year observations. The mean value of CCD is

[Insert Table 4]

0.670, indicating that 67.0% of S&P 500 nonfamily firms disclose information about climate change risks in their annual reports. For family firms, there are only 255 firm-year observations. The mean value of CCD equals to 0.702, which is slightly higher than that in nonfamily firms. However, the t-test shows that there is no statistical difference in the mean value of CCD. In the same vein, the average value of DSpecificity is not significantly different between family firms and nonfamily firms. Whereas, I find that on average family firms have lower disclosure ranks than nonfamily firms, and this difference is significant at the 1% level. Panel A also shows that only 3.1% of family firms prioritize family control and influence dimension, while family identity dimension is more salient in 29.0 % of the family firms in my sample. The results are inconsistent with Arena and Michelon (2018), mainly because of the selected sample. They use a sample of companies listed on the Milan Stock Exchange, yet I focus on S&P 500 index firms. According to Arena and Michelon (2018), about 60% of the firms listed on the Milan Stock Exchange are family owned, accounting for more than 25% of market capitalization. However, only about 35% of S&P 500 firms are identified as family firms (Anderson and Reeb, 2003; Chen et al., 2008). Also, Italian family firms have a higher degree of ownership concentration, which explains the greater mean value of CI in Italian family firms. Another variable of interest is SASB_MT. The mean value of SASB_MT suggests that climate change risks are more material to nonfamily firms (p-value=0.027). Panel B in Table 4 presents the changes in CCD from 2011-2016. We can see that the mean value of CCD keeps growing over the sample period, implying that S&P 500 firms have an increasing awareness of disclosing CCR across time. However, the mean value of DSpecificity and DRank fails to continuously increase from 2011 to 2016.

[Insert Table 5]

Table 5 presents the correlation matrix. Panel A consists of variables that are used to examine the difference in disclosure decisions and disclosure quality between family firms and their nonfamily counterparts. Contrary to my expectation, there is no significantly positive correlation between FF and CCD. Whereas, control variables SASB_MT, LEV, SIZE and ROA are significantly related to CCD at the 1% level. When it comes to disclosure quality, only two control variables LEV and SIZE are found to be significantly correlated with DSpecificity. In contrast, DRank is significantly related to all the control variables. More importantly, I find a negative correlation between DRank and FF, which is inconsistent with my first hypothesis that family firms are inclined to have higher disclosure quality.

The correlation matrix in panel B focuses on two types of family firms and their disclosure behaviors. Independent variable CI is not found to be correlated with climate change disclosure decisions and disclosure quality. In terms of independent variable ID, it is positively correlated with DSpecificity, but not correlated with DRank.

Another notable correlation in table 5 is the one between DSpecificity and DRank. Given that DSpecificity and DRank are two measurements of disclosure quality, there should exist a positive association between them. However, panel A shows no significant correlation, while panel B reveals a negative correlation coefficient. The results suggest that DSpecificity may not be in accordance with DRank when measuring disclosure quality, and this explains the competing findings mentioned above.

Taken together, the largest absolute value of correlation coefficient between any two explanatory variables is 0.472, less than 0.7. Therefore, multilinearity would not be a serious problem in the following regression analyses.

4.2 Multivariate Analysis

Table 6 presents the multivariate analysis results of six regression models. My first hypothesis predicts that family firms are more likely to engage in climate change disclosures and have higher disclosure quality than nonfamily firms.

[Insert Table 6]

Panel A provides the regression analyses to examine this hypothesis. The first column is a LOGIT regression model with the dependent variable CCD. I find that there is no significant relationship between FF and CCD, indicating that family firms do not differ from nonfamily firms in terms of climate change disclosure decisions. Nonetheless, control variables SASB_MT and SIZE are demonstrated to be positively related to CCD at the 1% level. In other words, firms' disclosure decisions largely depend on the materiality of climate change risks. Also, larger firms are more inclined to issue climate change disclosures, which is in line with previous research (Rankin et al., 2011). Model 2 and model 3 test the difference in disclosure quality. No significant relationship is found between FF and DSpecificity. However, in model 3, FF is negatively associated with DRank at the 5% level, rejecting the first hypothesis that family firms tend to have higher disclosure quality. As for control variables, SASB_MT and SIZE are positively related to DRank, implying that disclosure quality in larger firms and firms which have material CCR is of higher quality (Cotter and Najah., 2012). Additionally, the coefficients of IND_BOD and ROA are significantly negative at the 5% level. These results suggest that firms with lower percentage of independent directors on the board and with poorer financial performance have higher disclosure quality than other firms (Prado-Lorenzo et al., 2009). The different results in model 2 and model 3 may stem from diverse standards that are used by DSpecificity and DRank to measure disclosure quality. Overall, the results in panel A fail to demonstrate my hypothesis 1.

Panel B shows the testing results for hypotheses 2 and 3. These two hypotheses focus on the behavior of family firms in which family control and influence and family identity are the primary dimensions, positing that these two features of family firms shape their disclosure decisions. I therefore expect that family firms with strong emphasis on control and influence are less willing than other family firms to disclose CCR and exhibit poorer climate-related disclosure practices, while family firms focusing on family identity display superior disclosure performance. In Model 4, only control variables SASB_MT and SIZE are positively related to CCD, implying that the heterogeneity among family firms

has no effects on climate change disclosure decisions. With regard to model 5 and model 6, I discover that only family firms with strong focus on family identity dimension have higher DSpecificity and DRank, which supports the hypothesis 3(b) that family firms in which family identity dimension is more salient have higher disclosure quality than other family firms.

5. Additional Tests

In order to better evaluate the regression results, I perform some additional tests in this section.

[Insert Table 7]

First of all, the definition of family firms used in my regression models excludes lone founder firms. In the additional tests, I use an alternative definition of family firms and identify lone founder firms as family firms (Anderson and Reeb, 2003; Chen et al., 2008) and re-run the regression models with this new definition (shown in Panel A and Panel B). In line with the previous results, family ownership has no significant influence on climate change disclosure decisions. Nor does it affect the disclosure specificity. In addition, there is no difference between two features of family firms and other family firms regarding climate change disclosure decisions. The only different results for the two definitions of family firms lie in the disclosure rank. Including lone founder firms as family firms, I find that FF and ID are no longer related to the disclosure rank. Therefore, one important concern in this study is the definition of family firms. Due to a diverse set of identifications of family firms, the empirical results greatly depend on which definition we use for analysis.

Second, in order to see the results affected by the materiality, I split the firms into two sub-samples (SASB_MT=0 and SASB_MT=1) in Panel C. The materiality is not found to impact the relationship between FF and CCD. In other words, family ownership is not related to climate change disclosure decisions no matter the climate change risks are material or not.

Third, I consider the industry fixed effects in the regression models. Given that my sample consists of 9 industries [8], I establish 8 dummy variables to

8 Industries: Basic Materials, Consumer Goods, Consumer Services, Health Care, Industrials, Oil & Gas, Technology, Telecommunications, and Utilities.

control for the industry fixed effects. Slightly different from the results in Table 6, FF is no longer negatively related to DRank, indicating that family firms do not differ from nonfamily firms in terms of disclosure rank. Panel E shows that ID is positively related to DSpecificity and DRank, which is consistent with previous results. Another notable difference lies in the R^2. R^2 increases after adding the industry dummies, suggesting that the model fitness is enhanced.

6. Conclusion

6.1 Summary and Implications

Nowadays, the climate change issue has become a tremendous threat to human society. It is imperative to study this issue in various fields including accounting. Although the US SEC requires firms to disclose climate changes risks in 10-Ks if these risks are material to their operations, managers still enjoy a discretion in making decisions about climate change disclosures. Moreover, the SEC's inconsistent enforcement of climate change disclosures makes the decision more complex. In order to better investigate the determinants of climate change disclosures, I first examine the influence of family ownership on climate change disclosure decisions and disclosure quality. Furthermore, I dig into the heterogeneity among family firms to see whether two specific features of family firms (i.e. family control and influence, family identity) differ from other family firms regarding climate change disclosures.

The results of this study show that family ownership has no impact on climate change disclosure decisions, which is contrary to my expectation. This can be explained by the fact that my sample is collected from S&P 500 index. These public listed firms are exposed to the identical regulatory environment and pressures from stakeholders. Moreover, with the increasing awareness of climate change disclosures, nowadays firms are more willing to follow the SEC 2010 guidance. Therefore, the disclosure decision largely depends on the materiality rather than the family ownership.

In addition, the results also reveal that family ownership is negatively related to disclosure rank. On one hand, this unexpected result may be attributed to the less severe agency problem in family firms. Therefore, managers in family firms have fewer incentives to provide extensive information on climate change

risks. On the other hand, family owners have to undertake a large part of disclosure costs, and these costs (e.g. proprietary costs) may even threaten the family ownership. In order to maintain their ownership, family members would rather issue climate change disclosures of lower quality. However, this negative relationship is not found in DSpecificity. I interpret the underlying cause as a methodological issue. I initiate the definition of DSpecificity by adding up the specific proportions of climate change disclosures, which may fail to completely capture disclosure quality compared with variable DRank.

Focusing on the heterogeneity among family firms, I find that the two features of family firms are as likely as other family firms to disclose climate change risks, because the primary motivation is the materiality. Family firms in which family control and influence is more salient do not show any relationship with DSpecificity and DRank. This finding may result from one of my limitations that the measurement of family control and influence dimension may not fully capture the complexity of it. Finally, in agreement with my hypothesis 3(b), family firms oriented by family identity dimension are reported to exhibit better disclosure quality.

In spite of certain limitations, this study takes the first step to study climate change disclosures in family firms in the context of SEC 2010 guidance. Therefore, this paper makes several contributions to the extant literature. First, it enriches the literature on both climate change disclosures and family firms Second, it demonstrates that the heterogeneity among family firms has an impact on climate change disclosure quality, providing support for the validity of SEW model. Third, it sheds light on the study of SEC 2010 guidance and lays the ground work for future research to thoroughly understand this complex disclosure decision. The empirical results have implications for managers in shaping their climate change disclosure decisions, and offer investors insights on evaluating climate change disclosures. For example, managers in family firms can take this study into account to adjust their CCR disclosure strategies since results show that family firms have lower disclosure quality. Moreover, investors can have a better knowledge of managers' CCR disclosure decisions within different firms, which is helpful in making appropriate investment decisions. Last but not least, my findings may be of interest to regulators who intend to enhance the

guidance on climate change disclosures. They might revise the guidance to motivate family firms to disclose high-quality information about CCR considering the negative relationship between family ownership and CCR disclosure quality.

6.2 Limitations and Future Work

Since this paper takes the first step to investigate climate change disclosures in family firms, it inevitably has several limitations. First, following Berrone et al., (2012), Gomez-Mejia et al., (2014), and Arena and Michelon (2018), I rely on the SEW model to examine the influence of the heterogeneity among family firms on climate change disclosures. I borrow the definition of family control and influence dimension (CI) from Arena and Michelon (2018). Whereas, Gavana et al., (2017) define this dimension as a dummy variable that takes value 1 if the CEO is a family member and 0 otherwise, which is totally different from my definition. Therefore, future work could enhance the definition of CI to further investigate this specific feature of family firms.

The second limitation refers to the selected sample. In this paper, I use a sample of S&P 500 firms. As indicated in the regression results, the family ownership in these public listed family firms exerts no influence on shaping disclosure decisions regarding climate change risks. However, this conclusion may not apply to private family firms. Another concern about the sample is that S&P 500 firms have lower degree of ownership concentration compared with Italian companies used by Arena and Michelon (2018). Only 12 family firms are found to be oriented by family control and influence. The limitation provides opportunities for future work to extend this research topic into the global context. For instance, researchers can compare family firms in stakeholder-oriented countries with those in shareholder-oriented countries regarding climate change disclosures (Labelle et al., 2018).

Third, there are diverse definitions of family firms (Miller et al., 2007; Prencipe et al., 2014). As indicated in additional tests, my primary regression results are sensitive to different definitions of family firms.

The final limitation is the inconsistency between DSpecificity and DRank. The data of DRank is computed directly by CookESG research, while DSpecificity is calculated by summing up regulatory risks, physical risks and renewable &

clean energy. Consequently, one potential explanation of the inconsistency is that DRank employs a stricter evaluation mechanism than DSpecificity. Therefore, for future work, researchers could develop a new measure of CCR disclosure quality through content analysis or other tools.

Table 1. Literature on Determinants of Climate Change Disclosures

			Economic Determinants			Ecological Determinants		Regulatory Determinants		
Authors (year)	Country	Industry	Financial Performance	Leverage	Size	Carbon Emissions	Carbon-intensive industry	Kyoto Protocol	Other GHG-related regulations	Others
Amran et al. (2014)	Asia Pacific	All			▪		+			
Apergis et al., (2013)	UK, France, Germany	CO2-Intensive				+				Sig.
Ben-Amar and McIlkenny (2015)	Canadian	All	+		+					
Ben-Amar et al. (2017)	Canadian	All								
Brouhle and Harrington (2010)	Canada	CO2-Intensive			+				▪	
Choi et al., (2013)	Australia	All	▪	▪	+	+	+		+	
Comyns (2016)	Global	Oil & Gas							+	
Cotter and Najah, (2012)	Global	All	▪	+	+					
Freeman and Jaggi, (2005)	Global	CO2-Intensive	▪	▪	+			+		▪
Giannarakis et al. (2018)	European	All			+					
Jira and Toffel (2013)	Global	All	+			▪	▪	+		
Liesen et al. (2015)	European	All								
Rankin et al (2011)	Australia	All			+				+	
Yu and Ting (2012)	Global	All					−			Sig.

(continued)

Table 1. (continued)

			Disclosure Determinants		Other Determinants			
Authors (year)	Country	Industry	Prior/Related Disclosures	EMS	Ownership Structure	Environmental Performance	Board of Directors	Stakeholder Pressure
Amran et al. (2014)	Asia Pacific	All		+			+	
Apergis et al., (2013)	UK,France, Germany	CO2-Intensive						
Ben-Amar and McIlkenny (2015)	Canadian	All					+	
Ben-Amar et al. (2017)	Canadian	All					+	
Brouhle and Harrington (2010)	Canada	CO2-Intensive	+					
Choi et al., (2013)	Australia	All						
Comyns (2016)	Global	Oil&Gas						
Cotter and Najah, (2012)	Global	All	+					
Freeman and Jaggi, (2005)	Global	CO2-Intensive						
Giannarakis et al. (2018)	European	All			+	+		
Jira and Toffel (2013)	Global	All	+					
Liesen et al. (2015)	European	All						+
Rankin et al (2011)	Australia	All		+				
Yu and Ting (2012)	Global	All						

Adapted from Hahn et al., (2015).

Note. GHG=greenhouse gases; + indicates a positive and significant relationship; - indicates a negative and significant relationship; ▪ indicates no significant relationship; "Sig." indicates a significant relationship without a direction.

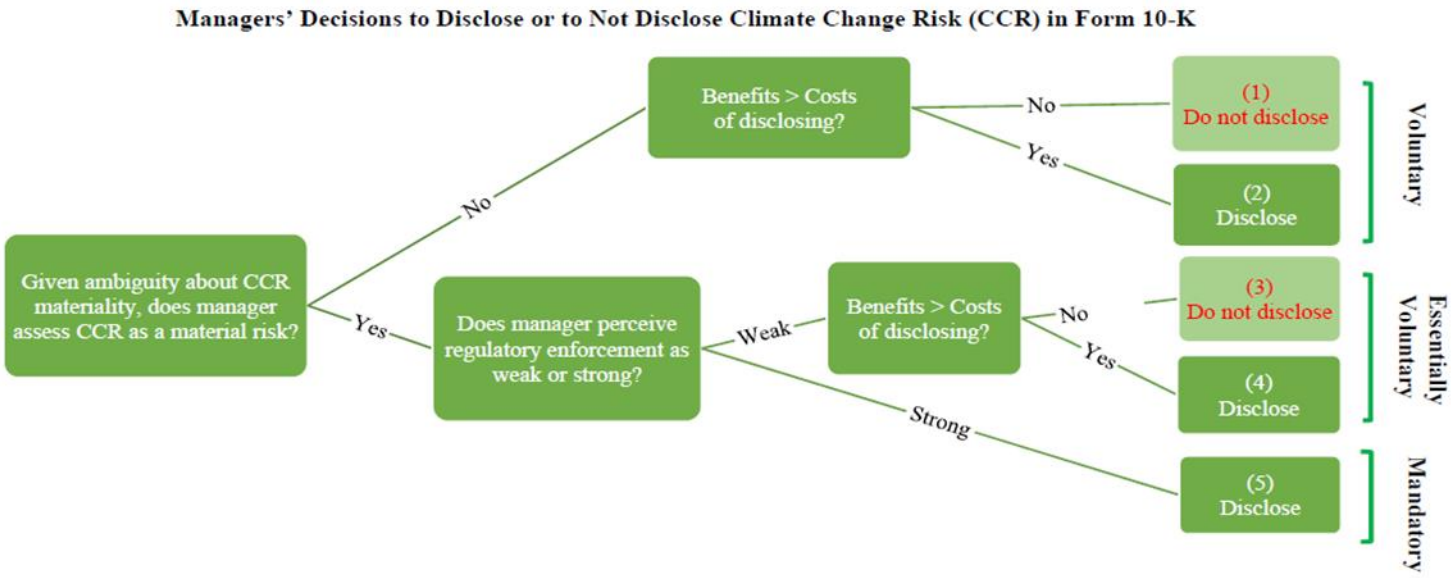
Table 2. Literature on Consequences of Climate Change Disclosures

Authors (year)	Country	Industry	Cost of equity	Cost of debt	Firm value	Asset prices	Other related disclosures
*Chen and Gao (2012)	U.S.	Electric companies	+	+			
*Griffin et al. (2017)	U.S.	All			−		
Guo and Yang (2017)	U.S.	All					+
Jung et al. (2018)	Australian	All		−			
*Li et al. (2014)	Australian	All	▪	+			
*Liesen et al. (2017)	European	All				Sig.	
Matsumura et al. (2014)	U.S.	All			+		
Matsumura et al. (2017)	U.S.	All	−				
Saka and Oshika (2014)	Japanese	Manufacturing sector			+		

Adapted from Hahn et al., (2015).

Note. + indicates a positive and significant relationship; - indicates a negative and significant relationship; ▪ indicates no significant relationship; "Sig." indicates a significant relationship without a direction. Articles denoted with * focus on the effects of carbon emissions.

Figure 1



Decision tree of managers' CCR disclosure decisions (from Matsumura et al., 2017)

Figure 2

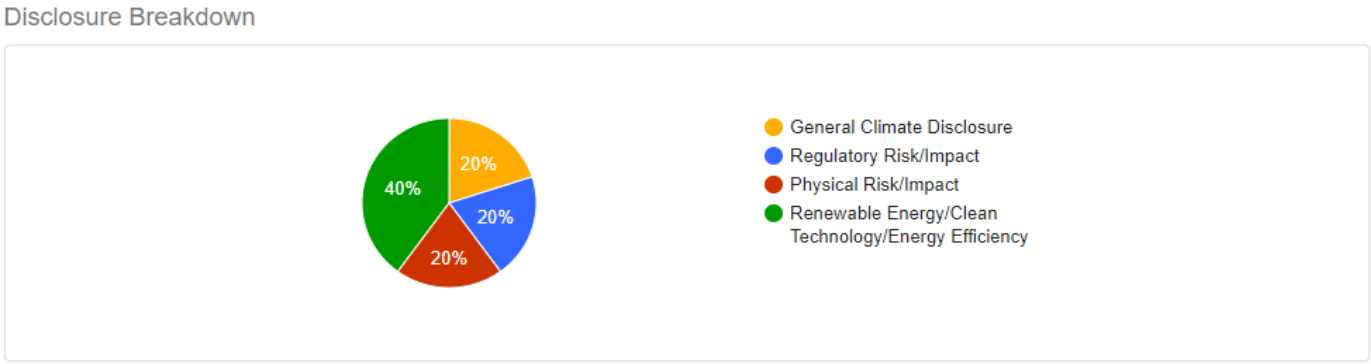


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Table 3 Definition of variables

Variable	Definition	Measurement
CCD	Climate change disclosure decisions	Binary variable equals to 1 if the firm discloses climate change information in year t in 10-Ks, 0 otherwise
DSpecificity	Disclosure specificity	The total of the proportions of disclosures devoted to physical and regulatory risks as well as the disclosures about investments in clean and renewable energy
DRank	Disclosure rank	Rank percentiles listed in the CookESG database
FF	Family firms	Binary variable equals to 1 if the founder or descendant or family member is director or officer or large shareholder holding more than 5% shares and the firm is not a lone founder firm, 0 otherwise
CI	Family control and influence	Binary variable equals to 1 if single family holds more than 50% of the shares, 0 otherwise
ID	Family identity	Binary variable equals to 1 if the family name is part of the firm name, 0 otherwise
IND_BOD	Board independence	Percentage of independent directors sitting on the board
SIZE	Firm size	Natural logarithm of total assets
LEV	Leverage	Total liabilities divided by total assets
ROA	Return on assets	Net income divided by total assets
MT_BK	Market-to-book ratio	Market value of a company's assets (as measured by the market value of its outstanding stock and debt) divided by the replacement cost of the company's assets (book value)
SASB_MT	CCR materiality	Variable SASB_MT is coded 1 if at least one of the two issues (i.e. GHG emissions and physical impacts of climate change) is classified as material in the Map, and 0 otherwise.

Table 4 Descriptive statistics

Panel A: Partitioned by family firms and nonfamily firms

	FF=0 (Nonfamily firms) n=1671			FF=1(Family firms) n=255			
Variable	Mean	Median	SD	Mean	Median	SD	t-test p-value
Dependent variables							
CCD	0.670	1	0.470	0.702	1	0.458	0.315
DSpecificity(%)	82.009	85	17.801	81.453	85	19.054	0.701
DRank	59.432	64	28.429	49.866	50	27.199	0.000***
Independent variables							
CI	—	—	—	0.031	0	0.175	—
ID	—	—	—	0.290	0	0.455	—
Control variables							
SASB_MT	0.386	0	0.487	0.314	0	0.465	0.027**
LEV	0.584	0.590	0.164	0.597	0.597	0.152	0.241
SIZE	9.635	9.618	1.070	9.591	9.463	1.091	0.543
IND_BOD(%)	84.662	88.889	8.075	85.216	88.889	7.857	0.312
ROA	7.490	6.680	5.307	8.533	7.792	4.981	0.004***
MT_BK	4.249	2.969	4.154	4.443	3.326	4.262	0.492

***. Difference is significant at the 0.01 level.
**. Difference is significant at the 0.05 level.
*. Difference is significant at the 0.1 level.

Panel B: Changes in CCD, DSpecificity, and DRank over the sample period

	2011	**2012**	**2013**	**2014**	**2015**	**2016**
CCD(Mean)	0.631	0.640	0.643	0.693	0.698	0.737
DSpecificy(Mean)	81.713	82.563	82.361	81.783	80.735	82.587
DRank(Mean)	57.728	58.234	58.109	58.181	58.600	57.896

Note. This table reports the descriptive statistics of all the sample firms. Panel A shows the results partitioned by family firms and nonfamily firms. Panel B presents the changes in CCD, DSpecificity, DRank from 2011 to 2016. I winsorize LEV SIZE IND_BOD ROA MT_BK. All the variables are defined in Table 3.

Table 5 Correlation matrix

Panel A: Full Sample

	1	2	3	4	5	6	7	8	9	10
1. CCD	1									
2. DSpecificity	—	1								
3. DRank	—	-0.038	1							
4. FF	0.023	-0.011	-0.115**	1						
5. SASB_MT	0.284**	0.000	0.528**	-0.051*	1					
6. LEV	0.122**	-0.107**	0.125**	0.018	0.074**	1				
7. SIZE	0.192**	-0.087**	0.203**	-0.003	0.124**	0.289**	1			
8. IND_BOD	0.041	-0.050	0.069*	0.007	0.128**	0.225**	0.250**	1		
9. ROA	-0.154**	0.034	-0.303**	0.055*	-0.253**	-0.339**	-0.287**	-0.169**	1	
10. MT_BK	0.010	0.003	-0.065*	-0.002	-0.064**	0.168**	-0.038	-0.054*	0.097**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

-. Cannot be computed because CCD is constant. The correlation between DSpecificity and DRank can be computed only when CCD=1.

Panel B: Sample of Family firms

	1	2	3	4	5	6	7	8	9	10	11
1. CCD	1										
2. DSpecificity	—	1									
3. DRank	—	-0.211**	1								
4. CI	0.019	0.092	0.039	1							
5. ID	0.114	0.195**	0.033	0.133*	1						
6. SASB_MT	0.237**	-0.070	0.574**	-0.073	-0.004	1					
7. LEV	0.233**	-0.341**	0.001	-0.072	0.157*	0.019	1				
8. SIZE	0.263**	-0.314**	0.218**	-0.119	0.121	0.011	0.310**	1			
9. IND_BOD	-0.098	0.025	0.000	-0.334**	-0.193**	0.159*	0.069	0.016	1		
10. ROA	-0.121	0.162*	-0.199**	0.132*	-0.028	-0.148*	-0.472**	-0.248**	-0.004	1	
11. MT_BK	0.036	-0.108	-0.101	-0.005	-0.043	-0.050	0.172**	0.032	-0.005	0.015	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

-. Cannot be computed because CCD is constant. The correlation between DSpecificity and DRank can be computed only when CCD=1.

Note. This table presents two correlation matrices. Panel A shows the correlation among dependent variable (CCD, DSpecificity, DRank), independent variable (FF), and other control variables (SASB_MT, LEV, SIZE, IND_BOD, ROA, MT_BK) based on the full sample. Panel B shows the correlation in family firms. I winsorize LEV SIZE IND_BOD ROA MT_BK. All the variables are defined in Table 3.

Table 6 Multivariate Analysis

Panel A: Regression results for model 1-3

	Model 1 CCD (LOGIT)		**Model 2 DSpecificity(%) (Linear)**		**Model 3 DRank (Negative Binomial)**	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value
FF	0.273	0.304	-0.299	0.906	-0.143	0.022**
SASB_MT	1.352	0.000***	0.587	0.784	0.475	0.000***
LEV	0.593	0.368	-9.955	0.128	0.151	0.409
SIZE	0.292	0.007***	-1.036	0.348	0.052	0.099*
IND_BOD	-0.013	0.255	-0.036	0.721	-0.005	0.033**
ROA	-0.015	0.319	-0.013	0.930	-0.009	0.036**
MT_BK	0.001	0.299	0.005	0.585	0.000	0.218
Intercept	-1.372	0.297	101.842	0.000***	3.735	0.000***
Year dummies	YES		YES		YES	
NO. observations	1926		1299		896	
R^2	0.100		0.018		0.024	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Panel B: Regression results for model 4-6

	Model 4 CCD (LOGIT)		**Model 5 DSpecificity(%) (Linear)**		**Model 6 DRank (Negative Binomial)**	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value
CI	0.157	0.886	11.030	0.238	0.177	0.349
ID	0.568	0.447	10.909	0.041**	0.261	0.061**
SASB_MT	1.537	0.033**	-3.495	0.484	0.707	0.000***
LEV	2.872	0.144	-43.050	0.010**	-0.526	0.155
SIZE	0.595	0.058*	-2.753	0.293	0.129	0.032**
IND_BOD	-0.037	0.230	0.473	0.043**	-0.004	0.531
ROA	0.029	0.550	-0.079	0.739	-0.005	0.507
MT_BK	0.002	0.437	-0.010	0.388	-0.001	0.081*
Intercept	-4.059	0.285	95.826	0.002***	3.042	0.000***
Year dummies	YES		YES		YES	
NO. observations	255		179		172	
R^2	0.175		0.269		0.045	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Note. This table reports the regression results for model 1-6 to test the influence of family ownership and heterogeneity among family firms on climate change disclosure decisions and disclosure quality. I winsorize LEV SIZE IND_BOD ROA MT_BK. All the variables are defined in Table 3. Standard errors are clustered at the firm level.

Table 7 Additional Tests

Panel A: Regression results for model 1-3 (include lone founder firms)

	Model 1 CCD (LOGIT)		**Model 2 DSpecificity(%) (Linear)**		**Model 3 DRank (Negative Binomial)**	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value
FF	0.235	0.278	0.186	0.925	-0.055	0.254
SASB_MT	1.351	0.000***	0.605	0.777	0.476	0.000***
LEV	0.582	0.378	-10.042	0.125	0.144	0.432
SIZE	0.296	0.006***	-1.037	0.348	0.049	0.122
IND_BOD	-0.013	0.256	-0.035	0.726	-0.005	0.037**
ROA	-0.014	0.336	-0.014	0.919	-0.010	0.026**
MT_BK	0.001	0.289	0.005	0.580	-0.000	0.237
Intercept	-1.430	0.277	101.783	0.000***	3.759	0.000***
Year dummies	YES		YES		YES	
NO. observations	1926		1299		1276	
R^2	0.100		0.018		0.024	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Panel B: Regression results for model 4-6 (include lone founder firms)

	Model 4 CCD (LOGIT)		**Model 5 DSpecificity(%) (Linear)**		**Model 6 DRank (Negative Binomial)**	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value
CI	0.366	0.710	6.915	0.312	0.087	0.579
ID	0.484	0.340	8.092	0.047**	0.120	0.293
SASB_MT	1.279	0.008***	0.083	0.985	0.688	0.000***
LEV	1.409	0.304	-34.853	0.002***	-0.264	0.344
SIZE	0.373	0.071*	-1.772	0.372	0.055	0.246
IND_BOD	-0.024	0.282	0.210	0.267**	-0.005	0.219
ROA	-0.005	0.871	-0.082	0.706	-0.006	0.383
MT_BK	0.001	0.544	-0.014	0.137	-0.001	0.000***
Intercept	-1.803	0.511	103.614	0.000***	3.882	0.000***
Year dummies	YES		YES		YES	
NO. observations	421		293		286	
R^2	0.108		0.167		0.040	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Note. This table reports the regression results for model 1-6 to test the influence of family ownership and heterogeneity among family firms on climate change disclosure decisions and disclosure quality by including lone founder firms. I winsorize LEV SIZE IND_BOD ROA MT_BK. All the variables are defined in Table 3. Standard errors are clustered at the firm level.

Panel C: Regression results for model 1 (partitioned by SASB_MT)

	SASB_MT=1		**SASB_MT=0**	
Variable	Coef.	p-value	Coef.	p-value
FF	0.325	0.546	0.267	0.371
LEV	1.848	0.905	0.571	0.445
SIZE	0.512	0.068*	0.257	0.030**
IND_BOD	0.027	0.220	-0.021	0.097*
ROA	-0.057	0.036**	-0.002	0.895
MT_BK	0.039	0.457	0.001	0.392
Intercept	-5.319	0.124	-0.429	0.759
Year dummies	YES		YES	
NO. observations	725		1201	
R^2	0.088		0.031	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Note. This table reports the regression results for model 1 partitioned by SASB_MT=0 and SASB_MT=1 to test the influence of family ownership on climate change disclosure decisions. I winsorize LEV SIZE IND_BOD ROA MT_BK. All the variables are defined in Table 3. Standard errors are clustered at the firm level.

Panel D: Regression results for model 1-3 (include industry fixed effects)

	Model 1 CCD (LOGIT)		**Model 2 DSpecificity(%) (Linear)**		**Model 3 DRank (Negative Binomial)**	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value
FF	0.279	0.300	0.222	0.931	-0.052	0.436
SASB_MT	0.810	0.007***	1.672	0.542	0.208	0.003***
LEV	1.157	0.222	-25.885	0.001	0.140	0.548
SIZE	0.213	0.085*	-1.042	0.329	0.039	0.216
IND_BOD	-0.003	0.839	0.043	0.686	-0.006	0.023**
ROA	0.029	0.190	-0.086	0.679	-0.006	0.381
MT_BK	-0.045	0.074*	0.510	0.038	-0.008	0.305
Intercept	15.248	0.000***	108.569	0.000***	4.455	0.000***
Year dummies	YES		YES		YES	
Industry dummies	YES		YES		YES	
NO. observations	1610		1179		1159	
R^2	0.165		0.061		0.046	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Panel E: Regression results for model 4-6 (include industry fixed effects)

	Model 4 CCD (LOGIT)		**Model 5 DSpecificity(%) (Linear)**		**Model 6 DRank (Negative Binomial)**	
Variable	Coef.	p-value	Coef.	p-value	Coef.	p-value
CI	0.557	0.661	9.079	0.518	0.269	0.359
ID	0.935	0.252	15.983	0.004***	0.255	0.048**
SASB_MT	1.163	0.119	0.292	0.959	0.470	0.017**
LEV	3.495	0.182	-55.235	0.006***	-0.552	0.320
SIZE	0.759	0.031**	-4.361	0.036**	0.164	0.002***
IND_BOD	-0.007	0.856	0.719	0.004***	-0.002	0.829
ROA	0.028	0.729	0.496	0.269	-0.008	0.567
MT_BK	-0.053	0.345	0.157	0.710	-0.005	0.574
Intercept	8.282	0.285	104.254	0.001***	3.248	0.001***
Year dummies	YES		YES		YES	
Industry dummies	YES		YES		YES	
NO. observations	206		158		153	
R^2	0.222		0.424		0.057	

***. Significant at the 0.01 level.
**. Significant at the 0.05 level.
*. Significant at the 0.1 level.

Note. This table reports the regression results for model 1-6 to test the influence of family ownership and heterogeneity among family firms on climate change disclosure decisions and disclosure quality after adding the industry dummies. I winsorize LEV SIZE IND_BOD ROA MT_BK. All the variables are defined in Table 3. Standard errors are clustered at the firm level.

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