

Essays on Finance and Risk

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Thesis submitted to the University of Nottingham for the degree of

Doctor of Philosophy

November 2022

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Abstract

This thesis consists of three essays on corporate finance, with a focus on corporate governance in both the US and Chinese markets. The causal effect of reduced disclosure levels on the risk of default in the US market from 2008 to 2019 is examined in the first topic using regression discontinuity (RD) designs as the main identification strategy and the rule of *Smaller Reporting Company Regulatory Relief and Simplification* as the exogenous source of variation. The results indicate that smaller reporting companies, which are permitted to provide scaled disclosure in their 10-Ks, experience significantly and economically higher default risk. I demonstrate that the effect of information loss due to reduced disclosure levels dominates the effect of loss of commitment to mandatory disclosure and that, compared to previously qualified smaller reporting companies, newly qualified smaller reporting companies face steeper increases in bankruptcy risk during their first year of eligibility. The analyses also indicate that strong external oversight mechanisms, better corporate governance, and credible audit quality tend to alleviate the negative impact of reduced disclosure levels on the risk of default. The results are robust under alternative model specifications, regression discontinuity design assumptions and measures of default risk.

Using the book-tax gap not attributable to accounting accruals as the measure of tax avoidance, the impact of corporate culture on the tendency of companies to avoid tax from tax authorities in the US market is empirically examined in the second topic. Following the "Competing Values Framework", corporate culture is classified into four culture dimensions: collaborate, control, create and compete, and quantified by examining 10-Ks using text analysis. The results indicate that companies with a collaboration- and competition-oriented culture have a tendency to avoid more tax, while those with a control-oriented culture tend to avoid less.

The results also indicate that the impact of a collaboration- and competition-oriented culture on tax avoidance is mitigated when the measure of high-powered incentives is taken into consideration. This indicates that reducing the agency problem weakens the links between cultures and tax avoidance. The results are also robust to alternative measures of tax avoidance and different model specifications.

The third chapter investigates the effects of monitoring and advisory roles of friendly boards on CEO compensation under the Chinese context. The robust findings reveal that friendly boards weaken monitoring efficiency, thus attenuating a positive link between CEO compensation and firm performance. However, friendly boards better perform advisory duties, thus weakening a negative link between CEO compensation and R&D expenditure. Most importantly, the results show that friendly boards increase firms' R&D investment by alleviating CEO compensation risk, and also enhance innovation efficiency by strengthening a positive link between the number of patents and R&D investments. It is worth noting that although the empirical analyses have uncovered the beneficial side of friendly boards, it does not contradict to earlier studies which state that independent boards are good for firms. The extended analyses in this study show that while there is an absent link between firm value and friendly boards in general, friendly boards still increase firm value by serving their advisory functions on R&D projects.

Acknowledgements

First, I would like to take this opportunity to sincerely thank my supervisors, Dr. Thanaset Chevapatrakul and Dr. Rong Huang, for their guidance, advice, support, company and patience during the whole period of my PhD studies. Their guidance has expanded my ways of thinking, providing me with a deeper understanding of finance research. Their serious and rigorous research spirit was a constant source of encouragement for me to move forward.

Second, I would like to express my deepest gratitude to Prof. Charlie Cai and Dr. Qing Ma for their valuable suggestions and constructive comments.

Last, but not least, my special thanks go to my parents, Jianbin Yi and Qiang Yin, for their understanding, support, encouragement and love throughout my whole life.

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Chapter 1

Introduction

This thesis consists of three topics on corporate finance, with a major focus on corporate governance issues. While the first two chapters concern the impact of information disclosure on the risk of default, and the effect of corporate culture on firms' tendency to avoid tax both in the American market, the third chapter offers new insights and discusses the impact of friendly boards in the Chinese firms.

Default occurs when a firm fails to meet its debt obligations. It is one of the most disruptive events a firm can experience due to its adverse impact of a great many operational aspects, ranging from supply chain interruptions to staff redundancy and loss of customers, to name but a few (Brogaard et al. 2017). Research on the determinants of default risk has uncovered a number of factors that have an impact on the risk of bankruptcy. Ericsson et al. (2009) find that firm leverage and volatility are among the variables which can explain the variation in the credit default swap (CDS) spreads. Brogaard et al. (2017) report a statistically significant decrease in the risk of default around the 2001 decimalisation when the SEC reduced the minimum tick size from 1/16 a dollar to 1/100 of a dollar, suggesting that enhanced liquidity causes the risk of default to decline. Baghdadi et al. (2020) find that co-opted boards are associated with higher default risk because they are likely to facilitate erratic and arbitrary decision-making behaviour. However, studies on the link between the risk of default and information asymmetry is scarce. Among a handful of them is the work of Giesecke & Goldberg (2008), who propose a structural model of corporate default risk to demonstrate that information asymmetry can lead to an event premium. If public investors cannot

observe the threshold asset value at which the management liquidates the firm, they face an immediate default risk because they cannot determine how close the firm is to default.

The first topic of this thesis is devoted to an examination of the causal impact of voluntarily reduced disclosure in 10-Ks on default risk using the rule of *Smaller Reporting Company Regulatory Relief and Simplification* as an exogenous source of variation and a regression discontinuity design as the main identification strategy to quantify the effect of information asymmetry on default risk. The SRC rule allows firms whose equity float values are smaller than $75 million ($250 million) in the fiscal year 2008 (2018) and newly-qualified smaller reporting companies whose equity float values are smaller than $50 million ($200 million) onwards to voluntarily adopt the reduced disclosure level for 10 non-financial items in their 10-Ks. Since the eligibility to adopt a reduced level of disclosure is dictated by the thresholds prescribed by the well-defined SRC rule, firms are categorised as smaller or non-smaller reporting firms exogenously. By exclusively observing firms near the equity float thresholds that possess the same characteristics, except for receiving different treatment, the identification strategy in this chapter completely rules out endogeneity.

It is hypothesised that information asymmetry and information risk are intensified among smaller reporting companies by both the loss of commitment to mandatory disclosure and the reduced level of disclosure, which, in turn, exacerbate the risk of default. Based on this hypothesis, the estimated results using sample from 2008 to 2019 point to a significant rise in default risk among firms qualified under the SRC rule, which suggests that there is a positive association between information asymmetry and the risk of default. These results also apply to alternative model specifications, different choices of bandwidths and subsample estimations that exclude firms susceptible to public float manipulation located near the threshold.

The main analyses are also extended in several ways. First, the results of using Difference-in-Differences approach indicate that, while there is no evidence to suggest that the disclosure level of newly-eligible smaller reporting companies is different from that of previously-qualified smaller reporting companies, the former

suffer from a much larger increase in the default risk than the latter when they are both compared to non-smaller reporting companies. These results echo a study by Cohen et al. (2020), in which they find that, since investors tend to capture changes to 10-Ks, they view a sudden reduction in 10-K lengths as a negative signal. Second, the sample is restricted to 2007-2008 and 2017-2018 in order to isolate the risk of default caused by the effect of loss of commitment to mandatory disclosure from the effect of loss of information by comparing smaller reporting companies that chose to provide scaled disclosures and smaller reporting companies that chose to provide full disclosure to non-smaller reporting companies. Based on the results, the impact of the loss of information on the default risk dominates that of the loss of commitment. Third, having proved that an increase of information asymmetry causes the risk of default to rise, it is hypothesised that good corporate governance, which aims to improve the information environment, should lessen the impact of reduced disclosure on the risk of default. The analyses show that the causal impact of the reduced disclosure level on the risk of default vanishes in smaller reporting companies monitored by a large number of analysts, with higher institutional ownership, independent boards and audited by the Big 4 accounting firms.

The findings make a number of contributions. First, except Fu & Trigilia (2018) who provide a theoretical model and show a negative association between disclosures and default risk, this study is the first one empirically examining the effects of voluntarily reduced disclosure on default risk. The results reveal that both the loss of information and loss of commitment to mandatory disclosure caused by the eligibility to the SRC rule price information asymmetry, thus increasing default risk. Hence, the results indicate that while the well-defined SRC rule is devised out of a desire with the best hope to assist small business in reducing reporting burden, the unexpected and inevitable consequence is that firms which are eligible for the SRC rule see their default risk increase. Second, using DiD approach to compare default risk between smaller reporting companies who choose to maintain their disclosure levels and non-smaller reporting companies, the results show that default risk still increases among smaller reporting companies who choose to maintain their disclosure levels. Thus, the results fill the gap in the literature

relevant to information disclosures that voluntary disclosures cannot fully replace mandatory disclosure in affecting default risk. Most importantly, the results are provocative for practitioners. The results indicate that although it is inevitable for smaller reporting companies to see their default risk increase, remedial actions such as increasing oversight mechanisms, strengthening corporate governance, and improving the audit quality can be taken to lessen the negative impact of the SRC rule on default risk.

Taxation is the greatest source of government revenue and one of the most significant costs for firms. Tax avoidance occurs when an enterprise retains cash within the company that should go to the government otherwise. Hence, it is generally accepted that shareholders prefer tax avoidance since they prefer any transactions which lead to enhanced firm value. In fact, the determinants of tax avoidance are well-documented in the literature. For example, Rego (2003) show that firm size is positively related to tax avoidance, since larger firms may have more opportunities to avoid tax based on structuring transactions to shift taxable income to lower tax jurisdictions. Chen et al. (2010) find that family firms are less likely to engage in tax avoidance, being more concerned with the potential penalty and reputational damage from IFS. Over-confident CEOs are more likely to avoid tax while those CEOs with military experience are less likely to avoid it (Law & Mills 2017, Hsieh et al. 2018).

However, research about the link between corporate culture and tax avoidance is still scarce, with the major focus being on the impact of corporate social responsibility. Lanis & Richardson (2015), for example, use a matched sample of tax-avoidant and non-tax-avoidant observations to show that the higher a firm's level of performance of its corporate social responsibility, the lower the likelihood that it will attempt to avoid tax. Similar relationships between CSR and tax avoidance can be also found by Sikka (2010), Hoi et al. (2013), Hasseldine & Morris (2013) and Col & Patel (2019). Different from these studies which utilise the existing database to indicate corporate culture, the second topic of this thesis employs text mining methods to quantify corporate internal cultures. Following the "Competing Values Framework" developed by Cameron & Quinn (1999) and Cameron et al. (2014), corporate culture is classified into four cultural quadrants,

namely, collaborate, control, create and compete. Each cultural quadrant is measured as the ratio of the number of occurrences of key words to the total number of words in the same 10-K reporting following Fiordelisi & Ricci (2014) and Fiordelisi et al. (2019). Tax avoidance is measured as the book-tax gap not attributable to accounting accruals.

The results suggest that firms with a collaboration-oriented culture engage more in tax avoidance. This finding thus reveal that a collaborative culture, by definition, cultivates a collaborative working atmosphere and increases internal information transparency, which has been proved by the prior literature of Gallemore & Labro (2015*a*) and Hsieh et al. (2018) to be positively related to tax avoidance. Second, organisations oriented to a control culture strictly follow rules and remove any component that prevents perfection (Cameron et al. 2014). Therefore, the results indicate that firms oriented to a control culture are less likely to avoid corporate tax. Third, firms based on a competitive culture avoid more tax. This is consistent with Cameron et al. (2014) that competitive firms focus on fast profitability. Tax avoidance, as a fast way to generate corporate internal funds, is attractive to competitive firms. The results are also relevant when managerial high-powered incentives are taken into consideration. The results show that the positive links between collaborative culture and tax avoidance, and between competitive culture and tax avoidance are attenuated by incentive compensation, thus, the findings indicate that better alignment between managers and the board team weakens the links between cultures and tax avoidance. These results are also robust to alternative measures of tax avoidance.

Further investigations involve examining through which mechanisms corporate cultures affect tax avoidance. According to Gallemore & Labro (2015*a*), tax avoidance is impossible without a good internal information environment. Therefore, I conjecture that firms oriented to different cultures face different internal information environments. Staff involvement is highly encouraged in firms oriented to a collaborative culture, thus, firms oriented to this culture naturally construct efficient communication channels and are more internally information transparent. However, a control culture is a hierarchical culture. Thinking tax department as a unit business segment that has the superior knowledge about when and how

to avoid tax, tax managers may be reluctant to provide suggestions about tax avoidance opportunity instead of waiting and following managers' and the boards' directions since any opposite idea is suppressed in this culture (Cameron et al. 2014). Therefore, a less transparent internal information environment is established. In terms of a competitive culture, firms are market-oriented when they are dominated by this culture. They have to build a bridge between organisations and customers and respond to the market timely. Therefore, efficient communication channels have to be established both internally and externally. To sum up, if the internal information environment is a mechanism to explain how corporate culture affects tax avoidance, it is expected to see that the positive (negative) effect of a collaborative and competitive (control) culture on tax avoidance is attenuated (enhanced) when firms are more internally information asymmetrical.

Following Gallemore & Labro (2015*a*), firms' internal information environment is measured as business (geographic) dispersion. The intuition is that firms operating on multiple segments need to combine segments' information together. Such procedures always result in information aggregation problems, thus a poor internal information environment. As predicted, the results suggest that the positive (negative) effect of a collaborative and competitive (control) culture on tax avoidance is attenuated (enhanced) when firms have higher levels of business (geographic) dispersion. Therefore, the internal information environment acts as the mechanism through which corporate culture affects tax avoidance.

The empirical work is also extended to examine whether managerial compensation affects the links between corporate cultures and tax avoidance through reduced agency problems. To do so, I examine whether the negative effects of incentive compensation on the links between a collaborative culture and tax avoidance, and between a competitive culture and tax avoidance are enhanced when firms have higher levels of institutional holdings and greater board independence. The results show that the effects of managers' incentive compensation on the links between cultures and tax avoidance is strengthened, therefore, echoing the conjecture.

The second chapter makes a number of contributions. First, although the importance of corporate culture has been well documented in the literature and hotly discussed among practitioners, the impact of which on tax avoidance is under-

developed and lacks empirical support. This study follows Cameron et al. (2014)'s "Competing Values Framework" and quantifies corporate culture by utilising text analysis methods. Thus, this study directly answers the question of whether and how corporate culture affects tax avoidance. Second, the results indicate that firms with a collaboration- and competition-oriented culture avoid more corporate tax, while those with a control culture avoid less tax. Hence, the results are helpful for policymakers and regulators who care about detecting a firm's involvement in tax avoidance.

Starting from the separation of principals and agents in modern corporate governance, the board sets CEO compensation based on firm performance in order to monitor CEOs (Jensen & Meckling 1976*a*, Fama & Jensen 1983, Core & Guay 1999). In line with this theory, empirical work in China has found a positive link between CEO compensation and firm performance (Kato & Long 2006*a*, Firth et al. 2006, 2007, Conyon & He 2011). Therefore, CEO compensation is regarded as a tool used by the board to function their monitoring duties.

According to Adams & Ferreira (2007), the board typically has two duties — monitoring and advising. Thus, a hotly debated issue is focused on the role played by a friendly board. On the one hand, a friendly board weakens monitoring efficiency and thus may violate the tenants of modern corporate governance mechanisms (Schmidt 2015). On the other hand, a management-friendly board has a superior advantage in performing advisory duty and thus may be beneficial to a firm under certain circumstances (Adams & Ferreira 2007, Schmidt 2015). The third chapter aims to examine both the monitoring and advisory roles played by a friendly board under the Chinese context since there is a missing analysis on this topic in China. Specifically, the aims of this chapter are twofold. First, the empirical design is going to examine the effects of friendly boards on the link between CEO pay and firm performance. It is conjectured that a friendly board has attenuated monitoring efficiency, thus weakening a positive link between CEO pay and firm performance. However, by being more friendly, such boards are more likely to compensate CEOs additionally for their efforts in achieving better firm performance. Under this circumstance, the pay-for-performance is observed to be enhanced. The second goal of this chapter is to examine the advisory role of a friendly board. R&D

investment involves an enormous cash outflow with uncertain outcomes, which can be transferred to the increased stock price volatility. Earlier studies show a negative link between CEO compensation and R&D expenditure since costs incurred for developing R&D projects require a long-term procedure to realise the unknown and unpredictable profits in the future, causing poor firm performance in the short-run and hence, the decreased CEO compensation (Bizjak et al. 1993, Chambers et al. 2002, Cheng 2004, Santosuosso et al. 2016). As shown in Bushee (1998) and Cheng (2004)' studies, CEOs try to reduce R&D spending to opportunistically increase short-term profitability due to the negative impact of R&D expenditure on their compensation, leading to firms' R&D under-investment problems. It is hypothesised that a friendly board has an exclusive information advantage in R&D investments, and better access to CEOs' investment decisions, thus, to show their support, would compensate CEOs additionally and avoids them from compensation risk in terms of R&D projects. On the contrary, since R&D projects come with information asymmetry, it is easier for CEOs and boards to collude with each other if the information is less transparent. A collusion between CEOs and friendly boards negatively affect firm performance, subsequently lowering CEO compensation. Consequently, a negative link between CEO pay and friendly boards is enhanced in firms with friendly boards. In all, the effects of friendly boards' monitoring and advisory duties become an empirical examination, which is fully discussed in the third chapter.

Data are collected from the China Stock Market and Accounting Research Database (CSMAR) between 2007 and 2021. CEO compensation is measured as the logarithm form of total cash-based pay, including salary, bonuses and commissions following Murphy (1985), Lambert et al. (1993), Finkelstein & Boyd (1998), Murphy (1999) and Devers et al. (2007). Firm performance and R&D expenditure are measured as return on the market value of equity and the ratio of R&D expenditure to total sales, respectively. Three distinct measures are used to indicate friendly boards: whether the CEO's relative is sitting on the board, CEO duality and board dependence. As a result, I find that a positive link between CEO compensation and firm performance is attenuated by a friendly board, suggesting that a friendly board has weaker monitoring efficiency, thus attenuating the pay-

for-performance link. The results also indicate that a friendly board mitigates a negative association between CEO pay and R&D expenditure, showing that a friendly board has a superior advantage in performing the advisory role, thus compensating CEOs initially and additionally when CEO compensation faces a sudden reduction in terms of R&D investments. These results are robust using the alternative measures of R&D expenditure and friendly boards, and after solving the potential endogeneity.

To sum up, the results till this point imply that CEOs supervised by a friendly board may be more risk-seeking since their compensation is less determined by firm performance, but more by their behaviour of investing in R&D projects. Therefore, the analyses are extended to firstly check whether the relatively higher R&D expenditure can be observed in firms with a friendly board. The results indicate a positive link between R&D expenditure and a management-friendly board and also show that this link is enhanced in terms of higher CEO compensation.

Modern corporate governance mechanisms have been consistently emphasising the importance of increasing board independence since it enhances board monitoring efficiency and decreases agency problems. However, despite the widespread belief that independent boards are good for firms, recent literature both theoretically and empirically shows that less independent boards still increase firm value under certain circumstances (Adams & Ferreira 2007, Harris & Raviv 2008, Schmidt 2015). Therefore, this chapter is also extended to examine whether the relatively higher R&D investments in firms with management-friendly boards lead to higher innovation outcomes, and whether a friendly board increases firm value by functioning its advisory duty. The results are fourfold. First, a positive link between innovation outcome and R&D expenditure is enhanced by a friendly board. Second, a management-friendly board increases firm value only in high-tech firms. Third, although there is a missing link between firm value and a friendly board in general, a friendly board still increases firm value by functioning advisory duties on R&D projects. Fourth, the positive effect of a friendly board on the link between firm value and R&D investment is enhanced in high-tech firms. Taken together, the results do not contradict to the modern corporate governance theories that independent boards increase firm value. Instead, the findings echo studies by Adams

& Ferreira (2007) and Schmidt (2015) that both boards' monitoring and advising duties can contribute to the increased firm value. Whether one function dominates the other one in determining firm value depends on each firm's circumstance. For example, high-tech firms which have high advisory needs benefit from having a friendly board.

This chapter contributes to both literature and practitioners. First, the findings fill the void in the literature and help understand the meaning of having a friendly board under the Chinese context. This chapter empirically finds that a friendly board has its dark side that it has weaker monitoring efficiency, thus weakening the power of the pay-for-performance link. The results also suggest a bright side of a friendly board that by better performing its advisory duty, it weakens a negative link between CEO pay and R&D expenditure. Therefore, the results show a trade-off of having a management-friendly board. Second, this chapter also examines whether CEOs supervised by a friendly board are more risk-seeking, thus investing more in R&D projects. The findings indicate a positive link between R&D expenditure and a friendly board and also show that alleviating CEO compensation risk is a mechanism through which a management-friendly board increases R&D investments. Hence, the findings are helpful for both policymakers and practitioners. For example, according to "The Medium- to Long-term Science and Technology Development Plan: Outline of China", the Chinese government has been consistently emphasising increasing R&D investments and reducing reliance on imported technology. The results indicate that having a friendly board is a potential solution to this plan since it cures CEOs' myopic R&D investment problems caused by the negative impact of R&D spending on CEO compensation, as a result, making firms get more involved in R&D activities. Third, despite the widespread belief that independent boards increase firm value, the results also answer a hotly discussed issue of whether friendly boards can still enhance firm value. The results indicate that while there is no direct link between firm value and a friendly board in general, a friendly board directly increases firm value for firms with high advice needs, for example, high-tech firms. Therefore, the findings indicate that whether firms choose to have a friendly board should depend on each firm's situation and decide with caution. Receiving more valuable advice from a friendly board comes at a cost of reduced

monitoring efficiency. For advice-demanded firms such as firms in the high-tech industry, they benefit from having a friendly board.

Chapter 2

Financial Disclosures and the Risk of Default: Analysis of the Smaller Reporting Company Rule

2.1 Introduction

Default occurs when a firm fails to meet its debt obligations and it is one of the most disruptive events a company can experience, since it has an adverse effect on many operational aspects, ranging from interruptions in the supply chain to staff redundancies and loss of customers, among others. The legal and administrative costs incurred in the event of default could also be prohibitive, further jeopardising the firm's financial health. Even if a firm continues to service its debts, an increased risk of default could have an implication on the company's performance, stock price, and costs of borrowing. As documented by Campbell et al. (2008), stocks that are financially distressed deliver anomalously low returns but high standard deviations, market betas, and loadings on HML and SMB factors (Fama & Kenneth 1993). Dichev (1998) finds that firms with a higher default risk have earned substantially lower than average returns since 1980, which suggests that default risk is not rewarded.

Researchers have uncovered a number of factors that can be used to determine the risk of default. Fang et al. (2009) reported that higher stock liquidity leads to higher firm performance and lower bankruptcy risk. Ericsson et al. (2009) found

that firm leverage and volatility can explain variation in the credit default swap (CDS) spreads. Brogaard et al. (2017) reported a statistically significant reduction in the risk of default around the 2001 decimalisation when the SEC reduced the minimum tick size from 1/16 of a dollar to 1/100. The authors cited enhanced liquidity, stemming from the decimalisation, as the driver behind the decline in default risk. From a corporate governance point of view, Baghdadi et al. (2020) found that co-opted boards are associated with a higher risk of default as they are likely to facilitate more erratic and arbitrary decision-making behaviours. They further documented that external oversight mechanisms which reduce information asymmetry, such as institutional ownership, analyst as well as media coverage, weaken the association between board co-option and the risk of default.

Although previous studies on the determinants of the risk of default are insightful, the effects of information disclosure on default risk is still underdeveloped. In this chapter, I examine the causal impact of voluntarily reduced disclosure on the risk of default. Evidence on the causal effects of disclosure is difficult to obtain since identifying counterfactuals, unaffected control groups, or natural experiments that would allow a clean identification of the effects and the economic consequences of disclosure is a key challenge (Healy & Palepu 2001, Leuz & Wysocki 2016). As pointed out by Healy et al. (1999), disclosure changes are unlikely to be random events as they tend to coincide with changes in firm economics and governance. Simply modelling the risk of default as a function of disclosure would result in a biased estimate due to omitted variables, since disclosure could potentially be determined, at least in part, by the risk of default. To address the endogeneity issue, the *Smaller Reporting Company Regulatory Relief and Simplification* rule (hereafter the SRC rule) is employed as the exogenous source of variation and regression discontinuity (RD) designs is utilised as the main identification strategy to estimate the effect of the reduced level of disclosure on default risk. The SRC rule allows firms whose equity float values are smaller than $75 million ($250 million) in the fiscal year 2008 (2018) and newly-qualified smaller reporting companies whose equity float values are smaller than $50 million ($200 million) onwards to voluntarily adopt the reduced disclosure level for 10 non-financial items

in their 10-Ks.[1] Since the eligibility to reduce the disclosure level is dictated by the thresholds, prescribed by the well-defined SRC rule, whether a company is classified as a smaller reporting company or a non-smaller reporting company is determined exogenously. Focusing exclusively on observations of firms near the equity float thresholds which possess the same characteristics, except for the smaller reporting company and the non-smaller reporting company statuses, this identification strategy completely rules out endogeneity. It is hypothesised in this study that both the loss of commitment to mandatory disclosure as well as the reduction in the disclosure level caused by the SRC rule among smaller reporting companies exacerbate information asymmetry and information risk, which, in turn, elevate the risk of default.

The sample ranges from January 2008 to December 2019, constitutes a total of 25,276 firm-year observations for 4,144 unique firms, and covers an intersection of data obtained from the CRSP, Compustat, and SEC's EDGAR databases. The risk of default is estimated by following Bharath & Shumway (2008), whose expected default frequency (EDF) measure uses the same functional form and inputs as the Merton distance-to-default (DD) framework, which is based on Merton (1974), but does not require an iterative process to solve a system of nonlinear equations. Compared to the Merton DD model, the EDF measure has been proved to better predict the actual default rates out-of-sample. In order to address the legal uncertainty of the definition of an "affiliate" and hence, the definition of public float, the public float information is directly extracted from the cover pages of 10-Ks using a textual analysis to classify the firms in the sample as smaller reporting companies or non-smaller reporting companies.[2]

As a preview of the main findings, the RD results show that, eligible smaller reporting companies do voluntarily reduce their level of disclosure. The 10-K reports, filed by smaller reporting companies, are about 16% smaller in size,

[1]The list of the 10 non-financial items in 10-Ks for which smaller reporting companies can voluntarily provide scaled disclosure can be found in Table A1 in the Appendix.

[2]It is stated on the SEC website (https://www.sec.gov/smallbusiness/goingpublic/SRC) that the public float is calculated by multiplying the number of the company's common shares held by non-affiliates by the market price and, in the case of an IPO, adding the product obtained to that number by multiplying the common shares covered by the registration statement by their estimated public offering price. However, as pointed out by Iliev (2010), there is legal ambiguity around the definition of an "affiliate".

contain 7% fewer words and 12% lower word counts among the 10 items in the report where the reduced level of disclosure is allowed. It is found that the reduced level of disclosure leads to an increase in the risk of default, as measured by the EDF, by approximately 4 basis points after controlling for factors that have been documented to affect default risk. The estimated effect, evaluated at the unconditional mean of the EDF, is equivalent to an increase of about 70% of the default risk, which has a statistically significant and economic impact. These results are robust to alternative model specifications, different bandwidths, and subsamples where observations of firms located near the threshold which are most susceptible to public float manipulation are excluded. Crucially, the RD designs in this chapter satisfy both the assumptions of no manipulation of public floats and the continuity of the covariates around the cutoff, confirming that observations of firms located in the vicinity of the threshold are "as if randomly assigned". As a check for robustness, the RD models are estimated based on the stronger assumptions of local randomisation and obtain similar results. Falsification tests are also conducted in this study to show that the effect of the voluntarily reduced disclosure level is absent at all the artificial thresholds under investigation. Besides, the results are found to be robust when the alternative measures are taken of default risk–*Z-score* and *O-score*. Taken together, a combination of these results emphasises the significantly economic and statistical impact caused by the deterioration of the information environment on the risk of default due to the voluntarily reduced level of disclosure.

The main analyses are extended in several ways. First, the effect of the voluntarily reduced disclosure level on the risk of default is quantified when firms become eligible for reduced disclosure under the SRC rule for the first time. Motivated by Cohen et al. (2020) who report that, while numerical entries in the current year's financial reports can be easily compared to those in previous year's, investors do not always notice changes in 10-K text. It is hypothesised that recently-qualified smaller reporting companies experience a sharp rise in the risk of default due to investors' ability to easily notice a sudden reduction in their disclosure levels. The empirical results show that, while there is no evidence to suggest that the disclosure level of newly-eligible smaller reporting companies

differs from that of previously-qualified smaller reporting companies, the former suffer from a much larger increase in default risk than the latter when they are both compared to non-smaller reporting companies. Second, in order to disentangle the impact of the loss of commitment to mandatory disclosure from the impact of the information loss on the risk of bankruptcy, I employ the difference-in-differences (DiD) approach to analyse the samples of smaller reporting companies and non-smaller reporting companies around the 2007-2008 and the 2017–2018 periods. The results demonstrate that the impact of the information loss on the risk of default is stronger than that of the loss of commitment to mandatory disclosure. Both effects are found to be stronger during the former period when the SRC rule was first introduced than during the latter period when the rule was amended.

Existing research has shown that information intermediaries and strengthened corporate governance improve information environment. I conduct additional analyses by examining whether different degrees of analyst coverage, institutional ownership, and board independence transform the impact of the voluntarily reduced disclosure level on the risk of default. I also investigate if smaller reporting companies that are audited by a Big 4 accounting firm suffer the same degree of an increase in bankruptcy risk as smaller reporting companies that are audited by a smaller, non-Big 4 firm. The findings show that the causal impact of the voluntarily reduced disclosure level on the risk of default vanishes among smaller reporting companies that are followed by a large number of analysts and smaller reporting companies with higher institutional ownership. The results suggest that strong external oversight mechanisms, which improve governance and information environment, lessen the impact of the reduced disclosure on the risk of default. The analysis results of the impact of board independence on the association between the risk of default and the voluntarily reduced disclosure level indicate that the presence of independent boards attenuates the link between the risk of bankruptcy and the eligibility to a reduced disclosure level. An investigation on whether enhanced assurance on financial statements provided by the Big 4 accounting firms has any impact on the connection between the voluntarily reduced disclosure level and the risk of default suggests that smaller reporting companies that are audited by a Big 4 accounting company do not suffer an increase in default risk.

This chapter makes a number of key contributions. First, despite Fu & Trigilia (2018) who theoretically prove a negative link between default risk and information disclosures, the effects of disclosures on the risk of default risk have not been well understood. This chapter is the first one to provide empirical evidence of the effects of voluntarily reduced disclosure on default risk and employs the well-defined SRC rule as the exogenous variation and regression discontinuity designs as the main identification strategy, thus ruling out the potential endogeneity. The findings highlight a trade-off between the costs and benefits of the eligibility to voluntarily provide scaled disclosure. While the SRC rule was devised out of a desire with the best hope to assist small businesses in reducing costs associated with financial reporting (Cheng et al. 2013), an unintended consequence caused by the voluntarily reduced disclosure levels is an increase in information asymmetry, resulting in an increase in the risk of default. Therefore, the results are provocative for policymakers to notice the side effects of the SRC rule. Second, using the DiD approach to compare smaller reporting companies who choose to maintain their disclosure levels with non-smaller reporting companies, the techniques help fill the gap in the literature on the commitment effects of mandatory disclosures on default risk. The results lead to conclude that smaller reporting companies still experience higher default risk even if they voluntarily maintain their disclosure levels, underlining the importance of mandatory disclosure which provides credible mechanisms that cannot be replaced by voluntary disclosure. Most importantly, this study emphasises that the effects of the eligibility to the SRC rule on default risk can be mitigated by the higher number of financial analysts following, higher institutional holdings, more independent boards, and Big-4 auditors. The findings thus imply that although the negative impact of the SRC rule among smaller reporting firms cannot be avoided, smaller companies can take remedial actions such as increasing oversight mechanisms, strengthening corporate governance, and improving the audit quality to lessen the impact of the SRC rule on the risk of default while benefiting from the reduced reporting burden. Hence, the findings are also of great importance for practitioners.

This chapter proceeds as follows. The next section provides the institutional background of the SRC rule. Section 2.3 reviews existing literature and develops

hypotheses. Section 2.4 discusses the data and the construction of variables. The main empirical analysis is explained and discussed in Section 2.5. Sections 2.6 and 2.7 present model diagnostics and check for the robustness of the results, respectively. In Section 2.8, I analyse the effect of the reduced disclosure on the risk of default among newly eligible smaller reporting companies. Section 2.9 disentangles the impact of information loss on the risk of default from the impact of the loss of commitment to mandatory disclosures. I discuss the impact of external oversight mechanisms, independent boards, and the Big 4 on the association between the reduced disclosure level and the risk of default in Section 2.11. Finally, Section 2.12 concludes this chapter.

2.2 Institutional Background

In 1992, the Securities and Exchange Commission (SEC) adopted Regulation S-B, a securities law that outlined integrated reduced disclosure requirements for small businesses. Regulation S-B was prescribed under the Securities Act of 1933 and the Securities Exchange Act of 1934, requiring all registered firms on the SEC to disclose their essential financial information to their investors. It was the first deregulation of its kind, aiming to deviate small businesses from the "one-size-fits-all" policy and, more importantly, helping them lower their compliance costs.

Under Regulation S-B, firms with both revenues and public equity floats of less than $25 million were permitted to provide scaled disclosure, allowing them to complete a simplified version of the disclosure forms, thus giving them the option to report significantly smaller amount of financial information about their businesses. Reducing the burden of financial disclosure for public firms was, however, still controversial – especially after the SOX was passed in 2002. The costs of complying with the SOX for smaller firms in particular were still far too high as they were likely to pay disproportionately higher costs in order to comply with reporting regulations due to the fixed cost nature of compliance.[3] Therefore, in 2005, the

[3] Iliev (2010) reports that, on average, the management report (MR) filers had to pay approximately $698,000 more in audit fees in order to comply with the SOX. His estimates of the 2-year buy-and-hold returns of MR filers, ending after the filing of the 2004 reports, were, on average, around 17% lower than those of nonfilers, suggesting that the costs of Section 404 of the SOX outweigh the benefits.

SEC chartered the Advisory Committee on Small Public Companies (ACSPC) to re-evaluate the reporting system for small companies.[4]

Following recommendations by ACSPC, the SEC discarded Regulation S-B and instead adopted the *Smaller Reporting Company Regulatory Relief and Simplification* rule (hereafter the SRC rule) in July 2007. Under the SRC rule, firms with public equity floats of less than $75 million (or revenue lower than $50 million if public floats could not be calculated) were permitted, but not required, to voluntarily reduce the disclosure levels of the 10 non-financial items in their 10-K files, including, for instance, the description of business, qualitative and quantitative disclosure on market risk, business and other risk factors, policies and procedures for approving related party transactions and executive compensation, etc.[5] The rule required all eligible companies, regardless of whether or not they voluntarily opted to provide the scaled disclosure, to identify themselves as smaller reporting companies by ticking the appropriate box in the SEC filings. This entitles them to comply with certain SEC rules and regulations that are less onerous.

The initial threshold used to classify smaller reporting companies and non-smaller reporting companies was $75 million for public float or $50 million for revenue if the value of public float could not be determined. However, if a company did not qualify as a smaller reporting company in 2008, it would not qualify in the future unless its public float fell below $50 million as of the last business day of its second fiscal quarter. In order to avoid a situation in which a firm frequently entered and exit the SRC status due to small fluctuations in their public floats, once a company acquired the SRC status, it would then remain a smaller reporting company until its public float again exceeded $75 million.[6]

A decade later, the SEC adopted the amendments to the definition of smaller reporting companies which became effective in September 2018. Under the new definition, a company qualifies as a smaller reporting company if it has public

[4]See Appendix A1 for a list of items permitted for the reduced disclosure and detailed comparisons between smaller reporting firms and non-smaller reporting firms.

[5]See Appendix A1 for the list of items permitted for the reduced disclosure and detailed comparison between smaller reporting companies and non-smaller reporting companies.

[6]A smaller reporting company (SRC) is defined in Rule 405 under the Securities Act as a company that is not an investment company, an asset-backed issuer or a majority-owned subsidiary of a parent that is not a smaller reporting company, and that has a public float of less than $75 million as of the last business day of its most recently completed second fiscal quarter.

float of less than $250 million or it has less than $100 million in annual revenue and no public float or public float of less than $700 million. Once a company determines that it does not qualify as a smaller reporting company under the applicable thresholds, it will not subsequently qualify until its public float falls below a lower threshold, set at 80% of the initial qualification threshold (i.e., $200 million). A smaller reporting company that subsequently qualifies under the lower $200 million public float threshold remains qualified until its public float again exceeds $250 million.[7] The advantage of being a smaller reporting company is that such a company comply with certain SEC rules and regulations that are less onerous. Smaller reporting companies are also granted the flexibility to comply with the rule by allowing them to pick and choose between scaled or non-scaled financial and non-financial disclosure requirements on an item-by-item basis.

The details of the SRC rule can also be found in the Appendix Table A2.

2.3 Theoretical Framework

Financial reporting and disclosure are crucial to a well-functioning and efficient capital market. Each year, the majority of US public firms are required to produce a 10-K and file it to the US Securities and Exchange Commission (SEC). A 10-K contains detailed information about the firm's ongoing business, risks, as well as the operating and financial results. Most importantly, firms are prohibited by law from making materially false or misleading statements in their 10-Ks and from omitting material information that can ensure the accuracy of the disclosure. The company's CFO and CEO are required, under the Sarbanes-Oxley Act (SOX), to certify that the 10-K is accurate. Some companies go beyond the SEC's requirements and participate in voluntary communication, such as analysts' presentations, conference calls, press releases, internet sites, management forecasts, and other corporate reports, among others.

As discussed at length in Healy & Palepu (2001), the need for financial reporting and disclosure emerges from information asymmetry and agency conflicts between managers and outside investors. The authors cite information differences and

[7] See https://www.sec.gov/rules/final/2018/33-10513.pdf for the details of the explanation of SRC rule.

conflicting incentives between entrepreneurs and savers as potential sources of a breakdown in the functioning of the capital market. A number of studies find that reducing information risk through increased voluntary disclosure ameliorates information asymmetry, as well as agency conflicts (Diamond & Verrecchia 1991, Healy & Palepu 2001). Welker (1995), for example, demonstrates that firms with a higher level of disclosure have smaller bid-ask spreads, which signify less severe information asymmetry. This finding is confirmed by Healy et al. (1999), who observe that an expanded disclosure level induces investors to revise their valuations of stock prices upwards. They also find that higher stock liquidity, larger coverage by analysts, and more interest by institutional investors are all positively associated with the amount of disclosure.[8] Gelb & Zarowin (2002) document a positive correlation between the level of disclosure and the amount of information about future earnings impounded in the stock prices. Furthermore, Botosan (1997) finds that an increased level of disclosure significantly lowers the cost of equity capital, while Sengupta (1998) reports a negative relationship between disclosure levels and the cost of debt. According to Baiman & Verrecchia (1996) and Brogaard et al. (2017), investors have more confidence in companies with high levels of disclosure since they believe that the firms' stock transactions are likely to take place at fair prices.

Prior studies also document that the decreased information asymmetry results in decreased default risk from different perspectives. For example, by employing a structural model of corporate default risk, Giesecke & Goldberg (2008) demonstrate that information asymmetry can induce an event premium, which they define as compensation for the abrupt changes in security prices that occur at default. As the threshold asset value at which the management liquidates the firm is private information, investors are taken by surprise when the firm value reaches the default threshold and therefore demand compensation for being exposed to non-diversifiable corporate default risk. Hence, it is in the interest of the management to improve transparency in order to reduce the premium required by investors. Lindset et al. (2014) present a theoretical model of credit spreads in which both debtholders and equityholders have incomplete information about the financial health of the

[8]Similar findings are uncovered by Leuz & Verrecchia (2000) using data on the German stock markets.

company. The information is incomplete because it is revealed with a time lag and is asymmetrically distributed between debtholders and equityholders. The authors find that the degree of information asymmetry between debtholders and equityholders is positively associated with the risk of default. Furthermore, Fu & Trigilia (2018) use a dynamic moral hazard model to show that disclosure lowers information asymmetry between managers and investors, lessening the variation in the value of the firm's stock and funding liquidity, both of which are required to alleviate the agency problem in the optimal contract.[9]

Hence, in this chapter, it is hypothesised that the loss of information as well as the loss of commitment to mandatory disclosure among smaller reporting companies may cause these firms to experience increased information asymmetry, and thus, additional risk.

On the one hand, although the SRC rule was designed to ease the burden of financial reporting, the adoption of scaled disclosure under the SRC rule may inadvertently jeopardise a firm's credit rating. According to Berger & Ofek (1995), lower disclosure levels increase managers' proclivity to invest in assets that destroy the shareholders' value, causing managers to act less in the shareholders' interests (Ball 2006), resulting in the increased default risk.

On the other hand, even though smaller reporting companies voluntarily disclose the full information on their 10-Ks and try to maintain their disclosure levels, compared with non-smaller reporting companies that are required by the SEC to disclose in full, their information asymmetry is still expected to increase as they lose their commitment effects provided by the mandatory disclosures (Cheng et al. 2013). Rock (2001) defines the SEC disclosure system as an effective means to increase information transparency, since it regulates the form and quality of disclosures, allows reporting obligations to be adjusted over time and most importantly, is a reliable and specialised enforcement mechanism. The combination of criminal and civil liability generally makes mandatory disclosure a credible commitment

[9]The agency theory warns that managers may choose to maximise their own benefits rather than those of the shareholders. Therefore, information disclosure by management is essential for shareholders to monitor their actions, which helps mitigate the agency problem by disciplining managers to act in the best interest of shareholders (Bushman & Smith 2001). Investors seek high-quality disclosures that reduce information asymmetry and improve shareholders' ability to better relate managerial decisions to firm performance(Diamond & Verrecchia 1991, Lombardo & Pagano 2002).

mechanism for firms to avoid the high cost of failing to meet the disclosure obligation. Hence, mandatory disclosure is a mechanism to monitor managers and make them accountable for their empire-building tendency (Schumpeter 1911, Bushman & Smith 2001, Dominguez-Martinez et al. 2006, Hope & Thomas 2008), thereby preventing them from pursuing projects for their own private benefits that lead to a poorer firm performance at the expense of the shareholders' interests. If firms choose to voluntarily disclose information on their 10-Ks, managers have an opportunity to disclose it strategically to enable them to pursue their private interests instead of those of the shareholders, causing a more volatile cash flow (Hope & Thomas 2008). Since voluntary disclosures lack an official supervision mechanism, they cannot fully replace the mandatory disclosures, thus causing relatively higher information asymmetry, as well as a higher risk of default.[10]

2.4 Data and Construction of Variables

2.4.1 Sample

The sample covers the period between January 2008 (the year in which the SRC rule was first enacted) and December 2019 and constitutes an intersection of data obtained from the CRSP, Compustat, and SEC's EDGAR databases. Beginning with the CRSP databases, the default risk is calculated following Bharath & Shumway (2008). Consistent with prior papers (Bharath & Shumway 2008, Brogaard et al. 2017, Baghdadi et al. 2020), financial firms (SIC codes between 6000–6999) are excluded from the sample [11]. This leaves 29,636 observations and 4,681 firms. The sample is next merged with the intersection of the CSRP

[10]Other strands of literature on voluntary disclosure include studies led by Chow & Wong-Boren (1987), Raffournier (1995), Meek et al. (1995), Ho & Wong (2001), Chau & Gray (2002), Eng & Mak (2003), Barako et al. (2006), Lim et al. (2007), Wang et al. (2008), and Francis et al. (2008) who examine factors that influence voluntary disclosures, which include firm characteristics, managerial ownership, and board structure, drawn from the evidence in different countries. More research papers are focused on analysing the cost and benefit of firms that opt for voluntary disclosure, for example, Wagenhofer (1990), Depoers (2000), Dedman et al. (2008), and Wang et al. (2008). My work also adds to the existing literature in relation to analysing the content of the 10-K reports, such as Loughran & McDonald (2011), Ertugrul et al. (2017), and Kim et al. (2019).

[11]To be in line with the extant literature related to default risk (Bharath & Shumway 2008, Brogaard et al. 2017, Baghdadi et al. 2020), I only exclude from the initial sample financial firms. In the following section, the empirical work will be conducted to examine whether the results remain enact when the sample excludes both financial and utility firms.

and Compustat Merged (CCM) database to produce a sample of firms with available financial information to be used as controls (28,001 observations and 4,395 firms remained). Using firms' Central Index Key (CIK) numbers, the sample is subsequently merged with a sample of 10-Ks, retrieved from the SEC's EDGAR database (27,976 observation and 4391 firms remained). After discarding those observations with missing information [12], the final sample constitutes a total of 25,276 firm-year observations for 4,144 unique firms.

Details of how the sample is constructed can be seen in Table 2.1.

Table 2.1
Construction of sample

	Sample Size	Number of Firms
Default risk calculation between 2008 and 2019	29,636	4,681
Merged with CCM identifier to obtain financial information	28,001	4,395
Merged with the SEC's EDGAR database	27,976	4,391
Drop observations with unavailable values	25,276	4,144

This table reports the sample construction procedure. The sample constitutes the intersection of data from the CRSP, Compustat, and SEC's EDGAR databases, covering a period between January 2008 and December 2019. Financial firms (SIC codes between 6000–6999) are excluded from the sample.

2.4.2 The Measure of Default Risk

The implied probability of default, also called the expected default frequency (EDF), is calculated following Bharath & Shumway (2008). The EDF measure uses the same input and functional forms as the Merton distance-to-default (DD) model, but an iterative procedure is not required to solve a system of nonlinear equations. Bharath & Shumway (2008) report that out-of-sample bankruptcy events can be more accurately predicted using the EDF model than the Merton DD model.[13] the

[12] According to the amended SRC rule, firms can be classified as smaller reporting companies or non-smaller reporting companies based on the public float test or the revenue test. I exclude 66 firms that were qualified as smaller reporting companies under the revenue test, but not under the public float test in 2018 from the sample. They represent approximately 1.6% of the total number of firms in the sample.

[13] Based on the Merton DD model, the firm's equity is considered to be a call option on its underlying assets with the strike price equal to the face value of its debt, which is assumed to be a zero coupon bond. Under this framework, a firm defaults when its asset value falls below the face value of its debt. The probability of default is estimated as the cumulative normal density function of distance-to-default (DD), calculated using the firm's underlying value, the firm's volatility, and the face value of the its debt.

EDF is constructed as follows.

$$DD_{i,t} = \frac{\ln\left(\frac{Equity_{i,t} + Debt_{i,t}}{Debt_{i,t}}\right) + \left(r_{i,t-1} - \frac{\sigma^2_{V_{i,t}}}{2}\right) \times T_{i,t}}{\sigma_{V_{i,t}} \times \sqrt{T_{i,t}}}, \tag{2.1}$$

$$\sigma_{V_{i,t}} = \frac{Equity_{i.t}}{Equity_{i,t} + Debt_{i,t}} \times \sigma_{E_{i,t}} + \frac{Debt_{i,t}}{Equity_{i,t} + Debt_{i,t}} \times \left(0.05 + 0.25 \times \sigma_{E_{i,t}}\right), \tag{2.2}$$

and

$$EDF_{i,t} = N\left(-DD_{i,t}\right) \tag{2.3}$$

where i and t index firm and year, respectively. $Equity_{i,t}$ is firm i's market value of equity (in millions of dollars) calculated as the product of the number of shares outstanding and the stock price at the end of the fiscal year t; $Debt_{i,t}$ is the face value of debt calculated as the sum of the debt in the current liabilities (Compustat item 45) and half of the long-term debt (Compustat item 51) at the end of fiscal year t; $r_{i,t-1}$ is firm i's stock return during the past 12 months; $\sigma_{E_{i,t}}$ is the stock return volatility estimated using the monthly stock returns from the previous year; $\sigma_{V_{i,t}}$ is calculated from $\sigma_{E_{i,t}}$, approximating the volatility of firm i's assets as shown in Eq. (2.2); T is set to one in order to calculate the annual default probability; and $N(\bullet)$ is the cumulative standard normal distribution function.

2.4.3 Assignment of Control and Treatment Statuses

The firms in the sample are classified as smaller reporting companies (treated) and non-smaller reporting companies (control) in each year based on their public equity float values at the last business day of their most recently completed second fiscal quarter in that year. Following the description of the SRC rule, which was explained in detail in Section 2.2, the \$75 million threshold is applied to classify observations of firms in the sample for the fiscal year 2008 and the \$50 million threshold is applied to classify newly-qualified smaller reporting companies from 2008 onwards. I use the thresholds of \$250 million and \$200 million for observations of firms in

fiscal years 2018 and 2019 according to the amended SRC rule, respectively.[14]

The SEC defines public floats as the aggregated market value of the issuer's outstanding voting and non-voting common stocks held by non-affiliates. As pointed out by Iliev (2010), the definition of "affiliates" is subject to considerable legal uncertainty, which complicates the determination of the public float value.[15] In order to circumvent the legal ambiguity issue, a textual analysis is employed to directly retrieve the public float values from the 10-K reports in the sample. Specifically, a text mining algorithm is used to search for a sentence containing the phrase "... market value of ..." on the first page of each 10-K document in the sample. After this phrase is located, the algorithm looks for the value of equity float which is usually found in the same sentence, and extracts it. If the algorithm fails to locate a value in the same sentence, the equity float value is manually checked and extracted from the report.[16]

For example, the Art's-Way Manufacturing Co., Inc. provides information on its public float on the first page of its 10-K report filed in 2008, which reads as follows:

> *"... the aggregate market value of the voting and non-voting common equity held by non-affiliates computed by reference to the price at which the common equity was last sold, or the average bid and asked price of such common equity, as of the last business day of the registrant's most recently completed second fiscal quarter (public float) was $15,415,571.49."*

[14] According to the amended SRC rule, firms can be classified as smaller reporting companies or non-smaller reporting companies based on the public float test or the revenue test. I exclude 66 firms that were qualified as smaller reporting companies under the revenue test, but not under the public float test in 2018 from the sample. They represent approximately 1.6% of the total number of firms in the sample.

[15] According to the 1997's SEC Release No. 33-7391, the SEC define: "A person shall be deemed not to be an affiliate for purposes of this section if the person: (i) is not the beneficial owner, directly or indirectly, of more than 10% of any class of equity securities of the issuer; (ii) is not an officer of the issuer; and (iii) is not a director of the issuer". This definition clearly excludes persons who are not executive officers, directors, or 10% shareholders. Nevertheless, members of one or more of these classes may contend, nevertheless, that they are not affiliates because they are not in a "control" position. A "facts and circumstances" test would be used to determine the affiliate status of these people.

[16] Some companies report their public floats using "million" or "billion". For example, American Airlines Group Inc. declare their public floats in their 10-K report as: " ... The aggregate market value of the voting stock held by non-affiliates of the registrant as of June 30, 2015, was approximately $27 billion ...". The text parsing algorithm is also designed to correct for the inconsistency in the unit.

According to the information provided by Art's-Way Manufacturing Co., Inc., the value of its equity float in the year 2008 was \$15,415,571.49.[17] Since this equity float value was smaller than the \$75 million threshold applicable in 2008, the Art's-Way Manufacturing Co., Inc. was classified as a smaller reporting company for the year 2008.

A binary variable, $SRC_{i,t}$, is defined based on the well-defined SRC rule. $SRC_{i,t}$ takes the value of 1 if firm i is classified as a smaller reporting company in year t, and 0 otherwise. The details of the thresholds used to classify smaller reporting and non-smaller reporting companies are shown in Table A2 in Appendix.

2.4.4 Control Variables

Following Bharath & Shumway (2008), Campbell et al. (2008), and Brogaard et al. (2017), a vector of control variables is used for the analysis. Firm size is controlled as the logarithm of assets (*LnAssets*). Since bankruptcy firms are likely to have an extremely high level of debt in relation to their assets, both the logged value of debt (*LnDebt*) and leverage (*Leverage*) are included in the set of controls, calculated as the ratio of total debts to total assets. Since it has been reported that firms are more likely to experience high volatility prior to bankruptcy, the inverse of the annualised stock return volatility (*Vol*) is also included in the controls, where the annualised return volatility (σ_E) is computed using the standard deviation of monthly stock returns over the previous year. The ratio of net income to total assets (*NI*) and the excess return (*ER*), calculated as the difference between the stock's annual return and the CRSP value-weighted return, are also included in the set of controls.

To mitigate the impact of outliers, all the control variables are winsorised at the 1st and 99th percentiles.

The details of variable constructions can be found in the Appendix Table A3.

[17] I detect a total of 2,492 firms whose first page of the 10-K report does not contain phrase "... market value of ...". For these firms, I collect public float information manually.

2.5 Empirical Analysis

2.5.1 Summary Statistics

The descriptive statistics for the major variables can be found in Table 2.2. The sample mean of the EDF is found to be 0.06 and the median EDF is 0, implying that at least 50% of the observations in the sample are estimated to have no or very little default risk. The mean and median EDF values are identical to the values of 0.0619 and 0, reported in Brogaard et al. (2017). In line with their finding, the distribution of the EDF in the sample is skewed to the right with a minimum and maximum value of 0 and 0.946, respectively. The other firm characteristics appear to be standard. *Leverage* has a mean of around 0.6. The average values for both *NI* and *ER* suggest that firms in the sample have negative profitability and slightly negative excess returns while the medians indicate that the distributions of *NI* and *ER* are left-skewed and right-skewed, respectively.

Table 2.2
Summary statistics

	Mean	Median	Std.Dev.	Min.	Max.	Obs.
EDF	0.060	0.000	0.183	0.000	0.946	25,276
LnAssets	6.789	6.875	2.042	2.387	11.447	25,276
Leverage	0.589	0.567	0.269	0.108	1.669	25,276
LnDebt	4.457	4.837	2.738	−3.381	9.737	25,276
σ_E	0.135	0.107	0.106	0.003	2.282	25,276
NI	−0.046	0.028	0.257	−1.456	0.264	25,276
ER	−0.002	−0.041	0.456	−0.912	1.929	25,276

This table reports the descriptive statistics of variables employed in the analyses for the period between January 2008 and December 2019. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. σ_E is the annualised return volatility. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return.

2.5.2 The Impact of Eligibility on the Information Environment under the SRC Rule: Textural Analysis of Disclosure

The first step of analysis involves assessing the impact of eligibility under the SRC rule on the information environment. Specifically, whether smaller reporting companies, given their eligibility under the SRC rule to adopt a scaled disclosure, voluntarily choose to disclose a smaller amount of information is examined. Following Ertugrul et al. (2017), the file size (in bytes) of the 10-K reports (*FileSize*) and the file size of the 10-K reports, excluding extraneous material such as figures and tables (*NetFileSize*) are calculated. Loughran & McDonald (2014) propose that the 10-K file size is a straightforward measure of the amount of information in the 10-K files. It is easily computed and is not prone to the substantial measurement errors of other textual procedures that requires parsing of the 10-K documents. In addition, the text in the 10-Ks in the sample is analysed to determine the total number of words in the documents (*TotalWords*) and the total number of words that occur at least once in the reports (*UniqueWords*).[18] All the variables are in logarithms.

Panel A of Table 2.3 reports results of a univariate analysis, comparing file size and word count statistics of 10-K reports of smaller reporting companies ($SRC = 1$) to those of non-smaller reporting companies ($SRC = 0$). Consistent with the conjecture, it is found that the average file size of 10-Ks filed by smaller reporting companies is smaller than the average file size of 10-Ks filed by non-smaller reporting companies. While the file size of 10-K reports for smaller reporting companies has a mean value of approximately 4.0 MB, the file size of 10-Ks for non-smaller reporting companies is around 9.3 MB.[19] Furthermore, smaller reporting companies submit 10-Ks that contain fewer numbers of words on average compared to 10-Ks filed by non-smaller reporting companies. The differences in the means are statistically significant at better than the 1% significance level.

[18]The total number of words and the number of unique words in 10-K reports are calculated after excluding stopwords which are not informative. Examples of stopwords include: a, an, the, and, should, must, those, very, etc.

[19]As an example, the average size of 10-K files of smaller reporting companies is computed as: $e^{15.193} \times 10^{-6} \approx 4$ MB.

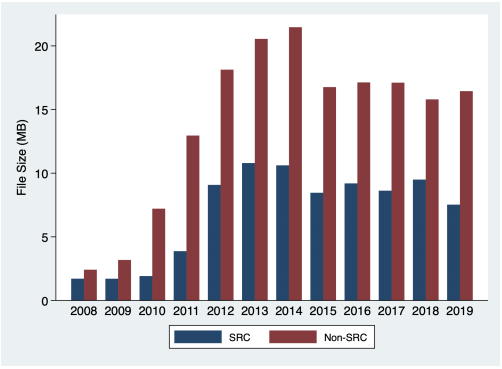
Table 2.3
Univariate analysis of disclosure

	Treated (SRC)	Control (Non-SRC)	Difference
Panel A			
n	4,812	20,464	
FileSize	15.193	16.050	−0.856***
NetFileSize	12.517	12.900	−0.383***
TotalWords	10.493	10.868	−0.375***
UniqueWords	7.940	8.081	−0.141***
Panel B			
TotalItems	9.832	10.183	−0.351***
Item 1	6.744	6.818	−0.074**
Item 1A	7.964	8.412	−0.447***
Item 5	5.464	5.666	−0.202***
Item 6	3.260	4.649	−1.289***
Item 7	8.339	8.577	−0.238***
Item 7A	3.826	5.375	−1.548***
Item 8	6.689	7.692	−0.913***
Item 11	4.136	3.422	0.714***
Item 13	3.977	3.454	0.523***

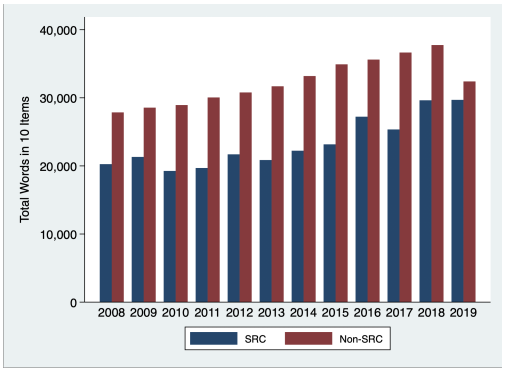
The table reports the results of the univariate analysis, comparing the mean values of file size and the mean values of word counts of 10-Ks filed by smaller reporting companies to those filed by non-smaller reporting companies. *Filesize* is the log of file size (in bytes) of 10-Ks. *NetFileSize* is the log of file size (in bytes) after extraneous material such as figures and tables have been removed. *TotalWords* is the log of the total word counts of 10-Ks. *UniqueWords* is the log of the total number of words which occurs at least once in 10-Ks. *TotalItems* is the total number of words in 9 items eligible for the reduced disclosure on 10-Ks. *Item 1*, *Item 1A*, *Item 5*, *Item 6*, *Item 7*, *Item 7A*, *Item 8*, *Item 11* and *Item 13* are the simple summations of the number of words for each item. The SEC allows smaller reporting companies to reduce the disclosure levels in total 10 items in the S-K form. Since both the item 402: Executive Compensation and item 407: Corporate Governance are included in item 11 in 10-Ks, the total number of the reduced items in 10-K reports is therefore 9.

Figure 2.1(a) shows the changes in the average file size of 10-Ks, submitted to the SEC by both smaller reporting companies and non-smaller reporting companies, over the period 2008-2019. Two features stand out. First, the average 10-K file size for non-smaller reporting companies is larger than that of smaller reporting companies in every single year over the entire sample period. Second, consistent with Li (2008) who report evidence of an increasing trend of financial report complexity, a steady increase is witnessed in the average 10-K file size for both types of firms, starting from 2010 onwards. The trend subsequently peaked in 2014 before stabilising from year 2015.

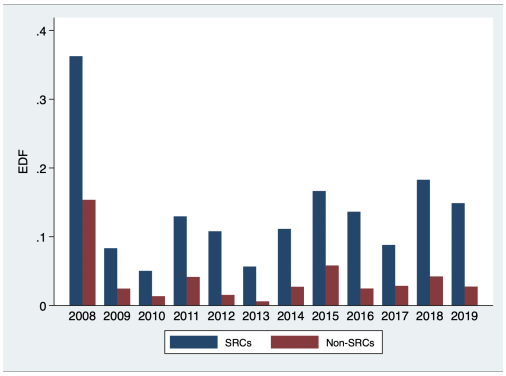
Figure 2.1
10-Ks' file size and word counts and the EDF during 2008-2019



(a) *FileSize*



(b) *TotalItems*



(c) *EDF*

These figures compare the average 10-K file sizes (*FileSize*), the average total word counts of the 10 items in 10-Ks where voluntary reduced disclosure is allowed under the SRC rule (*TotalItems*), and the average expected default frequencies (*EDF*) for smaller reporting companies and non-smaller reporting companies over the period of 2008–2019. *FileSize* is the log of file size (in bytes) of 10-Ks. *TotalItems* is the total number of words of the 9 items eligible for the reduced disclosure on 10-Ks. The SEC allows smaller reporting companies to reduce the disclosure levels in 10 items in the S-K forms. Since both the item 402 (Executive Compensation) and item 407 (Corporate Governance) are included in item 11 in 10-Ks, the total number of the reduced disclosure items in 10-K reports is therefore 9. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008).

I now turn the focus to the 10 items on 10-Ks where smaller reporting companies are permitted to voluntarily provide scaled disclosure. The changes in the average total word counts among the 10 items over time for both smaller reporting companies and non-smaller reporting companies are illustrated in Figure 2.1(b). While the mean total numbers of words for the 10 items for non-smaller reporting companies appear to be higher than those for smaller reporting companies throughout the period under investigation, the average numbers of words for both types of firms are found to rise steadily between 2008 and 2018. I report in Panel B of Table 2.3 the average total word counts (in logarithms) of these 10 items, denoted by

TotalItems. The value of *TotalItems* for smaller reporting companies of 9.832 is lower than the corresponding value of 10.183 for non-smaller reporting companies, which suggests that while the average total word counts of the 10 items for smaller reporting companies is approximately 18,600 words, the corresponding figure for non-smaller reporting companies is around 26,400. The difference is statistically significant at better than the 1% level. I also calculate the average number of words (in logarithms) separately for each of these 10 items.[20] According to the reported word count statistics in Table 2.3, the average word counts for smaller reporting companies are lower than the corresponding word counts for non-smaller reporting companies except for Items 11 and 13, which refer to executive compensation, corporate governance, and the firm's policies and procedures for approving related-person transactions. The differences are all found to be statistically significant at conventional levels. Taken together, the results of the univariate analysis of file size and word counts indicate that smaller reporting companies, on average, voluntarily adopt the reduced disclosure framework for financial reporting, as permitted by the SEC under the SRC rule.

Although the results of the univariate analysis of the file size and the word counts indicate that smaller reporting companies voluntarily provide a scaled disclosure in their 10-K reports, they should be interpreted with caution because the analysis is performed at the means and does not account for factors that could potentially cause the characteristics of smaller reporting companies and non-smaller reporting companies to differ. To address this issue, an RD design is used to estimate the effect of firms' eligibility to voluntarily adopt the reduced disclosure framework under the SRC rule on the disclosure level.

In a sharp RD model, identifications rely on the presumptions of discontinuity in the probability of treatment and the inability of firms to precisely manipulate their treatment status (i.e., the values of public float) around the threshold. Since companies in the sample are classified as either smaller reporting companies or non-smaller reporting companies based on the value of their public floats, as specified by the well-defined SRC rule and cannot easily place themselves into

[20]Because Item 11 in 10-K reports includes information about executive compensation and corporate governance, which correspond to S-K Items 402 and 407 under Regulation S-K, Table 2.3 therefore shows only the word count statistics for the 9 unique 10-K items.

one of these groups due to the difficulty in precisely manipulate their public floats, the presumption of discontinuity in the probability of treatment and no manipulation are, by design, satisfied. As a result, observations around the cutoff can be regarded as good as being randomly assigned. Therefore, the effect of the eligibility to voluntarily adopt a scaled disclosure under the SRC rule on the disclosure levels can therefore be calculated by comparing the average disclosure level of observations that lie just below the cutoff to those of observations that lie just above it. It is worth noting that the eligibility for reduced disclosure is discontinuous at the threshold, the variation of the firm characteristics around the threshold is presumed to be continuous for the RD results to be valid. If these characteristics are discontinuous at the cutoff, then the estimated causal effect will be biased (Lee & Lemieux 2010). This assumption is formally tested in Section 2.6 below.

To quantify the impact of the eligibility to voluntarily provide scaled disclosure on the disclosure level, the following RD model is estimated:

$$Disclosure_{i,t} = \alpha_0 + \alpha_1 SRC_{i,t} + \alpha_2 Float_{i,t} + \alpha_3 (SRC_{i,t} \times Float_{i,t}) + \upsilon_i + \gamma_t + \varepsilon_{it}, \quad (2.4)$$

where i and t indicate firm and year, respectively. The variable $Disclosure_{i,t}$ denotes the measures of disclosure level: *FileSize*, *NetFileSize*, *TotalWords*, *UniqueWords*, and *TotalItems*. The dummy variable, $SRC_{i,t}$, equals 1 if firm i qualifies for the scaled disclosure under the SRC rule in year t, and 0 otherwise. The assignment variable, $Float_{i,t}$, denotes the distance between the equity float value (in logarithms) of firm i and the corresponding cutoff (in logarithms) in year t.[21] The interaction term $SRC_{i,t} \times Float_{i,t}$ captures the possible difference in the slope of the regression lines on both sides of the threshold. The industry and the year fixed effects are included in the model, denoted by υ_i and γ_t, respectively.[22] The parameter of interest is α_1 whose estimate quantifies the effect of the eligibility to provide scaled disclosure on the disclosure level. A negative and statistically significant value

[21] As discussed in Section 2.2, companies with public float values below $75 million during 2008–2018 and $250 million from 2018 onwards are classified as smaller reporting companies under the SRC rule. For the purpose of estimating Eq. (2.5), I recentre the two thresholds and rescale the public float values around the recentred cutoff.

[22] The year fixed effects are included in Eq. (2.4) to capture the impact of increasing length of 10-K reports over time as documented by Cohen et al. (2020).

of $\hat{\alpha}_1$ would point to reduced levels of disclosure of smaller reporting companies compared to those of non-smaller reporting companies. In estimating Eq. (2.4), standard errors are clustered at the firm level.

An important and practical issue in the estimation of a sharp RD model is the choice of bandwidth. This is the area of the neighbourhood around the threshold in which observations are included to fit the local polynomial that approximates the unknown regression functions. As discussed in Lee & Lemieux (2010), choosing the optimal bandwidth is typically an empirical issue. They recommend selecting a bandwidth that makes the RD plot look informative. The bandwidth should be sufficiently wide to reduce the amount of noise, but sufficiently narrow enough to compare observations that are close enough to the threshold.[23] The MSE-optimal bandwidth is employed to estimate Eq. (2.4). This optimises the bias-variance trade-off and it is the most popular approach in practice for computing the optimal bandwidth around the cutoff point. This technique involves minimising the mean square error (MSE), which is the sum of the squared bias and its variance. Moreover, a uniform weighing kernel function is adopted, which assigns equal, positive weights to all the observations with public float values within the interval $[c-h, c+h]$, where c is the cutoff and h is the MSE-optimal bandwidth size, and zero weights to the observations outside the interval.[24]

The results are reported in Table 2.4. The estimates of α_1 for all the disclosure measures are negative and statistically significant at the conventional levels, which suggests that smaller reporting companies voluntarily disclose less information in their 10-K reports compared to non-smaller reporting companies. For example,

[23]In choosing a bandwidth, researchers need to be conscious of a bias-variance trade-off. On the one hand, a smaller bandwidth reduces the "smoothing bias" of the local polynomial approximation, but it is likely to cause the estimates to be imprecise. On the other hand, a bandwidth that is too wide leads to more smoothing bias – if the unknown function differs significantly from the polynomial model employed in the estimation – but will likely increase the precision of the estimates because of the larger number of observations included in the estimation. Identifying the correct functional form for the RD model becomes necessary with a wider bandwidth as it is more difficult to distinguish discontinuity at the cutoff from nonlinear trends.

[24]Related literature also proposes two other techniques to select the kernel function: triangular and expanechnikov. The triangular kernel function assigns zero weight to all the observations outside the interval $[c-h, c+h]$, but positive weights to all the observations within this interval but the weight is maximised at the point where $X_i = c$ and declines symmetrically and linearly as the value of X_i becomes further from the cutoff. The expanechnikov kernel gives a quadratic decaying weight to observations within $[c-h, c+h]$ and zero weight to the rest. As explained in Cattaneo et al. (2019), estimation results are typically not very sensitive to the choice of kernel.

based on the file size of 10-K reports, the value of $\hat{\alpha}_1$ of -0.159, which is statistically significant at the 1% level, indicates that the 10-K reports filed by smaller reporting companies are approximately 16% smaller in size than those filed by non-smaller reporting companies. Furthermore, the value of $\hat{\alpha}_1$ of -0.119 for the RD specification where *TotalItems* is the dependent variable, shown in the last column of Table 2.4, suggests that the total number of words of the 10 items in the 10-K files where scaled disclosure is permitted is around 12% lower for smaller reporting companies compared to the total number of words for the same 10 items for non-smaller reporting companies.

Table 2.4
Regression discontinuity design estimation of disclosure

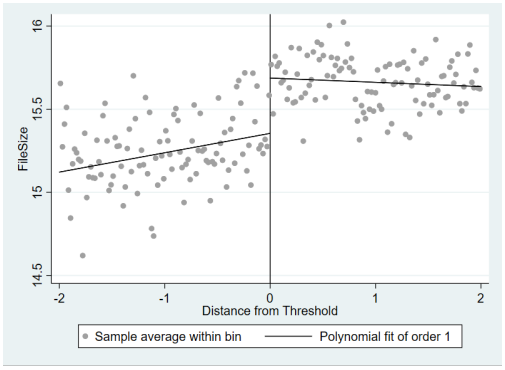
VARIABLES	*FileSize*	*NetFileSize*	*TotalWords*	*UniqueWords*	*TotalItems*
SRC	−0.159***	−0.064*	−0.074**	−0.026*	−0.119**
	(0.037)	(0.036)	(0.037)	(0.015)	(0.059)
Float	0.001	0.017	−0.005	0.007	0.100
	(0.049)	(0.066)	(0.070)	(0.017)	(0.075)
SRC × *Float*	0.202***	0.164*	0.169*	0.065**	0.070
	(0.075)	(0.092)	(0.098)	(0.025)	(0.139)
Constant	14.517***	12.795***	10.770***	8.024***	12.534***
	(0.042)	(0.250)	(0.263)	(0.136)	(0.099)
Observations	3,049	2,207	2,163	3,455	2,551
R^2	0.763	0.179	0.177	0.174	0.118
Firms	1,295	1,059	1,046	1,406	1,209
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES

This table reports the regression discontinuity results for Eq. (2.4) using 10-K characteristics as the dependent variables. *FileSize* is the log of file size (in bytes) of 10-Ks. *NetFileSize* is the log of file size (in bytes) of 10-Ks after extraneous material such as figures and tables have been removed. *TotalWords* is the log of the total word counts of 10-Ks. *UniqueWords* is the log of the total number of words which occurs at least once in 10-Ks. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *TotalItems* is the total number of words of the 9 items eligible for the reduced disclosure on 10-Ks. The SEC allows smaller reporting companies to reduce the disclosure levels in 10 items in the S-K forms. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

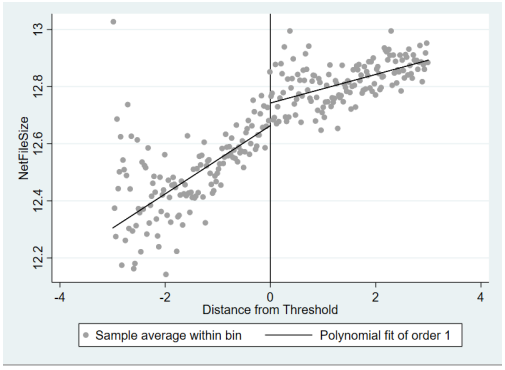
The RD plots that show the effect of the eligibility under the SRC rule on the disclosure level, are presented in Figures 2.2(a)–2.2(e). In each plot, the values along the horizontal axis measure the distance between the public float value and the threshold (both in logarithms). The values along the vertical axis show the

disclosure levels. Bins of observations of smaller reporting companies are located to the left of the cutoff while bins of observations of non-smaller reporting companies are situated to the right of the cutoff. Consistent with the RD estimation results reported in Table 2.4, sharp drops are observed in the disclosure levels immediately to the left of the thresholds for all the disclosure measures. The graphical evidence leads to conclude that eligible smaller reporting companies voluntarily adopt the reduced disclosure requirements under the SRC rule.

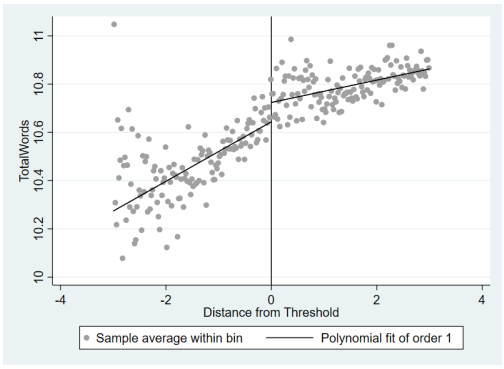
Figure 2.2
Regression discontinuity plots: The impacts of eligibility to voluntarily provide scaled disclosure on information environments



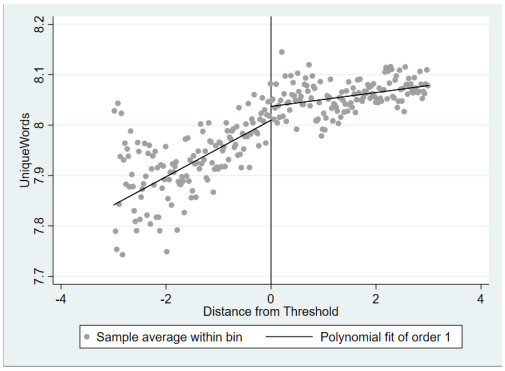
(a) *FileSize*



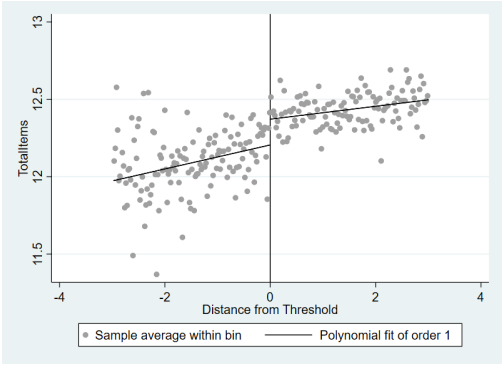
(b) *NetFileSize*



(c) *TotalWords*



(d) *UniqueWords*



(e) *TotalItems*

These figures show the RD plots based on the effect of the eligibility under the SRC rule on the information environment. Values along the horizontal axis measure the distance between the public float value and the normalised threshold (in logarithms). Values along the vertical axis show the levels of disclosure. Bins of observations of smaller reporting companies are located to the left of the cutoff while bins of observations of non-smaller reporting companies are situated to the right of the cutoff.

2.5.3 The Impact of the Eligibility under the SRC Rule on the Risk of Default

An RD framework was used in the previous section to demonstrate that smaller reporting companies voluntarily provide a scaled disclosure. An attempt will be made in this section to answer the main research question, specifically, by examining if smaller reporting companies that voluntarily adopt the reduced disclosure framework are also susceptible to increased bankruptcy risk. A univariate analysis is first conducted to determine possible differences in the average default risk between smaller reporting companies and non-smaller reporting companies. The T-test statistics are reported in Table 2.5. The results suggest that smaller reporting companies have a significantly higher default risk than non-smaller reporting companies. The average EDF of smaller reporting companies is 14.6%, whereas the corresponding value of non-smaller reporting companies is much lower at 3.9%. The difference of 10.7% is statistically significant at better than the 1% significance level. The results of the univariate analysis demonstrate that firms eligible for a scaled disclosure under the SRC rule experience a higher default risk.

Table 2.5
Univariate analysis of default risk

VARIABLE	Treated ($SRC = 1$)	Control ($SRC = 0$)	Difference
n	4,812	20,464	
EDF	0.146	0.039	0.107***
Z-Score	−0.741	3.023	−3.765***
O-Score	2.955	0.579	2.376***

This table compares the average default risk between smaller reporting companies and and non-smaller reporting companies. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *Z-score* is the measure of default risk, computed following Altman (1968). *O-score* is the measure of default risk, estimated following Ohlson (1980). ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

In the next analysis, the following RD model is employed to estimate the effect of the reduced disclosure level on the risk of default:

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + \beta_4' \boldsymbol{x}_{it} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.5}$$

where i and t denote firm and year, respectively. $EDF_{i,t}$ is the measure of default risk estimated following Bharath & Shumway (2008) as explained in Section 2.4.2. The dummy variable, $SRC_{i,t}$, equals 1 if firm i is eligible for a scaled disclosure under the SRC rule at year t and 0 otherwise. The running variable, $Float_{i,t}$, denotes the distance between company i's equity float (in natural logarithms) and the corresponding (in natural logarithms) cutoffs in year t. The interaction term $SRC_{i,t} \times Float_{i,t}$ captures the possible difference in the slope of the regression lines on both sides of the re-centred threshold. The elements in vector $\boldsymbol{x}_{it}$ are control variables, including firm size (*FirmSize*), calculated as the log value of total assets, leverage (*Leverage*) measured as the ratio of total debt to total assets, the natural log of the face value of debt (*LnDebt*), the inverse of the annualised stock return volatility (*Vol*), the ratio of net income to total assets (*NI*), and the excess return (*ER*). Finally, the year fixed effects are included to capture the time-varying characteristic of the default risk caused by the changing macroeconomic environments, and the industry fixed effects are included to address the heterogeneity across industries, as discussed by Chava & Jarrow (2004) and Brogaard et al. (2017).[25]

In addition to the baseline model in Eq. (2.5), the stability of the estimated effect is checked by experimenting with the following three alternative specifications:

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.6}$$

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.7}$$

and

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3' \boldsymbol{x}_{it} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.8}$$

Both Eqs. (2.6) and (2.7) exclude the control variables. Eq. (2.6) and Eq. (2.8) force the slopes of the fitted lines on both sides of the threshold to be the same, while Eq. (2.5) and Eq. (2.7) allow the slopes to change. The parameter of interest

[25]Since different industries face different levels of competition and, therefore, the likelihood of bankruptcy can differ for firms in different industries that have otherwise identical balance sheets. Moreover, different industries may have different accounting conventions, which implies that the likelihood of bankruptcy can differ for firms in different industries, which otherwise have identical balance sheets (Chava & Jarrow 2004). To check the robustness of the results, estimation results for models that include the firm fixed effects are qualitatively similar to those for models with the industry fixed effects.

is β_1, the estimate of which quantifies the effect of the reduced level of disclosure on the risk of default. A positive and statistically significant value of $\hat{\beta}_1$ would suggest an increase in the risk of default for smaller reporting companies that are permitted to provide a scaled disclosure. The standard errors are clustered at the firm level in order to adjust for a serial correlation of the risk of default.

The estimation results for Eqs. (2.5)–(2.8) are presented in Table 2.6, from which it can be seen that the estimated values of the coefficient on SRC in all the specifications are positive and statistically significant at the conventional levels. All the estimates of the effect suggest that smaller reporting companies experience statistically and economically significant higher rates of default compared to non-smaller reporting companies. Considering the magnitude of the estimate of β_1 in column (4) when control variables and interaction terms are all included in the model, the value of 0.042 indicates that the reduced level of disclosure under the SRC rule causes the EDF to increase by a magnitude of around 4 basis points. This is equal to an approximate increment of 69% relative to the unconditional mean of the EDF of 6.0%. It is worth noting that excluding the control variables from the RD results in higher estimates of β_1 but it does not qualitatively change the findings that smaller reporting companies suffer greater default risk stemming from the reduced level of disclosure.

Table 2.6
Regression discontinuity estimation of default risk (linear models)

VARIABLES	(1) *EDF*	(2) *EDF*	(3) *EDF*	(4) *EDF*
SRC	0.059***	0.060***	0.041***	0.042***
	(0.015)	(0.015)	(0.012)	(0.012)
Float	0.011	−0.004	−0.048***	−0.060***
	(0.016)	(0.018)	(0.012)	(0.015)
SRC × *Float*		0.035		0.028
		(0.032)		(0.023)
LnAssets			0.056***	0.056***
			(0.005)	(0.005)
Leverage			0.208***	0.207***
			(0.021)	(0.021)
LnDebt			0.010***	0.010***
			(0.002)	(0.002)
Vol			−0.010***	−0.010***
			(0.001)	(0.001)
NI			−0.072***	−0.072***
			(0.012)	(0.012)
ER			−0.093***	−0.093***
			(0.005)	(0.005)
Constant	0.125***	0.132***	−0.152***	−0.147***
	(0.021)	(0.022)	(0.030)	(0.030)
Observations	3,787	3,787	4,142	4,142
R^2	0.165	0.166	0.433	0.433
Firms	1,603	1,603	1,664	1,664
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±0.779]	[±0.779]	[±0.887]	[±0.887]

This table reports the regression discontinuity results for Eqs. (2.5)–(2.8), estimated using observations of firms within the MSE-optimal bandwidth around the normalised threshold. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

To capture any potential non-linearity, the polynomial terms of $SRC_{i,t} \times Float_{i,t}$ are added to Eqs. (2.5), (2.6), (2.7) and (2.8), and the modified specifications have the following functional forms:

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + f\left(\bullet\right) + \beta_4' \boldsymbol{x}_{it} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.9}$$

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.10}$$

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.11}$$

and

$$EDF_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3' \boldsymbol{x}_{it} + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.12}$$

where $f\left(\bullet\right)$ denotes polynomial terms of $SRC_{i,t} \times Float_{i,t}$, the order of which is selected based on the Bayesian Information Criterion (BIC). The estimation results are presented in Table 2.7. Consistent with the linear RD estimation results reported in Table 2.6, it is found that default risk is statistically and economically higher among smaller reporting companies, compared to non-smaller reporting companies. All the estimates of β_1 are statistically significant at the conventional levels. Overall, the results shown in Tables 2.6 and 2.7 indicate that the eligibility of smaller reporting companies to provide a scaled disclosure escalates the risk of bankruptcy. The RD plots illustrated in Figures 2.3(a)–2.3(f) depict sudden rises in the EDF to the left of the threshold, which indicates sharp increases in the risk of default among smaller reporting companies.

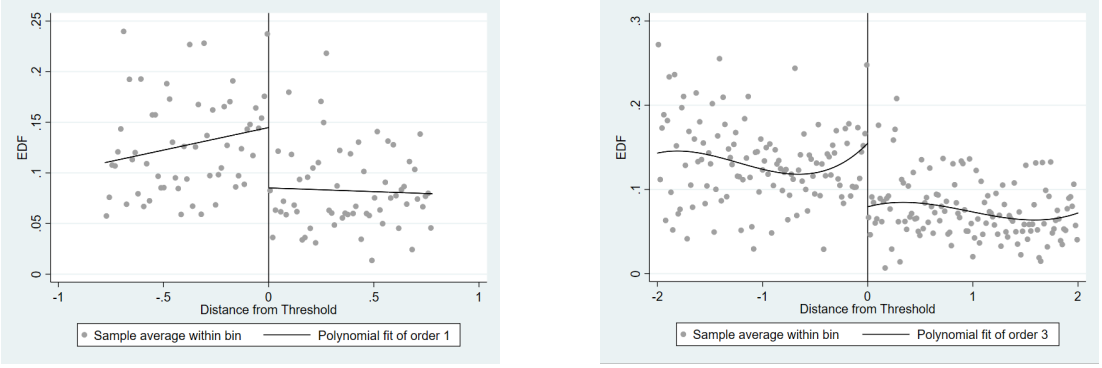
Table 2.7
Regression discontinuity estimation of default risk (non-linear models)

VARIABLES	(1) *EDF*	(2) *EDF*	(3) *EDF*	(4) *EDF*
SRC	0.052***	0.084***	0.038***	0.048***
	(0.014)	(0.021)	(0.010)	(0.016)
Float	0.005	0.041	−0.049***	−0.080**
	(0.012)	(0.055)	(0.008)	(0.038)
SRC × *Float*		0.137		0.119*
		(0.102)		(0.068)
LnAssets			0.058***	0.058***
			(0.004)	(0.004)
Leverage			0.201***	0.201***
			(0.015)	(0.015)
LnDebt			0.007***	0.007***
			(0.002)	(0.002)
Vol			−0.010***	−0.010***
			(0.001)	(0.001)
NI			−0.091***	−0.091***
			(0.008)	(0.008)
ER			−0.091***	−0.091***
			(0.004)	(0.004)
Constant	0.153***	0.151***	−0.153***	−0.143***
	(0.015)	(0.018)	(0.027)	(0.028)
Observations	8,659	8,659	10,202	10,202
R^2	0.159	0.160	0.423	0.423
Firms	2,558	2,558	2,773	2,773
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±1.681]	[±1.681]	[±2.035]	[±2.035]
Polynomial Order	3	3	3	3

This table reports the regression discontinuity results for Eqs (2.10)– (2.12), estimated using observations of firms within the MSE-optimal bandwidth around the normalised threshold. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

To sum up, the findings are consistent with the studies of Verrecchia (1983), Sengupta (1998), and Cheng et al. (2013) that an increase in market illiquidity among firms is observed stemming from the eligibility to voluntarily scaled disclo-

Figure 2.3
Regression discontinuity plots: The impact of reduced disclosure on default risk



(a) (b)

This figure shows the regression discontinuity (RD) plots where the value along the x-axis is the distance between the public float and the re-centered cutoff point and the value on the y-axis is the measure of default risk measured using the EDF calculated following Bharath & Shumway (2008). Panel (a) illustrates the local linear fitted regression. Panel (b) shows the observations around the cutoff along with the fitted regression lines for the RD model in Eq. (2.5) with up to the 3rd-order polynomials.

sure. The authors state that mandatory disclosure serves as a credible commitment mechanism and that losing such commitment due to disclosure deregulation is costly in the absence of a loss of information. Findings in this section demonstrate that investors price in the information risk due to an increase in information asymmetry, which, in turn, causes the risk of default to rise. I further disentangle the impact of the loss of commitment to mandatory disclosure on the risk of default from the impact of the increase in information asymmetry in Section 2.9.

2.6 Model Specification Test

The empirical evidence presented thus far shows the economically and statistically significant causal impact of the reduced disclosure level on the risk of default. This section contains two diagnostic tests to ensure that the underlying RD design assumptions are satisfied and the results are valid. The first test involves examining whether firms that are located in the vicinity of the threshold manipulate their public float values in order to gain the SRC status.[26] The second test entails

[26]In their paper, Nondorf et al. (2012) find that some firms with a public float of $75 million attempt to temporarily reduce its value during their second fiscal year quarter by lowering the stock prices and increasing insider buying.

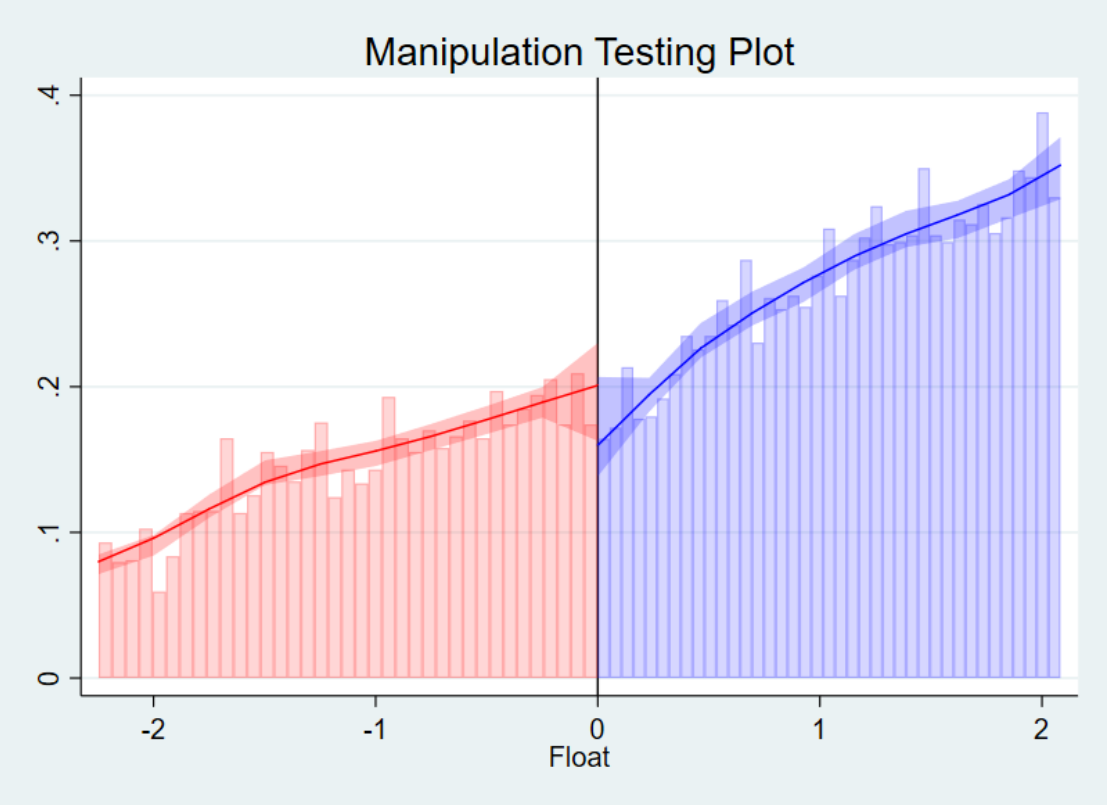
focusing on the area around the threshold to scrutinise whether the observable firm characteristics of the smaller reporting companies in the treatment group are similar to those of the non-smaller reporting companies in the control group. The idea is that no systematic differences should be observed in the characteristics of firms located in the neighbourhood around the threshold if they cannot precisely manipulate their public floats.

2.6.1 Density of the Public Float Values

A technique developed by McCrary (2008) is employed to examine the density of the public float values near the cutoff. The approach tests whether the number of observations located just below the threshold is significantly different from the number of observations just above it. If firms with public float values close to the threshold do not have the ability to manipulate their public floats, the observations of smaller reporting companies and non-smaller reporting companies around the cutoff should be more or less the same.

The distribution of the public float is shown in the histogram in Figure 2.4. The values along the horizontal axis represent the distance between the public float and the cutoff (in logarithms), while the values on the vertical axis represent the density. The lines on both sides of the threshold signify the fitted density of the equity float along with the 95% confidence intervals, which are depicted by the shaded areas. As can be seen from Figure 2.4, there is no evidence of "bunching" of observations immediately to the left of the threshold. The fitted density functions on both sides of the threshold also appear to be very close to each other, and more importantly, it is clear that the confidence intervals overlap. Taken together, all the evidence indicates no manipulation of public float among the observations located very near the cutoff. I further conduct a statistical test to examine the discontinuity of the public float density around the cutoff. The test statistic, calculated following McCrary (2008), equals -0.9734 with a p-value of 0.3304. I, therefore, fail to reject the null hypothesis of no manipulation of public float in the vicinity of the cutoff.

Figure 2.4
Plot of density of the public float values



The figure provides a graphic representation of the continuity in density test with shaded 95% confidence intervals. The x-axis is the distance-to-threshold, calculated as the difference between firm public float and the cutoff (in logarithms). The y-axis is the density. The lines on both sides of the threshold represent the fitted density of the equity float along with the 95% confidence intervals which are depicted by the shaded areas.

2.6.2 Continuity of Observable Firm Characteristics around the Cutoff

The next examination entails determining whether the observable characteristics of firms in the treatment group are similar to those of firms in the control group in the vicinity of the threshold. The idea is that there should be no systematic differences in the characteristics of firms located in the neighbourhood of the threshold if they cannot precisely manipulate their public floats. Therefore, the observable firm characteristics should be continuous at the cutoff point and this is tested by a modified version of Eq. (2.7). Specifically,

$$Characteristic_{i,t} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.13}$$

where $Characteristic_{i,t}$ denotes each of the control variables, already discussed in Section 2.4.4. The CER-optimal bandwidth is employed in the estimation, following the recommendation by Cattaneo et al. (2019), since the inference is the only point of interest here, not the estimates of the parameters.[27] As can be seen from the results shown in Table 2.8, the estimates of β_1 are not statistically significant for all the firm characteristics. The RD plots of Eq. (2.13), illustrated in Figures 2.5(a)–2.5(f), also show no discernible jumps at the cutoffs, which suggests that the characteristics of smaller reporting companies are similar to those of non-smaller reporting companies in the vicinity of the threshold. This implies that observations of smaller reporting companies and non-smaller reporting companies located near the cutoff are as good as randomly assigned, confirming the validity of the baseline RD estimation results.

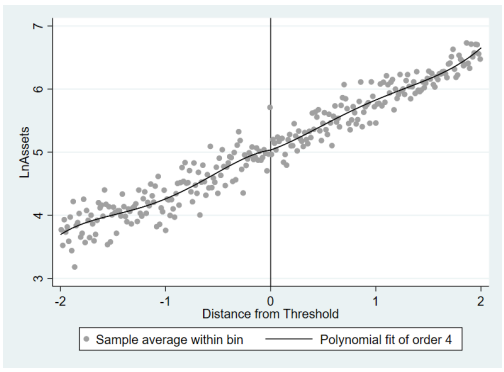
[27] The CER-optimal bandwidth minimises an approximation to the coverage error.

Table 2.8
Test of continuity of covariates at the threshold

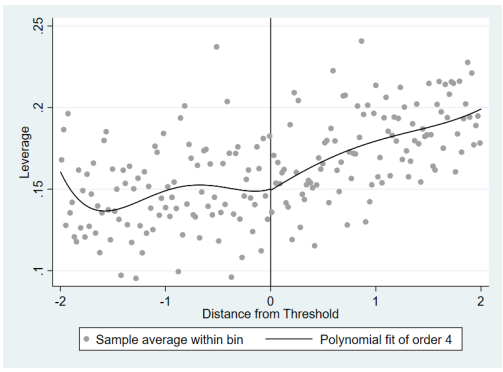
VARIABLES	(1) *LnAssets*	(2) *Leverage*	(3) *LnDebt*	(4) *Vol*	(5) *NI*	(6) *ER*
SRC	0.121	0.023	0.104	−0.282	−0.037	−0.069
	(0.079)	(0.018)	(0.110)	(0.302)	(0.028)	(0.049)
Float	1.115***	0.014	0.963***	0.606	0.049	−0.090
	(0.180)	(0.025)	(0.175)	(0.393)	(0.066)	(0.098)
SRC × *Float*	−0.382	0.033	−0.331	−1.498**	−0.180*	0.079
	(0.255)	(0.036)	(0.246)	(0.680)	(0.103)	(0.152)
Constant	4.673***	0.224***	2.253***	7.814***	−0.199	−0.181
	(0.155)	(0.076)	(0.534)	(0.750)	(0.151)	(0.114)
Observations	2,509	3,616	3,717	4,008	2,070	2,642
R^2	0.425	0.175	0.298	0.386	0.260	0.099
Firms	1,261	1,535	1,586	1,663	1,120	1,300
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Bandwidth	[±0.532]	[±0.783]	[±0.765]	[±0.823]	[±0.445]	[±0.557]

This table reports the regression discontinuity results for Eq. (2.13), estimated using observations of firms within the CER-optimal bandwidth around the normalised threshold for falsification purposes following Cattaneo et al. (2019). *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

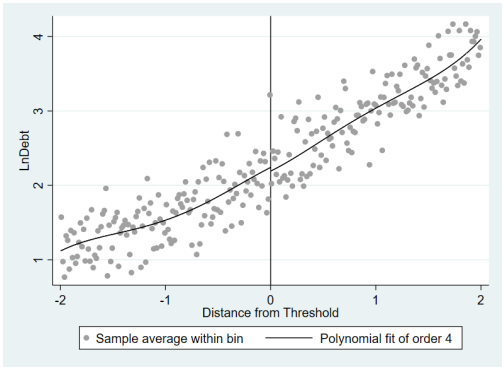
Figure 2.5
Regression discontinuity plots of covariates



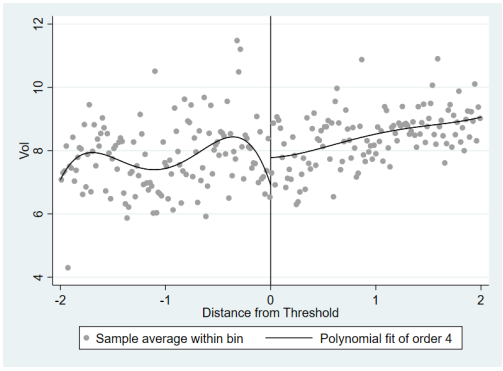
(a) Firmsize (*LnAssets*)



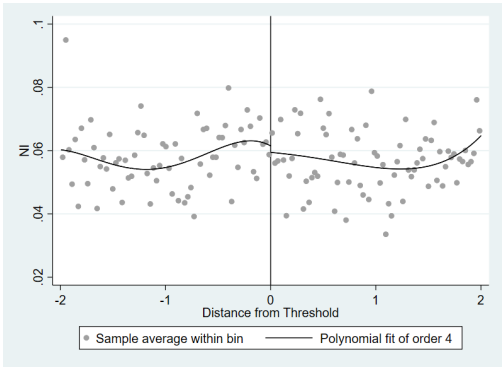
(b) Leverage (*Leverage*)



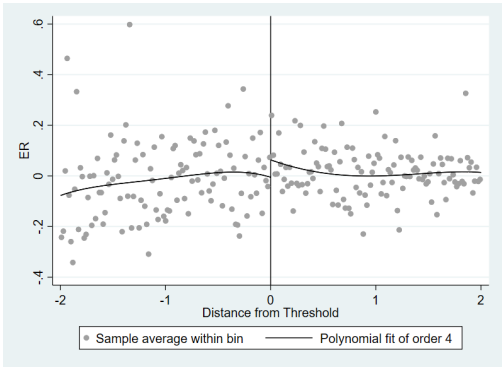
(c) Debt (*LnDebt*)



(d) Volatility (*Vol*)



(e) Net Income (*NI*)



(f) Excess Return (*ER*)

The figure provides a graphic representation of RD plots for all predetermined covariates. The y-axes from panel (a) to (e) are *Firmsize*, *Leverage*, *LnDebt*, *VOL*, *NI*, and *ER*, respectively. The x-axis is the distance between public float and the cutoff point.

2.7 Robustness Checks

In this section, a number of sensitivity checks are made to ensure that the results remain robust under different model parameters. First, the sensitivity of the RD

estimation results to the potential manipulation of public float around the cutoff is subjected to the so-called "donut-hole" test.[28] Second, the robustness of the results under different bandwidth choices is tested by re-estimating Eq. (2.5) using bandwidths, computed using different optimisation techniques. Third, a falsification test is applied to the RD model by investigating whether the statistically and economically significant causal impact of the reduced disclosure on the risk of default remains at some fake thresholds. Fourth, an alternative RD approach which is based on assumptions of local randomisation is analysed. Fifth, in Section 2.5.3, both the dependent variable and independent variables are in the same period. The robustness check will be conducted using the forward measure of the dependent variable to test whether the results remain unchanged. Sixth, following prior literature related to default risk (Bharath & Shumway 2008, Brogaard et al. 2017, Baghdadi et al. 2020), I only exclude financial firms from the entire sample. The empirical work is also tested when both the financial and utility firms are excluded from the sample, and finally, the alternative measures of default risk, namely, the *Z-score* and *O-score*, are used to determine whether the results remain intact.

2.7.1 Sensitivity of Observations near the Threshold: The "Donut-Hole" Test

Even though the results of the analysis of the density of public float, discussed in Section 2.6.1, confirm that firms do not manipulate their public floats, since firms located in the vicinity of the threshold are most likely to manipulate their SRC statues, it is still worth examining if the effect of the voluntarily reduced disclosure level on default risk remains intact without the presence of the "suspect" firms. To do so, I discard observations whose values of public float lie very close to the cutoff from the sample and re-estimate Eq. (2.5) using only the remaining observations – effectively, creating a "donut-hole" around the threshold.[29]

[28] As pointed out by Cattaneo et al. (2019), it is natural to assume that if systematic manipulation of the running variable occurs, observations whose values of the running variable are located closest to the cutoff are those most likely to have engaged in manipulation.

[29] A useful by-product of this procedure allows us to evaluate whether the RD results are susceptible to the extrapolation involved in local polynomial estimation since the effect of observations in the proximity of the cutoff outweighs those further away from it when fitting the

The estimation results for subsamples from which observations within the 1%, 2%, and 3% radius of the threshold are excluded are shown in Table 2.9. In line with the main results for the full sample reported in Table 2.6, the estimates of β_1 are all positive and statistically significant at better than the 1% significance level, indicating that the causal effect of a scaled disclosure on the risk of default remains qualitatively unchanged after removing observations of firms that could potentially manipulate the values of their public floats from the sample.

local polynomial models (Cattaneo et al. 2019).

Table 2.9
Donut-Hole analysis

	(1) 0.01	(2) 0.02	(3) 0.03
VARIABLES	Dependent Variable : *EDF*		
SRC	0.042***	0.036***	0.035***
	(0.012)	(0.013)	(0.013)
Float	−0.060***	−0.062***	−0.062***
	(0.015)	(0.015)	(0.016)
SRC × *Float*	0.028	0.022	0.020
	(0.023)	(0.023)	(0.024)
LnAssets	0.056***	0.056***	0.057***
	(0.005)	(0.005)	(0.005)
Leverage	0.215***	0.221***	0.218***
	(0.021)	(0.021)	(0.021)
LnDebt	0.010***	0.009***	0.009***
	(0.002)	(0.002)	(0.002)
Vol	−0.010***	−0.010***	−0.010***
	(0.001)	(0.001)	(0.001)
NI	−0.072***	−0.069***	−0.071***
	(0.012)	(0.012)	(0.012)
ER	−0.093***	−0.092***	−0.092***
	(0.005)	(0.005)	(0.005)
Constant	−0.150***	−0.145***	−0.146***
	(0.030)	(0.030)	(0.030)
Observations	4,105	4,061	4,019
R^2	0.434	0.433	0.433
Firms	1,661	1,657	1,647
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Bandwidth	[±0.887]	[±0.887]	[±0.887]

This table reports the regression discontinuity results for Eq. (2.5), estimated using observations of firms within the MSE-optimal bandwidth after excluding observations locating within the 1%, 2%, and 3% radius around the normalised threshold. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.7.2 Different Choices of Bandwidth

The robustness of the results to different bandwidth choices is examined in this section based on using three alternative bandwidth size calculation techniques, namely, MSE2, CER and CER2. The first alternative bandwidth, MSE2-optimal, is similar to the MSE-optimal bandwidth except that the bandwidth size to the left and to the right of the threshold is allowed to differ. The second technique, known as the CER-optimal bandwidth, minimises the asymptotic coverage error rate of a robust bias-corrected confidence interval for the treatment effect.[30] Finally, the third approach, the CER2-optimal, is similar to the CER-optimal bandwidth, but allows the bandwidth size to the left and to the right of the cutoff to be different.

The results of estimating the RD model in Eq. (2.5) using the three alternative bandwidths are reported in Table 2.10. It can be seen that the estimates of β_1 are all positive and statistically significant at the 1% significance level, which indicates that the causal impact of the voluntarily reduced disclosure level on the risk of default remains robust under different bandwidths choices.

[30]The CER-optimal bandwidth decays faster than the MSE-optimal bandwidth and the CER-optimal bandwidth is always smaller than the MSE-optimal bandwidth in practically all the relevant sample sizes (Cattaneo et al. 2019).

Table 2.10
Regression discontinuity estimation of default risk using different bandwidths

VARIABLES	(1) *EDF*	(2) *EDF*	(3) *EDF*
SRC	0.042***	0.046***	0.045***
	(0.015)	(0.011)	(0.014)
Float	−0.078***	−0.050***	−0.057***
	(0.030)	(0.005)	(0.010)
SRC × *Float*	0.074	0.025	0.036
	(0.049)	(0.019)	(0.038)
LnAssets	0.053***	0.057***	0.057***
	(0.006)	(0.004)	(0.005)
Leverage	0.209***	0.215***	0.212***
	(0.028)	(0.017)	(0.021)
LnDebt	0.011***	0.004**	0.006***
	(0.003)	(0.002)	(0.002)
Vol	−0.011***	−0.010***	−0.011***
	(0.001)	(0.001)	(0.001)
NI	−0.075***	−0.074***	−0.070***
	(0.016)	(0.010)	(0.012)
ER	−0.094***	−0.091***	−0.093***
	(0.007)	(0.004)	(0.005)
Constant	−0.136***	−0.156***	−0.157***
	(0.037)	(0.024)	(0.028)
Observations	2,447	7,121	4,347
R^2	0.460	0.418	0.429
Firms	1,226	2,237	1,722
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Bandwidth	[±0.544]	[−0.869,1.738]	[−0.570,1.140]

This table reports the regression discontinuity results for Eq. (2.5), estimated using observations of firms within the CER-optimal, MSE2-optimal, and CER2-optimal bandwidths around the normalised threshold. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.7.3 Artificial Cutoffs

The results reported thus far suggest that smaller reporting companies, with a value of equity float lower than $75 million between 2008 and 2017 and $250 million from 2018 onwards were at greater risk of bankruptcy compared to non-smaller reporting companies. In this section, a falsification check is used to determine if smaller reporting companies with other threshold values are at greater risk of default compared to non-smaller reporting companies. It is expected that there is no discontinuous jump at these "artificial" cutoffs due to the absence of treatment. Evidence to the contrary would question the validity of the findings.

The experiment involves eight artificial cutoffs: $55 million, $65 million, $85 million, $95 million, $230 million, $240 million, $260 million, and $270 million. Only observations of smaller reporting companies (non-smaller reporting companies) are included in the estimations when the artificial cutoff is lower (higher) than the actual cutoff in order to avoid contamination from the genuine treatment effect. Hence, the falsification analysis of each of the artificial cutoffs is only focused on the observations of firms with the same treatment status.[31]

The results of the RD estimation with artificial cutoffs are reported in Table 2.11, from which it can be seen that none of the estimates of β_1 reported in Table 2.11 is statistically significant at the conventional levels. The results indicate that the effect of the reduced level of disclosure on the risk of default is absent around all the artificial thresholds.

[31]The CER-optimal bandwidth is employed in the estimation following (Cattaneo et al. 2019) due to only being interested in the statistical inference, rather than the point estimates.

Table 2.11
Falsification tests: Regression discontinuity estimation of default risk at artificial cutoffs

VARIABLES	(1) \$55	(2) \$65	(3) \$85	(4) \$95	(5) \$230	(6) \$240	(7) \$260	(8) \$270
				Dependent Variable : *EDF*				
SRC	0.005	−0.019	0.014	−0.022	0.005	0.050	0.031	0.001
	(0.018)	(0.023)	(0.022)	(0.017)	(0.019)	(0.033)	(0.023)	(0.019)
Float	−0.066**	−0.054*	−0.016	0.035	−0.067***	−0.065***	−1.267	−0.071
	(0.029)	(0.029)	(0.281)	(0.107)	(0.015)	(0.014)	(0.935)	(0.373)
SRC × *Float*	−0.003	0.210	−0.078	−0.051	0.507	−0.413	1.221	0.023
	(0.082)	(0.243)	(0.284)	(0.112)	(0.374)	(1.244)	(0.938)	(0.374)
LnAssets	0.097***	0.090***	0.080***	0.081***	0.087***	0.088***	0.086***	0.088***
	(0.007)	(0.008)	(0.010)	(0.008)	(0.007)	(0.007)	(0.008)	(0.006)
Leverage	0.399***	0.399***	0.320***	0.343***	0.307***	0.304***	0.320***	0.324***
	(0.034)	(0.038)	(0.042)	(0.037)	(0.029)	(0.029)	(0.044)	(0.027)
LnDebt	−0.031***	−0.027***	−0.029***	−0.031***	−0.027***	−0.027***	−0.027***	−0.029***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.004)	(0.005)	(0.005)	(0.004)
Vol	−0.009***	−0.010***	−0.009***	−0.010***	−0.010***	−0.010***	−0.008***	−0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NI	−0.104***	−0.099***	−0.067***	−0.068***	−0.070***	−0.072***	−0.107***	−0.124***
	(0.016)	(0.018)	(0.021)	(0.017)	(0.015)	(0.015)	(0.026)	(0.019)
ER	−0.052***	−0.055***	−0.052***	−0.055***	−0.071***	−0.071***	−0.063***	−0.066***
	(0.006)	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.012)	(0.007)
Constant	−0.202***	−0.184***	−0.242***	−0.238***	−0.337***	−0.354***	−0.379***	−0.308***
	(0.038)	(0.042)	(0.056)	(0.044)	(0.039)	(0.046)	(0.065)	(0.049)
Observations	2,239	1,832	1,435	1,912	2,820	2,753	1,268	3,125
R^2	0.472	0.487	0.383	0.394	0.444	0.445	0.445	0.445
Firms	1,026	913	816	971	1,204	1,190	791	1,324
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Bandwidth	[±0.645]	[±0.616]	[±0.389]	[±0.427]	[±0.782]	[±0.800]	[±0.303]	[±0.735]

The table reports the RD results based on Eq. (2.5) using the artificial cutoffs at \$55, \$65, \$85, \$95, \$230, \$240, \$260, \$270 millions in Columns 1-8, respectively. Industry and year fixed effects are included in the regression models. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.7.4 Local Randomisation

The standard continuity-based framework is adopted in all the RD analyses in this chapter up to this point. Although the standard approach facilitates a smoothness of the regression functions, an alternative approach to the RD analysis based on a stronger assumption of local randomisation would ensure that the observations within a narrow bandwidth in the vicinity of the cutoff are as good as those randomly assigned. The assessment in this section involves determining whether the observed causal effect of the eligibility of smaller reporting companies to voluntarily provide scaled disclosure on default risk persists under a stronger assumption of local randomisation.

First, a data-driven technique is used to compute the bandwidth around the cutoff where the treatment can be plausibly assumed to have been "as-if" randomly assigned. The optimal bandwidth is estimated to be $h = [-0.035, 0.035]$, resulting in a number of observations of 67 smaller reporting companies and 76 non-smaller reporting companies. As a result of restricting the number of observations around the threshold within the selected bandwidth h, the difference between the mean EDF of smaller reporting companies and that of non-smaller reporting companies is 0.151 with the p-value of less than 1%, as reported in Table 2.12. Consistent with the results of using the standard continuity-based framework, this indicates that the scaled disclosure is associated with a greater risk of default. In addition, the differences in the average values of observable firm characteristics between smaller reporting companies and non-smaller reporting companies are calculated to check for evidence of discontinuity in the values of the observable variables.[32] The statistics reported in Table 2.12 are deemed to be valid because there is no statistically significant difference between the means as all the p-values are greater than the 10%.

[32]Unlike the standard RD approach, which involves an estimation of separate bandwidths for each covariate, the estimation under the local randomisation assumes that treatment is "as-if" randomly assigned in the selected window h. Therefore, the same window $h = [-0.035, 0.035]$ is used to investigate the discontinuity of the values of the covariates at the cutoff.

Table 2.12
Regression discontinuity estimation of default risk and covariates under the local randomisation assumptions

Variables	Difference in Means	Treated	Control
EDF	0.151***	67	76
LnAssets	0.269	67	76
LnDebt	0.228	67	76
Leverage	0.027	67	76
Vol	−0.710	67	76
NI	−0.068	67	76
ER	−0.152	67	76

This table reports the regression discontinuity results under the local randomisation assumptions. Differences in means between observations of smaller reporting companies and non-smaller reporting companies within the selected windows are reported. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The next examination entails determining whether the risk of default changes significantly at artificial thresholds other than the $75 million and the $250 million when the models are estimated based on the local randomisation assumption. The same eight artificial thresholds are used as in the investigation in Section 2.7.3: $55 million, $65 million, $85 million, $95 million, $230 million, $240 million, $260 million, and $270 million. The results of the placebo tests, reported in Table 2.13, show no evidence of significant changes in the EDF at the artificial thresholds, since the differences in the mean values of the EDF of the treated and the control observations are not statistically significant at the conventional levels.

Table 2.13
Falsification tests: Regression discontinuity estimation of default risk under the local randomisation assumptions at artificial cutoffs

Threshold	Difference in Means	Treated	Control
\$55	−0.004	71	80
\$65	0.009	39	44
\$85	−0.037	71	52
\$95	0.022	49	38
\$230	−0.013	50	50
\$240	0.052	16	11
\$260	−0.063	42	39
\$270	−0.350	34	42

This table reports the regression discontinuity results under the local randomisation assumptions at the artificial thresholds for falsification purposes. Differences in the average values of EDF between observations of smaller reporting companies and non-smaller reporting companies within the selected windows are reported. A total of 8 artificial thresholds are experimented: \$55, \$65, \$85, \$95, \$230, \$240, \$260, \$270 millions.

2.7.5 The Timing of the Impact

In Section 2.5.3 where the impact of the eligibility to the voluntarily scaled disclosure under the SRC rule on the default risk is empirically examined, both the default risk and the disclosure measures are constructed in the same period. In this Section, empirical work will be done to further investigate whether the causality between the eligibility to provide scaled disclosure and the risk of default exists using the forward measure of default risk.

The empirical models are as follows:

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + \beta_4' \boldsymbol{x}_{it} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.14}$$

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.15}$$

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.16}$$

and

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3' \boldsymbol{x}_{it} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.17}$$

In addition to the non-linear models in Eq. (2.14), the stability of the estimated effect is checked by experimenting with the following four non-linear specifications:

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + f\left(\bullet\right) + \beta_4' \boldsymbol{x}_{it} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.18}$$

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.19}$$

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3 \left(SRC_{i,t} \times Float_{i,t}\right) + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.20}$$

and

$$EDF_{i,t+1} = \beta_0 + \beta_1 SRC_{i,t} + \beta_2 Float_{i,t} + \beta_3' \boldsymbol{x}_{it} + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{2.21}$$

where i and t denote firm and year, respectively. $EDF_{i,t+1}$ is the measure of default risk for firm i in year $t+1$ estimated following Bharath & Shumway (2008) as explained in Section 2.4.2. The dummy variable, $SRC_{i,t}$, equals 1 if firm i is eligible for a scaled disclosure under the SRC rule in year t and 0 otherwise. The running variable, $Float_{i,t}$, denotes the distance between company i's equity float (in natural logarithms) and the corresponding (in natural logarithms) cutoffs in year t. The interaction term $SRC_{i,t} \times Float_{i,t}$ captures the possible difference in the slope of the regression lines on both sides of the re-centred threshold. $f\left(\bullet\right)$ denotes polynomial terms of $SRC_{i,t} \times Float_{i,t}$, the order of which is selected based on the Bayesian Information Criterion (BIC). The elements in vector $\boldsymbol{x}_{it}$ are control variables, including firm size ($FirmSize$), calculated as the log value of total assets, leverage ($Leverage$) measured as the ratio of total debt to total assets, the natural log of the face value of debt ($LnDebt$), the inverse of the annualised stock return volatility (Vol), the ratio of net income to total assets (NI), and the excess return (ER). Finally, the year fixed effects are included to capture the time-varying characteristic

of the default risk caused by the changing macroeconomic environments, and the industry fixed effects are included to address the heterogeneity across industries, as discussed by Chava & Jarrow (2004) and Brogaard et al. (2017).[33]

The results are reported in Table 2.14. According to which, the results are in line with the main results shown in Table 2.6 and Table 2.7. The estimates of β_1 are all positive and statistically significant, implying that the eligibility to provide scaled disclosure in time t also has a longer impact on default risk in the future.

[33]Since different industries face different levels of competition and, therefore, the likelihood of bankruptcy can differ for firms in different industries that have otherwise identical balance sheets. Moreover, different industries may have different accounting conventions, which implies that the likelihood of bankruptcy can differ for firms in different industries, which otherwise have identical balance sheets (Chava & Jarrow 2004). To check the robustness of the results, estimation results for models that include the firm fixed effects are qualitatively similar to those for models with the industry fixed effects.

Table 2.14
Regression discontinuity estimation of default risk (timing effects)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable : *EDF*							
SRC	0.016***	0.016***	0.006***	0.007***	0.016***	0.016***	0.007***	0.006***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Float	−0.004	−0.007	−0.040***	−0.045***	−0.001	0.006	−0.037***	−0.028
	(0.011)	(0.014)	(0.011)	(0.014)	(0.011)	(0.049)	(0.009)	(0.040)
SRC × *Float*		0.008		0.010		−0.018		−0.033
		(0.021)		(0.019)		(0.085)		(0.067)
LnAssets			0.032***	0.032***			0.034***	0.034***
			(0.005)	(0.005)			(0.004)	(0.004)
Leverage			0.121***	0.121***			0.120***	0.119***
			(0.026)	(0.026)			(0.018)	(0.018)
LnDebt			0.007**	0.008**			0.006***	0.006***
			(0.003)	(0.003)			(0.002)	(0.002)
Vol			−0.007***	−0.007***			−0.007***	−0.007***
			(0.001)	(0.001)			(0.001)	(0.001)
NI			−0.046***	−0.046***			−0.036***	−0.036***
			(0.013)	(0.013)			(0.009)	(0.009)
ER			−0.089***	−0.089***			−0.090***	−0.090***
			(0.006)	(0.006)			(0.004)	(0.004)
Constant	−0.022*	−0.020	−0.197***	−0.195***	−0.014	−0.014	−0.205***	−0.204***
	(0.011)	(0.012)	(0.028)	(0.028)	(0.010)	(0.014)	(0.022)	(0.024)
Observations	3,706	3,706	3,532	3,532	7,459	7,459	8,005	8,005
R^2	0.092	0.092	0.25	0.252	0.092	0.092	0.252	0.252
Firms	1,469	1,469	1,403	1,403	2,204	2,204	2,260	2,260
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Polynomial Order	1	1	1	1	3	3	3	3
Bandwidth	[±0.998]	[±0.998]	[±0.993]	[±0.993]	[±1.092]	[±1.092]	[±2.095]	[±2.095]

The table reports the RD results based on Eq. (2.14) and Eq. (2.7.5). Industry and year fixed effects are included in the regression models. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.7.6 Excluding Utility Firms

Consistent with prior papers related to default risk (Bharath & Shumway 2008, Brogaard et al. 2017, Baghdadi et al. 2020), I only exclude the financial industry from the main sample. In this section, the empirical work is done to examine whether the results remain intact when the sample excludes both the financial and utility industries. Mirroring the models shown in Section 2.5.3, the results excluding both financial and utility firms are shown in Table 2.15. The results remain unchanged.

Table 2.15
Regression discontinuity estimation of default risk (excluding financial and utility industries)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable : *EDF*							
SRC	0.055***	0.056***	0.039***	0.040***	0.048***	0.084***	0.038***	0.048***
	(0.015)	(0.015)	(0.012)	(0.012)	(0.014)	(0.020)	(0.011)	(0.017)
Float	0.007	−0.003	−0.048***	−0.059***	−0.001	0.053	−0.049***	−0.088*
	(0.013)	(0.016)	(0.012)	(0.014)	(0.012)	(0.051)	(0.010)	(0.045)
SRC × *Float*		0.021		0.023		0.114		0.139*
		(0.027)		(0.022)		(0.096)		(0.079)
LnAssets			0.056***	0.056***			0.060***	0.060***
			(0.005)	(0.005)			(0.004)	(0.004)
Leverage			0.207***	0.207***			0.203***	0.204***
			(0.022)	(0.022)			(0.015)	(0.015)
LnDebt			0.011***	0.011***			0.007***	0.007***
			(0.002)	(0.002)			(0.002)	(0.002)
Vol			−0.011***	−0.011***			−0.010***	−0.010***
			(0.001)	(0.001)			(0.001)	(0.001)
NI			−0.071***	−0.071***			−0.086***	−0.086***
			(0.012)	(0.012)			(0.009)	(0.009)
ER			−0.094***	−0.094***			−0.092***	−0.092***
			(0.005)	(0.005)			(0.004)	(0.004)
Constant	0.128***	0.132***	−0.151***	−0.147***	0.163***	0.158***	−0.159***	−0.149***
	(0.021)	(0.021)	(0.030)	(0.030)	(0.015)	(0.017)	(0.026)	(0.027)
Observations	4,276	4,276	4,191	4,191	8,990	8,990	9,025	9,025
R^2	0.160	0.160	0.434	0.434	0.163	0.164	0.426	0.426
Firms	1,716	1,716	1,666	1,666	2,598	2,598	2,569	2,569
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Polynomial Order	1	1	1	1	3	3	3	3
Bandwidth	[±0.893]	[±0.893]	[±0.914]	[±0.914]	[±1.784]	[±1.784]	[±1.841]	[±1.841]

The table reports the RD results based on Eq. (2.5) and Eq. (2.5.3), respectively. Industry and year fixed effects are included in the regression models. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.7.7 Alternative Measures of Default Risk

The robustness of the baseline results are checked in this section by investigating whether the causal effect of a voluntary scaled disclosure remains strong when the risk of default is measured by alternative methods. Two alternative measures of default risk, the *Z-Score* of Altman (1968) and the *O-Score* of Ohlson (1980) are respectively used in place of the EDF in Eq. (2.5).

The *Z-score* attempts to predict defaults using five accounting ratios. Specifically, the model is as follows:

$$Z\text{-}score_{i,t} = 1.2\frac{WC_{i,t}}{TA_{i,t}} + 1.4\frac{RE_{i,t}}{TA_{i,t}} + 0.6\frac{MV_{i,t}}{TL_{i,t}} + 1.0\frac{Sales_{i,t}}{TA_{i,t}} + 3.3\frac{EBIT_{i,t}}{TA_{i,t}}, \quad (2.22)$$

where TA is the total assets; TL is the total liabilities; WC is the ratio of working capital to total assets; RE is the ratio of retained earnings to total assets; MV is the ratio of market value of equity to book value of total liabilities; $Sales$ is the ratio of sales to total assets; and $EBIT$ is the ratio of the earnings before interest and taxes to total assets. The higher the value of the *Z-score*, the lower is the risk of default. The mean *Z-score* of the sample is 2.31 and the median is 2.56. The standard deviation is 4.78 and the maximum and the minimum values are -22.7 and 16.41, respectively.

The *O-score* measure for firm i in year t is computed using nine accounting ratios as follows:

$$\begin{aligned} O\text{-}score_{i,t} = &-1.32 - 0.407\ln\frac{TA_{i,t}}{GNP_t} + 6.03\frac{TL_{i,t}}{TA_{i,t}} - 1.43\frac{WC_{i,t}}{TA_{i,t}} + 0.0757\frac{CL_{i,t}}{CA_{i,t}} \\ &- 2.37\frac{NI_{i,t}}{TA_{i,t}} - 1.83\frac{CF_{i,t}}{TL_{i,t}} + 0.285 \times \mathbf{1}_{[NI_{i,t-1}<0]} \times \mathbf{1}_{[NI_{i,t-2}<0]} \\ &- 1.72 \times \mathbf{1}_{[TL_{i,t}>TA_{i,t}]} - 0.521\frac{NI_{i,t} - NI_{i,t-1}}{|NI_{i,t}| + |NI_{i,t-1}|}, \end{aligned} \quad (2.23)$$

where TA, TL, and WC are defined in the same way as in Eq. (2.22); GNP is the GNP price-level index; CL is the current liabilities; CA is the current assets; NI is the net income; CF is the operational cash flows; and $\mathbf{1}_{[\bullet]}$ is an indicator function which equals 1 if and only if the argument is true and 0 otherwise. A higher value

of *O-score* implies a greater default risk. The *O-score* of the full sample has a mean of 3.17 and a median of 2.79, respectively. The minimum value is −1.75 and the maximum value is 14.44 with a standard deviation of 2.63.[34] [35]

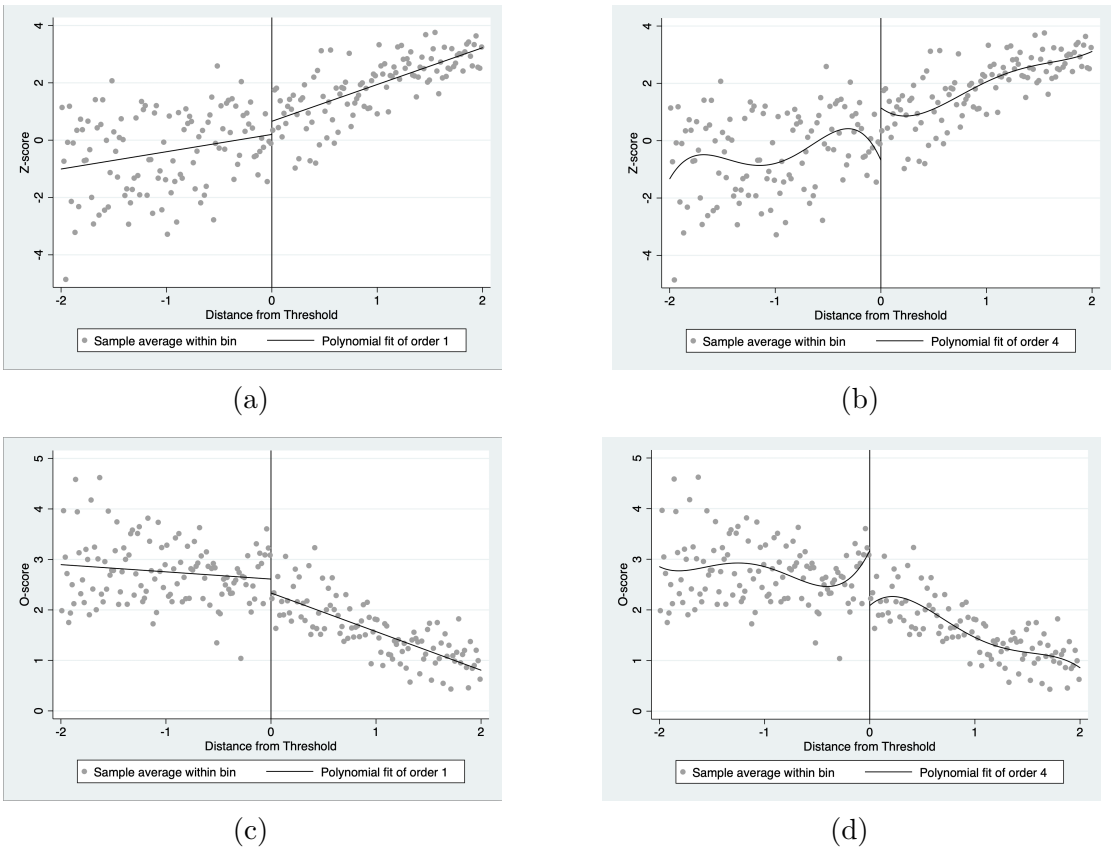
The RD design analysis of both the *Z-score* and the *O-score* begins by showing the RD plots. Panels (a) to (d) in Figure 2.6 show a discontinuity of the default risk measures at the cutoffs. More specifically, Panel (a) shows that, according to the local linear fitted regression line, the *Z-score*s of smaller reporting companies immediately to the left of the threshold are significantly lower than the *Z-score*s to the right of the threshold that represent non-smaller reporting companies. The RD plot corresponding to the *O-score* is shown in Panel (c). Again, a discontinuous change is observed in the risk of default around the cutoff where observations for smaller reporting companies to the left of the threshold appear to have higher *O-score*s, indicating a greater risk of default. Both of these findings are in line with the results obtained when using the EDF as the default risk measure.[36]

[34] A correlation matrix of the three measures of default risk is also calculated. The (untabulated) results show that the *Z-score* is negatively correlated with the *O-score* and the EDF with the correlation coefficients of −0.680 and −0.239, respectively. The value of −0.680 is close to the value of the correlation coefficient between the *Z-score*and the *O-score* reported by Griffin & Lemmon (2002). The EDF is significantly and positively related to the *O-score* with an estimated value of 0.332. All the correlation coefficients are statistically significant at the conventional levels. The fact that the three measures are not strongly correlated suggests that they carry different information about the risk of default.

[35] A univariate analysis is conducted to examine the possible differences in the average default risk between smaller reporting companies and non-smaller reporting companies using alternative measures of default risk. The results are reported in Table 2.5. The average *Z-score* of smaller reporting companies is −0.741 while the corresponding value of non-smaller reporting companies is 3.023. The difference of 3.765 is statistically significant at the 1% significance level. Similarly, the average *O-score* of smaller reporting companies is 2.955 compared to 0.579 for non-smaller reporting companies. The difference of 2.376 is statistically significant at the 1% significance level. The differences of *Z-score* and *O-score* between smaller reporting companies and non-smaller reporting companies both suggest that smaller reporting companies have significantly higher default risk relative to non-smaller reporting companies.

[36] I also show RD plots for *Z-score* and *O-score* measures of default risk with the fitted regressions up to the 4th-order polynomials whose order are selected based on the Bayesian Information Criterion as shown in Panel (b) and (d) in Figure 2.6. The figures show the similar patterns to the local linear fitted regression lines.

Figure 2.6
Regression discontinuity plots of Z- and O-scores



This figure shows the regression discontinuity (RD) plots where the value along the x-axis is the distance between the public float and the re-centered cutoff point and the value on the y-axis is the measure of default risk measured using *Z-score* and *O-score*, respectively. Panel (a) and (c) illustrate the local linear fitted regression. Panel (b) and (d) show the observations around the cutoff along with the fitted regression lines with up to the 4th-order polynomials.

Tables 2.16–2.19 contain the RD design estimation results when the *Z-score* and the *O-score* are employed as the measures of default risk. The results of local linear models are presented in Tables 2.16 and 2.18, while the results of models with up to the 4th polynomial order are shown in Tables 2.17 and 2.19. Consistent with the results using the EDF as the dependent variable, the results of both of the *Z-score* and the *O-score* indicate that reduced levels of information disclosure increase the risk of default.

Table 2.16
Regression discontinuity estimation of *Z-score* (linear models)

VARIABLES	(1) *Z-score*	(2) *Z-score*	(3) *Z-score*	(4) *Z-score*
SRC	−2.249**	−2.253**	−1.694**	−1.695**
	(1.056)	(1.058)	(0.815)	(0.815)
Float	−2.073	−1.289	−2.753*	−4.459*
	(1.501)	(1.929)	(1.494)	(2.323)
SRC × *Float*		−1.640		3.494
		(2.658)		(2.903)
LnAssets			1.611**	1.614**
			(0.653)	(0.654)
Leverage			−2.723	−2.701
			(2.925)	(2.928)
LnDebt			−0.582	−0.584
			(0.425)	(0.425)
Vol			0.067	0.069
			(0.052)	(0.053)
NI			16.961***	16.979***
			(3.028)	(3.030)
ER			−0.166	−0.168
			(0.251)	(0.252)
Constant	1.545	1.311	−1.792	−1.390
	(1.647)	(1.648)	(2.617)	(2.633)
Observations	2,286	2,286	1,807	1,807
R^2	0.057	0.057	0.284	0.285
Firms	1,160	1,160	1,000	1,000
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	Yes
Bandwidth	[±0.525]	[±0.525]	[±0.425]	[±0.425]

The table reports the RD results within the MSE-optimal bandwidths based on Eqs. (2.5)–(2.8) when the alternative measure of default risk – *Z-score* is employed as the dependent variable. *SRC*, equals 1 if firm i qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *SRC* × *Float* denotes the interaction term of *SRC* and *Float*. *LnAssets* is the log value of total assets; *Leverage* is the ratio of total debt to total assets; *LnDebt* is the log value of face value of debt; *Vol* is the inverse of the annualized return volatility; *NI* is the ratio of net income to total assets; *ER* is the difference between the stock's annual return and the CRSP valued-weighted return. Columns 1 shows results excluding control variables and the interaction term *SRC* × *Float*. Column 2 shows results excluding control variables. Column 3 shows the results excluding the interaction term *SRC* × *Float*. Year and industry fixed effects are included in the regression. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2.17
Regression discontinuity estimate of *Z-score* (non-linear models)

VARIABLES	(1) *Z-score*	(2) *Z-score*	(3) *Z-score*	(4) *Z-score*
SRC	−1.842*	−2.479*	−1.324	−1.898*
	(1.060)	(1.379)	(0.861)	(1.101)
Float	−1.243	−19.626*	−2.041	−16.224
	(1.528)	(10.715)	(1.302)	(10.268)
SRC × *Float*		29.094		21.381
		(23.629)		(17.210)
LnAssets			3.149***	3.149***
			(0.514)	(0.513)
Leverage			2.990	2.996
			(4.571)	(4.574)
LnDebt			−1.835***	−1.835***
			(0.635)	(0.636)
Vol			0.283***	0.282***
			(0.038)	(0.039)
NI			4.935***	4.936***
			(1.490)	(1.490)
ER			0.526***	0.523***
			(0.186)	(0.186)
Constant	2.308**	3.477***	−11.352***	−10.267***
	(1.027)	(1.268)	(2.282)	(2.344)
Observations	4,916	4,916	4,889	4,889
R^2	0.067	0.067	0.497	0.497
Number of Firms	1,814	1,814	1,804	1,804
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±1.161]	[±1.161]	[±1.064]	[±1.064]
Polynomial Order	4	4	4	4

The table reports the RD results within the MSE-optimal bandwidths based on Eqs (2.10)– (2.12) when the alternative measure of default risk – *Z-score* is employed as the dependent variable. This table differs from Table 2.16 by adding a polynomial term of the interaction term *SRC* × *Float* into the regression to capture potential nonlinearity. *SRC*, equals 1 if firm i qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *SRC* × *Float* denotes the interaction term of *SRC* and *Float*. *LnAssets* is the log value of total assets; *Leverage* is the ratio of total debt to total assets; *LnDebt* is the log value of face value of debt; *Vol* is the inverse of the annualized return volatility; *NI* is the ratio of net income to total assets; *ER* is the difference between the stock's annual return and the CRSP valued-weighted return. Columns 1 shows results excluding control variables and the interaction terms. Column 2 shows results excluding control variables. Column 3 shows the results excluding the interaction terms. Year and industry fixed effects are included in the regression. The order of the before-mentioned polynomial term is selected based on the Bayesian Information Criterion (BIC) and is shown in the last row of the table for each regression. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2.18
Regression discontinuity estimate of *O-score* (linear models)

VARIABLES	(1) *O-score*	(2) *O-score*	(3) *O-score*	(4) *O-score*
SRC	1.410**	1.403**	1.070**	1.074**
	(0.598)	(0.597)	(0.461)	(0.461)
Float	1.071	−0.723	1.699**	1.225
	(0.766)	(0.766)	(0.733)	(0.830)
SRC × *Float*		3.642***		0.989
		(1.343)		(0.797)
LnAssets			−1.350**	−1.345**
			(0.685)	(0.685)
Leverage			2.391	2.399
			(2.203)	(2.205)
LnDebt			0.489	0.487
			(0.389)	(0.389)
Vol			−0.018	−0.017
			(0.020)	(0.020)
NI			−10.423***	−10.418***
			(1.865)	(1.866)
ER			0.377*	0.376*
			(0.225)	(0.225)
Constant	3.848**	4.384***	7.667***	7.785***
	(1.671)	(1.693)	(2.234)	(2.233)
Observations	2,064	2,064	2,249	2,249
R^2	0.043	0.044	0.252	0.252
Firms	1,095	1,095	1,149	1,149
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±0.473]	[±0.473]	[±0.519]	[±0.519]

The table reports the RD results within the MSE-optimal bandwidths based on Eqs. (2.5)–(2.8) when the alternative measure of default risk – *O-score* is employed as the dependent variable. *SRC*, equals 1 if firm i qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *SRC* × *Float* denotes the interaction term of *SRC* and *Float*. *LnAssets* is the log value of total assets; *Leverage* is the ratio of total debt to total assets; *LnDebt* is the log value of face value of debt; *Vol* is the inverse of the annualized return volatility; *NI* is the ratio of net income to total assets; *ER* is the difference between the stock's annual return and the CRSP valued-weighted return. Columns 1 shows results excluding control variables and the interaction term *SRC* × *Float*. Column 2 shows results excluding control variables. Column 3 shows the results excluding the interaction term *SRC* × *Float*. Year and industry fixed effects are included in the regression. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 2.19
Regression discontinuity estimate of *O-score* (non-linear models)

VARIABLES	(1) *O-score*	(2) *O-score*	(3) *O-score*	(4) *O-score*
SRC	1.671**	1.110**	0.614**	0.578*
	(0.742)	(0.434)	(0.311)	(0.346)
Float	2.191	2.593	1.003*	−0.663
	(1.843)	(3.718)	(0.548)	(2.993)
SRC × *Float*		3.605		5.276
		(5.825)		(4.649)
LnAssets			−0.529***	−1.378***
			(0.163)	(0.095)
Leverage			3.882***	5.393***
			(0.704)	(0.274)
LnDebt			0.184**	0.182***
			(0.085)	(0.050)
Vol			−0.001	−0.046***
			(0.004)	(0.018)
NI			−7.020***	−0.261
			(0.352)	(0.210)
ER			0.084	−0.199***
			(0.068)	(0.059)
Constant	0.897	1.362	1.996**	6.954***
	(0.993)	(0.843)	(0.879)	(1.047)
Observations	4,566	4,566	4,478	4,478
R^2	0.024	0.173	0.925	0.521
Firms	1,742	1,742	1,721	1,721
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±0.992]	[±0.992]	[±0.985]	[±0.985]
Polynomial Order	4	4	4	4

The table reports the RD results within the MSE-optimal bandwidths based on Eqs (2.10)– (2.12) when the alternative measure of default risk – *Z-score* is employed as the dependent variable. This table differs from Table 2.18 by adding a polynomial term of the interaction term *SRC* × *Float* into the regression to capture potential nonlinearity. *SRC*, equals 1 if firm i qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *SRC* × *Float* denotes the interaction term of *SRC* and *Float*. *LnAssets* is the log value of total assets; *Leverage* is the ratio of total debt to total assets; *LnDebt* is the log value of face value of debt; *Vol* is the inverse of the annualized return volatility; *NI* is the ratio of net income to total assets; *ER* is the difference between the stock's annual return and the CRSP valued-weighted return. Columns 1 shows results excluding control variables and the interaction terms. Column 2 shows results excluding control variables. Column 3 shows the results excluding the interaction terms. Year and industry fixed effects are included in the regression. The order of the before-mentioned polynomial term is selected based on the Bayesian Information Criterion (BIC) and is shown in the last row of the table for each regression. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The estimation results that mirror all the main results under the EDF are presented in the Appendix. Tables A4 and A5 contain the RD design estimation results using alternative bandwidths: CER, MSE-2, and CER-2. The estimated parameters of *SRC* in both tables suggest that a voluntary reduction of the disclosure level increases the risk of default, as measured by the Z-score and the *O-score*. These results are consistent with those reported in Section 2.5.3 and Tables 2.6 and 2.7 when the risk of default is measured using the EDF of Bharath & Shumway (2008).

Next, Tables A6–A7 show the RD design estimation results of the Z-score and the *O-score* when the threshold is assumed to take values other than \$75 million and \$250 million. As can be seen in the tables, the estimated parameters of *SRC* are not statistically significant in all of the specifications. This indicates that there is no significant difference between the observations lying to the left of the threshold and those to the right of it. These results are in line with those discussed in Section 2.7.3 and reported in Table 2.11.

The RD design models of the *Z-score* and the *O-score* under the local randomisation assumption are also examined. The differences in the means between the treated and the control observations around the cutoff for the *Z-score*and the *O-score* are -3.351 and 1.362 with the p-values of 0.031 and 0.013, respectively. Finally, the results of the falsification check of the different artificial thresholds under a local randomisation assumption are shown in Tables A8 and A9. Again, the analysis mirrors the one in Section 6.4 where a total of eight artificial thresholds are used. There is no evidence of a significant difference between the default risk of smaller reporting companies and non-smaller reporting companies at all the artificial cutoffs.

2.8 First Timer Analysis

The effect of the reduced disclosure level on the risk of default when firms become eligible under the SRC rule for the first time is investigated in this section. The analysis is, in part, motivated by the argument of Cohen et al. (2020) that, while it is easy to compare the entries in numerical financial statements since they

are reported alongside figures from prior financial years, investors do not always compare the year's 10-K text to last year's. As a result, they often miss the latest disclosure, which is buried in lengthy reports and is likely to be negative. Cohen et al. (2020) report an economically and statistically zero announcement-day return after the release of 10-K files and show that documentary changes affect stock returns with a lag. They attribute their findings to investors being "lazy" and "inattentive" to the important information contained in changes to 10-K reports. They also find that the impact of investors' inattentiveness to stock return is diminished when more investors potentially compare and pay attention to changes in 10-K files by downloading not only the 10-K documents for the current year, but also those for the prior year. Since the reduced disclosure level adopted by newly-eligible smaller reporting companies is one of the most conspicuous changes to 10-K reports, it is easily noticeable by investors. Therefore, the risk of default among newly-qualified smaller reporting companies is expected to rise sharply due to the increased information risk and the deterioration of the information environment.

Table 2.20
Numbers of newly qualified smaller reporting companies during 2008–2019

Year	N
2008	552
2009	250
2010	83
2011	54
2012	68
2013	47
2014	35
2015	76
2016	87
2017	43
2018	219
2019	140

The table reports statistics on the number of newly eligible smaller reporting companies for the first time in each year between 2008 and 2019.

The number of newly-eligible smaller reporting companies from 2008 to 2019

is shown in Table 2.20 as a first step in the analysis. According to this table, a total of 552 companies were classified as smaller reporting companies in 2008 when the SRC rule was first enacted, but the number of newly qualified smaller reporting companies halved in 2009 and fell sharply from 2010 onwards. It increased significantly again from 43 in 2017 to 219 in 2018 when the threshold was raised from $75 million to $250 million.

The level of disclosure among newly-qualified smaller reporting companies is now examined based on the following model:

$$\nabla \, TotalItems_{i,t} = \delta_0 + \delta_1 NewSRC_{i,t} + \gamma_t + \varepsilon_{i,t}, \tag{2.24}$$

where $\nabla \, TotalItems_{i,t} = TotalItems_{i,t} - TotalItems_{i,t-1}$; $NewSRC_{i,t}$ is a binary variable that takes a value of 1 if firm i is eligible for the provision of scaled disclosure in year t but not in year $t-1$, and 0 otherwise; and γ_t captures the year fixed effect.[37] The standard errors are all clustered at the firm level.

While observations in the treated group, whose values of $NewSRC_{i,t} = 1$ are newly qualified smaller reporting companies, two control groups of firms are employed when estimating Eq. (2.24). The firms in the first control group were classified as smaller reporting companies in any year prior to year t. Firms in the second control group are non-smaller reporting companies. In order to ensure that the firm characteristics of the treated group and the control group are similar, the treated firms are matched with the control firms in the corresponding control group based on the propensity score matching (PSM) technique.[38]

The estimation results are reported for the first and the second control groups in columns (1) and (2) in Table 2.21, respectively. Although the estimate of δ_1 shown in column (1) is positive, it is statistically insignificant, which suggests that the total word counts of the 10 items of 10-K reports that are allowed to have the reduced level of disclosure is similar for both smaller reporting companies that were already eligible for the reduced disclosure level prior to year t and newly qualified

[37] The functional form of Eq. (2.24) is also employed by Cornett et al. (2020) and Nguyen et al. (2020) to examine bank actions when they enter the stress test for the first time.

[38] I estimate propensity score on *LnAssets*, *Leverage*, *LnDebt*, *Vol*, *NI* and *ER*. Treated group and control group are matched without replacement using the logit of the propensity score within a 0.05 standard deviations. The comparison of means across the matched samples is presented in Table A10 in the Appendix.

smaller reporting companies that are eligible in the same year. However, the results in column (2) show that, when comparing the word count of newly-eligible smaller reporting companies to those of non-smaller reporting companies, the former are found to reduce the amount of disclosure by approximately 13.5%. This difference is statistically significant at better than the 1% level.

Table 2.21
Difference-in-Differences estimation of disclosure for newly qualified smaller reporting companies

	(1) *TotalItems*	(2) *TotalItems*	(3) *TotalItems*
NewSRC	0.049	−0.135***	
	(0.040)	(0.050)	
OldSRC			−0.117*
			(0.064)
Constant	12.404***	12.736***	12.664***
	(0.127)	(0.122)	(0.132)
Observations	2,002	1,288	1,392
R-squared	0.114	0.144	0.191
Firms	1,051	1,056	738
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

This table reports the difference-in-differences estimation results for Eqs. (2.24) and (2.25). *TotalItems* is the total number of words of the 9 items eligible for the reduced disclosure on 10Ks. The SEC allows smaller reporting companies to reduce the disclosure levels in 10 items in the S-K forms. *NewSRC* is a binary variable whose value equals 1 if the firm is eligible to provide scaled disclosure in the current year but not in the previous year, and 0 otherwise. *OldSRC* is a dummy variable whose value equals 1 if firm is a smaller reporting company at any time prior to the current year, and 0 otherwise. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The following model is estimated to complete the analysis of the disclosure level of the 10 items in 10-K files:

$$\nabla \, TotalItems_{i,t} = \delta_0 + \delta_1 \, OldSRC_{i,t} + \gamma_t + \varepsilon_{i,t}, \tag{2.25}$$

where $OldSRC_{i,t}$ is a dummy variable with a value that equals 1 if firm i is a smaller reporting company at any time prior to year t, and 0 otherwise. The control group for this analysis consists of non-smaller reporting companies that are matched to smaller reporting companies in the treated group using PSM. The estimation results are reported in column (3) of Table 2.21. The estimated value of

δ_1 of -0.117 indicates that, compared to non-smaller reporting companies, smaller reporting companies that are eligible for scaled disclosure prior to year t reduce the amount of disclosure of the 10 items by around 11.7%.

The focus now turns to the following model to estimate the effect of the reduced disclosure requirement on the risk of default:

$$\nabla EDF_{i,t} = \phi_0 + \phi_1 NewSRC_{i,t} + \phi_2' \nabla \boldsymbol{x}_{i,t} + \gamma_t + \varepsilon_{i,t}, \tag{2.26}$$

where $\nabla EDF_{i,t} = EDF_{i,t} - EDF_{i,t-1}$ and $\nabla \boldsymbol{x}_{i,t} = \boldsymbol{x}_{i,t} - \boldsymbol{x}_{i,t-1}$. $\boldsymbol{x}_{i,t}$ is a vector containing the control variables that have been previously discussed in Section 2.4.4.[39] The estimation results of both of the corresponding control groups are reported in columns (1) and (2) of Table 2.22, respectively. The estimations of ϕ_1 in both columns are positive and statistically significant at better than the 1% level, which suggests that recently-qualified smaller reporting companies are exposed to greater default risk compared to both previously-eligible smaller reporting companies and non-smaller reporting companies. While the estimate of ϕ_1 reported in column (1) is 0.046, the estimate in column (2) is 0.118. This finding points to a stronger impact on the risk of default when comparing first-time smaller reporting companies to non-smaller reporting companies than when comparing first-time smaller reporting companies to smaller reporting companies that have already qualified for the reduced disclosure requirements.

Finally, the default risk of firms that acquired the SRC status at any time prior to time t is compared to that of non-smaller reporting companies. The specific estimation model is as follows:

$$\nabla EDF_{i,t} = \phi_0 + \phi_1 OldSRC_{i,t} + \phi_2' \nabla \boldsymbol{x}_{i,t} + \gamma_t + \varepsilon_{i,t}, \tag{2.27}$$

where observations of firms in the control groups are non-smaller reporting companies. The estimation result for Eq. (2.27) is reported under column (3) in Table 2.22. The estimate of ϕ_1 is found to be positive and statistically significant, which suggests that previously-eligible smaller reporting companies continue to experi-

[39] I estimate propensity score on *LnAssets*, *Leverage*, *LnDebt*, *Vol*, *NI* and *ER*. Treated group and control group are matched without replacement using the logit of the propensity score within 0.05 standard deviations. The comparison of means across the matched samples are presented in Table A11 in the Appendix.

ence a greater risk of bankruptcy, compared to non-smaller reporting companies. When testing the statistical differences between pairs of estimates of parameters of interest, it is found that the differences are all statistically significant at better than the 5% level.

Table 2.22
Difference-in-Differences estimation of default risk for newly qualified smaller reporting companies

	(1) *EDF*	(2) *EDF*	(3) *EDF*
NewSRC	0.046***	0.118***	
	(0.009)	(0.014)	
OldSRC			0.076***
			(0.012)
LnAssets	−0.056***	−0.022*	0.001
	(0.009)	(0.013)	(0.012)
Leverage	0.086**	0.128***	0.098**
	(0.035)	(0.045)	(0.039)
LnDebt	0.099***	0.050***	0.031***
	(0.008)	(0.010)	(0.008)
Vol	−0.022***	−0.021***	−0.012***
	(0.002)	(0.002)	(0.001)
NI	−0.017	−0.044*	−0.082***
	(0.014)	(0.024)	(0.026)
ER	−0.117***	−0.104***	−0.102***
	(0.008)	(0.010)	(0.010)
Constant	0.070	−0.087	−0.035
	(0.055)	(0.080)	(0.051)
Observations	2,944	1,710	2,086
R-squared	0.473	0.546	0.481
Firms	1,522	1,384	1,050
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the DiD results for Eq. (2.26) and Eq. (2.27). *NewSRC* equals 1 if the firm is eligible to provide scaled disclosure in the current year but not in the last year, and 0 otherwise. *OldSRC* equals 1 if firm is a smaller reporting company at any time prior to the current year, and 0 otherwise. The definitions of other variables are the same with prior tables. Year and industry fixed effects are included in all the regression. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

In summary, the results in this section indicate that, compared to non-smaller reporting companies, newly-eligible smaller reporting companies and previously-eligible smaller reporting companies reduce their disclosure levels of the 10 items that are permitted under the SRC rule. However, there is no evidence to suggest

that the level of disclosure of newly-eligible smaller reporting companies and previously-eligible smaller reporting companies is different. Both types of smaller reporting companies appear to suffer a greater risk of default than non-smaller reporting companies, although newly-qualified smaller reporting companies seem to experience a much larger increase in default risk.

2.9 Information Effects and Commitment Effects of Financial Disclosures on Default Risk

So far in this chapter, it has been shown that permitting smaller reporting companies to voluntarily reduce disclosure levels increases their risk of default. The causal impact of the eligibility under the SRC rule could be potentially transmitted via two separate channels, namely, the loss of commitment to mandatory disclosure and the loss of potentially useful information about the firm value. While there is no effect of information loss if a smaller reporting company voluntarily maintains its disclosure level and continues to make a full report of its financial performance, there is still an increase in default risk due to an increase in information asymmetry caused by the loss of commitment to mandatory disclosure. As a result of their research, Cheng et al. (2013) warn of worsening liquidity among smaller reporting companies, which can be attributed to the unintended consequence of the regulation that causes the loss of commitment by companies to provide mandatory disclosure.

In this section, the difference-in-differences (DiD) approach is used to disentangle the impact of the loss of commitment to mandatory disclosure from the impact of the loss of information on the risk of default around 2007–2008 when the SRC rule was first introduced and 2017–2018 when the SRC rule was amended to increase the threshold from $75 million to $250 million. Based on the fact that smaller reporting companies are allowed to provide scaled disclosures, the sample can be divided into smaller reporting companies which include firms that reduce their disclosure levels and firms that voluntarily maintain their disclosure levels, and non-smaller reporting companies. The empirical work is conducted by comparing each of the two groups among these three subsamples. Specifically, smaller reporting companies are compared with non-smaller reporting companies in order to test the robustness

for the effects of voluntarily reduced disclosures on default risk while using the DiD approach. When smaller reporting companies that reduce their disclosure levels are compared with smaller reporting companies that maintain their disclosure levels, the difference is the loss of information on 10-Ks since both of these two groups lose commitment effects. When smaller reporting companies that maintain their disclosure levels are compared with non-smaller reporting companies, the difference is the loss of commitment effects as these two groups generally report the same amount of information on their 10-K reports.

Using samples of smaller reporting companies and non-smaller reporting companies, the following DiD model for each time period is first examined to investigate the impact of the eligibility to provide scaled disclosure under the SRC rule on the risk of default:

$$EDF_{i,t} = \lambda_0 + \lambda_1 SRC_i + \lambda_2 Post_t + \lambda_3 \left(SRC_i \times Post_t\right) + \lambda_4' \boldsymbol{x}_{i,t} + \varepsilon_{i,t}, \qquad (2.28)$$

where $SRC_i = 1$ if firm i is classified as a smaller reporting company in year 2008 (or 2018), $\boldsymbol{x}_{i,t}$ is the vector of controls as defined in Section 2.4.4, and $t \in \{2007, 2008, 2017, 2018\}$ where $Post_{2007} = Post_{2017} = 0$ and $Post_{2008} = Post_{2018} = 1$. The interest is focused on the estimate of λ_3 which quantifies the effect of the eligibility under the SRC rule on the risk of default. Smaller reporting companies in the treated group are matched with non-smaller reporting companies in the control groups using the PSM to ensure that the characteristics of the firms in both groups are similar, except for their treatment status.[40] All the standard errors are clustered at the firm level.

The estimation results for Eq. (2.28) are reported in columns (1) and (4) of Table 2.23. The estimate of λ_3 of 0.172 in column (1) indicates that the risk of default among eligible smaller reporting companies rose by approximately 17 basis points after the SRC rule became effective in 2008. This figure is much higher than the corresponding estimate of 9 basis points reported in column (4), using the

[40]I estimate propensity score on *LnAssets*, *Leverage*, *LnDebt*, *Vol*, *NI* and *ER*. Treated group and control group are matched without replacement using the logit of the propensity score within 0.05 standard deviations. The comparisons of means across the matched samples are presented in Table A12 in the Appendix.

2017-2018 sample, when the threshold was raised from $75 million to $250 million.

The default risk among smaller reporting companies that reduced their disclosure levels around 2007–2008 and 2017–2018 is compared to that of smaller reporting companies that maintain their disclosure levels in order to investigate the effect of the loss of information on default risk. The following model is estimated:

$$EDF_{i,t} = \lambda_0 + \lambda_1 Reduced_i + \lambda_2 Post_t + \lambda_3 \left(Reduced_i \times Post_t\right) + \lambda_4' \boldsymbol{x}_{i,t} + \varepsilon_{i,t}, \quad (2.29)$$

where $Reduced_i$ is a binary variable that equals 1 if a smaller reporting company i reduced its disclosure level in year 2008 (or 2018), and 0 if it is a smaller reporting company that maintains the level of disclosure [41]. To identify the disclosure levels among the observations of smaller reporting companies during the analysis periods, all the 10-K reports filed by smaller reporting companies in 2008 and 2018 are manually checked and 347 out of 552 smaller reporting companies are found to have reduced their disclosure levels in 2008.

The estimated results of the DiD model in Eq. (2.29) are shown in column (2) for the 2007–2008 sample and in column (5) for the 2017-2018 sample of Table 2.23. The estimate of λ_3 for the 2007–2008 sample is positive and statistically significant at the 1% level, which suggests that the default risk of the smaller reporting companies that reduce their level of disclosure increases by approximately 18 basis points around the introduction of the SRC rule compared to smaller reporting companies that maintain their disclosure levels. The estimate of λ_3 for the latter period reported under column (5) is about 8 basis points. The number is around 50% smaller when compared to the corresponding estimate for the 2007-2008 period.

The impact of the loss of commitment to a mandatory disclosure on the risk of default is quantified next based on the following model:

$$EDF_{i,t} = \lambda_0 + \lambda_1 Maintained_i + \lambda_2 Post_t + \lambda_3 \left(Maintained_i \times Post_t\right) + \lambda_4' \boldsymbol{x}_{i,t} + \varepsilon_{i,t}, \quad (2.30)$$

[41] I focus on the short window around the introduction of the SRC rule in 2008 to mitigate concerns relating to reverse causality and to better control for the impact of unobserved variables which are unlikely to change significantly during a short time period.

where $Maintained_i$ is a binary variable which takes a value of 1 if firm i is a smaller reporting company that voluntarily maintained its disclosure in 2008 and 2018, and 0 if firm i is a propensity score matched non-smaller reporting company in the same year.

The DiD estimation results of Eq. (2.30) for the 2007–2008 and the 2017-2018 samples are shown in columns (3) and (6) of Table 2.23, respectively. Both of the estimates of λ_3 are positive and statistically significant at better than the 5% significance level, which suggests that the loss of commitment to mandatory disclosure among smaller reporting companies which voluntarily maintained their disclosure levels cause the risk of default to rise during both of the investigated time periods. This finding echoes that of Cheng et al. (2013) and Brogaard et al. (2017) that the loss of commitment to mandatory disclosure causes the stock liquidity to decline. Interestingly, it seems that the increased risk of bankruptcy due to the introduction of the SRC rule in 2007–2008 is estimated to be approximately 18 basis points, while the increase around 2017–2018 is only about 7 basis points. This could be due to a stronger reaction by investors to the loss of commitment around the introduction of the SRC rule than during the latter period.

Taken together, the results in this section show that the impact of information loss on the risk of default outweighs the loss of commitment to mandatory disclosure as the estimated coefficients at $Reduced \times Post$ are larger than the coefficients at $maintain \times Post$ during both of the investigated time periods. When comparing the estimated impact across both time periods, the effects of the loss of information and the loss of commitment to mandatory disclosure are found to be smaller during the latter period between 2017–2018 than the 2007–2008 period.

Table 2.23
Difference-in-Differences estimation of default risk: The effect of information loss vs. the effect of loss of commitment to mandatory disclosures

	(1) *EDF*	(2) *EDF*	(3) *EDF*	(4) *EDF*	(5) *EDF*	(6) *EDF*
	2007-2008			2017-2018		
SRC	0.083***			0.030		
	(0.026)			(0.021)		
SRC × *Post*	0.172***			0.090***		
	(0.033)			(0.027)		
Reduced		0.063**			0.068**	
		(0.028)			(0.032)	
Reduced × *Post*		0.180***			0.082***	
		(0.001)			(0.016)	
Maintained			0.084***			0.031
			(0.031)			(0.026)
Maintained × *Post*			0.178***			0.072**
			(0.038)			(0.030)
Post	0.296***	0.517***	0.290***	−0.029*	0.110***	−0.022
	(0.040)	(0.043)	(0.043)	(0.015)	(0.035)	(0.015)
LnAssets	0.010	0.008	0.010	0.050***	0.053**	0.022
	(0.015)	(0.018)	(0.016)	(0.015)	(0.024)	(0.017)
Leverage	0.270***	0.279***	0.263***	0.232***	0.245**	0.152**
	(0.055)	(0.076)	(0.059)	(0.059)	(0.105)	(0.059)
LnDebt	0.013*	0.040***	0.012	−0.007	0.001	0.003
	(0.007)	(0.010)	(0.008)	(0.007)	(0.015)	(0.007)
Vol	−0.047***	−0.057***	−0.044***	−0.017***	−0.019***	−0.015***
	(0.007)	(0.007)	(0.007)	(0.002)	(0.004)	(0.002)
NI	−0.017	−0.018	0.015	−0.061	−0.050	−0.044
	(0.032)	(0.034)	(0.036)	(0.037)	(0.046)	(0.040)
ER	−0.146***	−0.157***	−0.138***	−0.078***	−0.115***	−0.087***
	(0.023)	(0.024)	(0.027)	(0.015)	(0.025)	(0.017)
Constant	−0.252***	−0.362***	−0.253***	−0.155*	−0.189	−0.032
	(0.076)	(0.095)	(0.082)	(0.082)	(0.143)	(0.090)
Observations	828	618	721	834	322	712
R^2	0.662	0.562	0.671	0.580	0.532	0.573
Firms	598	423	519	578	225	505
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	NO	NO

This table reports the difference-in-differences estimation results for Eqs. (2.28)–(2.30). *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement in fiscal year 2008 (or 2018), and 0 otherwise. $t \in \{2007, 2008, 2017, 2018\}$ where $Post_{2007} = Post_{2017} = 0$ and $Post_{2008} = Post_{2018} = 1$. *Reduced* is a binary variable which equals 1 if the firm is a smaller reporting companies that voluntarily reduced its disclosure level in year 2008 (or 2018), and 0 if the firm a smaller reporting company that maintained its disclosure level in the same period. *Maintained* is a binary variable which equals 1 if the firm is a smaller reporting company that voluntarily maintained its disclosure in 2008 (or 2018), and 0 if the firm is a propensity score matched non-smaller reporting company in the same year. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). Industry fixed effects is included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.10 Possible Confounding Effects of SOX Section 404

The Sarbanes-Oxley Act (SOX) was passed in 2002. Section 404 of SOX requires companies to install and regularly test internal processes to ensure the quality of financial reporting. It also requires managers to report their findings in a special management's report which is attested by an outside auditor. Extensive research has found that auditors' attestation to management's assessment of the company internal control improves financial reporting quality and reduces information risk (Krishnan et al. 2020).

Under Section 404 of SOX, smaller firms with public floats of $75 million or less during fiscal years 2002–2005 were classified as *non-accelerated filers* (NAFs). They did not have to comply with Section 404 of SOX, exempting them from having to submit the management's reports until 2007 and auditors' attestations until June 2010 (Iliev 2010). Since the threshold used in the classification of smaller reporting companies and non-accelerated filers is identical, it is thus possible that the causal impact of the reduced disclosure levels on default risk among smaller reporting companies under the SRC rule is confounded by the impact of the exemption for non-accelerated filers under Section 404 of SOX. Fortunately, the effects of accelerated filers can be separately tested by repeating the regression discontinuity designs prior to the adoption of the SRC rule.

We address this issue by estimating the following models:

$$EDF_{i,t} = \zeta_0 + \zeta_1 NAF_{i,t} + \zeta_2 Float_{i,t} + \zeta_3 \left(NAF_{i,t} \times Float_{i,t}\right) + f\left(\bullet\right) + \zeta_4' \boldsymbol{x}_{i,t} + \upsilon_i + \gamma_t + \varepsilon_{i,t}, \tag{2.31}$$

$$EDF_{i,t} = \zeta_0 + \zeta_1 NAF_{i,t} + \zeta_2 Float_{i,t} + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{i,t}, \tag{2.32}$$

and

$$EDF_{i,t} = \zeta_0 + \zeta_1 NAF_{i,t} + \zeta_2 Float_{i,t} + \zeta_3 \left(NAF_{i,t} \times Float_{i,t}\right) + f\left(\bullet\right) + \upsilon_i + \gamma_t + \varepsilon_{i,t}, \tag{2.33}$$

using data for the period between 2002–2007 prior to the introduction of the SRC

rule where $NAF_{i,t}$ is a dummy variable equals 1 if firm i is a non-accelerated filer, and 0 if firm i is an accelerated filer in fiscal year t. We expect the estimates of our parameter of interest, ζ_1, to be indistinguishable from zero.

The estimation results are presented in Table 2.24. None of the estimates of ζ_1 is statistically significant, implying that the risk of default is not impacted by an exemption among non-accelerated filers under Section 404 of SOX. Therefore, the increased default risk is fully driven by the well-defined SRC rule which permits smaller reporting companies to provide scaled disclosures.

Table 2.24
Regression discontinuity estimation of default risk: The Impact of SOX section 404

	(1) *EDF*	(2) *EDF*	(3) *EDF*	(4) *EDF*
NAF	0.012	0.006	−0.011	−0.015
	(0.016)	(0.016)	(0.014)	(0.014)
Float	−0.019	0.014	−0.038***	−0.010
	(0.012)	(0.018)	(0.014)	(0.020)
	(0.012)	(0.018)	(0.022)	(0.028)
NAF × *Float*		−0.056**		−0.048*
		(0.024)		(0.025)
LnAssets			0.057***	0.058***
			(0.006)	(0.006)
Leverage			0.253***	0.253***
			(0.034)	(0.034)
LnDebt			−0.008***	−0.008***
			(0.003)	(0.003)
Vol			−0.009***	−0.009***
			(0.001)	(0.001)
NI			−0.048***	−0.047***
			(0.016)	(0.016)
ER			−0.061***	−0.061***
			(0.006)	(0.006)
Constant	0.100*	0.115**	−0.115***	−0.104**
	(0.056)	(0.058)	(0.041)	(0.042)
Observations	2,394	2,394	890	890
R^2	0.139	0.141	0.411	0.412
Firms	1,032	1,032	659	659
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±1.066]	[±1.066]	[±0.927]	[±0.927]

This table reports the RD results for Eqs. (2.10)–(2.33), estimated using observations of firms for the period 2002–2007 within the MSE-optimal bandwidth around the normalised threshold. *NAF* is a dummy variable which equals 1 if the firm qualifies for the non-accelerated filer status under Section 404 of SOX, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the logged value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the logged value of the face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP value-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.11 The Impact of External Oversight, Corporate Governance, and Audit Quality

2.11.1 The Impact of External Oversight Mechanisms

External oversight mechanisms that improve corporate governance and the information environment, such as analyst following and equity holding by institutional investors, have been shown to affect the risk of default. The discovery of private information by financial analysts reduces uncertainty, as well as information asymmetry. By acting as information intermediaries between managers and investors, they can influence both the mean and the conditional variance of a firm's future cash flows, which, in turn, affect the probability of default (Healy & Palepu 2001, Cheng & Subramanyam 2008). In addition, financial analysts also help to reduce agency costs, raise firms' future expected cash flows, reduce leverage, and decrease default risk by monitoring managerial behaviour.

While the monitoring role of financial analysts indirectly affects the probability of default, institutional investors can directly influence default risk by means of equity ownership. As stockholders, institutional investors participate in monitoring managerial activities through voting and other governance mechanisms. However, their informational role is limited and indirect, being based on their power to encourage managers to provide the markets with better information.

This investigation of the impact of the eligibility of smaller reporting companies to provide scaled disclosure under the SRC rule on the risk of default is extended by incorporating external oversight mechanisms in the analysis. Specifically, this involves determining if the uncovered effect of the reduced disclosure level on the probability of default differs among firms that are covered by a large number of analysts and those that have a small number of analytical followers. The question of whether higher institutional ownership alleviates the effect of the reduced disclosure level on the risk of default is also investigated.

To determine if a company is followed by a high or a low number of analysts, the sample of firms in each year is divided into five quintiles based on the number of analysts following them. The data on analyst coverage is obtained from I/B/E/S.

The firms in the three intermediate quintiles are discarded and only those in the top and bottom quintiles are retained. Those in the top quintile are followed by the largest number of analysts, while those in the bottom quintile are covered by the smallest number. The same approach is used to categorise the firms in the sample into those with high and low institutional ownership. The information on institutional holding is taken from Thomson Reuters Institutional Holdings (13F).

Eq. (2.5) is estimated separately for each subsample of high and low analysts following as well as high and low institutional holding. The RD results are reported in columns (1)–(4) of Table 2.25. The estimates of β_1 indicate that the risk of default of smaller reporting companies that are followed by a small number of analysts rises by about 4 basis points and that of smaller reporting companies with low institutional ownership rises by about 3 basis points. Both estimates are statistically significant at the conventional levels. However, none of the estimates of β_1 of smaller reporting companies that are followed by a large number of analysts and smaller reporting companies with high institutional ownership is found to be statistically significant, which suggests that stronger external oversight mechanisms mitigate the link between the reduced disclosure level and the risk of default. The differences between β_1 across the two respective subsamples are statistically significant at better than the 10% significance level.

Table 2.25
Regression discontinuity estimation of default risk: The impacts of external oversight mechanisms

	(1) *EDF* Low *Alyst*	(2) *EDF* High *Alyst*	(3) *EDF* Low *Insti*	(4) *EDF* High *Insti*
SRC	0.040**	0.315	0.030*	−0.136
	(0.020)	(0.255)	(0.016)	(0.116)
Float	−0.049**	−0.023***	−0.052***	−0.182
	(0.020)	(0.005)	(0.014)	(0.185)
SRC × *Float*	0.016	0.322*	0.013	0.325***
	(0.035)	(0.176)	(0.018)	(0.364)
LnAssets	0.054***	0.027***	0.042***	0.109***
	(0.008)	(0.007)	(0.007)	(0.037)
Leverage	0.202***	0.065***	0.184***	0.189
	(0.031)	(0.019)	(0.029)	(0.178)
LnDebt	0.010***	−0.002	0.012***	−0.000
	(0.003)	(0.002)	(0.003)	(0.019)
Vol	−0.005***	−0.001***	−0.009***	−0.014*
	(0.002)	(0.000)	(0.001)	(0.007)
NI	−0.083***	−0.121***	−0.008**	−0.026
	(0.024)	(0.024)	(0.003)	(0.136)
ER	−0.084***	−0.045***	−0.061***	−0.129**
	(0.009)	(0.009)	(0.009)	(0.062)
Constant	−0.171***	−0.011	−0.103**	−0.178
	(0.047)	(0.025)	(0.043)	(0.178)
Observations	1,557	2,856	2,258	132
R^2	0.434	0.259	0.415	0.765
P-value(χ^2 test)	0.000		0.054	
Firms	721	585	843	118
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±1.046]	[±9.612]	[±1.463]	[±0.503]

This table reports the regression discontinuity results for Eq. (2.5) taking into account the impacts of external oversight mechanisms on the association between reduced disclosure and default of risk. Firms are sorted into five quintiles based on the number of analysts following and the proportion of institutional ownership. Results reported under Column 1 (Low *Alyst*) use observations in the bottom quintile while results in Column 2 (High *Alyst*) use observations in the top quintile when firms are sorted by the number of analysts following. Results reported in Column 3 (Low *Insti*) use observations in the bottom quintile while results in Column 4 (High *Insti*) use observations in the top quintile when firms are sorted by the proportion of institutional ownership. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.11.2 The Impact of Board Independence

A number of researchers have found a link between the composition and characteristics of the board and the success or failure of a firm. For example, Ashbaugh-Skaife et al. (2006) show that the degree of board independence is negatively related to credit ratings, while Platt & Platt (2012) find that bankrupt firms tend to have smaller, less independent boards with younger board members. They also show that bankrupt firms are likely to have independent board members who own more stocks in total.

The investigation in this section involves determining if the degree of board independence moderates the relationship between the risk of default and the reduced level of disclosure. First, information on the board size and the number of independent directors sitting on the boards of the sample firms is downloaded from the BoardEx database and then the sample firms are divided into five quintiles each year based on the ratio of the number of independent directors to the board size. Only observations of firms that belong to the top and the bottom quintiles are retained and those that belong to the three intermediate quintiles are discarded. Observations in the top quintile are companies with the most independent boards, while those in the bottom quintile are companies with the least independent boards. The RD model in Eq. (2.5) is then estimated on the two subsamples separately.

The estimation results are reported in columns (1) and (2) of Table 2.26. The estimate of β_1 for the subsample of firms with the least independent boards points to a statistically significant and positive relationship between the risk of default and the reduced level of disclosure. However, there appears to be no link between the risk of bankruptcy and the disclosure level among the smaller reporting companies with the most independent boards as the estimated parameter is not statistically significant. This suggests that smaller reporting companies with independent boards do not suffer from the increased default risk. The difference between the estimates of β_1 of the two subsamples is statistically significant at better than the 5% level.

Table 2.26
Regression discontinuity estimation of default risk: The impacts of corporate governance and audit quality

	(1) *EDF* Low *Indep*	(2) *EDF* High *Indep*	(3) *EDF* *Big4*=0	(4) *EDF* *Big4*=1
SRC	0.040**	−0.262	0.034**	0.043
	(0.019)	(0.291)	(0.015)	(0.029)
Float	−0.021	−0.349	−0.032**	−0.120**
	(0.017)	(0.721)	(0.015)	(0.050)
SRC × *Float*	0.009	−0.415	−0.013	0.092
	(0.029)	(1.085)	(0.024)	(0.098)
LnAssets	0.049***	0.043	0.054***	0.070***
	(0.009)	(0.246)	(0.008)	(0.011)
Leverage	0.133***	0.122	0.136***	0.250***
	(0.042)	(0.375)	(0.036)	(0.042)
LnDebt	0.010***	0.010	0.011***	0.004
	(0.004)	(0.071)	(0.004)	(0.005)
Vol	−0.002**	−0.037	−0.001	−0.017***
	(0.001)	(0.041)	(0.003)	(0.001)
NI	−0.119***	−0.262	−0.097***	−0.057*
	(0.023)	(0.420)	(0.018)	(0.033)
ER	−0.065***	0.091	−0.076***	−0.111***
	(0.009)	(0.152)	(0.008)	(0.012)
Constant	−0.220***	0.327	−0.229***	−0.155***
	(0.056)	(1.019)	(0.044)	(0.058)
Observations	1,251	56	1,929	898
R^2	0.376	0.877	0.360	0.534
P-value(χ^2 test)		0.015		0.025
Firms	554	49	739	547
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bandwidth	[±1.098]	[±0.548]	[±1.088]	[±0.548]

This table reports the regression discontinuity results for Eq. (2.5) taking into account the impacts of corporate governance and audit quality on the association between reduced disclosure and default of risk. Firms are sorted into five quintiles based on the ratio of independent directors on the board. Results reported under Column 1 (Low *Indep*) use observations in the bottom quintile while results under Column 2 (High *Indep*) use observations in the top quintile when firms are sorted by the number of analysts following. Results reported under Column 3 (Big 4) use observations of firms whose auditors are a Big 4 company while results under Column 4 (Non-Big 4) use observations of firms whose auditors are a non-Big 3 company. *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

2.11.3 The Impact of Audit by the Big Four

According to the agency theory, credible financial reporting reduces the information asymmetry between managers and shareholders. Consequently, the improved information environment boosts investor confidence, raise the stock price, and lower the cost of borrowing (Jensen & Meckling 1976*b*). Prior research on audit quality shows that investors perceive that the four largest international accounting firms (the Big 4) provide a better quality of audit than their smaller competitors (non-Big 4). The enhanced assurance of financial statements provided by the Big 4 relative to other audit firms is expected to translate into a tangible benefit for the client in the form of the lower *ex ante* cost of equity capital (Khurana & Raman 2004). According to another stream of research based on investigating the audit quality of an audit from an investor's perspective, an audit by one of the Big Four alleviates the valuation problem caused by private information and an auditor with a good reputation helps to reduce uncertainty and lower perceived risk (Slovin et al. 1990).

The examination in this section involves determining whether an audit by a Big 4 firm changes the relationship between the company's risk of default and the level of disclosure. The sample is divided into two subsamples of companies that use a Big 4 auditor and companies that use a non-Big 4 auditor based on the information about the audit firms which obtained from the Compustat database. The RD model in Eq. (2.5) is then estimated separately using observations from two subsamples. The estimation results are shown in columns (3) and (4) of Table 2.26. It is clear from the estimates of β_1 that, while the relationship between the reduced disclosure level and risk of default remains positive and statistically significant for smaller reporting companies audited by non-Big 4 firms, there is no link between the reduced disclosure level and the risk of bankruptcy among smaller reporting companies audited by Big 4 firms because the estimate of β_1 is not statistically significant. The difference between the estimated coefficients for the two subsamples is statistically significant at better than the 5% significance level, which suggests that the improved quality of financial reporting, provided by the Big 4 auditors shields smaller reporting companies from the increased risk of default, caused by the reduced level of disclosure.

2.12 Conclusions

In this chapter, the causal effect of the reduced level of disclosure in 10-K reports on the risk of default is investigated. The SRC rule, which allows companies with equity float values below the prescribed thresholds to voluntarily provide scaled disclosure in their 10-Ks is used as the exogenous source of variation and RD designs are employed as the main identification strategy. It is hypothesised that the reduced level of disclosure causes the information environment to deteriorate, thereby exacerbating information asymmetry and information risk, leading to an increase in the risk of default.

The results reveal that smaller reporting companies usually choose to reduce the disclosure level when they are given an option to voluntarily reduce it under the SRC rule. Compared to the 10-Ks filed by non-smaller reporting companies, the 10-K reports filed by smaller reporting companies contain around 7% fewer words and 3% fewer unique words, and are 16% smaller in size. Based on the findings, there is a greater degree of information asymmetry among smaller reporting companies. The RD analysis of the causal impact of the reduced disclosure level on the risk of default shows that smaller reporting companies are prone to experience a statistically and economically significant increase in default risk, as measured by the EDF, of around 4 basis points. This is equivalent to an approximately 69% rise in the risk of default of smaller reporting companies evaluated at the conditional mean value of the EDF. These results remain qualitatively unchanged when the analysis is conducted using different choices of bandwidths, artificial cutoffs, and an alternative RD design with a stronger assumption of local randomisation.

Additional analysis shows that the risk of default of newly-qualified smaller reporting companies rises sharply during the first years of their eligibility compared to that of previously-qualified smaller reporting companies and non-smaller reporting companies. It is also found that the impact of information loss due to the reduced disclosure level on the risk of default dominates the impact of a loss of commitment to mandatory disclosure. Both of these impacts are found to have been much stronger during the introduction of the SRC rule during 2007–2008 than around the period when the definition of smaller reporting companies was amended in 2018.

To sum up, this research implies that, although the SRC rule was conceived from a desire to help small businesses to reduce their reporting burdens, it has a side effect that it exacerbates information asymmetry, and as a result, increases the risk of default. The increased rate of bankruptcy stemming from the eligibility to the SRC rule is inevitable among smaller reporting companies even if they choose to maintain their levels of disclosure in 10-Ks. However, this study provides potential solutions that remedial actions smaller reporting companies can take to lessen the impact of the reduced disclosure on the risk of default, such as increasing oversight mechanisms and strengthening corporate governance, and improving the audit quality.

Appendix

Table A1
Reduced disclosure level in 10-K fillings applicable to smaller reporting companies

10-K item	Name	Reduced Disclosure
Item 1	Description of business	Describe the development of its business during the last three years, rather than five years for the large reporting firms.
Item 1A	Risk Factor	Not required
Item 5	Market price of and dividends on registrant's common equity and related stockholder matters	Not required to provide the information required by paragraph e (stock performance graph).
Item 6	Selected financial data	Not required.
Item 7	Management's discussion and analysis of financial condition and results of operation	Provide more streamlined disclosure for management's discussion and analysis of financial condition and results of operation by requiring only two years of analysis if the company is presenting only two years of financial statements instead of the three years currently required of larger companies. Not required to provide tabular disclosure of contractual obligations.
Item 7A	Quantitative and qualitative disclosures about market risk	Not required
Item 8	Supplementary financial information	Not required
Item 11	Executive compensation	Not required to report a MD&A as required of large reporting firms. Only required to report disclosure about the CEO and two other highly-compensated executive officers. Provide only three of the seven tables required of large reporting companies.
Item 11	Corporate Governance	Not required to provide information on Compensation Committee Interlocks and Insider Participation and Compensation Committee Report.
Item 13	Transactions with related persons, promoters and certain control persons	Not required to provide disclosure relating to policies and procedures for reviewing related person transactions.

Table A2
The description of the SRC rule

Criteria	Rule in 2008	Rule in 2018
	Initial Qualification Threshold	
Public Float	Public float of less than $75 million	Public float of less than $250 million
Revenue	Less than $50 million of annual revenues and no public float	Less than $100 million of annual revenues and no public float, or public float of less than $700 million
	Subsequent Qualification Threshold	
Public Float	Public float of less than $50 million	Public float of less than $200 million
Revenue	Less than $40 million of annual revenues and no public float	Less than $80 million of annual revenues, if it previously has $100 million or more of annual revenues; and less than $560 million of public float, if it previously had $700 million or more of public float.

A non-SRC that subsequently gains the SRC status based on public float of less than $200 million will qualify as an SRC regardless of its revenues. For further information, please see: https://www.sec.gov/smallbusiness/goingpublic/SRC.

Table A3
Variable definition

Variable	Symbol	Definition
Dependent Variable		
Default Risk	*EDF*	Expected default frequency, computed as $N(-DD)$, where $N(\bullet)$ is the cumulative standard normal distribution function and DD is distance-to-default
Z-score	*Z-score*	An accounting-based measure of default risk, computed following Altman (1968)
O-score	*O-score*	An accounting-based measure of default risk, computed following Ohlson (1980)
Gross File Size	*FileSize*	10-K file size, calculated as the log of gross file size
Net File Size	*Netfilesize*	net 10-K file size, calculated as the log of gross file size excluding extraneous material
Total Words	*TotalWords*	Log of total number of words, after excluding stopwords
Unique words	*UniqueWords*	Log of the number of words occurring at least once in the 10-K file, after excluding stopwords
Word Counts in 10 Items	*TotalItems*	Log of the total number of words in items eligible for the reduced disclosure on 10-K reports
Independent Variable		
Eligibility for Reduced Disclosure	*SRC*	Dummy variable taking 1 if a firm's public float is below the threshold in year t, and zero otherwise
Assignment Variable	*Float*	Distance between the log of firm public float and the log of cutoff
Log of Firm Size	*LnAssets*	Log of total assets
Leverage	*Leverage*	The ratio of total debt to total assets
Log of Debt	*LnDebt*	Log of face value of debt
Volatility	*Vol*	The inverse of the annualized stock return volatility
Net Income	*NI*	The ratio of net income to total assets
Excess Return	*ER*	The difference between the stock's annual return and CSRP value-weighted return

This table describes the main variables used in this chapter. Default data are obtained from the CRSP databases; the financial data are obtained from the CRSP and Compustat merged quarterly databases. Public float information is extracted from 10-K reporting using text mining.

Table A4
Regression discontinuity estimation of *Z-score* using different bandwidths

VARIABLES	(1) *Z-score*	(2) *Z-score*	(3) *Z-score*
SRC	−1.645**	−0.956	−0.734*
	(0.812)	(0.657)	(0.418)
Float	−4.521*	0.402	−0.242
	(2.335)	(0.265)	(0.486)
SRC × *Float*	3.977	−0.320	−4.676**
	(2.952)	(2.471)	(2.049)
LnAssets	1.608**	0.877***	1.260***
	(0.656)	(0.291)	(0.276)
Leverage	−2.623	−4.223***	−7.889***
	(2.972)	(1.362)	(0.937)
LnDebt	−0.593	−0.522***	−0.086
	(0.430)	(0.187)	(0.112)
Vol	0.067	0.043*	0.072***
	(0.052)	(0.025)	(0.023)
NI	17.087***	13.255***	2.163**
	(3.053)	(1.456)	(0.931)
ER	−0.158	0.151	0.425***
	(0.259)	(0.174)	(0.115)
Constant	−1.276	0.445	−2.257
	(2.646)	(1.367)	(1.519)
Observations	1,798	5,077	2,612
R^2	0.285	0.280	0.417
Firms	994	1,823	1,287
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Bandwidth	[±0.423]	[−0.396,1.498]	[−0.311, 0.794

This table reports the regression discontinuity results for Eq. (2.5) with alternative measure of default risk, estimated using observations of firms within the CER-optimal, MSE2-optimal, and CER2-optimal bandwidths around the normalised threshold. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A5
Regression discontinuity estimation of *O-score* using different bandwidths

VARIABLES	(1) *O-score*	(2) *O-score*	(3) *O-score*
SRC	0.770**	0.915***	0.545**
	(0.351)	(0.352)	(0.249)
Float	0.964	0.153	0.247
	(0.978)	(0.202)	(0.280)
SRC × *Float*	−0.019	1.479	−1.112
	(1.917)	(1.061)	(2.773)
LnAssets	−1.688*	−0.821**	−0.998**
	(0.896)	(0.325)	(0.470)
Leverage	1.893	3.511***	2.955*
	(2.936)	(1.128)	(1.669)
LnDebt	0.656	0.300*	0.390
	(0.534)	(0.180)	(0.278)
Vol	0.004	0.002	0.008
	(0.005)	(0.005)	(0.006)
NI	−10.945***	−9.199***	−9.941***
	(2.459)	(1.156)	(1.547)
ER	0.445*	0.175	0.257
	(0.262)	(0.146)	(0.197)
Constant	7.918***	4.998***	5.521***
	(2.731)	(1.258)	(1.728)
Observations	1,675	5,166	3,321
R^2	0.232	0.311	0.278
Firms	938	1,844	1,455
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Bandwidth	[±0.392]	[−0.395,1.527]	[−0.343, 1.021]

This table reports the regression discontinuity results for Eq. (2.5) with alternative measure of default risk, estimated using observations of firms within the CER-optimal, MSE2-optimal, and CER2-optimal bandwidths around the normalised threshold. *SRC* is a dummy variable which equals 1 if the firm qualifies for the reduced disclosure requirement, and 0 otherwise. *Float* denotes the distance between company equity float value (in logarithm) and the corresponding cutoff (in logarithm). *EDF* is the expected default frequency, calculated following Bharath & Shumway (2008). *LnAssets* is the log value of total assets. *Leverage* is the ratio of total debt to total assets. *LnDebt* is the log value of face value of debt. *Vol* is the inverse of the annualized return volatility, i.e., $Vol = 1/\sigma_E$. *NI* is the ratio of net income to total assets. *ER* is the difference between the stock annual return and the CRSP valued-weighted return. Year and industry fixed effects are included in all the regressions. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A6
Falsification tests: Regression discontinuity estimation of *Z-score* at artificial cutoffs

VARIABLES	(1) $55	(2) $65	(3) $85	(4) $95	(5) $230	(6) $240	(7) $260	(8) $270
				Dependent Variable : *Z-score*				
SRC	0.553	−1.181*	0.110	0.207	−0.467	−0.972	0.153	0.241
	(0.397)	(0.606)	(0.536)	(0.405)	(0.415)	(0.628)	(0.940)	(0.332)
Float	1.132	1.526	−0.019	0.388	0.784	−0.001	−21.972	−6.874
	(0.920)	(1.057)	(7.301)	(2.670)	(0.544)	(0.622)	(37.007)	(7.244)
SRC × *Float*	−4.137*	6.524	0.905	0.449	4.538	45.414	23.219	7.911
	(2.129)	(6.529)	(7.380)	(2.759)	(9.337)	(29.980)	(36.821)	(7.192)
LnAssets	0.912***	0.763***	0.581**	0.473**	−0.078	0.006	−0.122	−0.267
	(0.221)	(0.258)	(0.275)	(0.238)	(0.201)	(0.227)	(0.193)	(0.171)
Leverage	−3.711***	−4.598***	−5.661***	−5.448***	−5.285***	−5.407***	−5.517***	−5.462***
	(0.776)	(0.891)	(1.158)	(0.969)	(0.797)	(0.860)	(0.924)	(0.819)
LnDebt	−0.271**	−0.189	−0.188	−0.204	−0.156	−0.193	−0.214**	−0.186**
	(0.135)	(0.158)	(0.142)	(0.127)	(0.115)	(0.132)	(0.095)	(0.089)
Vol	0.107***	0.098***	0.038	0.057**	0.038	0.032	−0.006	0.008
	(0.024)	(0.029)	(0.028)	(0.024)	(0.026)	(0.028)	(0.033)	(0.029)
NI	10.525***	10.551***	9.150***	8.774***	8.225***	8.152***	7.593***	7.372***
	(0.595)	(0.639)	(0.783)	(0.664)	(0.668)	(0.758)	(1.115)	(0.980)
ER	0.266**	0.223*	0.371**	0.390***	0.357***	0.406***	0.365**	0.428***
	(0.124)	(0.127)	(0.153)	(0.135)	(0.136)	(0.149)	(0.168)	(0.152)
Constant	−1.410	−0.772	1.463	1.999*	5.501***	5.034***	5.186***	5.793***
	(1.097)	(1.324)	(1.315)	(1.105)	(1.125)	(1.203)	(1.654)	(1.207)
Observations	1,868	1,480	1,630	2,227	1,966	1,653	1,620	1,992
R^2	0.627	0.620	0.499	0.503	0.509	0.515	0.426	0.434
Firms	911	806	889	1,071	970	870	915	1,026
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Bandwidth	[±0.476]	[±0.461]	[±0.462]	[±0.539]	[±0.520]	[±0.460]	[±0.419]	[±0.487]

The table reports the RD results based on Eq. (2.5) using the artificial cutoffs at $55, $65, $85, $95, $230, $240, $260, $270 millions in Columns 1-8, respectively. Industry and year fixed effects are included in the regression models. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A7
Falsification tests: Regression discontinuity estimation of *O-score* at artificial cutoffs

VARIABLES	(1) $55	(2) $65	(3) $85	(4) $95	(5) $230	(6) $240	(7) $260	(8) $270
				Dependent Variable : *O-score*				
SRC	−0.303	1.353	−0.428	−0.103	−1.337	−1.056	−0.245	−0.162
	(0.330)	(0.880)	(0.500)	(0.216)	(1.200)	(1.258)	(0.284)	(0.146)
Float	−0.603	−0.807	7.085	0.703	2.649	1.845	11.247	1.519
	(1.433)	(0.916)	(6.310)	(1.184)	(2.508)	(1.868)	(11.079)	(3.477)
SRC × *Float*	2.551*	−9.579	−6.382	−0.538	10.619	27.185	−11.486	−1.628
	(1.525)	(7.653)	(6.161)	(1.494)	(8.787)	(34.461)	(11.106)	(3.535)
LnAssets	−1.021***	−1.050***	0.067	−0.190	−2.238	−2.052	−0.278***	−0.232**
	(0.297)	(0.331)	(0.241)	(0.216)	(1.922)	(1.737)	(0.104)	(0.110)
Leverage	5.161***	5.469***	6.683***	5.619***	0.098	0.508	5.079***	5.258***
	(1.040)	(0.935)	(1.515)	(0.997)	(5.016)	(4.504)	(0.527)	(0.563)
LnDebt	0.125	0.090	−0.426	−0.160	0.999	0.908	0.005	−0.020
	(0.136)	(0.140)	(0.264)	(0.173)	(0.977)	(0.879)	(0.075)	(0.081)
Vol	−0.021	−0.030	0.020	0.011	−0.068	−0.065	−0.014	−0.016
	(0.019)	(0.021)	(0.019)	(0.017)	(0.049)	(0.042)	(0.010)	(0.010)
NI	−9.225***	−8.828***	−8.208***	−8.065***	−10.118***	−9.792***	−6.420***	−6.316***
	(0.724)	(0.546)	(0.674)	(0.569)	(3.165)	(2.838)	(0.335)	(0.339)
ER	0.260**	0.295**	−0.224**	−0.078	−0.171	−0.191	−0.055	−0.060
	(0.120)	(0.134)	(0.087)	(0.069)	(0.156)	(0.157)	(0.062)	(0.067)
Constant	5.500***	5.575***	−0.373	0.585	10.683	9.700	1.588**	1.255**
	(1.600)	(1.602)	(1.051)	(1.050)	(9.626)	(8.696)	(0.643)	(0.612)
Observations	1,603	1,356	988	1,564	1,796	1,932	1,867	1,636
R^2	0.640	0.655	0.703	0.683	0.195	0.197	0.725	0.721
Firms	841	767	634	870	466	952	994	922
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Bandwidth	[±0.348]	[±0.404]	[±0.236]	[±0.330]	[±0.466]	[±0.552]	[±0.486]	[±0.386]]

The table reports the RD results based on Eq. (2.5) using the artificial cutoffs at $55, $65, $85, $95, $230, $240, $260, $270 millions in Columns 1-8, respectively. Industry and year fixed effects are included in the regression models. Standard errors are clustered at the firm level and reported in parentheses. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A8
Falsification tests: Regression discontinuity estimation of *Z-score* under local randomisation assumptions at artificial cutoffs

Threshold	Difference in Means	Treated	Control
\$55	−2.205	66	75
\$65	6.800	37	43
\$85	−0.987	67	52
\$95	−2.078	45	37
\$230	−0.687	47	57
\$240	2.208	14	11
\$260	−0.393	41	33
\$270	0.359	31	39

The table reports regression discontinuity estimates for the artificial cutoffs under the local randomization. Difference in Means is the difference-in-means estimate between the treatment and control group within the selected windows. Column denoted as "Treated" reports the number of observations of smaller reporting companies and the column denoted as "Control" reports the number of observations of non-smaller reporting companies

Table A9

Falsification tests: Regression discontinuity estimation of *O-score* under local randomisation assumptions at artificial cutoffs

Threshold	Difference in Means	Treated	Control
$55	1.143	66	75
$65	−4.973	37	44
$85	−0.093	66	52
$95	0.455	45	36
$230	0.689	48	57
$240	−2.860	14	11
$260	−0.992	41	33
$270	−0.527	30	39

The table reports regression discontinuity estimates for the artificial cutoffs under the local randomization. Difference in Means is the difference-in-means estimate between the treatment and control group within the selected windows. Column denoted as "Treated" reports the number of observations of smaller reporting companies and the column denoted as "Control" reports the number of observations of non-smaller reporting companies

Table A10
Comparison of means across matched samples (1)

	Treated	Control	Difference	P-value
Panel A				
LnAssets	4.330	4.386	−0.056	0.294
Leverage	0.220	0.237	−0.017	0.139
LnDebt	2.265	2.350	−0.086	0.229
Vol	6.195	6.312	−0.116	0.487
NI	−0.243	−0.255	0.012	0.531
ER	0.043	0.038	0.004	0.924
Panel B				
LnAssets	5.287	5.288	−0.001	0.990
Leverage	0.273	0.283	−0.009	0.543
LnDebt	3.132	3.213	−0.081	0.392
Vol	6.816	6.665	0.151	0.467
NI	−0.156	−0.166	0.010	0.594
ER	0.134	0.108	0.026	0.647
Panel C				
LnAssets	5.200	5.153	0.047	0.326
Leverage	0.247	0.258	−0.011	0.457
LnDebt	3.008	2.986	0.022	0.794
Vol	8.106	8.026	0.079	0.744
NI	−0.104	−0.111	0.007	0.655
ER	0.058	0.068	−0.010	0.817

The table compares the difference in means across matched samples for the corresponding Table 2.21. Panel A, B and C show the comparison results for columns (1), (2) and (3) in Table 2.21, respectively.

Table A11
Comparison of means across matched samples (2)

	Treated	Control	Difference	P-value
Panel A				
LnAssets	4.330	4.358	−0.028	0.556
Leverage	0.239	0.236	0.003	0.767
LnDebt	2.342	2.335	0.007	0.912
Vol	5.853	5.943	−0.090	0.512
NI	−0.275	−0.288	0.013	0.409
ER	0.008	−0.021	0.030	0.423
Panel B				
LnAssets	5.391	5.383	0.008	0.875
Leverage	0.295	0.302	−0.008	0.570
LnDebt	3.289	3.357	−0.068	0.411
Vol	6.609	6.564	0.046	0.809
NI	−0.169	−0.177	0.008	0.615
ER	0.059	0.088	−0.029	0.491
Panel C				
LnAssets	5.367	5.327	0.040	0.312
Leverage	0.269	0.276	−0.007	0.543
LnDebt	3.191	3.189	0.002	0.978
Vol	8.192	8.033	0.159	0.433
NI	−0.091	−0.098	0.007	0.574
ER	0.079	0.089	−0.009	0.807

The table compares the difference in means across matched samples for the corresponding Table 2.22. Panel A, B and C show the comparison results for columns (1), (2) and (3) in Table 2.22, respectively.

Table A12
Comparison of means across matched samples (3)

	Treated	Control	Difference	P-value
Panel A				
LnAssets	4.862	4.837	0.024	0.729
Leverage	0.240	0.248	−0.007	0.698
LnDebt	2.233	2.381	−0.149	0.381
Vol	2.598	2.540	0.058	0.755
NI	−0.159	−0.175	0.015	0.544
ER	−0.076	−0.067	−0.009	0.826
Panel B				
LnAssets	5.910	5.830	0.080	0.293
Leverage	0.314	0.316	−0.002	0.925
LnDebt	3.751	3.677	0.075	0.577
Vol	8.222	8.351	−0.129	0.668
NI	−0.113	−0.123	0.010	0.638
ER	−0.128	−0.109	−0.019	0.631

The table compares the difference in means across matched samples for the corresponding Table 2.23. Panel A and B show the comparison results for columns (1) and (2) in Table 2.23, respectively.

Chapter 3

Corporate Culture, High-Powered Incentives and Tax Avoidance

3.1 Introduction

The question of what kind of firms are more likely to avoid tax has been thoroughly investigated in the literature, both in relation to firm-level determinants (Slemrod & Yitzhaki 2002, Hoopes et al. 2012, Lanis & Richardson 2015) and in a principal-agent framework (Slemrod 2004, Desai & Dharmapala 2006, Dyreng et al. 2010, Gaertner 2014). However, despite the growing number of works that are focused on the association between corporate social responsibility and tax avoidance (Hoi et al. 2013, Col & Patel 2019), the effect of firms' culture on tax avoidance has not yet been well understood. Therefore, the aim of this chapter is to fill this void with an empirical examination of the effects of different corporate internal cultures on tax avoidance and the moderating effect of managers' higher-powered incentives on the association between culture and tax avoidance.

According to O'Reilly (1989) and Kreps (1990), corporate culture matters in firms' every operation. Since employees face choices that cannot be properly regulated in advance, it plays a role as a constraint within an organisation (Guiso et al. 2015) and invisibly affects staff's working practices and the operation of the firm. Therefore, this study explores whether different corporate cultures shape a firm's decision to avoid tax. Following Cameron et al. (2014), Fiordelisi & Ricci (2014) and Fiordelisi et al. (2019), corporate culture is classified on the basis of

the "Competing Values Framework" by analysing text on 10-K filings obtained from the Edgar database. A unique corporate culture dataset is constructed, which contains four types of culture: collaborate, control, create and compete, by calculating the percentages of the occurrences of keywords in each cultural dimension to the total number of words in the same 10-K reporting. By obtaining information from the Compustat databases, tax avoidance is estimated as a book-tax gap not attributable to earnings management following Desai & Dharmapala (2006). Therefore, this measure attempts to remove underlying determinants that are not driven by intentional tax avoidance measured as earnings management, leaving the portion only driven by intentional tax purpose in the residual. In addition, managers' high-powered incentives are estimated as the ratio of the value of stock options awarded to total compensation based on the Execucomp database. After merging all the datasets on corporate culture, tax avoidance and incentive compensation together, the final sample consists of a panel of 1,817 firms from 2006 to 2021.

The empirical findings reveal that corporations with a culture that is based on collaboration tend to avoid more tax. The result is in line with prior literature of Gallemore & Labro (2015*a*) and Hsieh et al. (2018) that tax avoidance is a complicated process that requires collaboration among staff, and thus confirms the hypothesis that a collaborative culture cultivates collaborative working atmosphere and increases internal information transparency, which are supposed to positively affect a firm's level of tax avoidance. Second, the results show that firms with a control-oriented culture decrease tax avoidance. This result echoes Cameron et al. (2014) that organisations oriented to a control culture aim to prevent any components from perfection, thus less likely to avoid tax but strictly follow the rules. Third, firms with a culture which is based on competition avoid more tax. The result is consistent with Cameron et al. (2014) that fast profitability is always the top goal for competition-oriented firms. These firms consistently scan signals from markets and respond quickly in order to obtain short-term returns. Tax avoidance is one of the quickest ways to generate internal funds, thus appealing to firms oriented to a competitive culture. However, the empirical results do not support any significant relationship between a creative culture and tax avoidance. This

is due to that creative-oriented firms focus on innovation. They generally look at big pictures and big ideas, and pursue constant growth and profitability (Cameron et al. 2014). Thus, they are reluctant to undertake tax avoidance intentionally.

Following Bauer (2016) that the alignment between shareholder and managers' interests is an important factor in understanding corporate tax avoidance, the empirical framework also incorporates the effects of managerial high-powered incentives on the links between corporate cultures and tax avoidance into arguments based on the assumptions that incentive compensation better aligns managers and the board team together. The results are found to be relevant. The empirical findings suggest that a positive relationship between a collaborative culture and tax avoidance is weakened by managerial incentive compensation. This echoes the study by Rob & Zemsky (2002) that intensifying individual compensation makes staff allocate more effort to their individual work and less to the work which requires collaboration. Hence, the mitigating effect of incentive compensation on the link between a collaborative culture and tax avoidance is observed. Second, the results indicate that incentive compensation weakens a positive link between a competitive culture and tax avoidance. Competition-oriented firms focus on fast profitability. However, managerial incentive compensation is used as a tool to align managers' long-term interests with shareholders' future value. Therefore, managers paid by incentive compensation focus on firms' long-term return, rather than the instant profitability generated by tax avoidance, mitigating the impact of a competitive culture on tax avoidance. I do not find any significant effects of managerial compensation on the links between a control culture, a creative culture and tax avoidance. The reasons might be that firms are already highly regulated when they are dominated by a control culture. The reduced agency problem, as a result of the increased managers' compensation, has little effect, at the margin, on the impact of a control culture on tax avoidance. However, in creation-oriented firms, earlier studies show a positive link between incentive compensation and innovation (Balkin et al. 2000, Xue 2007, Chang et al. 2015). Their results suggest that the provision of high-powered incentives makes managers focus on sustainable growth, thus are reluctant to pursue fast profitability achieved by tax avoidance.

The results are also econometrically relevant. Specifically, the results indicate

that a one standard deviation increase in a collaborative culture is associated with a 0.360% increase in tax avoidance, a one standard deviation increase in a control culture is linked to a 0.285% decrease in tax avoidance, and a one standard deviation increase in a competitive culture is related to a 0.450% increase in tax avoidance. However, a 1% increase in incentive compensation weakens the association between a collaborative culture and tax avoidance by 4.23 basis points, and attenuates the link between a competitive culture and tax avoidance by 3.45 basis points.

The robustness checks are performed using the alternative measures of tax avoidance. First, the book-tax gap not attributable to discretionary accruals is replaced with the book-tax gap not attributable to total accruals following Desai & Dharmapala (2006). Second, the book-tax gap itself is used as a measure of tax avoidance while controlling earnings management as the regressor. The fact that the findings are consistent with those of baseline models suggests that the results are robust when applied to the alternative measures of tax avoidance.

Next, the empirical work is going to examine through which mechanisms corporate cultures affect tax avoidance. Gallemore & Labro (2015*a*) state that tax avoidance is impossible without a good internal information environment. A collaborative culture encourages broad employee involvement and thus information is efficiently spread among staff within collaboration-oriented firms. However, in control-oriented firms where hierarchical management structures are emphasised, radical ideas are always suppressed in these firms (Cameron et al. 2014). Tax managers who have superior information on tax avoidance opportunities find themselves reluctant to provide advice on tax planning opportunities instead of waiting and following the boards' directions. Therefore, based on the "top-to-down" tones, an efficient communication channel is difficult to establish. In addition, firms focus on developing a competitive culture are market-oriented. They are sensitive to customers' opinions and respond quickly. Therefore, these firms are expected to be more informational transparent in order to fast react to markets. It is conjectured that if different corporate cultures affect tax avoidance through impacting on firms' internal information environment, the attenuated (enhanced) effects of the impact of a collaborative, competitive (control) culture on tax avoidance can be observed

in firms with lower internal information transparency.

Following Gallemore & Labro (2015*a*), I measure corporate internal information environment using firms' business and geographic dispersion. The intuition is that firms operating on multiple segments need to combine segments' information together. Such procedures always result in information aggregation problems, causing a poor information environment. Consistent with conjectures, the results indicate that the positive (negative) effect of a collaborative, competitive (control) culture on tax avoidance is attenuated (enhanced) in firms with higher degrees of business (geographic) dispersion. Therefore, the internal information environment acts as the mechanism to explain the effects of corporate cultures on tax avoidance.

Further investigations involve determining whether managers' high-powered incentive affects the associations between corporate cultures and tax avoidance through decreased agency problems. To do so, I examine whether the effects of managerial high-powered incentive on the links between cultures and tax avoidance is different in firms with higher institutional holdings and greater board independence levels based on the assumption that institutional investors and independent boards have stronger incentives and greater abilities to monitor managers, thus better aligning managers and the boards together. The conjecture is that if the effects of managerial compensation on the relationships between corporate cultures and tax avoidance are caused by weakened agency problem, the enhanced effect of which can be observed in firms with higher institutional holdings and greater board independence levels. As a result, the empirical findings echo the conjecture and reveal that the negative effects of managers incentive compensation on the links between a collaborative culture, a competitive culture and tax avoidance are strengthened when firms are with higher ratios of institutional holdings and greater levels of board independence.

This study contributes to the existing literature in a variety of ways. First, prior researchers have documented a vast range of determinants of tax avoidance. For example, Francis et al. (2013) find a significantly negative relationship between managerial ability and tax avoidance. Hoi et al. (2013) suggest that corporate social responsibility is negatively related to the book-tax gap. Olsen & Stekelberg (2016) document the statistically and economically significant effects of CEO narcissism on

the likelihood that a firm avoids tax, and Francis et al. (2016) show that Republican CEOs are more likely to avoid tax. However, it appears that the impact of corporate culture on tax avoidance is still not fully understood. Numerical papers look at the effects of corporate culture on tax avoidance mainly focusing on the impact of corporate social responsibilities. For example, Lanis & Richardson (2015) employ a matched sample of tax-avoidant and non-tax-avoidant firms and find that socially responsible firms avoid less tax. The authors also document that among seven categories of corporate social responsibilities, community relations and diversity are the driving forces that lead firms to engage less in tax avoidance. However, unlike these papers, this study is the first one examining the effects of corporate internal cultures on tax avoidance by quantifying the cultural measures using text analysis methods from assessing 10-K filers. The results reveal that corporate cultures, indeed, shape a firm's decision in activities of tax avoidance, thus helping explore the effects of invisible firm characteristics on tax avoidance.

Second, the results also contribute to the literature related to corporate culture. Although there is a widespread belief that corporate culture is essential, literature lacks the empirical analyses to answer whether and how corporate culture affects tax avoidance. As a result, the findings support that firms with a collaboration- and competition-oriented culture avoid more tax, while those with a control-oriented culture engage less in tax avoidance. Hence, this study provides the empirical supporting that corporate culture indeed shapes a firm's level of tax avoidance.

Third, According to Desai & Dharmapala (2009) and Riedel (2018), although tax avoidance can be totally legal, it is immoral. The coverage of tax avoidance by the media can trigger public outrage, further jeopardising a firm's value. Firms thus have strong incentives to hide their tax avoidance activities (Desai & Dharmapala 2009). Identifying a firm's engagement in tax avoidance becomes difficult for practitioners. Therefore, the results in this study provide directions and are helpful for both policymakers and regulators who care about detecting a firm's engagement in tax avoidance activity.

The remainder of this chapter proceeds as follows. Section 3.2 reviews literature and develops hypotheses. Section 3.4 contains a description of the data and empirical framework. All the results are discussed in Section 3.5 and the chapter

is concluded in Section 3.9.

3.2 Literature Review

3.2.1 Literature on Tax Avoidance

As defined in Hanlon & Heitzman (2010)'s work, tax avoidance means different things to different people. Thus, it lacks a universal definition. Dyreng et al. (2008), for example, define tax avoidance as any transaction that reduces explicit tax liabilities. Frank et al. (2009) explain it as the reduced manipulation of taxable income through tax planning, which may or may not be considered as fraudulent tax evasion. As a result of the ambiguous definitions of tax avoidance, terms such as tax avoidance, tax management and tax planning are used interchangeably in the literature in order to indicate tax avoidance. In this study, I follow Desai & Dharmapala (2006)'s framework to identify and construct tax avoidance measure, which is the book-tax gap not attributable to accounting manipulations. Hence, this study focuses on the difference in income between which is reported to shareholders and to the tax authorities that is intentionally caused by a firm's decision.

The determinants of tax avoidance have been well-documented in the literature. Starting with firm-level characteristics, Gupta & Newberry (1997), Rego (2003), Siegfried (1973) and Graham & Tucker (2006) find a positive relationship between tax avoidance and firm size. They argue that larger firms better affect political processes and develop expertise in tax planning in order to organise their activities in optimal tax-saving ways. On the contrary, Zimmerman (1983) and Omer et al. (1993) propose that smaller firms have a tendency to avoid more tax because they are less likely to be subjected to government scrutiny. Despite the ambiguous results of the impact of firm size on tax avoidance, other empirical research about the firm-level determinants of tax avoidance shows that public firms, firms that have greater social responsibilities, and firms that receive a tax-related SEC comment letter tend to decrease tax avoidance (Hoopes et al. 2012, Lanis & Richardson 2015, Kubick et al. 2016), while those targeted by hedge fund activists, with non-disclosure of geographical earnings, using derivative and with concentrated customers tend to avoid more tax (Cheng et al. 2012, Hope et al. 2013, Donohoe

2015, Huang et al. 2016) [1].

The effect of executives' characteristics on tax avoidance cannot be ignored either. Dyreng et al. (2010) are the first researchers who examine the relationship between individual managers and tax avoidance. Although they find that individual executives, especially CEOs, play a statistically and economically significant role in determining a firm's level of tax avoidance, they fail to disclose the channel through which executives affect corporate tax avoidance. Subsequent researchers who were inspired by their study discover that Republican CEOs, narcissistic CEOs, over-confident CEOs, and CEOs who are more aggressive in respect of their personal taxes and with greater ability tend to positively affect a firm's level of tax avoidance (Francis et al. 2012, Chyz 2013, Olsen & Stekelberg 2016, Koester et al. 2017, Hsieh et al. 2018, Chyz et al. 2019), while CEOs with military experience tend to decrease corporate tax avoidance (Law & Mills 2017) [2].

A growing number of researchers mention that the explanation of why firms avoid tax should be investigated within the agent-principal framework. The most debated issue of tax avoidance literature within this framework is the association between tax avoidance and executive compensation. For instance, Desai & Dharmapala (2006) find that incentive compensation negatively affects corporate tax avoidance. They contend that tax avoidance and managerial rent extractions can be complementary, which, in turn, increases the opportunity for managers to divert corporate resources for their personal benefits. They further prove that this negative association only exists in poorly-governed firms. Borrowing their complementary theory, Chen et al. (2010) explain their empirical findings that family firms are less tax aggressive than their non-family counterparts as they fear minority investors who may view tax avoidance by insiders as a means to extract rent. Kim et al. (2011) demonstrate that the level of tax avoidance is positively associated with firm stock price crash risk because avoiding tax facilitates rent extractions by providing tools, masks and justifications for bad news hoarding activities for an extended period.

The research of Desai & Dharmapala (2006) is provocative and, as such, the results have been questioned by many scholars. Some evidence is highlighted when

[1] The summary of the literature about the firm-level determinants of tax avoidance can be found in the Appendix Table A2.

[2] The summary of the effect of executive features on tax avoidance can be found in the Appendix Table A3.

questioning this issue. First, the traditional view which based on the agency theory is that tax avoidance can be regarded as a risky and value-enhancing investment. Therefore, equity incentives motivate executives to take part in a risky investment, thereby leading to a positive relationship between tax avoidance and incentive compensation. Second, Desai & Dharmapala (2006) assume that poorly-governed firms will not use incentive compensation to encourage tax avoidance because they lack the proper governance mechanisms to prevent rent extraction. This assumption neglects the nature of equity compensation that equity incentives by their nature are important governance mechanisms (Demsetz & Lehn 1985, Core & Guay 1999). Managerial equity incentives are used as substitutes for other governance mechanisms when direct monitoring is too costly or infeasible (Armstrong et al. 2015), therefore, increasing managerial incentive compensation should cure rent extraction and encourage tax avoidance. Third, there is little evidence of managers attempting to divert rents for their personal interests in terms of tax avoidance with the exception of Russia based on research by Porta et al. (1998) and Desai et al. (2007) who show a positive link between tax avoidance and rent extraction there. However, Porta et al. (1998) also mention that creditors and shareholders in Russia have weaker rights than their counterparts in the United States, and the legal enforcement of those rights is also weak. As a result, the opportunities for executives to expropriate the firm's wealth in the US are different from Russia. This is later echoed by the research of Blaylock (2016) which shows no evidence of a relationship between tax avoidance and economically significant rent extraction among US firms in general. The author even argues that there is an alternative explanation to the one provided by earlier researchers who borrow the complementary theory to describe their results. For example, a negative relationship between a family firm and tax avoidance found by Chen et al. (2010) can be alternatively explained as family owners being more concerned than non-family owners about the potential penalty and reputational damage of an IRS audit. Likewise, a positive relationship between tax avoidance and stock price crash risk revealed by Kim et al. (2011) is because tax avoidance is a risky, but value-enhancing activity that often has a negative outcome.

Furthermore, empirical studies by other researchers also reveal the existence of

a positive link between tax avoidance and equity incentives. For instance, Phillips (2003) finds that compensating business-unit managers on an after-tax basis leads to a level of higher tax avoidance and this is further proved by Slemrod (2004), who demonstrates that tax reporting incentives provided by managers' incentive compensation contracts could result in corporate tax non-compliance. Rego & Wilson (2012) also find that higher equity risk incentives are associated with a greater level of tax avoidance. By conducting a more detailed research, Armstrong et al. (2015) firstly demonstrate that CEO's risk-taking equity incentives have a positive association with the average tax avoidance level. More specifically, they employ a series of quantile regressions and find that this positive relationship is stronger when the levels of tax avoidance are in higher quantiles. This suggests that managerial equity incentives are a crucial determinant of aggressive tax positions that are likely to entail more risk. [3].

3.2.2 Literature on Corporate Culture

Corporate culture represents the unspoken code of communication among the members of an organisation (Cremer 1993). According to Sadri & Lees (2001), a corporate culture is formed when:

> 'People come from a variety of ethnic backgrounds and cultural heritages, have a variety of personalities, and have been shaped by a diverse range of experience. When people from diverse backgrounds are brought together in a company, these factors will manifest themselves in an infinite variety of ways. Over time a dominant set of norms will emerge, guiding the way in which work is accomplished within the organization."

Therefore, corporate culture is an intangible concept, a set of norms and values that are widely shared and firmly supported by every member of the organisation (O'reilly & Chatman 1996). Culture plays a non-negligible role in corporations, affecting every employee and the entire operations of the company (Bénabou & Tirole 2002, Tabellini 2008).

[3]To clarify the debate of the impact of incentive compensation on tax avoidance, a series of studies of the association between managerial incentive and tax avoidance is summarised in the Appendix Table A5.

The importance of corporate culture has been well documented in the literature. Sackmann (2011), Fiordelisi & Ricci (2014), and Guiso et al. (2015) find that a good corporate culture increases firms' performance; Teerikangas & Very (2006), Bouwman (2013), Viegas-Pires (2013) and Li et al. (2021) show that corporate culture has a significant impact on M&A activity, while Fiordelisi et al. (2019) reveal that a creative corporate culture is an important driver of innovation.

However, since there is still an absence of research about the impact of corporate culture on tax avoidance, this chapter aims to examine the effects of corporate culture on firms' levels of tax avoidance. Following the work of Cameron et al. (2014) whose measures of corporate culture drawn on the "Competing Values Framework" of Quinn & Rohrbaugh (1983), corporate culture is grouped as internal and external. The former includes collaborative and control quadrants, while the latter consists of creative and competitive quadrants. This classification is also widely used in the finance literature (Panayotopoulou et al. 2003, Fiordelisi & Ricci 2014, Fiordelisi et al. 2019).

Specifically, a collaborative culture is flexibility-oriented in terms of human competencies, people development and the solidification of collaborative work (Cameron et al. 2014). The aim of this kind of culture is to promote an effective relationship among staff and, since employees are encouraged to participate in the decision-making process, teamwork is appreciated (Cameron & Quinn 1999). A collaborative culture motivates staff and empowers them based on an efficient communication system. Panayotopoulou et al. (2003) define the ultimate goal of a collaborative culture as the promotion of collective processes and cohesion based on consensus and extensive employee participation. Therefore, a collaborative culture enhances value by hiring, developing and appreciating their human resources.

The other type of internal cultural quadrant is called control, which is focused on stability. A mantra for the control quadrant could be: "better, cheaper and more reliable" (Cameron et al. 2014). This is a hierarchical culture and, as such, it is fairly bureaucratic and focused on internal improvements based on a top-down, efficient organisational hierarchy (Porcu et al. 2019). Companies oriented by a control culture create value through internal improvement in efficiency. Employees of companies with this culture are required to pay attention to rules and regulations

on how certain tasks should be performed (Cameron & Quinn 1999). Any radical ideas are always suppressed in these firms (Cameron et al. 2014). Panayotopoulou et al. (2003) define the characteristics of a control culture as the strict regulation of employees' work practices, compliance with standardised procedures, maintenance of stability and hierarchical relationships. In short, the objective of a control culture is to improve certainty, predictability, and regularity by removing any components that prevent perfection and the achievement of error-free outcomes (Cameron et al. 2014).

A creative culture is one of the two types of external cultures. Its aim is to produce new products and services, create new market niches, and add value to the firm by strengthening entrepreneurial activities. According to Cameron et al. (2014), the key challenges for firms with a creation-oriented culture consist of improving the portfolio of products and services based on innovation and helping new ideas to flourish. Employees of firms with this type of culture are focused on the constant pursuit of growth; hence, they tend to engage in more risk-taking behaviour and are less afraid of uncertainty than others.

Finally, the other type of external culture is a competitive culture. Firms with a competitive culture are focused on achieving "right-now-results" and aim to increase shareholders' short-term profitability. The main features of this type of culture are responsibility, prompt action and aggression (Cameron et al. 2014). Competitive firms constantly scan the signals from the market and consistently focus on increasing the firm value. Fast profitability is their typical goal and speed is a crucial factor in maintaining a competitive advantage.

For the details of the "Competing Values Framework", please see Table 3.1.

Table 3.1
The Competing Values Framework - culture, leadership, value drivers, and efficiency

Culture	Orientation	Leader Type	Value Driver	Theory of Effectiveness
CLAN	Collaborate	Facilitator, Mentor and Teambuilder	Commitment, Communication and development	Human Development and High Commitment
HIERARCHY	Control	Coordinator, Monitor, and Organizer	Efficiency, Timeliness, Consistency and Uniformity	Control and Efficiency with Capable Processes
ADHOCRACY	Create	Innovator, Entrepreneur and Visionary	Innovative Output, Transformation and Agility	Innovativeness, Vision, and Constant Change
MARKET	Compete	Hard-driver, Competitor and Producer	Market Share, Goal Achievement and Profitability	Aggressively Competing and Customer Focus

The table compares the leadership, value driver and theory of efficiency among four types of cultures obtained from Cameron et al. (2014).

3.3 Hypothesis Development

3.3.1 The Link between a Collaborative Culture and Tax Avoidance

According to Cameron et al. (2014), firms oriented to a collaborative culture cultivates a collaborative atmosphere and staff engagement are encouraged in these firms. It is conjectured that since tax avoidance requires collaboration among staff, it is easier for firms oriented to this culture to avoid tax. To illustrate the collaboration needs of tax avoidance, some facts are demonstrated. Tirole (2010), for example, use the Enron scandal as an example of the fact that manipulating the accounts requires the cooperation and collusion of partners. Hsieh et al. (2018) show that CEOs rely on CFOs to execute their financial reporting decisions. More specifically, two cases can be considered when discussing the collaboration needs of tax avoidance. First, taking Starbucks as an example, since tax is paid on a profit basis, Starbucks avoids taxes by raising its costs through inter-corporation. In details, the head office of Starbucks, situated in Seattle, Washington, US, funds other corporations via pumping debts. These corporations, in turn, should pay interests back to their headquarter. The interests rate are flexible and determined by financial directors from the head office to increase operation costs. In this way, Starbucks avoids taxes perfectly and legally. Another case is the well-known "Double Irish and Dutch Sandwich Hole" used by Google company. A US customer buys products from the Google website. Once received the amount paid by the customer, Google US company should pay Google Ireland Holding company for using the brands. However, Google Ireland Holding company does not have any physical office with staff and it is fully managed from Bermuda. Google Ireland Holding company subsequently pays the amount that it received from Google US company to Google Netherlands B.V. According to the Dutch law, the amount received from Google Netherlands B.V. should pay back to Google Ireland Holding company. Tax is, therefore, paid in Google Ireland Holding company at Bermuda's tax rate, which is zero. The above two cases imply that tax avoidance involves complicated processes which require staff within the organisation collaborate. A collaborative culture, by definition, cultivates a collaborative working atmosphere,

and thus make corporate tax avoidance feasible.

Besides, according to Hartnell et al. (2011) and Fiordelisi & Ricci (2014), a collaborative culture increases employee involvement. Open communication is encouraged and firms implement programmes to enhance decentralised decision making. Internal information efficiency is, therefore, established within collaboration-oriented firms. As shown in Gallemore & Labro (2015*a*)'s study, internal information transparency increases the opportunities for firms to avoid tax. Hence, the first hypothesis is:

Hypothesis 1a: Firms with a collaboration-oriented culture avoid more tax.

On the contrary, since employees' engagements are welcomed in collaboration-oriented firms, firms oriented to this culture respect opinions raised by every single employee. The lack of a hierarchical management mechanism may impede the way that corporate avoids tax. For example, once the top management team propose the intention to avoid tax, it is easy to be against by employees as tax avoidance is totally legal but immoral. Besides, following Desai & Dharmapala (2006)'s complementary theory, tax avoidance and rent extraction happen together. Since information environment is supposed to be more transparent within collaboration-oriented firms, rent extraction is unlikely to happen, which, in turn, decreases the possibility to avoid tax. Hence, the alternative hypothesis is,

Hypothesis 1b: Firms with a collaboration-oriented culture avoid less tax.

3.3.2 The Link between a Control Culture and Tax Avoidance

For control-oriented firms, their management structures are highly concentrated and directly supervised by the board team and interests-related parties (Fiordelisi & Ricci 2014). According to Koester et al. (2017), executives with greater ability are more likely to set a "tone at the top" approach to emphasise cost minimisation. As a control culture encourages a hierarchical management style, firms oriented

to this culture are expected to use the top-to-down approach, and thus have a superior controlling power in reducing costs. Since tax avoidance is a way to retain cash inside an organisation instead of going to the government, firms with a control culture are expected to find tax avoidance appealing since it reduces explicit corporate tax liabilities.

Hypothesis 2a: Firms with a control-oriented culture avoid more tax.

According to Fiordelisi & Ricci (2014) and Cameron et al. (2014), firms oriented to a control culture typically make extensive use of standardized procedures and emphasize rule enforcement and consistency. Therefore, control-oriented firms focus on regularity, remove any components that prevent perfection and aim to minimise their exposure to risk. These firms, thus, are less willing to avoid tax but strictly follow the G.A.A.P. rules. Besides, although tax avoidance can be totally legal, it requires companies to invest in techniques and resources to find the appropriate methods to avoid it. Previous work by Hsieh et al. (2018) show that CEOs rely on CFOs' financial expertise to execute financial reporting decisions. Viewing the tax department as a business unit, CFOs are reluctant to provide suggestions on the potential opportunities for tax avoidance instead of waiting and following the management's directions since individual opinions are always suppressed in control-oriented firms. Hence, this kind of firms are expected to have fewer opportunities for avoiding tax.

Hypothesis 2b: Firms with a control-oriented culture avoid less tax.

3.3.3 The Link between a Creative Culture and Tax Avoidance

A creative culture is one of the external cultures that focuses on innovation. Not surprisingly that Fiordelisi et al. (2019) find a positive link between a creative culture and innovation output. However, earlier studies by Atanassov & Liu (2015) and Gao et al. (2016) show that a firm's innovation level is also positively related

to its level of tax avoidance. Hence, there is expected to be a positive relationship between a creative culture and tax avoidance. Besides, a creative culture encourages firms to take risks. Rule breaking and reaching beyond barriers are common characteristics of firms dominated by a creative culture (Fiordelisi & Ricci 2014). Although there are clear cases of tax law violation, lawyers and economists classify tax evasion as illegal and tax avoidance as legal, which is reached as a quick conclusion since it is difficult to determine the legality of any tax behaviour (Weisbach & Nussim 2003). In the US context, for example, too much tax avoidance would be suspected as tax evasion and penalised by the Internal Revenue Service. However, it increases the firm's after-tax value if undetected (Desai & Dharmapala 2006, Kim et al. 2011). Therefore, since firms with a creative culture are reluctant to take risks, they may think of avoiding tax as a valuable form of investment.

Hypothesis 3a: Firms with a creative-oriented culture avoid more tax.

On the other hand, as mentioned above, the value driver of a creative culture is to create new market inches. Firms oriented to this culture pursue constant change and focus on long-term returns. They generally look at big pictures and big ideas. Tax avoidance is not a constant way to generate internal funds, in other words, creative-oriented firms barely regard tax avoidance as their sustainable growth plan instead of focusing on developing their major business. It is expected a negative link between tax avoidance and a creative culture.

Hypothesis 3b: Firms with a creative-oriented culture avoid less tax.

3.3.4 The Link between a Competitive Culture and Tax Avoidance

A competitive culture is the other type of external cultures. Firms that are anchored in this cultural type pursue immediate gains. They heavily pay attention to bottom line measures of profitability (Cameron et al. 2014). Fast profitability is their typical goal and speed is a crucial factor in maintaining a competitive ad-

vantage. These firms are customer-oriented, thus aiming to achieve better-looking financial reports. According to Hanlon (2005) and Desai & Dharmapala (2009), tax avoidance can be used as an effective earnings management tool for companies to achieve profit goals, reduce tax burdens, and increase cash flow. It is conjectured that tax avoidance is attractive to competition-oriented firms since it is a fast way to generate internal company funds, to make better-looking profitability shown on the financial reports.

Hypothesis 4a: Firms with a competitive-oriented culture avoid more tax.

On the contrary, instead of pursuing fast profitability, firms dominated by this culture are market-oriented. These firms typically put customers and shareholders first and judge success based on customers' and shareholders' reactions. As mentioned above, tax avoidance can be perfectly legal, but it is immoral. Too much tax avoidance detected by customers may cause them to lose their confidence in these firms. Therefore,

Hypothesis 4b: Firms with a competitive-oriented culture avoid less tax.

3.3.5 The Effects of Managerial Compensation on the Links between Cultures and Tax Avoidance

Earlier researchers have observed that individual managers have a significant effect on corporate culture. Managers with diverse leadership styles have an enormous effect on the organisation's culture due to their domination of its value, language, symbols, procedures and routines, and their emphasis on teamwork and employee engagement (Cameron & Quinn 1999, Panayotopoulou et al. 2003, Cameron et al. 2014). Therefore, managers' high-powered incentives are added to the models to examine the effects of individual managers on the associations between different corporate cultures and tax avoidance based on the assumption that high-powered incentives reduce agency problems.

First, Rob & Zemsky (2002) discuss the association between incentives and

a firm's collaborative culture in their work and demonstrate that intensifying incentives causes workers to allocate more effort to their individual tasks and less to cooperative work. Hence, it is expected that the effect of a collaborative culture on tax avoidance should be attenuated by the provision of high-powered incentives to managers.

Second, according to Tian & Yang (2014), increasing CEOs' incentive pay results in increased CEO power. As a control culture is a hierarchical culture which focuses on developing managements' controlling rights, it is expected that increased CEO power will have enhanced effect on the impact of a control culture on a firm's level of tax avoidance.

Third, empirical work by earlier researchers indicates that the provision of incentive compensation for managers is positively related to the firm's ability to innovate (Balkin et al. 2000, Xue 2007, Chang et al. 2015). In other words, managers are driven by high-powered incentives to foster a creative culture in order to motivate innovation within an organisation. Therefore, it is expected that high-powered incentives will enhance the effect of a creative culture on tax avoidance.

Finally, firms oriented to a competitive culture focus on short-term profitability. According to Bebchuk & Fried (2003), incentive compensation is used to cure managers' myopic version and align their personal interests with the long-term performance of the firm. Therefore, the short-term profitability goal caused by a competitive culture contradicts to the aim of providing managers with high-powered incentives. It is expected that the effect of a competitive culture on tax avoidance is weakened by managerial incentive compensation.

Hypothesis 5: High-powered incentives weaken the association between collaboration- and competition-oriented cultures and tax avoidance, but enhance the association between control- and creation-oriented cultures and tax avoidance.

3.4 Data and Construction of Variables

The sample covers the period between 2006 and 2021 and includes an intersection of data obtained from the Compustat, Execucomp and SEC's EDGAR databases. Following Desai & Dharmapala (2006), tax avoidance is measured as the book-tax gap not attributable to the discretionary component of total accruals based on the Compustat database. The sample is then merged with the Execucomp database to obtain a sample of firms with information on managerial compensation. Following Cameron et al. (2014), Fiordelisi & Ricci (2014) and Fiordelisi et al. (2019), corporate culture measures are quantified by using text mining methods on 10-Ks archived in the SEC's EDGAR database. The sample is subsequently merged with the culture sample using firms' Central Index Keys (CIKs). Firms in the financial industry (SIC codes between 6000—6999) and utility industry (SIC codes between 4900—4999) are excluded from the sample. Observations with missing information are dropped. I also require each firm to have at least two consecutive years of observations to allow for the lagged variables in the model. The final sample includes 1,817 firms and 12,836 observations.

Details of how the sample is constructed can be seen from Table 3.2.

Table 3.2
Construction of sample

	Sample Size	Number of Firms
Tax avoidance measures from the Compustat database	17,617	2,379
Merged with Execucomp database	17,617	2,379
Merged with cultural measures	17,511	2,367
Merged with all the control variables	17,466	2,360
Drop financial and utility firms	15,984	2,133
Drop observations with missing values	12,836	1,817

The table reports the sample construction procedure. The sample constitutes the intersection of data obtained from the Compustat, Execucomp and SEC's EDGAR databases, covering a period between 2006 and 2021.

3.4.1 Measuring Tax Avoidance

Following Manzon & Plesko (2002) and Desai & Dharmapala (2006), the tax avoidance variable is calculated as the book-tax gap not attributable to earnings management. Therefore, this measure tends to capture a firm's level of tax avoidance intentionally. In the first stage, the book-tax gap is calculated. Specifically, it is measured as the difference between the book income and the taxable income. To quantify the taxable income, assuming that each firm faces a tax rate, TR, it follows that the taxable income equals the current federal tax expense divided by TR.

$$\hat{Y}^T = \frac{CFTE}{TR}, \tag{3.1}$$

where $\hat{Y}^T$ is the taxable income, $CFTE$ is current federal tax expense and TR is the tax rate. The book-tax gap is measured as:

$$BT = Y^S - \hat{Y}^T, \tag{3.2}$$

where BT is the book-tax gap, Y^S is the book income and $\hat{Y}^T$ is the taxable income. The book-tax gap is then scaled by a lagged value of the firm's total assets when constructing this measure of tax avoidance. Following Desai & Dharmapala (2006), firms with non-positive taxable income are excluded since they are assumed to have weak incentives, at the margin, to engage in tax avoidance.

In the second step, earnings management has to be isolated from the book-tax gap. I follow Dechow et al. (1995)'s modified Jones (1991)'s model to measure

the discretionary (abnormal) part of total accruals since it is widely used in the finance and accounting literature. Specifically, I calculate the discretionary accruals beginning with the total accruals.

$$TA_{i,t} = (\nabla CA_{i,t} - \nabla CL_{i,t} - \nabla Cash_{i,t} + \nabla STD_{i,t} - \nabla Dep_{i,t})/A_{i,t-1}, \tag{3.3}$$

where $TA_{i,t}$ is total accruals for firm i in year t, and ∇ represents a one-year change in a variable. $CA_{i,t}$ is the current assets for firm i in year t; $CL_{i,t}$ is the current liabilities; $Cash_{i,t}$ is the cash holdings; $STD_{i,t}$ is the long-term debt in current liabilities; $Dep_{i,t}$ is the depreciation and amortization expense for firm i in year t; $A_{i,t-1}$ is the firm's total assets for firm i year $t-1$.

Following Dechow et al. (1995)'s model, the following cross-sectional regression equation is estimated using the firms in each Fama and French industry and each year:

$$\frac{TA_{i,t}}{A_{i,t-1}} = \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{\Delta Sales_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t}, \tag{3.4}$$

where $TA_{i,t}$ is the total accruals for firm i in year t, calculated as described in Eq.(3.3); $A_{i,t-1}$ is the total assets for firm i in year $t-1$; $\Delta Sales_{i,t}$ is the change in sales for firm i in year t; $PPE_{i,t}$ is the gross property, plant and equipment for firm i in year t.

The parameters obtained from Eq.(3.4) are used to estimate the discretionary part of earnings management,

$$DA_{i,t} = \frac{TA_{i,t}}{A_{i,t-1}} - \alpha_1 \frac{1}{A_{i,t-1}} - \alpha_2 \frac{\Delta Sales_{i,t} - \Delta Rec}{A_{i,t-1}} - \alpha_3 \frac{PPE_{i,t}}{A_{i,t-1}}, \tag{3.5}$$

where $DA_{i,t}$ is the measure of the discretionary part of total accruals for firm i in year t. $TA_{i,t}$ is the total accruals for firm i in year t, calculated as described in Eq.(3.3); $A_{i,t-1}$ is the total assets for firm i in year $t-1$; $\Delta Sales_{i,t}$ is the change in sales for firm i in year t; $\Delta Rec_{i,t}$ is the change in receivables for firm i in year t; $PPE_{i,t}$ is the gross property, plant and equipment for firm i in year t. Following Jones (1991) and Hutton et al. (2009), $\Delta Rec_{i,t}$ is included in the model as it is the standard modification of Jones (1991) model which attempts to capture a change

in sales as a result of aggressive recognition of questionable sales.

To isolate earnings management from the book-tax gap, an Ordinary Least Squares (OLS) regression is employed. The model specification is as follows:

$$BT_{i,t} = \beta_1 DA_{i,t} + \mu_i + \varepsilon_{i,t}, \tag{3.6}$$

where $BT_{i,t}$ is the book-tax gap for firm i in year t, scaled by a lagged value of total assets; $DA_{i,t}$ is the discretionary accruals. μ_i is the average value of the residuals for firm i over the sample period; and $\varepsilon_{i,t}$ is the deviation in year t from firm i's average residual μ_i.

Therefore, a firm's level of tax avoidance is:

$$TS_Jnoes_{i,t} = \mu_i + \varepsilon_{i,t}, \tag{3.7}$$

where $TS_Jnoes_{i,t}$ is the tax avoidance value for firm i in year t.

3.4.2 Measuring Corporate Culture

To quantify the measures of corporate culture, the text analysis method is exploited in this chapter. According to Stone et al. (1966), the text analysis approach is a technique which reflects the features specific to a text in a systematic and objective manner. Since the languages used by employees of an organisation in their official documents reveal the development of the corporate culture over time (Levinson & Levinson 2003, Fiordelisi & Ricci 2014, Fiordelisi et al. 2019), the corporate culture variables are quantified by analysing 10-Ks retrieved from the SEC's EDGAR database. This technique also offers measures of corporate culture that are less prone to the subjectivity of the researchers, and thus are widely adopted in the finance and accounting literature.

Following Cameron & Quinn (1999) and Cameron et al. (2014), corporate culture is classified into four categories, namely, collaborate, control, create and compete. Each culture variable is quantified as the ratio of the number of occurrences of keywords in each culture dimension to the total number of words in the same 10-Ks. The bags of keywords are taken from Fiordelisi & Ricci (2014) and Fiordelisi et al. (2019) as shown in Table 3.3.

Table 3.3
Bag of words

Culture	Bag of Words
Collaborate	balan*, capab*, cohes*, collab*, collectiv*, commit*, commun*, competen*, consens*, contribut*, cooperat*, coordin*, decentr*, dialogue*, employ*, empower*, engag*, facilitator*, help*, hir*, human*, interper*, involv*, long- last*, long-term*, loyal*, mentor*, mutual*, people*, relation*, responsib*, retain*, reten*, reward*, skill*, social*, solidif*, team*, teamwork*, train*, willingness*, work group*
Control	administrat*, analys*, boss*, buror*, cautio*, cheap*, chief*, conservat*, consisten*, control*, cost*, cut*, disciplin*, document*, effectiv*, efficien*, enhance*, improv*, logic*, measur*, method*, organize*, outcom*, predictab*, procedur*, process*, productiv*, qualit*, regular*, rule*, standard*, system*, technical*, uniform*
Create	adapt*, chang*, creat*, discontin*, dream*, dynamic*, emerg*, entrepre*, envis*, experim*, fantas*, freedom*, futuri*, idea*, imagin*, inventive*, new*, niche*, origin*, pioneer* uncertain*, unpredictable*, ventur*, vision*, unafra*
Compete	achiev*, acquir*, acquis*, aggress*, analyst*, attack*, client*, challeng*, compet*, customer*, edge*, excellen*, expand*, expans*, fast*, growth*, market*, perform*, position*, pressur*, profit*, rapid*, result*, revenue*, share*, short-term*, speed*, superior*, value*, win*

The table summarizes keywords in each culture dimension following Fiordelisi & Ricci (2014) and Fiordelisi et al. (2019).

3.4.3 Measuring Managerial Incentives

Following Desai & Dharmapala (2006) and Shue & Townsend (2017), managers' high-powered incentives ($IC_{i,t}$) are calculated as the ratio of managers' stock options awarded to total compensation summed across the top-five managers for firm i in year t. Specifically,

$$IC_{i,t} = \frac{\sum_j Option_{i,t}}{\sum_j Option_{i,t} + \sum_j Salary_{i,t} + \sum_j Bonus_{i,t}}, \tag{3.8}$$

where $IC_{i,t}$ is the ratio of managers' stock options awarded to total compensation for firm i in year t; $\sum_j$ means the sum of the values across the top-five managers; *Option* is the value of stock options awarded; *Salary* and *Bonus* represent salary and bonuses, respectively.

3.4.4 Measuring Control Variables

Following Desai & Dharmapala (2006), a vector of control variables is selected in the analysis. The changes in the firm's scale are captured by controlling firm size, calculated as the log value of total assets and as the log value of the market value of equity. As managers can influence the company's after-tax value by changing the company's future tax obligation, future tax liabilities are controlled in the model measured as the ratio of deferred tax expense to total assets.

The details of the variable definitions can be found in the Appendix Table A1.

3.5 Empirical Analysis

3.5.1 Summary Statistics

To show summary statistics, I firstly begin it with plotting the Word Clouds for four kinds of corporate cultures. Figure 3.1 shows the visual representations of word frequencies. The most commonly the keywords occur in 10-K filings, the larger the word appears in the figures generated. As can be seen from Figure 3.1, the most frequently used words for collaboration-oriented firms are "Employ*" and "Commi*" which implies that a collaboration-oriented firm focuses more on human empowerment and commitments. For firms with a control-oriented culture, they tend to use the terms: "Cut*", "Control*" and "Measure*", which indicates that these firms try to increase certainty and predictability, and thus decrease errors. Firms with a creativity-oriented culture tend to most frequently use the words "Chang*", "New*" and "Origin*", thereby suggesting that these firms develop long-term performance and create new market inches. Finally, "Share*", "Market*" and "Win*" are among the most frequently used words for competition-oriented firms, indicating that they strive to maintain their position in the market and always play to win.

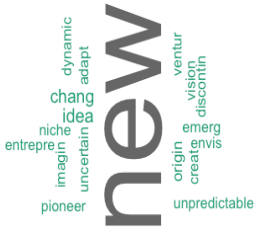
Figure 3.1
WordClouds for four culture dimensions



(a) Collaborate



(b) Control



(c) Create



(d) Compete

These figures show the wordclouds for four different culture dimensions.

Table 3.4 reports the descriptive statistics for the main variables used in analyses. The sample mean for the book-tax gap not attributable to discretionary accruals is 0.015, with the minimum value at −0.253 and maximum value at 0.222. Among four types of corporate culture, the average value of $COM_{i,t-1}$ is found to be 0.026 and it is the highest value compared to other three culture dimensions. This result is in line with the work of Fiordelisi & Ricci (2014) who also reports that a competitive culture is the leader of these four cultural quadrants.

As stated by Intel Cor., "passion for innovation helps us maintain our role as a technology leader", firms in different industries may focus on developing different culture dimensions in order to gain effectiveness. Therefore, a contingency table is reported in Table 3.5 to show the associations between industries and corporate cultures [4]. The Pearson's Chi-squared test value is 115.908 with the

[4] I classify industries based on SIC 4-digit codes.

Table 3.4
Summary statistics

Variable	Mean	S.D.	Min.	Max.	N
TS_Jones	0.015	0.062	−0.253	0.222	12,836
IC	0.344	0.270	0.000	0.996	12,836
COL	0.009	0.008	0.001	0.087	12,836
CON	0.016	0.006	0.005	0.062	12,836
CRE	0.011	0.012	0.001	0.077	12,836
COM	0.025	0.015	0.001	0.121	12,836
LnAssets	7.439	1.548	2.700	13.184	12,836
LnMktval	7.746	1.587	2.708	13.537	12,836
Deferred	0.029	0.038	0.000	0.287	12,836

This table summarises statistics for the main variables used in this chapter. Data are obtained from Compustat, Execucomp, and Edgar databases, respectively. *TS* is the book-tax gap not attributable to total accruals for firm i in year t; *TS_Jones* is the book-tax gap not attributable to discretionary accruals for firm i in year t. *IC* is the ratio of stock options awarded to total compensation summed across the top-five executives, where total compensation indicates the sum of salary, bonus and the value of option awards. *COL*, *CON*, *CRE* and *COM* are firm-year measures for four different corporate cultures, representing collaboration-, control, creation- and competition-oriented cultures, respectively. *LnAssets*s is the natural logarithm of total assets. *LnMktval* is the natural logarithm of market value of equity and *Deferred* is the ratio of deferred tax expense to total assets.

corresponding P-value at 0.000, thus, the null hypothesis that there is no strong association in the population between the industry sector and the corporate culture is rejected. Focusing on the statistics reported in the table, as shown in the last row, the competition-oriented culture has the largest number of observations (10,557), occupying around 82.25% (10557/12836) of the full sample. This result echoes the result from the summary statistics where it suggests that the mean value of *COM* is the largest value among four culture quadrants. Therefore, achieving a competitive position is always the top goal for all companies. Looking at the fourth row, among different industries, the manufacturing industry (SIC codes between 2000 and 3999) has the highest number of observations in collaboration-, control-, creation-, and competition-oriented cultures with percentages of 50.00%, 50.91%, 52.37% and 51.15%, respectively. Therefore, compared to other industries, the manufacturing industry is the one that places the most attention to develop its corporate culture.

Table 3.5
Contingency table

	Collaborate	Control	Create	Compete	Total
Panel A: Actual Values					
0100-0900	1	0	7	37	45
1000-1499	4	35	33	278	350
1500-1799	3	3	11	119	136
2000-3999	98	334	733	5400	6565
4000-4999	16	15	102	632	765
5000-5100	8	25	57	534	624
5200-5999	38	144	186	1327	1695
7000-8999	27	99	298	2205	2629
9100-9729	1	1	0	25	27
Panel B: Expected Values					
0100-0900	0.7	2.3	5.0	37	45
1000-1499	5.3	17.9	38.9	287.9	350
1500-1799	2.1	7.0	15.1	5399.4	6565
2000-3999	11.7	39.1	729.8	4211.2	4799
4000-4900	20.7	75.4	85.0	629.2	765
5000-5100	9.5	31.9	69.4	513.2	624
5200-5999	25.9	86.6	188.4	1394.1	1695
7000-8999	40.1	134.4	292.3	2162.2	2629
9100-9729	0.4	1.4	3.0	22.2	27
Total	196	656	1427	10557	12836

The table is a contingency table showing the interrelation between corporate culture and industry sector. Corporate culture is classified into four dimensions: collaborcontradict ative, control, creative and competitive, measured as the ratio of the occurrences of keywords in each culture dimension to the total number of words in the same 10-K reporting. Culture dummy takes the value of one if culture i has the largest values among four cultures for firm i in year t, and zero otherwise. Industry sectors are classified based on SIC 4-digit code. 0100-0900 represents agriculture, forestry and fishing industry, 1000-1499 represents mining industry; 1500-1799 represents construction industry; 2000-3999 represents manufacturing industry; 4000-4900 represents transportation, communications, electric and gas industry; 5000-5199 represents wholesale trade industry; 5200-5999 represents retail trade industry; 7000-8999 represents services industry and 9100-9729 represents public administration industry. Pearson chi(27)=115.908; Pr=0.000.

Having looked at the data, it is appropriate to examine the hypotheses. This is done using both a univariate and multivariate analysis. In the univariate analysis, tax avoidance is sorted by four different culture quintiles in year $t-1$, and the level of tax avoidance is compared across the five culture quintiles. According to Table 3.6, tax avoidance is an increasing function of a collaborative culture and the difference-in-means estimation between the first and the fifth quantiles is 0.008 with a significance level of 1%. It is also suggested in this table that the level of tax avoidance decreases with an increase in a control culture from the

first to the fifth quantiles, and the avoidance level increases with an increase in a creative culture and competitive culture from the first to the fifth quantiles. The difference-in-means estimations between the first and the fifth quantiles for these results are significant at the better than 5% significance level.

Table 3.6
Univariate analysis

	Q1	Q2	Q3	Q4	Q5	Q5vsQ1
Tax Avoidance Sorted by Collaborative Culture in $t-1$						
TS_Jones_t	0.006	0.009	0.012	0.012	0.014	0.008***
Tax Avoidance Sorted by Control Culture in $t-1$						
TS_Jones_t	0.014	0.014	0.011	0.010	0.005	−0.008***
Tax Avoidance Sorted by Creative Culture in $t-1$						
TS_Jones_t	0.007	0.011	0.011	0.013	0.014	0.007***
Tax Avoidance Sorted by Competitive Culture in $t-1$						
TS_Jones_t	0.009	0.009	0.011	0.013	0.015	0.006**

The table summarises firm's level of tax avoidance by four culture quintiles in the sample from 2006 to 2021. Tax avoidance is measured as the book-tax gap not attributable to discretionary accruals (TS_Jones_t). Culture variables are obtained by analysing text on 10-Ks as described in Section 3.4.2. The difference-in-mean estimates between the fifth and the first quantiles are reported under the last columns. ***, ** , and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

3.5.2 The Effects of Corporate Cultures on Tax Avoidance

To examine the effects of different cultures on tax avoidance, the following models are estimated:

$$\begin{aligned} TS_Jones_{i,t} = \alpha_0 + \alpha_1 COL_{i,t-1} + \alpha_2 CON_{i,t-1} + \alpha_3 CRE_{i,t-1} \\ + \alpha_4 COM_{i,t-1} + \alpha_5 IC_{i,t-1} + \delta Control\ Variables_{i,t} \\ + \upsilon_i + \gamma_t + \varepsilon_{i,t}, \end{aligned} \tag{3.9}$$

where TS_Jones is a measure of tax avoidance, calculated as the book-tax gap not attributable to discretionary accruals; COL, CON, CRE and COM represent four cultural dimensions, namely, collaborate, control, create and compete, calculated by a textual analysis of the 10-K filings as described in the above section. $IC_{i,t-1}$ is a measure of high-powered incentives, calculated as the ratio of the value of

stock options awards to total compensation. Corporate cultures and incentive compensation measures are lagged for one period in the model, since it is expected that both of these elements will have a long-term effect on tax avoidance. A vector of controls includes $LnAssets_{i,t}$, calculated as the natural logarithm of total assets for firm i in year t; $LnMktval_{i,t}$, calculated as the natural logarithm of the market value of equity for firm i in year t; and $Deferred_{i,t}$, calculated as the ratio of deferred tax expense to total assets for firm i in year t. The firm and the year fixed effects are included in the model, which are denoted by υ_i and γ_t, respectively. All the variables are winsorized at the 1% and 99% levels to mitigate outliers and standard errors are clustered at the firm level.

Based on the hypotheses, it is expected that the estimated parameters from α_1 to α_5 are statistically significant, which indicates that corporate cultures affect firms' level of tax avoidance significantly.

The results are reported in column (1) of Table 3.7. According to which, the coefficient at *COL* is statistically significant and positive at the better than 5% significance level. This proves hypothesis 1a that firms oriented to a collaborative culture tend to increase their levels of tax avoidance. The result also indicates that tax avoidance involves complicated processes which need collaborations among staff within an organisation. The coefficient at *CON* is statistically significant and negative, which echoes hypothesis 2b that firms oriented to a control culture avoid less corporate tax. The result proves the work of Cameron et al. (2014) that organisations with a control culture remove any component that prevents perfection. Therefore, these firms are risk-averse, and thus strictly follow the G.A.A.P rule. The result is also in line with the work of Hsieh et al. (2018) that the management teams rely on the expertise provided by financial directors to manipulate accountings. As any opposite idea is suppressed in control-oriented firms, firms oriented to a control culture lose opportunities to avoid tax. In addition, the coefficient at *COM* is statistically significant and positive, echoing hypothesis 4a and suggesting a positive link between a competition-oriented culture and tax avoidance. The result, therefore, indicates that firms oriented to a control culture focus on short-term profitability. Tax avoidance, as a fast way to generate internal funds, is attractive to competition-oriented firms. Unfortunately, the coefficient at

CRE is not statistically significant at any significance level. According to Cameron et al. (2014), creation-oriented firms pursue constant growth and take innovation as their first goal. These firms may find them reluctant to get involve in tax avoidance since it is not a sustainable developing plan for a firm.

Table 3.7
Tax Avoidance, incentive compensation and corporate culture

VARIABLES	(1) *TS_Jones*	(2) *TS_Jones*	(3) *TS*	(4) *TS*	(5) *BT*	(6) *BT*
COL × *IC*		−1.910***		−2.192***		−1.540***
		(0.589)		(0.671)		(0.589)
CON × *IC*		0.018		0.019		0.013
		(0.558)		(0.633)		(0.559)
CRE × *IC*		1.125		1.166		1.107
		(0.859)		(0.943)		(0.860)
COM × *IC*		−1.042***		−0.979**		−1.037***
		(0.384)		(0.434)		(0.384)
COL	0.489***	0.451**	0.441***	0.527**	0.489***	0.458**
	(0.145)	(0.223)	(0.168)	(0.243)	(0.144)	(0.223)
CON	−0.400**	−0.447**	−0.402**	−0.402**	−0.412**	−0.459**
	(0.162)	(0.220)	(0.178)	(0.193)	(0.162)	(0.220)
CRE	0.238	0.213	0.263	0.217	0.234	0.211
	(0.250)	(0.257)	(0.254)	(0.261)	(0.250)	(0.257)
COM	0.258***	0.300**	0.275***	0.337**	0.254***	0.300**
	(0.095)	(0.133)	(0.106)	(0.147)	(0.095)	(0.134)
IC	−0.007**	−0.026**	−0.007*	−0.028**	−0.007**	−0.025**
	(0.003)	(0.010)	(0.004)	(0.011)	(0.003)	(0.010)
LnAssets	−0.032***	−0.029***	−0.035***	−0.031***	−0.033***	−0.029***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
LnMktval	0.027***	0.032***	0.032***	0.037***	0.028***	0.032***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Deferred	0.191***	0.094**	0.220***	0.121***	0.192***	0.094**
	(0.039)	(0.040)	(0.041)	(0.043)	(0.039)	(0.040)
EM					0.129***	0.122***
					(0.014)	(0.012)
Constant	0.051***	−0.036**	0.039***	−0.052***	0.072***	−0.014
	(0.014)	(0.016)	(0.015)	(0.017)	(0.014)	(0.016)
Observations	12,836	12,836	12,836	12,836	12,836	12,836
R^2	0.061	0.137	0.062	0.132	0.062	0.138
Firms	1,817	1,817	1,817	1,817	1,817	1,817
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

The table shows the results examining the effects of corporate cultures on tax avoidance, as well as the effects of managerial high-powered incentives on the links between cultures and tax avoidance. Column 1 and 2 report results for Eq.(3.9). Column 3 to 6 report results mirroring Eq.(3.9) but using the alternative measures of tax avoidance. All data are obtained from the Compustat, Excucomp and Edgar databases, respectively. *TS_Jones* is the book-tax gap not attributable to discretionary accruals. $TS_{i,t}$ is the book-tax gap not attributable to total accruals. *BT* is the book-tax gap. $IC_{i,t-1}$ is the ratio of the value of stock options awards to total compensation. *COL*, *CON*, *CRE* and *COM* are four types of corporate culture, quantified by the ratio of the appearance of keywords to the total number of words on 10-Ks in each cultural dimension. Firm and year fixed effects are included. Robust standard errors are clustered at the firm level and presented in parentheses; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level.

3.5.3 The Effects of Managerial Incentive Compensation on the Links between Cultures and Tax Avoidance

To examine the effects of managers' high powered-incentives on the links between corporate culture and tax avoidance, the following models are estimated:

$$\begin{aligned} TS_Jones_{i,t} = {} & \alpha_0 + \alpha_1 COL_{i,t-1} + \alpha_2 CON_{i,t-1} + \alpha_3 CRE_{i,t-1} \\ & + \alpha_4 COM_{i,t-1} + \alpha_5 IC_{i,t-1} + \alpha_6 \left(COL_{i,t-1} \times IC_{i,t-1}\right) \\ & + \alpha_7 \left(CON_{i,t-1} \times IC_{i,t-1}\right) + \alpha_8 \left(CRE_{i,t-1} \times IC_{i,t-1}\right) \\ & + \alpha_9 \left(COM_{i,t-1} \times IC_{i,t-1}\right) + \delta\, Control\ Variables_{i,t} \\ & + \upsilon_i + \gamma_t + \varepsilon_{i,t}, \end{aligned} \tag{3.10}$$

where *TS_Jones* is a measure of tax avoidance, calculated as the book-tax gap not attributable to discretionary accruals; *COL*, *CON*, *CRE* and *COM* represent four cultural dimensions, namely, collaborate, control, create and compete, calculated by a textual analysis of the 10-K filings as described in the above section. $IC_{i,t-1}$ is a measure of high-powered incentives, calculated as the ratio of the value of stock options awards to total compensation. The measures of the four different corporate cultures are then interacted with high-powered incentives ($IC_{i,t-1}$) in the model in order to further examine the effects of reduced agency problems on the relationships between corporate cultures and tax avoidance. Corporate cultures, incentive compensation measure, as well as their interaction terms are lagged for one period in the model, since it is expected that both of these elements will have a long-term effect on tax avoidance. A vector of controls includes $LnAssets_{i,t}$, calculated as the natural logarithm of total assets for firm i in year t; $LnMktval_{i,t}$, calculated as the natural logarithm of the market value of equity for firm i in year t; and $Deferred_{i,t}$, calculated as the ratio of deferred tax expense to total assets for firm i in year t. The firm and the year fixed effects are included in the model, which are denoted by υ_i and γ_t, respectively. All the variables are winsorized at the 1% and 99% level to mitigate outliers and standard errors are clustered at the firm level.

The results are reported under column (2) of Table 3.7. Despite the effects

of corporate cultures on tax avoidance which are found qualitatively similar to Section 3.5.2, the results suggest that managers' incentive compensation weakens the links between corporate cultures and tax avoidance. Specifically, the coefficient at $COL \times IC$ is statistically significant and negative, showing that a positive link between tax avoidance and a collaborative culture is weakened by incentive compensation. This echoes a study by Rob & Zemsky (2002) that intensifying incentives drives workers to allocate more effort to their own individual tasks and less effort to cooperative ones. Taken together, coefficient estimates at COL and $COL \times IC$ indicate that an increase of one standard deviation in COL is associated with a 0.360% increase in tax avoidance [5]; and an increase of 1% in IC will lead to a 0.432 increase in tax avoidance, compared with a 0.451 increase in tax avoidance without taking managerial high-powered compensation into account, which implies that a reduced agency problem weakens the association between a collaborative culture and tax avoidance by 4.23 basis points.

Similarly, the coefficient at $COM \times IC$ is statistically significant and negative, suggesting that managerial high-powered incentives weaken the positive effect of a competitive culture on tax avoidance. As mentioned earlier, firms oriented to a competitive culture are market-oriented and focus on fast profitability. Therefore, a positive link between a competitive culture and tax avoidance is observed in the analysis. However, the fast profitability goal is x to the purpose of providing managers with high-powered incentives which aims to reduce long-term agency problems and link managers' interests to firms' sustainable growth. Managers with high-powered incentives typically focus on the firm's long-term profitability and stability, and are, hence, less likely to avoid tax in pursuit of fast funds. Statistically, coefficient estimates on COM and $COM \times IC$ indicate that an increase of one standard deviation in COM is associated with a 0.450% increase in tax avoidance [6]; and a 1% increase in IC will lead to a 0.289 increase in tax avoidance, compared to a 0.300 increase in tax avoidance without considering incentive compensation, which again implies that a reduced agency problem weakens the positive association

[5]The estimate of 0.360 is obtained by calculating the following product: 0.451 × 0.008. 0.451 is the estimated coefficient on COL in column (2) and 0.008 is the standard deviation of COL.

[6]The estimate of 0.450% is obtained by calculating the following product: 0.300 × 0.015. 0.300 is the estimated coefficient at COM in column (2) and 0.015 is the standard deviation of COM.

between a competitive culture and tax avoidance by 3.45 basis points.

The coefficients at $CON \times IC$ and $CRE \times IC$ are not statistically significant at any significance level. The reason behind the insignificant parameter at $CON \times IC$ might be that in control-oriented firms, firms' management structures are already highly concentrated. These firms face fewer agency problems since management teams are supervised by the board team and interested parties directly and tightly (Fiordelisi & Ricci 2014). Therefore, the reduced agency problem, caused by an increase in managerial incentive compensation, has little effect, at the margin, on the impact of a control culture on tax avoidance. In terms of the insignificant coefficient at $CRE \times IC$, earlier studies show a positive link between managers' incentive compensation and innovation (Balkin et al. 2000, Xue 2007, Chang et al. 2015). Therefore, their results suggest that the provision of high-powered incentives makes managers focus on sustainable growth, thus reluctant to the fast profitability achieved by tax avoidance.

3.6 Robustness Check

Two alternative approaches for measuring corporate tax avoidance are adopted to examine the robustness of the results. First, the book-tax gap not attributable to total accruals is examined following Desai & Dharmapala (2006). The results are reported under columns (3) and (4) of Table 3.7. Consistent with the findings in Section 3.5.2 and 3.5.3, the results suggest that firms with a collaboration-, competition-oriented culture increase tax avoidance, while those with a control-oriented culture decrease tax avoidance. The results also imply that managerial high-powered incentives weaken the links between a collaboration culture and tax avoidance, and between a competition-oriented culture and tax avoidance.

To further proxy tax avoidance, the book-tax gap itself is used as the dependent variable while controlling earnings management as a regressor and then re-estimate the baseline models. The inferences from the inconsistent results are presumed to be due to using the true value of tax avoidance, rather than the estimated value. Specifically, the book-tax gap on earnings management was initially regressed in the baseline models and the predicted residuals were used to measure tax avoidance,

but now, this two-stage estimation of tax avoidance is combined into one step following Desai & Dharmapala (2006). The model specification is as follows:

$$\begin{aligned} BT_{i,t} = \beta_0 + \beta_1 COL_{i,t-1} + \beta_2 CON_{i,t-1} + \beta_3 CRE_{i,t-1} \\ +\beta_4 COM_{i,t-1} + \beta_5 EM_{i,t} + \beta_6 IC_{i,t-1} + \delta\, Control\ Variables_{i,t} \\ +\upsilon_i + \gamma_t + \varepsilon_{i,t}, \end{aligned} \tag{3.11}$$

and

$$\begin{aligned} BT_{i,t} = \beta_0 + \beta_1 IC_{i,t-1} + \beta_2 COL_{i,t-1} + \beta_3 \left(COL_{i,t-1} \times IC_{i,t-1}\right) + \beta_4 CON_{i,t-1} \\ +\beta_5 \left(CON_{i,t-1} \times IC_{i,t-1}\right) + \beta_6 CRE_{i,t-1} + \beta_7 \left(CRE_{i,t-1} \times IC_{i,t-1}\right) \\ +\beta_8 COM_{i,t-1} + \beta_9 \left(COM_{i,t-1} \times IC_{i,t-1}\right) + \beta_{10} EM_{i,t} \\ +\delta\, Control\ Variables_{i,t} + \upsilon_i + \gamma_t + \varepsilon_{i,t}, \end{aligned} \tag{3.12}$$

where $BT_{i,t}$ is the book-tax gap for firm i in year t calculated as described in Section 3.4.1; $COL_{i,t-1}$, $CON_{i,t-1}$, $CRE_{i,t-1}$ and $COM_{i,t-1}$ represent four cultural dimensions, namely, collaborate, control, create and compete, calculated by a textual analysis of the 10-K filings as described in section 3.4.2. $IC_{i,t-1}$ is a measure of high-powered incentives, calculated as the ratio of the value of stock options awards to total compensation. $EM_{i,t}$ is a proxy for earnings management for firm i in year t. A vector of controls includes $LnAssets_{i,t}$, calculated as the natural logarithm of total assets; $LnMktval_{i,t}$, calculated as the natural logarithm of the market value of equity; and $Deferred_{i,t}$, calculated as the ratio of deferred tax expense to total assets. The firm and the year fixed effects are included in the model, which are denoted by υ_i and γ_t, respectively.

The results are reported in columns (5) and (6) of Table 3.7. According to which, the coefficients at COL and COM are found to be statistically significant and positive, while those at CON are significant but negative. These are in line with the findings in Section 3.5.2. Besides, the coefficients at the interaction terms, $COL \times IC$ and $COM \times IC$, are statistically significant and negative at better than 5% significance level. These consistently suggest that a reduced level of agency

problems weakens the relationship between collaborative, competitive cultures and tax avoidance. Taken together, all the findings using the combined two-stage estimation are exactly the same as what they are found in the baseline estimations.

3.7 Mechanisms

Till this point, empirical work has been done and found robust results that firms with a collaboration- and competition-oriented culture avoid more tax, while those with a control culture engage less in tax avoidance. To complete the study, this section aims to examine the mechanisms through which corporate cultures affect tax avoidance.

According to Gallemore & Labro (2015*a*), tax avoidance opportunity is impossible without a good information environment. The authors argue that tax avoidance needs the coordination of tax planning across business and geographic segments. If the firms' internal information environment is poor, the risk taken in pursuing tax avoidance is very high and the firms' documentation can not constitute acceptable proof vis-à-vis the Internal Revenue Service. Therefore, the authors find a positive link between tax avoidance and firms' internal information transparency.

In fact, firms focus on developing different corporate cultures facing different degrees of internal information asymmetry. Firms oriented to a collaborative culture pay attention to developing cooperative processes. Broad employee involvement is highly encouraged in this cultural quadrant and thus employees participate in decision-making processes. Therefore, information is effectively spread among staff within an organisation. Second, firms which focus on developing a control-oriented culture focus on hierarchy, and internal operations are highly supervised by the board team. Thinking of the tax department as a business unit who have the superior financial expertise on tax avoidance opportunities, they succumb to pressure from the board who have less knowledge about tax avoidance opportunities for avoiding tax. Opposite ideas are often suppressed in control-oriented firms (Cameron et al. 2014). The tax department may be reluctant to provide information on tax avoidance opportunities instead of waiting and following the board's advice, therefore, effective communication among staff is difficult to be established. Turning

to a competition-oriented culture, firms oriented to this culture focus on the bottom line of financial reporting. These firms are sensitive to the customers' opinions and aim to provide timely feedback. Thus, these firms have to establish efficient communication channels to build bridges between firms and customers. To sum up, it is conjectured that if corporate cultures affect tax avoidance by impacting on corporate internal information environment, the attenuated (enhanced) effects of a collaborative, competitive (control) culture on tax avoidance can be observed in firms with less internal information transparency.

Therefore, in the following section, the empirical work is going to examine whether the effects of corporate culture on tax avoidance are impacted by different degrees of the internal information environment.

3.7.1 Firm Complexity

Following prior literature (Bushman et al. 2004, Gallemore & Labro 2015*a*, Loughran & McDonald 2020), this section focuses on business and geographic dispersion which are the measures of firm complexity to indicate a firm's internal information environment. The intuition is that firms operating on multiple segments face problems in combining diverse operations together. As mentioned by Chenhall & Morris (1986) and Bushman et al. (2004), combining segments together always lead to information aggregation problems which result in a poor internal information environment. It is expected that if different corporate cultures affect a firm's level of tax avoidance through the internal information environment, the positive (negative) effect of a collaborative and competitive (control) culture on tax avoidance will be weakened (enhanced) in more complex firms.

Specifically, following Gallemore & Labro (2015*a*), firm complexity is indicated as business (geographic) dispersion which is the sum of the squares of firm sales in each business (geographic) segment divided by total firm sales, then minus 1 and multiplied by minus 1. The higher value of which indicates a higher level of firm complexity, thus the worse information environment. To complete the analysis and follow the full structure of the "Competing Values Framework", although the empirical results do not support any significant effect of a creative culture on tax avoidance, the effect of the internal information environment on the link between

a creative culture and tax avoidance is also examined. The results are reported in Table 3.8.

According to the table, the results consistently show that firms with a collaboration-, and competition-oriented culture increase tax avoidance, while those with a control-oriented culture avoid less tax. Most importantly, the coefficients at the interaction terms, $COL \times Business_Dispersion$, $CON \times Business_Dispersion$, $COM \times Business_Dispersion$, $COL \times Geographic_Dispersion$, $CON \times Geographic_Dispersion$, and $COM \times Geographic_Dispersion$ are statistically significant and negative, suggesting that the positive (negative) effect of a collaborative and competitive (control) culture on tax avoidance is attenuated (enhanced) when firms face less internal information transparency.

Table 3.8
Tax avoidance, internal information environment and corporate culture

VARIABLES	*TS_Jones*	*TS_Jones*
COL × *Business_Dispersion*	−0.026***	
	(0.001)	
CON × *Business_Dispersion*	−0.014**	
	(0.007)	
CRE × *Business_Dispersion*	−0.009	
	(0.007)	
COM × *Business_Dispersion*	−0.021*	
	(0.012)	
Business_Dispersion	−0.001*	
	(0.000)	
COL × *Geographic_Dispersion*		−0.012***
		(0.003)
CON × *Geographic_Dispersion*		−0.012*
		(0.007)
CRE × *Geographic_Dispersion*		−0.005
		(0.004)
COM × *Geographic_Dispersion*		−0.019***
		(0.005)
Geographic_Dispersion		−0.001**
		(0.000)
IC	−0.003	−0.003
	(0.004)	(0.004)
COL	0.464**	0.477**
	(0.231)	(0.192)
CON	−0.549***	−0.514**
	(0.134)	(0.223)
CRE	0.063	0.051
	(0.108)	(0.166)
COM	0.414**	0.438***
	(0.171)	(0.134)
LnAssets	−0.027***	−0.028***
	(0.003)	(0.003)
LnMktval	0.032***	0.032***
	(0.002)	(0.002)
Deferred	0.111***	0.112***
	(0.043)	(0.041)
Constant	−0.056***	−0.023
	(0.019)	(0.018)
Observations	11,228	11,228
R-squared	0.146	0.146
Firms	1,662	1,662
Firm FE	YES	YES
Year FE	YES	YES

The table reports results corresponding to Section 3.7.1. The definition of variables can be found in Table A1. Robust standard errors are clustered at the firm level and presented in parentheses; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level.

3.8 Further Investigations

In Section 3.5.3 where the effects of managerial high-powered incentives on the links between corporate cultures and tax avoidance are examined, the empirical results suggest that high-powered incentives weaken the links between corporate cultures and tax avoidance. This section aims to find out whether the attenuated effects caused by managerial incentive compensations is as a result of reduced agency problems since earlier papers suggest a negative association between managerial compensation and agency problems (Murphy 1999, Guay et al. 2002, Bebchuk & Fried 2003, Jiraporn et al. 2005). To do so, I examine whether the negative effects of managers' high-powered incentives on the links between cultures and tax avoidance are enhanced in firms with higher institutional holdings and greater board independence. The intuition is that institutional investors and independent boards have stronger incentives and greater abilities to monitor managers, thus reducing agency problems. Therefore, if managerial incentives affect the links between cultures and tax avoidance through reduced agency problems, such effects should be observed to be enhanced in firms with higher institutional holdings and greater board independence. The empirical results are demonstrated in the following sections.

3.8.1 The Effects of Institutional Holdings

Following prior literature (Desai & Dharmapala 2006, 2009, Kim et al. 2014, Callen & Fang 2015), I obtain institutional holding data extracted from the CDA spectrum database based on Schedule 13F filings with the SEC by large institutional investors. As this variable is reported quarterly, it is averaged over the four quarters in a given year to measure the institutional ownership of firm i in year t. Specifically, if this firm-year fraction is above the industry median in a given year, the governance dummy variable (I) takes a value of one, and zero otherwise. Therefore, the full sample can be divided into two subgroups of firms with higher institutional holdings and firms with lower institutional holdings. I firstly re-examine Eq. (3.10) based on two subgroups separately. The results are reported under columns (2) and (3) of Table 3.9.

According to the table, the coefficients at $COL \times IC$ and $COM \times IC$ are statistically significant and negative only in firms with higher institutional holdings. Therefore, the results imply that managerial high-powered incentives affect the links between corporate cultures and tax avoidance through the reduced agency problem.

Among the estimated parameters at other variables, some interesting findings can be concluded. First, the results suggest that the coefficient at COM is only statistically significant and positive when firms have more institutional investors. The untabulated test of the difference between coefficients in columns (1) and (2) is significant at a better than 5% significance level, which implies that a better corporate governance mechanism has an incremental effect on the impact of a competitive culture on tax avoidance. Second, the coefficient at IC is only negative and statistically significant when firms have fewer institutional investors. The untabulated test of the difference between the estimated coefficients at IC under columns (1) and (2) is statistically significant at a better than 10% significance level. This finding is in line with that of Desai & Dharmapala (2006).

For a more formally statistical test, triple interaction terms are added to Eq. (3.10). The results are reported under column (3) of Table 3.9. According to which, the results are found to be qualitatively similar to the results using estimations on subgroups. The coefficient at $I \times COL \times IC$ and $I \times COM \times IC$ are statistically significant and negative, showing that the effects of managerial high-powered incentives on the links between cultures and tax avoidance are enhanced in terms of higher institutional holdings.

Table 3.9
Tax avoidance, institutional holdings, high-powered incentives and corporate culture

VARIABLES	*TS_Jones* I=1	*TS_Jones* I=0	*TS_Jones* *Full*
$COL \times IC \times I$			−1.191*
			(0.685)
$CON \times IC \times I$			−0.787
			(0.967)
$CRE \times IC \times I$			−0.480
			(1.370)
$COM \times IC \times I$			−1.185***

continued on next page

Table 3.9 – continued from previous page

VARIABLES	*TS_Jones* *I*=1	*TS_Jones* *I*=0	*TS_Jones* *Full*
			(0.442)
COL × *I*			−0.219
			(0.363)
CON × *I*			−0.178
			(0.352)
CRE × *I*			−0.025
			(0.098)
COM × *I*			−0.125**
			(0.063)
IC × *I*			0.016***
			(0.005)
COL × *IC*	−0.970**	−1.027	−1.260**
	(0.404)	(0.901)	(0.609)
CON × *IC*	−0.219	−0.964	−0.503
	(0.291)	(0.850)	(0.566)
CRE × *IC*	−1.842	−0.522	−0.308
	(1.233)	(1.548)	(1.429)
COM × *IC*	−1.251***	−0.885	−0.665**
	(0.457)	(0.563)	(0.280)
IC	0.013	−0.047**	−0.036**
	(0.014)	(0.018)	(0.015)
COL	0.213	0.373	0.492*
	(0.268)	(0.305)	(0.276)
CON	−0.231	−0.746**	−0.316*
	(0.273)	(0.327)	(0.177)
CRE	−0.042	0.044	−0.033
	(0.080)	(0.079)	(0.072)
COM	0.330**	0.237	0.199
	(0.168)	(0.185)	(0.157)
LnAssets	−0.033***	−0.020***	−0.028***
	(0.003)	(0.004)	(0.003)
LnMktval	0.034***	0.029***	0.032***
	(0.003)	(0.003)	(0.002)
Deferred	0.159***	0.034	0.096**
	(0.054)	(0.052)	(0.040)
I			−0.002
			(0.005)
Constant	−0.016	−0.076***	−0.034**
	(0.021)	(0.025)	(0.016)
Observations	7,957	4,879	12,836
R-squared	0.144	0.143	0.137
Firms	1,411	1,063	1,817
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

3.8.2 The Effects of Independent Boards

According to prior studies (Loureiro et al. 2011, Faleye et al. 2011), independent boards increase monitoring efficiency, thus reducing agency problems. Therefore, this section is going to examine whether the negative effects of incentive compensation on the links between cultures and tax avoidance can be enhanced in terms of greater board independence. If managerial incentive compensation affects the links between cultures and tax avoidance through attenuated agency problemS, the enhanced effectS of which can be observed in firms with more independent boards.

To so do, I obtain information about board independence from the BoardEx database. The sample is divided into two subsamples based on the proportion of the number of independent directors sitting on the boards. Specifically, if this proportion is above the industry median for firm i in year t, the dummy variable (*Indep*) equals one, and zero otherwise. The analyses are conducted both on the subsample basis and on the full sample with interaction terms. The results are reported in Table 3.10. The results are very similar to the results which are found using institutional holdings as measures of the reduced agency problems. The coefficients at $COL \times IC \times Indep$ and $COM \times IC \times Indep$ are statistically significant and negative, showing that the negative effects of managerial high-powered incentives on the links between cultures and tax avoidance are attenuated in firms with greater board independence. Therefore, the results prove that the weakened agency problems is the mechanism through which incentive compensation affects the links between corporate cultures and tax avoidance.

Table 3.10
Tax avoidance, board independence, high-powered incentives and corporate culture

VARIABLES	*TS_Jones* *Indep*=1	*TS_Jones* *Indep*=0	*TS_Jones* *Full*
$COL \times IC \times Indep$			−1.114**
			(0.495)
$CON \times IC \times Indep$			1.348
			(1.007)
$CRE \times IC \times Indep$			−0.673
			(0.656)
$COM \times IC \times Indep$			−1.136*
			(0.634)

continued on next page

Table 3.10 – continued from previous page

VARIABLES	*TS_Jones* *Indep*=1	*TS_Jones* *Indep*=0	*TS_Jones* *Full*
COL × *Indep*			0.648
			(0.692)
CON × *Indep*			−0.405
			(0.342)
CRE × *Indep*			−0.016
			(0.092)
COM × *Indep*			0.169**
			(0.077)
IC × *Indep*			0.032**
			(0.016)
COL × *Indep*	−0.694**	−0.974***	−0.971**
	(0.340)	(0.320)	(0.412)
CON × *Indep*	0.430	−1.272	−0.890
	(0.655)	(0.862)	(0.768)
CRE × *Indep*	0.298	0.291	0.482
	(0.274)	(0.344)	(0.468)
COM × *Indep*	−0.851*	−1.729***	−1.758***
	(0.458)	(0.606)	(0.491)
IC	0.005	−0.049***	−0.047***
	(0.014)	(0.018)	(0.015)
COL	0.459**	0.330**	0.248**
	(0.233)	(0.155)	(0.121)
CON	−0.492*	−0.405*	−0.448*
	(0.266)	(0.218)	(0.239)
CRE	0.029	0.127	0.013
	(0.075)	(0.080)	(0.076)
COM	0.335**	0.204	0.219
	(0.166)	(0.195)	(0.177)
LnAssets	−0.027***	−0.029***	−0.028***
	(0.004)	(0.004)	(0.003)
LnMktval	0.029***	0.038***	0.032***
	(0.003)	(0.003)	(0.002)
Deferred	0.070	0.144**	0.094**
	(0.058)	(0.061)	(0.040)
Indep			0.001
			(0.005)
Constant	−0.024	−0.076***	−0.037**
	(0.023)	(0.025)	(0.016)
Observations	7,296	5,540	12,836
R-squared	0.145	0.152	0.139
Firms	1,518	1,203	1,817
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

3.9 Conclusion

Corporate culture has been proved to be a non-negligible facet which affects several aspects of firms' operations. This study extends the research line and empirically examines the effects of the corporate culture on tax avoidance, together with the effect of managerial high-powered incentives on the relationships between corporate cultures and tax avoidance. Corporate culture is classified into the four quadrants of collaborate, control, create and compete based on the "Competing Values Framework" and quantified by a textual analysis of 10-K reporting. Tax avoidance and high-powered incentives are measured as the book-tax gap not attributable to accounting accruals and the ratio of the value of option awards to total compensation, respectively. The robust results suggest that firms with a collaborative and competitive culture tend to avoid more tax, while firms with a control culture have a tendency to avoid less. When managerial incentives are taken into account, the results suggest that it weakens the associations between cultures and tax avoidance. Besides, the results also reveal that corporate culture affects tax avoidance through the internal information environment and managerial incentive compensation affects the links between cultures and tax avoidance through the reduced agency problems.

To the best of the author's knowledge, this is the first study to provide empirical evidence that corporate culture contributes to a firm's tax avoidance decisions. The findings answer the question of whether and how corporate culture affects corporate tax avoidance. The results imply that corporate culture does indeed shape the behaviour of the employees of an organisation since the results suggest that different cultures affect tax avoidance in different ways. The results also imply that, as leaders of companies, managers are able to affect and lead the corporate culture since it is found that managerial incentive compensation weakens the links between culture sand tax avoidance. The findings are essential for regulators and practitioners who care about detecting a firm's level of tax avoidance.

Appendix

Table A1
Variable definition

Variable	Definition
TS_Jones	The book-tax gap not attributable to discretionary accruals
COL	The number of occurrences of key words in collaborative dimension to the total number of words in 10-K
CON	The number of occurrences of key words in control dimension to the total number of words in 10-K
CRE	The number of occurrences of key words in creative dimension to the total number of words in 10-K
COM	The number of occurrences of key words in competitive dimension to the total number of words in 10-K
IC	The ratio of option awarded to total compensation summed across the top-five executives
LnAssets	The logarithm form of total assets
LnMktval	The logarithm form of market value of equity
Deferred	The ratio of deferred tax expense to total assets

The table describes main variables used in this chapter. Data are obtained from the Compustat, Excucomp, and Edgar databases, respectively.

Table A2
Literature summary of the impact of firm-level determinants on tax avoidance

Author(s)	Determinants	Findings
Siegfried (1973)	Firm size	Larger firms tend to shelter more tax.
Stickney & McGee (1982)	Leverage	Firms with the lowest effective tax rates tend to be highly leveraged, heavily capital intensive, and involved in natural resource industries.
Zimmerman (1983)	Firm Size	Smaller firms tend to shelter more tax.
Omer et al. (1993)	Firm Size	Smaller firms tend to shelter more tax.
Gupta & Newberry (1997)	Capital Structure; Asset Mix; Performance	Corporate tax avoidance level is associated with a firm's capital structure, asset mix, and performance.

Table A2 continued

Rego (2003)	International Operations	The scale of international operations leads to more tax avoidance opportunities.
Graham & Tucker (2006)	Firm Size	Firm size is positively associated with the use of tax shelters and argue that tax shelters serve as a substitute for interest deductions in determining capital structure.
Hoopes et al. (2012)	Public Firms	U.S public firms undertake less aggressive tax positions when the expected likelihood of an IRS audit is higher.
Cheng et al. (2012)	Hedge Fund Activists	Relative to matched control firms, businesses targeted by hedge fund activists exhibit lower tax avoidance levels prior to hedge fund intervention, but experience increases in tax avoidance after the intervention.
Hope et al. (2013)	Disclosure	Managers perceiving that non-disclosure of geographic earnings helps mask tax avoidance behavior, thus higher tax avoidance level.

Table A2 continued

Graham et al. (2014)	Reputation	Using survey data, they find that reputation concerns are the import factor affecting firms tax planning strategy, and increasing earnings per share is an important outcome from a tax planning strategy.
Donohoe (2015)	Derivatives	Derivatives users avoid more tax than non-users, and tax savings from tax-timing opportunities.
Lanis & Richardson (2015)	CSR	More socially responsible firms are likely display less tax avoidance. More specifically, the CSR categories community relation and diversity represent particular important elements of CSR performance that reduce tax avoidance.
Kubick et al. (2016)	Comment Letter	Firms receiving a tax-related SEC comment letter, relative to firms receiving a non-tax comment letter, subsequently decrease their tax avoidance behaviour consistent with an increase in expected tax costs

Table A2 continued

Huang et al. (2016)	Concentrated Customer	Firms with a concentrated customer base is more likely to engage in tax avoidance.
Cen et al. (2017)	Customer–supplier Relationships	Firms in close customer–supplier relationships are better able to identify and implement tax avoidance strategies via supply chains.

Table A3
Literature summary of the impact of executive features on tax avoidance

Author(s)	Determinants	Findings
Dyreng et al. (2010)	Individual Executive	Individual executives play a statistically and economically significant role in determining the level of tax avoidance that firms undertake, and the results are slightly stronger for CEOs.
Francis et al. (2012)	Republican CEOs	Firms led by Republican CEOs have significantly higher levels of tax avoidance
Chyz (2013)	Personal Tax	Firms with CEOs who demonstrate a propensity to be aggressive on their personal taxes, as measured by whether the CEO engaged in manipulative stock option exercise backdating, are more likely to participate in corporate tax shelters.
Olsen & Stekelberg (2016)	Narcissism	A positive association between CEO narcissism and a firm's predicted probability of participating in a corporate tax shelter.

Table A3 continued

Koester et al. (2017)	Ability	Higher-ability managers engage in greater state tax planning activities, shift more income to foreign tax havens, make more research and development credit claims, and make greater investments in assets that generate accelerated depreciation deductions.
Law & Mills (2017)	Military Experience	Managers with military experience pursue less tax avoidance than other managers.
Hsieh et al. (2018)	Overconfidence	Companies are more likely to engage in tax-avoidance activities when they have both overconfident CEOs and overconfident CFOs.
Duan et al. (2018)	Publicity	CEOs with higher publicity manage to have a higher tax avoidance level.
Chyz et al. (2019)	Overconfidence	A positive relation between proxies for corporate tax avoidance and CEO overconfidence.

Table A3 continued

Table A4
Summary of the literature on the tax avoidance within the agent-principal framework

Author(s)	Determinants	Findings
Wilson (2009)	Corporate Governance	Active tax shelter firms with strong corporate governance exhibit positive abnormal returns. This finding is consistent with tax sheltering being a tool for wealth creation in well-governed firms.
Chen et al. (2010)	Family Firms	Family firms are less aggressive than their non-family counterparties.
Wang (2011)	Transparency	Transparent firms, which potentially have less severe agency problems, avoid more tax relative to their opaque counterparts.
Huseynov & Klamm (2012)	Corporate Governance	Tax fees are associated with lower GAAP ETR regardless of a firm's strengths or concerns for corporate governance or diversity, but are associated with lower Cash ETR when a firm has corporate governance strengths or diversity concerns.

Table A4 continued

Badertscher et al. (2013)	Concentrated Ownership	Firms with greater concentrations of ownership and control, and thus more risk averse managers, avoid less income tax than firms with less concentrated ownership and control.
Khurana & Moser (2013)	Institutional Shareholders	Less tax avoidance in firms held by long-term institutional shareholders, and these results are generally driven by poorly governed firms.
McGuire et al. (2014)	Dual Class	Dual class firms engage in less tax avoidance.
Gallemore & Labro (2015*b*)	Transparency	Tax avoidance is associated with higher quality(internal) information environment.

Table A5
Summary of the literature on the association between managerial incentive and tax avoidance

Author(s)	Sign	Findings
Phillips (2003)	Positive	Compensating business-unit managers on an after-tax basis leads to lower effective tax rates.
Slemrod (2004)	Positive	Corporate tax noncompliance could result from the tax reporting incentives provided by managers' incentive compensation contract.
Desai & Dharmapala (2006)	Negative	Tax avoidance is negatively related to incentive compensation, and this relation is driven by firms with weak governance.
Rego & Wilson (2012)	Positive	Larger equity risk incentives are associated with greater tax aggressiveness.
Armstrong et al. (2015)	Positive	Risk-taking equity incentives are positively related to tax avoidance and this relation is stronger in the right tail of the tax avoidance distribution.

Table A5 continued

Chi et al. (2017)	Negative	A negative association between CEO inside debt holdings and tax sheltering. Additional analyses suggest that the effect of inside debt on tax sheltering is more (less) pronounced in the presence of high default risk and liquidity threats.

Chapter 4

R&D Investment, Friendly Boards and CEO Compensation

4.1 Introduction

Starting from the separation of principals and agents in modern corporate governance, the board sets CEO compensation and incentives based on firm performance in order to monitor CEOs and align shareholder and managerial interests together (Jensen & Meckling 1976*a*, Fama & Jensen 1983, Core & Guay 1999). Echoing this principal-agent theory, prior research has empirically examined and found a positive link between CEO pay and firm performance (Lambert & Larcker 1987, Core et al. 1999, Baber et al. 1996, Murphy 1999), also with some evidence found in the Chinese market (Kato & Long 2006*a*, Firth et al. 2006, 2007, Conyon & He 2011). In this vein, the pay-for-performance link is a result of a board's monitoring duty that a board is likely to lower CEO compensation or fire the CEO after a bad performance.

However, according to Adams & Ferreira (2007), a board typically has two roles – monitoring and advising. A hotly debated issue thus is focused on the role played by a friendly board. According to prior studies (Adams & Ferreira 2007, Kang et al. 2018), theoretically, when performing these two roles, a management-friendly board has its dark side that it decreases board monitoring, thereby exacerbating the managerial agency problem. It also has a bright side that it reduces information asymmetry between CEOs and the board, serves better as an advisor, and bring

expertise to the management team. Triggered by these arguments, this chapter aims to offer empirical analyses on examining both the dark and bright sides of friendly boards in the Chinese context since there is a missing analysis on this topic in China.

Specifically, the first goal is to examine the effects of friendly boards on the pay-for-performance link. On the one hand, it is expected that by weakening its monitoring efficiency, a friendly board lessens the agency problem, thus penalising the pay-for-performance link since the link is used as a tool by the board to monitor CEOs. On the other hand, by being more friendly, a management-friendly board would compensate more for CEOs achieving better firm performance. A positive link between CEO pay and firm performance is observed to be enhanced. The second goal is to examine the effect of advisory duty played by friendly boards on CEO pay. R&D investment is an enormous cash outflow with uncertain outcomes, which transfer to increased stock price volatility. Previous studies by Chambers et al. (2002) and Santosuosso et al. (2016) find a negative link between firm profitability and R&D expenditure since costs incurred for developing R&D projects require a long-term procedure to achieve the unknown and unstable benefits in the future, thus negatively affecting CEO compensation in the short run. This explains the evidence of a negative association between CEO compensation and R&D expenditure shown in the literature of Bizjak et al. (1993) and Cheng (2004). As a consequence, firms face R&D under-investment problems (Bushee 1998). Therefore, the empirical work is designed to examine whether a negative association between CEO pay and R&D expenditure can be attenuated by a friendly board as a friendly board serves as an advisor, and has better access to CEO's investment decisions, and thus, would compensate for CEOs additionally and initially and avoid them from compensation risk facing R&D investments. However, in terms of R&D projects which come with information asymmetry (Holmstrom 1989), CEOs and friendly boards are more likely to collude with each other if the information is less transparent, leading to poorer firm value (Asch & Seneca 1976), as a result, lower CEO compensation. Under this circumstance, a negative link between CEO pay and R&D expenditure is observed to be enhanced by such boards. In all, the effects of friendly boards' monitoring and advisory functions, therefore, become an

empirical test which will be examined in this chapter.

Data are drawn from the China Stock Market and Accounting Research Database (CSMAR) from 2007 to 2021 since the CSMAR database starts disclosing R&D information in the year 2007. The total sample includes an unbalanced panel of 15,944 observations and 2,466 firms. CEO pay is defined as the logarithm form of total cash-based compensation, including salary, bonuses and commissions following Murphy (1985), Lambert et al. (1993), Finkelstein & Boyd (1998), Murphy (1999) and Devers et al. (2007). Firm performance and R&D expenditure are measured as return on the market value of equity and the ratio of R&D expenditure to total sales, respectively. Three distinct measures are used to indicate friendly boards: whether the CEO's relative is sitting on the board, CEO duality and board dependence.

As a result, I find that a friendly board has weakened monitoring efficiency, thus weakening a positive link between CEO pay and firm performance. Specifically, a one standard deviation increase in firm performance is associated with an approximately 7% increase in CEO compensation. A positive link between CEO pay and firm performance is attenuated by around 75% if a firm has a friendly board. Besides, by better performing its advisory role, a friendly board weakens a negative association between CEO pay and R&D expenditure. Econometrically, a one standard deviation increase in R&D spending is associated with a 0.08% reduction in CEO pay. A negative link between these two elements is weakened by 200% if a firm has a friendly board. These results are robust to alternative measures of R&D spending and friendly boards, as well as after solving the potential reverse causalities.

Till this point, the results indicate that a friendly board is less likely to lower CEO compensation or even fire a CEO after a bad performance as it has weakened monitoring efficiency. On the contrary, a friendly board mitigates the negative impact of R&D expenditure on CEO compensation. Taken together, the above analyses may imply that friendly boards foster risk-seeking CEOs since investing in risky projects such as R&D investments has a detrimental effect on CEO compensation and career risk. Therefore, the analyses are extended to check whether the relatively higher R&D expenditure can be observed in firms with

management-friendly boards. The results show a positive link between R&D expenditure and friendly boards, and also indicate that the channel underpinning this positive association is CEO compensation.

Modern corporate governance mechanisms have focused on raising board independence since it enhances board monitoring and reduces agency problems. Despite the widespread belief among practitioners and scholars that independent boards are good for firms, there is some recent evidence both theoretically and empirically showing that friendly boards increase corporate value by providing better advice (Adams & Ferreira 2007, Harris & Raviv 2008, Schmidt 2015). However, it is still inevitable to admit that, to some extent, the existence of friendly boards means less efficient corporate governance mechanisms. Therefore, the empirical study is extended in this chapter to check whether the relatively higher R&D outlay in friendly-board firms leads to higher innovation outcomes, and whether a friendly board contributes to the enhanced firm value by functioning its advisory role. The findings are fourfold. First, the results indicate that friendly boards enhance a positive link between innovation outcome and R&D expenditure, thereby increasing innovation efficiency. Second, friendly boards increase firm value directly only in high-tech industries. Third, although there is a missing link between firm value and friendly boards in general, friendly boards are still able to increase firm value by functioning their advisory duties on R&D projects. Fourth, by functioning its advisory duty on R&D projects, the positive effects of a friendly board on firm value are strengthened in high-tech firms.

To sum up, the results in this chapter do not contradict to the traditional agency theory that enhanced corporate governance mechanisms increase firm value. This study echoes recent studies by Adams & Ferreira (2007) and Schmidt (2015) and empirically proves that both monitoring and advising functions are boards' duties. Whether one function dominates the other one in determining firm value depends on each firm's situation. Those firms that are advice-demanded such as high-tech firms, they benefit from having friendly boards.

This study contributes to the literature in the following ways. First, it is worth noting that this chapter is conducted in the Chinese market. Starting from 1993 when the first stock was launched on the Shanghai Exchange Market, the concept of

performance-based compensation is promoted by the Chinese government in order to boost firm performance. Unlike well-developed countries such as the US and UK, the majority of Chinese firms pay CEOs on a cash basis. This has triggered lots of previous studies investigating the efficiency of the pay-for-performance link in the Chinese market. Despite the numerical evidence showing a positive link between firm performance and cash-based compensation (Kato & Long 2006*a*, Firth et al. 2006, 2007, Conyon & He 2011), the effect of a friendly board on the pay-for-performance link is still not understood. Empirical studies from the US market show that less independent boards have weaker monitoring efficiency, thus mitigating the pay-for-performance link. However, whether this effect still holds under the Chinese context is unknown and becomes an interest. Therefore, this study is the first one to provide empirical evidence showing that a friendly board also lessens monitoring efficiency for Chinese firms, thereby penalising the pay-for-performance link.

Second, the Chinese government has consistently emphasised the importance of developing domestic technology. One of the aims of the "The Medium- to Long-term Science and Technology Development Plan: Outline of China" issued by the Chinese government is to raise the intensity of R&D investments and reduce reliance on imported technology. This study is also the first one investigating the effect of a friendly board on the link between CEO compensation and R&D investments. The findings suggest a bright side of a friendly board that it weakens the negative effect of R&D expenditure on CEO pay, thereby avoiding CEO compensation and career risk in terms of R&D investments. Earlier studies by Bushee (1998) and Cheng (2004) show that since CEOs try to reduce R&D spending to opportunistically increase short-term profitability due to the negative impact of R&D expenditure on their compensation, firms face R&D under-investment problems. This chapter find that a friendly board foster risk-seeking CEOs and provide better incentives for CEOs to invest in R&D projects. As shown in the extension part in this chapter, the results indicate a positive link between R&D expenditure and firms with friendly boards. The findings also show that a friendly board strengthens a positive link between innovation outcome and R&D input, thus increasing innovation efficiency. Taken together, these findings thus provide a potential solution to the Chinese

development plan to increase innovation and are essential for policymakers.

Third, this study extends and finds that although there is no direct link between friendly boards and firm value in general, such boards still increase corporate value by providing valuable advice on R&D projects. These effects are proved to be stronger for firms in the high-tech industry. These findings echo the study by Adams & Ferreira (2007) under the US context and also fill the void in the literature on the effect of friendly boards on the firm value in the Chinese market. Hence, the findings are essential for practitioners. The results suggest that whether firms should adopt friendly boards depend on each firm's circumstance and should decide with caution. Receiving more valuable advice from friendly boards is at a cost of weakened monitoring efficiency. For high-tech firms, the benefits dominate the deficits when employing a friendly board.

4.2 Institutional Background

This study is examined in the Chinese context, thus, it is inevitable to discuss the institutional background in China. The development of the CEO compensation scheme in the Chinese market can be summarised into three stages. In the first stage, before 1978 [1], state-owned entities (hereafter, SOEs) were required to remit all the profit they generated to the central government and all deficits were covered by the state. Hence, there was no incentive plan for motivating CEOs before 1978. At that time, the CEOs of SOEs were the representatives of the central government, which had complete controlling rights over all SOEs and paid CEOs based on the civil service pay scale. Therefore, CEOs earned around three times the salary of ordinary workers, which reflected that their compensation was irrelevant to firm performance (Firth et al. 2006, 2007, Huang et al. 2009).

In the second stage, after 1978, the central government proposed the idea of performance-based CEO pay. At this time, the central government promoted market reform and the CEOs of SOEs had more autonomy and rights. Profits no longer had

[1]The Communist Party authorities began the economic reform in 1978 when basic market principles were introduced in two stages. The first stage was from the late 1970s to the early 1980s, and included the de-collectivisation of agriculture, the opening up of the country to foreign investment and the permission for entrepreneurs to start a private business. The second stage of reform was from the late 1980s and 1990s, when the private sector grew markedly, accounting for as much as 70% of China's gross domestic product by 2005.

to be submitted to the government, but could be retained and distributed within the firm. The central government also emphasised the importance of separating control from ownership then and later, in 1985, the concept of performance-based pay was first introduced by China's central government.

In the last stage, performance-based pay was widely promoted. In 1993, when the first stock was launched on the Shanghai Exchange Market, the central government required that all listed firms to be joint-stock firms with CEOs monitored by the company board. In 1997, the importance of continuing the economic reform in China was emphasised at the Fifteenth Chinese Communist Party Congress, but at the same time, the central government was trying to sell its shares in the market to make up for the large budget deficits of SOEs. However, the stock price continued to collapse and the central government had no choice but to abandon this plan. Instead, it further promoted linking CEO compensation to firm performance to boost firm profitability.

Unlike well-developed countries such as the US and UK where firms are required to completely disclose their CEO compensation, the Chinese Securities Regulation Committee (CSRC) did not require public companies to disclose information about CEO compensation before 2001 [1]. Later, between 2001 and 2005, it began to require public firms to disclose the aggregated sum of the top three highest-paid managers and board members, but individual pay was still not disclosed. Therefore, the majority of studies are typically based on the aggregated sum of the top three highest-paid managers to indicate CEO compensation during this period (Kato & Long 2006*c*,*b*, Firth et al. 2006, 2007, Ding et al. 2010, Firth et al. 2010, Conyon & He 2011).

In terms of the absolute amount of CEO pay, according to a study by Buck et al. (2008), CEO pay in China is relatively lower than its counterparts in US and UK. The average annual pay of the three highest-paid CEOs in China was about $0.012 million in 1998-2002, compared to about $2 million in the US and approximately $0.7 million in the UK. The failure to add equity-based compensation into the CEO compensation package may be a reason for this phenomenon.

[1] Although the CSRC did not require firms to report management compensation, some firms still choose to disclose it on a voluntary basis.

4.3 Literature Review

4.3.1 CEO Compensation

The standard explanation of how the board pay CEO compensation starts from the agency theory (Jensen & Meckling 1976*b*, Holmstrom 1989, Fama & Jensen 1983). It is predicted that the board defines the appropriate CEO compensation to overcome the principal-agent problems, aligning executives' and shareholders' interests together. Due to the difficulty in monitoring CEOs, the agency theory predicts a positive link between CEO pay and firm performance since firm performance is an explicit and observable factor, making the board easily assess CEOs' performance. In line with this theory, Kato & Long (2006*a*) use a sample of 937 firms in the Shanghai and Shenzhen Exchange Markets, and find executive compensation is positively associated with firm performance. Similar results can also be found in the work by Firth et al. (2006, 2007) and Conyon & He (2011).

It is noticeable that among the rich research by prior scholars, except Conyon & He (2011) who incorporate CEO share-based compensation in their study, empirical work related to CEO compensation under the Chinese context only considers CEO cash-based remuneration. Holmstrom (1979) and Core & Guay (1999) mention that stock-based compensation should be included in the CEO compensation package as it aligns CEO pay to the firms' long-term performance. The authors argue that if executives who hold the percentage of shares in the firm is small, they may have little incentive to perform their duties, since a reduction in the firm value, in the long run, have a negligible impact on their own wealth. Therefore, in the US studies, researchers find a positive link between CEO equity-based compensation and firm performance in US firms (Murphy 1985, Lambert et al. 1993, Finkelstein & Boyd 1998, Murphy 1999, Devers et al. 2007). The failure of this omission in Chinese studies is mainly because equity incentives are a very recent phenomenon in China, having only permitted since 2005, and the percentage of firms that adopt them is also relatively small [2] [3]. Firms find it difficult to find an appropriate source

[2] According to a survey by PwC, only 337 of China's domestic public firms announced plans to share equity incentive in 2019.

[3] According to the "Guidelines for the Implementation of Equity Incentive Work for Listed Companies Controlled by Central Enterprises" issued by the State-owned Assets Supervision and Administration Commission of the State Council in 2020, the central government starts

of stocks to reward CEOs. Treasury stocks and share repurchases are not allowed in the Chinese market and the issue of new shares requires additionally complicated regulatory approval (Mengistae & Xu 2004, Firth et al. 2006). Besides, due to the unclear disclosure about the stock holding position, even if firms disclose their CEO share-based pay, empirical work includes the equity-based incentives to indicate CEO compensation might still be a problem since it is impossible to distinguish CEOs' own purchases from the CEO compensation package. However, Chen et al. (2011) and Conyon et al. (2015) have proved that cash-based compensation can reflect all the compensation-related issues in the Chinese market.

4.3.2 Friendly Boards

The well-developed country, the US, has issued the Sarbanes-Oxley Act of 2002, which requires greater participation of independent directors in corporate governance, with the belief that outside directors are better able to monitor CEOs (Sarbanes 2002). Two decades later, the Act has been proven to be effective in the US market. Similar to this Act, the China Securities Regulatory Commission (CSRC) has issued a series of codes to improve corporate governance mechanisms in China. An important example is called "The Code of Corporate Governance" which requires firms to include independent directors in the board teams in order to strengthen corporate governance mechanisms (Lin et al. 2004).

However, despite the widespread belief that independent boards are good for firms, a recent study by Adams & Ferreira (2007) has shown that friendly boards increase firm value under certain circumstances. In their work, a board typically has two functions — discipline and advising. Apart from monitoring CEOs, boards are also expected to bring their expertise and timely advice to the management teams. When one function dominates the other one depends on the information exchange needs between CEOs and the board teams. The authors argue that, CEOs have a trade-off of revealing information to the board teams. On the one hand, if CEOs share information with the board teams, they receive better advice.

to promote SOEs to include equity-based compensation in their CEO compensation package. However, till 2022, only 80 SOEs disclose their equity-based incentive plans (have not been implemented yet). Therefore, before 2021, almost no SOEs adopt equity incentives since it is not allowed.

On the other hand, in turn, the information which revealed to the board team might be used by the board to monitor CEOs intensely. CEOs thus might protect themselves from intense monitoring at the cost of not receiving valuable advice. Adams & Ferreira (2007) conclude that management-friendly boards, despite being potentially less efficient in monitoring CEOs, may increase firm value by providing their advisory function.

Similar to Adams & Ferreira (2007)'s theoretical framework, Harrison et al. (1998), Raheja (2005) and Holmlstrom (2004) also emphasise the importance of information sharing between CEOs and the board teams. They argue that since it is costly for independent directors to obtain inside firm-specific information, independent boards may impede in the way that the boards offer valuable advice to CEOs. In China, independent directors are not allowed to offer advisory services by law. This makes the exchange of information between CEOs and boards more difficult to implement.

Echoing these theoretical frameworks, an empirical study by Schmidt (2015) shows that if the benefits from receiving advice from the board teams outweigh the costs of reduced monitoring, the phenomenon that friendly boards increase firm value can be observed. Therefore, they find a positive link between takeover returns and board friendliness since mergers and acquisitions are complex corporate events which need the boards to provide advice and approval.

4.4 Hypothesis Development

4.4.1 Hypothesis on the Monitoring Duty of Friendly Boards

It is generally agreed that one of the main directors' duties is to hire and fire the CEO, as to carry out their monitoring roles and ensure the best possible leadership for the company (Adams & Ferreira 2007). As a method of monitoring the CEO, directors set CEO compensation linked to firm performance in order to evaluate the CEO's performance. Therefore, the pay-for-performance link is used as a tool to cure agency problems and align the management and boards' interests together. Echoing this argument, massive evidence has shown a positive association between CEO compensation and firm performance (Lambert & Larcker 1987, Core et al.

1999, Baber et al. 1996, Murphy 1999, Kato & Long 2006*a*, Firth et al. 2006, 2007, Conyon & He 2011).

Paying CEOs on firm performance is thus the explicit magnification of boards' monitoring duty. However, less independent, more friendly boards, are proved to be passive in performing monitoring functions. Faleye et al. (2011), for example, find that firms with less independent boards have lower sensitivity of CEO turnover to firm performance. Cingano & Rosolia (2012) and Coles et al. (2012) find that friendly boards are less likely to dismiss CEOs after a poor performance. Taken together, prior evidence has shown that less independent, more friendly boards face weakened monitoring efficiency and thus lessen agency problems. As the pay-for-performance link is one of the ways used by the boards to due diligence on their monitoring duty, it is expected that,

H1a: A positive link between CEO compensation and firm performance is weakened by friendly boards.

However, according to Loureiro et al. (2011) and Hamm et al. (2015), CEOs supervised by weak boards are able to influence the target of the measurement basis for their compensation, as a result, they receive higher excess compensation. If firm performance gets better, it is possible that less independent, more friendly boards, are more likely to compensate CEOs additionally for CEOs' efforts in achieving better firm performance. Under this circumstance, a positive link between CEO pay and firm performance is observed to be enhanced.

H1b: A positive link between CEO compensation and firm performance is enhanced by friendly boards.

4.4.2 Hypothesis on the Advisory Duty of Friendly Boards

Despite the weakened monitoring efficiency played by friendly boards, earlier studies show that friendly boards are good at performing advisory duties. This function is especially essential for firms with advice-needed projects such as R&D investments (Adams & Ferreira 2007, Schmidt 2015). R&D projects come with

uncertainty and are long-term oriented. Since these projects usually only start to pay off several years after investing and profits generated by them are unpredictable, earlier studies show a negative relationship between firm profitability and R&D spending (Chambers et al. 2002, Santosuosso et al. 2016). This also explains the negative effect of R&D investments on CEO pay found in the studies of Bizjak et al. (1993) and Cheng (2004).

It is hypothesised that by serving their advisory function and rewarding CEOs for suitable R&D investment decisions, friendly boards mitigate a negative link between CEO pay and R&D investments. The reasons are as follows. Compared with independent boards, friendly boards establish mutual trust with the management teams, thus reducing any awkwardness CEOs feel about asking for advice (Li et al. 2008, Rosen 1983, Wu 2008). Communication efficiency increases and information asymmetry decreases as friendly boards are expected to get involved in the firm's day-to-day activities and provide timely advice (Song & Thakor 2006, Salancik & Pfeffer 1980, Baysinger & Hoskisson 1990, Judge & Zeithaml 1992, Alexander et al. 1993). This is essential for firms with advice-needed projects. For example, Schmidt (2015) find that friendly boards provide better advice during acquisitions made by more complex firms. Similarly, R&D projects typically involve exploring new ideas. It is of great importance for boards and CEOs to communicate over these projects, for boards to offer their advice, and show their approval and support. As stated by Milkovich et al. (1991), the possibility of implementing behaviour-based pay is an inverse function of information asymmetry between CEOs and board members. Friendly boards thus are expected to attenuate the negative impact of R&D expenditure on CEO pay since they are better able to know CEOs' R&D investment decisions, and thus show their support and motivate CEOs to invest, preventing CEOs from their compensation risk.

H2a: A negative link between CEO pay and R&D investments is weakened by friendly boards.

On the contrary, less independent, more friendly boards are more likely to collude with CEOs. Innovation process comes with information asymmetry, they

are normally protected from disclosing the cutting-edge information (Holmstrom 1989). Facing R&D projects, CEOs and friendly boards are more likely to collude with each other if information is less transparent. A collusion between CEOs and boards negatively affect firm value (Asch & Seneca 1976), resulting in lower CEO compensation. Hence,

H2b: A negative link between CEO pay and R&D investments is enhanced by friendly boards.

4.5 Data and Sample Construction

I obtain CEO compensation information, friendly board measures, R&D expenditure data as well as other financial accounting information used to calculate controls from the China Stock Market and Accounting Research (CSMAR) database. The sample begins from 2007 to 2021 and covers all listed A-share firms in the Shanghai and Shenzhen Exchange markets. The sample starts in 2007 because the CSMAR database started disclosing R&D relevant information only after the year 2007. I exclude firm-years with CEO compensation which is zero or missing. I also exclude firms in the financial section, firms with a special treatment designation (labelled as "ST" or "*ST"), observations with missing values, and firm-years with insufficient data to calculate the lag value of independent variables in the models. To mitigate the impact of outliers, all the variables are winsorized at the 1st and 99th levels. Therefore, the final sample consists of an unbalanced panel of 15,944 observations and 2,466 firms.

Details of how the sample is constructed are listed in Table 4.1.

Table 4.1
Construction of sample

	Sample Size	Number of Firms
Data from the CSMAR database with available CEO compensation	22,595	3,012
Drop financial firms	22,296	2,989
Drop ST or *ST firms	20,916	2,864
Drop missing values	15,944	2,466

The table reports the sample construction procedure. Data are obtained from the China Stock Market and Accounting Research (CSMAR) database from 2007 to 2021.

4.5.1 Measuring CEO Compensation

Unlike US studies which incorporate equity and equity option compensation to measure CEO pay, this study indicates CEO compensation using the logarithm form of CEO annual cash-based compensation, including salary, bonuses and commissions following (Kato & Long 2006*c*,*b*, Firth et al. 2006, 2007, Ding et al. 2010, Firth et al. 2010, Conyon & He 2011). The reason to do so is that equity-based compensation is a recent phenomenon in China and is underdeveloped. Most of the relevant data are either missing or insufficient for the empirical work. Besides, as a result of the unclear disclosure about the holding position, even though some firms disclose their CEO equity-based pay, it is still impossible to tell whether CEOs' stock holdings come from their own purchase or compensation package. However, Chen et al. (2011) and Conyon et al. (2015) have shown that the cash-based compensation is the best measure of CEO compensation which can reflect all the compensation-related issues in the Chinese market.

4.5.2 Measuring Management-Friendly Boards

Three distinct measures are used to indicate a friendly board in this research topic. The first proxy for a friendly board is constructed based on CEOs' personal ties since it establishes mutual trust, emotional attachment and intimacy. Information sharing is welcomed both through the formal and informal approach, thereby constructing a friendly board (Westphal 1999, Saint-Charles & Mongeau 2009, Kang et al. 2018). A dummy variable (*Relative*) equals one if one of the CEO's relatives is sitting on the board in the same company for firm i in year t, and zero otherwise.

The second friendly board measure is CEO duality. CEO duality represents the enhanced CEO power, thus, CEO is able to influence the nomination process of directors so that they can elect their friendly, constructing a friendly board (Johnson et al. 1993, Montgomery & Kaufman 2003). A dummy variable (*Duality*) equals one if a CEO also serves as the chairman of the board for firm i in year t, and zero otherwise.

The third indicator is board dependence (*Dependence*), measured as the number

of inside directors to the board size. Outside directors monitor CEOs based on the information provided by the management teams. Therefore, the independent boards may intervene in the CEOs' decisions and their supervision may be so tight that makes CEOs reluctant to share information with the board teams, constructing less friendly boards.

4.5.3 Measuring Firm Performance and R&D Expenditure

Following Finkelstein & Boyd (1998), Sanders & Carpenter (1998), Thomas et al. (2016) and Santosuosso et al. (2016), firm performance is measured as the return on the market value of equity and R&D expenditure is measured as the ratio of R&D expenditure to total sales.

4.5.4 Measuring Controls

A vector of control variables is included in this research topic following prior studies by John & John (1993), Conyon & He (2011) and Wang & Xiao (2011). Firm size is measured as the logarithm form of total assets (*LnAssets*). Leverage ratio (*Lev*) is measured as the total debt to total assets. Firm risk (*Vol*) is captured by the standard deviation of monthly stock returns in the past year. A firm's growth opportunity (*MB*) is measured as the ratio of the market value of equity to the book value of equity. Board size (*Board*) and CEO age (*Age*) are measured as the logarithm form of the number of directors sitting on the board and the logarithm form of CEO age, respectively. A dummy variable (*Gender*) equals one for a female CEO, and zero otherwise. Finally, *State* is a dummy variable coded one if firm i is a state-owned company, and zero otherwise.

The details of variable constructions can be found in the Appendix Table A1.

4.6 Empirical Analysis

4.6.1 Summary Statistics

The average CEO compensation for listed Chinese firms in the sample is summarised by year in Table 4.2, according to which, executive compensation grew considerably

in the sample year. The average CEO pay in 2007 is 474,751 CNY and rises to 1,391,544 CNY in 2021. Given that one Chinese yuan is valued at approximately 0.1314 US dollars in 2007 and 0.1550 US dollars in 2021, executive compensation grew from 0.06 million US dollars in 2007 to 0.22 million US dollars in 2021. Compared with US firms during the same time, the average CEO pay in US firms increased from around 14 million US dollars in 2007 to 20 million US dollars in 2021. CEO pay in listed Chinese firms is relatively lower than their counterparts in US CEOs in US firms earned over 233 times more than CEOs in Chinese firms in 2007 and 90 times more in 2021, showing that the gap in CEO compensation between Chinese and US firms converges during the sample year.

Table 4.2
Summary statistics of CEO compensation

Year	Pay	Year	Pay
2007	474,751	2015	771,887
2008	439,114	2016	835,392
2009	481,617	2017	912,255
2010	513,879	2018	1,036,436
2011	558,503	2019	1,147,457
2012	620,624	2020	1,257,252
2013	659,178	2021	1,391,544
2014	721,493		

The table reports the absolute values of CEO compensation from 2007 and 2021. CEO compensation data is obtained from CSMAR database and calculated as the sum of base salary, bonuses and commissions.

Table 4.3 summarises variables. As shown in the table, the average value of the logarithm form of CEO compensation is 13.373 with a standard deviation of 0.632, which is very similar to the values reported by Conyon & He (2011), Chan et al. (2022) and Kong et al. (2022). The average values for three distinct management-friendly board indicators are all around 30%, suggesting that about one-third of the sample has a friendly board. Besides, the average values of return on equity and market-to-book ratio are 0.017 and 2.241, which are analogous to the statistics reported by Chan et al. (2022). The reported ratio of R&D expenditure to total sales is 0.032. Around 50% of the sample firms are state-owned firms and less than 6% of CEOs are female. Overall, the reported summary statistics are found to be very similar to the prior work related to CEO compensation in the

Chinese market.

Table 4.3
Summary statistics

Variable	Mean.	S.D.	Min.	Med.	Max.	Obs.
Pay	13.373	0.632	12.37	13.370	14.385	15,944
Relative	0.388	0.487	0.000	0.000	1.000	15,944
Duality	0.382	0.486	0.000	0.000	1.000	15,944
Dependence	0.380	0.073	0.188	0.333	0.800	15,944
ROE	0.017	0.019	−0.001	0.009	0.058	15,944
RD	0.032	0.022	0.002	0.031	0.073	15,944
LnAssets	22.285	1.053	20.758	22.171	24.060	15,944
Vol	0.125	0.044	0.068	0.117	0.208	15,944
Leverage	0.062	0.069	0.000	0.034	0.199	15,944
MB	2.241	1.402	0.690	1.813	5.102	15,944
Board	2.296	0.209	1.946	2.303	2.639	15,944
Age	3.899	0.110	3.714	3.912	4.060	15,944
Gender	0.058	0.234	0.000	0.000	1.000	15,944
State	0.496	0.500	0.000	0.000	1.000	15,944

The table reports summary statistics for the variables used in the estimations. Data are obtained from the CSMAR database from 2007 to 2021. *Pay* is measured by the natural logarithm of salary, bonus and commissions. *Relative* is a dummy variable taking the value of one if a relative of the CEO is sitting on the board, and zero otherwise. *Duality* is a dummy variable taking the value of one if the CEO of a firm is also the chairman, and zero otherwise. *Dependence* is the ratio of inside directors on the board. *ROE* is measured as the ratio of return on the market value of equity. *RD* is measured as the ratio of R&D expenditure on total sales. *LnAssets* is measured as the natural logarithm of total assets. *Vol* is measured as the standard deviation of monthly stock returns in the previous year. *Leverage* is measured as the ratio of total debt to total assets. *MB* is measured as the ratio of the market value of equity to the book value of equity. *Board* is the log value of the number of individuals on the board. *Age* is the natural logarithm of CEO age. *Gender* equals one if a CEO is female, and zero otherwise. *State* is a dummy variable which equals one if a firm is a state-owned firm, and zero otherwise.

The univariate analyses based on different measures of a friendly board are presented in Table 4.4. Some findings can be concluded from this table. Taking the first panel as an example, first, CEOs are paid higher when firms have a management-friendly board. This is in line with Cingano & Rosolia (2012) and Coles et al. (2012) that CEOs supervised by friendly boards receive higher compensation. Second, the average value of return on the market value of equity for firms with a friendly board measured as *Relative* is 0.017. Compared with 0.016 for those firms without friendly boards, the statistics suggest that firms with management-friendly boards perform slightly better. Third, firms with a friendly board invest more in R&D projects, which is consistent with the findings concluded by Stein (1989), Xu (2009), Antia et al. (2010) and Kang et al. (2018) that a friendly board motivates

firms to innovate. In addition, a management-friendly board is more likely to hire a female CEO as the summary statistics show that the mean value of *Gender* is 0.088 when *Relative* = 1, compared to 0.040 when firms without friendly boards. Similar conclusions can be also achieved when the sample is classified by alternative measures of a management-friendly board — *Duality* and *Dependence*.

Table 4.4
Univariate analysis

	N.	Mean	S.D.	Min.	Medium	Max.	N.	Mean	S.D.	Min.	Medium	Max.
				Relative = 1						*Relative* = 0		
Pay	1,161	13.375	0.618	12.370	13.372	14.385	1,640	13.372	0.641	12.37	13.369	14.385
ROE	1,161	0.017	0.017	−0.001	0.009	0.058	1,640	0.016	0.019	−0.001	0.009	0.058
RD	1,161	0.034	0.020	0.002	0.033	0.073	1,640	0.029	0.023	0.002	0.027	0.073
LnAssets	1,161	22.014	0.940	20.758	21.912	24.060	1,640	22.456	1.085	20.758	22.386	24.060
Vol	1,161	0.127	0.045	0.068	0.118	0.208	1,640	0.124	0.044	0.068	0.116	0.208
Leverage	1,161	0.053	0.063	0.000	0.024	0.199	1,640	0.068	0.071	0.000	0.041	0.199
MB	1,161	2.169	1.350	0.690	1.177	5.102	1,640	2.286	1.432	0.690	1.846	5.102
Board	1,161	2.240	0.201	1.946	2.197	2.639	1,640	2.332	0.205	1.946	2.303	2.639
Age	1,161	3.884	0.118	3.714	3.891	4.060	1,640	3.909	0.103	3.714	3.912	4.060
Gender	1,161	0.088	0.283	0.000	0.000	1.000	1,640	0.040	0.195	0.000	0.000	1.000
State	1,161	0.133	0.340	0.000	0.000	1.000	1,640	0.726	0.446	0.000	1.000	1.000
				Duality = 1						*Duality* = 0		
Pay	1,522	13.376	0.629	12.370	13.365	14.385	1,923	13.372	0.634	12.370	13.373	14.385
ROE	1,522	0.018	0.018	−0.001	0.009	0.058	1,923	0.016	0.019	−0.001	0.009	0.058
RD	1,522	0.034	0.022	0.002	0.033	0.073	1,923	0.030	0.022	0.002	0.029	0.073
LnAssets	1,522	22.136	1.020	20.758	21.985	24.060	1,923	22.377	1.063	20.758	22.293	24.06
Vol	1,522	0.127	0.045	0.068	0.119	0.208	1,923	0.124	0.044	0.068	1.116	0.208
Leverage	1,522	0.057	0.067	0.000	0.026	0.199	1,923	0.066	0.069	0.000	0.039	0.199

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Table 4.4 – continued from previous page

	N.	Mean	S.D.	Min.	Medium	Max.	N.	Mean	S.D.	Min.	Medium	Max.
MB	1,522	2.239	1.384	0.690	1.823	5.102	1,923	2.242	1.413	0.690	1.800	5.102
Board	1,522	2.273	0.212	1.946	2.197	2.639	1,923	2.311	0.205	1.946	2.303	2.639
Age	1,522	3.916	0.109	3.714	3.932	4.060	1,923	3.889	0.109	3.714	3.892	4.060
Gender	1,522	0.063	0.243	0.000	0.000	1.000	1,923	0.055	0.228	0.000	0.000	1.000
State	1,522	0.360	0.480	0.000	0.000	1.000	1,923	0.581	0.493	0.000	1.000	1.000
	Dependence = 1						*Dependence* = 0					
Pay	1,992	13.379	0.631	12.370	13.382	14.385	2,129	13.368	0.633	12.370	13.362	14.385
ROE	1,992	0.017	0.018	−0.001	0.009	0.058	2,129	0.017	0.019	−0.001	0.010	0.058
RD	1,992	0.032	0.022	0.002	0.032	0.073	2,129	0.030	0.022	0.002	0.030	0.073
LnAssets	1,992	22.251	1.048	20.758	22.128	24.060	2,129	22.315	1.057	20.758	22.219	24.060
Vol	1,992	0.126	0.045	0.068	0.118	0.208	2,129	0.124	0.044	0.068	0.116	0.208
Leverage	1,992	0.061	0.068	0.000	0.199	0.033	2,129	0.064	0.070	0.000	0.036	0.199
MB	1,992	2.280	1.404	0.690	1.866	5.102	2,129	2.206	1.399	0.690	1.772	5.102
Board	1,992	2.260	0.246	1.946	2.302	2.639	2,129	2.328	0.162	1.946	2.303	2.639
Age	1,992	3.901	0.110	3.714	3.912	4.060	2,129	3.898	0.109	3.714	3.912	4.060
Gender	1,992	0.072	0.259	0.000	0.000	1.000	2,129	0.046	0.209	0.000.	0.000	1.000
State	1,992	0.443	0.497	0.000	1.000	1.000	2,129	0.443	0.497	0.000	0.000	1.000

4.6.2 Testing the Monitoring Role of a Friendly Board

To examine the monitoring function played by a friendly board, the following models are constructed,

$$Pay_{i,t} = \alpha_0 + \alpha_1 Relative_{i,t-1} + \alpha_2 \left(Relative_{i,t-1} \times ROE_{i,t-1}\right) + \alpha_3 ROE_{i,t-1} \quad (4.1)$$
$$+\lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it},$$
$$Pay_{i,t} = \alpha_0 + \alpha_1 Duality_{i,t-1} + \alpha_2 \left(Duality_{i,t-1} \times ROE_{i,t-1}\right) + \alpha_3 ROE_{i,t-1} \quad (4.2)$$
$$+\lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it},$$
$$Pay_{i,t} = \alpha_0 + \alpha_1 Dependence_{i,t-1} + \alpha_2 \left(Dependence_{i,t-1} \times ROE_{i,t-1}\right) + \alpha_3 ROE_{i,t-1} \quad (4.3)$$
$$+\lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}.$$

where *Pay* is the logarithm form of CEO total cash-based compensation, including salary, bonuses and commissions. *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly board measures: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. *ROE* is the return on the market value of equity. X represents a vector of firm-level control variables, including R&D expenditure (*RD*), measured as the ratio of R&D expenditure to total sales; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Leverage*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; growth opportunities (*MB*), indicated as the ratio of the market value of equity to the book value of equity; board size (*Board*), measured as the logarithm form of the total number of directors on the board; CEO age (*Age*), calculated as the logarithm form of CEO age; CEO gender (*Gender*), which equals one for a female CEO, and zero otherwise, and state (*State*), which is coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period following the research of Makri

et al. (2006), Chhaochharia & Grinstein (2009) and Banker et al. (2012).

It is expected that, in the above models, the coefficients at *ROE* are positive, showing a positive link between CEO pay and firm performance. In addition, the coefficients at all the interaction terms: $Relative_{i,t-1} \times ROE_{i,t-1}$, $Duality_{i,t-1} \times ROE_{i,t-1}$, and $Dependence_{i,t-1} \times ROE_{i,t-1}$ are expected to be significant, showing the monitoring effects of friendly boards on the pay-for-performance link.

The estimated results are shown in Table 4.5. According to which, the coefficients at *ROE* are statistically significant and positive across three columns. This result echoes prior studies by Mengistae & Xu (2004), Firth et al. (2007) and Chhaochharia & Grinstein (2009) that CEO compensation in the Chinese market is positively linked to firm performance. Focusing on the moderating effect of a friendly board, the coefficients at $Relative_{i,t-1} \times ROE_{i,t-1}$, $Duality_{i,t-1} \times ROE_{i,t-1}$, and $Dependence_{i,t-1} \times ROE_{i,t-1}$ are statistically significant and negative, suggesting that the pay-for-performance link is weakened by a management-friendly board. This is in line with prior studies by Adams & Ferreira (2007) and Kang et al. (2018) that a friendly board has weaker monitoring efficiency and by Armstrong et al. (2015) that managerial compensation is used as a tool by the board team to function its monitoring duty. Hence, an attenuated effect of a management-friendly board on the link between CEO compensation and firm performance is observed. From the econometric perspective and taking the first column as an example, the estimated parameters suggest that a one standard deviation increase in firm performance (*ROE*) is associated with an approximately 7% increase in CEO compensation, and a positive link between CEO pay and firm performance is weakened by around 75% if a firm has a friendly board.

Among other variables shown in the table, although the coefficient at *Dependence* is not significant but positive, the coefficients at *Relative* and *Duality* are statistically significant and positive. Taking together, this suggests that CEOs get highly paid from management-friendly boards. In addition, the results suggest that firm size, firms' growth opportunity and CEO age are positively linked to CEO compensation while firms' risk and leverage are negatively related to it. Similar results can be also found in the prior studies of Lewellen et al. (1987), Smith Jr & Watts (1992), John & John (1993), Lambert et al. (1993), Harvey & Shrieves

(2001) and Kuo & Yu (2014).

Table 4.5
Testing the monitoring role of a friendly board

VARIABLES	(1) *Pay*	(2) *Pay*	(3) *Pay*
Relative	0.035**		
	(0.017)		
Relative × *ROE*	−2.805***		
	(0.465)		
Duality		0.027**	
		(0.012)	
Duality × *ROE*		−2.861***	
		(0.416)	
Dependence			0.042
			(0.068)
Dependence × *ROE*			−4.317*
			(2.553)
ROE	3.710***	2.990***	4.296***
	(0.306)	(0.295)	(0.993)
RD	−0.031**	−0.022*	−0.020*
	(0.011)	(0.013)	(0.011)
LnAssets	0.363***	0.364***	0.364***
	(0.007)	(0.007)	(0.007)
Vol	−0.194**	−0.174**	−0.175**
	(0.081)	(0.081)	(0.081)
Lev	−0.455***	−0.462***	−0.462***
	(0.072)	(0.072)	(0.072)
MB	0.036***	0.036***	0.036***
	(0.003)	(0.003)	(0.003)
Board	0.080***	0.079***	0.082***
	(0.020)	(0.020)	(0.020)
Age	0.264***	0.255***	0.269***
	(0.042)	(0.043)	(0.042)
Gender	0.016	0.015	0.017
	(0.022)	(0.022)	(0.022)
State	−0.067	−0.068	−0.064
	(0.062)	(0.062)	(0.062)
Constant	4.011***	4.023***	3.967***
	(0.203)	(0.205)	(0.204)
Observations	15,944	15,944	15,944
R-squared	0.222	0.221	0.221
Firms	2,466	2,466	2,466
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results for Section 4.6.2. *Pay* is measured as the log value of the sum of salary, bonuses and commissions. Column (1) to (3) use *Relative*, *Duality* and *Dependence* to indicate a friendly board, respectively. The definition of other variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.6.3 Testing the Advisory Role of a Friendly Board

In Section 4.6.2, empirical work has been done to examine the monitoring effect of a friendly board on the pay-for-performance link. It is found that as a management-friendly board has weaker monitoring efficiency, it also weakens a positive link between CEO pay and firm performance. However, according to Adams & Ferreira (2007), a friendly board has its information advantage, therefore, it performs better on the board's advisory function.

To examine the advisory function of a friendly board, this section examines the moderating effect of a friendly board on the link between CEO pay and R&D expenditure. To test the hypothesis, the following models are estimated,

$$Pay_{i,t} = \beta_0 + \beta_1 Relative_{i,t-1} + \beta_2 \left(Relative_{i,t-1} \times RD_{i,t-1}\right) + \beta_3 RD_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{4.4}$$

$$Pay_{i,t} = \beta_0 + \beta_1 Duality_{i,t-1} + \beta_2 \left(Duality_{i,t-1} \times RD_{i,t-1}\right) + \beta_3 RD_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{4.5}$$

$$Pay_{i,t} = \beta_0 + \beta_1 Dependence_{i,t-1} + \beta_2 \left(Dependence_{i,t-1} \times RD_{i,t-1}\right) + \beta_3 RD_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}. \tag{4.6}$$

where *Pay* is the logarithm form of CEO total cash-based compensation, including salary, bonuses and commissions. *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly board measures: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. *RD* is the ratio of R&D expenditure to total sales. X represents a vector of firm-level control variables, including firm performance (*ROE*), measured as the return on the market value of equity; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Leverage*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; growth opportunities (*MB*), indicated as the ratio of the market value of equity to the book value of equity; board size (*Board*), measured

as the logarithm form of the total number of directors on the board; CEO age (*Age*), calculated as the logarithm form of CEO age; CEO gender (*Gender*), which equals one for a female CEO, and zero otherwise, and state (*State*), which coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period following the research of Makri et al. (2006), Chhaochharia & Grinstein (2009) and Banker et al. (2012).

To be consistent with hypotheses, it is expected that the coefficients at *RD* are statistically significant and negative, showing a negative link between CEO pay and R&D expenditure. Besides, if the coefficients at $Relative_{i,t-1} \times RD_{i,t-1}$, $Duality_{i,t-1} \times RD_{i,t-1}$, and $Dependence_{i,t-1} \times RD_{i,t-1}$ are significant and positive, the results echo hypothesis 2a and show that a management-friendly board has the superior information advantage on CEO's decisions, to show their support, a negative link between CEO compensation and R&D expenditure is observed to be mitigated by a friendly board as the board is more likely to avoid CEO compensation risk and implement the behaviour-based pay in terms of R&D investments. If the estimated parameters at $Relative_{i,t-1} \times RD_{i,t-1}$, $Duality_{i,t-1} \times RD_{i,t-1}$, and $Dependence_{i,t-1} \times RD_{i,t-1}$ are negative, the results are in line with hypothesis 2b that less independent boards are more likely to collude with CEOs, especially in terms of R&D projects which come with the high level of information asymmetry, leading to poor firm value, thus lower CEO pay.

The estimated results are reported in Table 4.6. According to which, the coefficients at *RD* are statistically significant and negative, showing a negative association between CEO compensation and R&D expenditure. This echoes studies by Bizjak et al. (1993), Chambers et al. (2002), Cheng (2004) and Santosuosso et al. (2016) that profits generated by R&D investments are unpredictable, causing a negative impact on firm profitability, thus negatively affecting CEO pay. This problem becomes more serious in the Chinese market since CEOs in the majority of Chinese firms, especially state-owned firms, are paid only on the cash basis, deepening the negative correlation between CEO cash-based compensation and incurred R&D expense. However, the estimated coefficients at $Relative \times RD$,

Duality × *RD*, and *Dependence* × *RD* are statistically significant but positive, suggesting that a friendly board weakens the negative link between CEO pay and R&D spending. This indicates a bright side of a friendly board that a friendly board dues diligence on the advisory role and has the information advantage about the CEO's decision making. Facing an R&D investment, a management-friendly board uses its information advantage to compensate CEOs with their appropriate decisions, preventing CEO compensation risk from R&D spending. From an econometric perspective, the results indicate that a one standard deviation increase in R&D spending is associated with a 0.08% reduction in CEO pay, and a negative link between CEO pay and R&D spending is weakened by 200% if a firm has a friendly board.

Among the controls, a positive link between CEO pay and firm performance persists. The signs of the estimated parameters among other control variables are consistent with prior studies and also similar to the results reported in Section 4.6.2.

Table 4.6
Testing the advisory role of a friendly board

VARIABLES	(1) *Pay*	(2) *Pay*	(3) *Pay*
Relative	0.007		
	(0.012)		
Relative × *RD*	0.076***		
	(0.029)		
Duality		0.006	
		(0.012)	
Duality × *RD*		0.029**	
		(0.014)	
Dependence			0.043
			(0.093)
Dependence × *RD*			0.095***
			(0.031)
ROE	2.686***	2.673***	2.638***
	(0.257)	(0.257)	(0.257)
RD	−0.038*	−0.008*	−0.020*
	(0.022)	(0.006)	(0.011)
LnAssets	0.361***	0.361***	0.361***
	(0.007)	(0.007)	(0.007)
Vol	−0.143*	−0.144*	−0.147*
	(0.082)	(0.082)	(0.082)
Lev	−0.454***	−0.452***	−0.452***
	(0.072)	(0.072)	(0.072)
MB	0.035***	0.035***	0.034***
	(0.003)	(0.003)	(0.003)
Board	0.074***	0.075***	0.079***
	(0.020)	(0.020)	(0.020)
Age	0.251***	0.251***	0.259***
	(0.043)	(0.043)	(0.043)
Gender	0.008	0.008	0.008
	(0.022)	(0.022)	(0.022)
State	−0.069	−0.069	−0.066
	(0.062)	(0.062)	(0.062)
Constant	4.135***	4.135***	4.083***
	(0.208)	(0.208)	(0.209)
Observations	15,944	15,944	15,944
R-squared	0.215	0.214	0.215
Firms	2,466	2,466	2,466
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results for Section 4.6.3. *Pay* is measured as the log value of the sum of salary, bonuses and commissions. Column (1) to (3) use *Relative*, *Duality* and *Dependence* to indicate a friendly board, respectively. The definition of other variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.7 Robustness Checks

This section includes the robustness checks for the empirical work conducted in Section 4.6.2 and 4.6.3. Specifically, this section examines whether the results remain unchanged using the alternative measures of R&D expenditure — the expensed proportion of R&D spending, and the alternative measure of a friendly board — the proportion of number of relatives of the CEO on the board. In addition, this section also discusses the potential endogeneity in Section 4.6.2 and 4.6.3.

4.7.1 Alternative Measures of R&D Investment

According to the Article 7 of "Accounting Standards for Business Enterprises No.6 – Intangible Assets" enacted by the Ministry of Finance in China, when R&D expenditure satisfies some requirements [4], a portion of it can be capitalised and treated as intangible assets in financial reports or as expenditure incurred in the current year if unsatisfied. Therefore, the first robustness check involves using the alternative measure of R&D expenditure — the uncapitalised proportion of R&D spending and re-examining empirical models in Section 4.6.3. The intuition is that if R&D spending is the cash outlay which reduces the firm short-term accounting and firm performance, and thus CEO compensation, the uncapitalised part of R&D expenditure should deepen this issue as it is the immediate expense shown in the financial reports.

The estimated results are reported in Table 4.7 and are very similar to the findings concluded in Section 4.6.3 [5]. The estimated coefficients at *EXRD* are significant and negative, most importantly, larger than the estimated values at *RD* in Section 4.6.3. The results indicate that as the immediate cash outflow,

[4]The R&D expenditures can be treated as an intangible asset if (1) the product has been completed, and is technically feasible to be used and sold; (2) the product is intended to be completed, used and sold. The firm should be able to clearly explain its purpose in developing the product; (3) The firm can prove the means and opportunities for the R&D product to generate returns in the market. If such a product is used internally, the firm also needs to prove its usefulness within the firm; (4) The firm must have sufficient technological, financial and other resources to support complete innovation, and also have the ability to use and sell it; and (5) The expenditure attributable to the development stage of the innovation must be able to be reliably measured.

[5]The number of observations are reduced in this section since some firms do not disclose in details whether their R&D spending is capitalised or expensed.

the expensed part of R&D expenditure dominates the capitalised part of it in terms of the reduction in CEO pay. Consistent with the prior findings, the results suggest that the negative association between CEO pay and uncapitalised R&D expenditure is attenuated by a management-friendly board.

Table 4.7
CEO compensation, expensed R&D spending and a friendly board

VARIABLES	(1) *Pay*	(2) *Pay*	(3) *Pay*
Relative	−0.034		
	(0.134)		
Relative × *EXRD*	0.118***		
	(0.028)		
Duality		−0.034	
		(0.134)	
Duality × *EXRD*		0.121***	
		(0.028)	
Dependence			−0.239
			(0.162)
Dependence × *EXRD*			0.540**
			(0.273)
EXRD	−0.043**	−0.042**	−0.189*
	(0.020)	(0.020)	(0.104)
ROE	3.015***	2.977***	2.959***
	(0.364)	(0.366)	(0.366)
LnAssets	0.370***	0.372***	0.360***
	(0.012)	(0.012)	(0.012)
Vol	−0.730***	−0.736***	−0.455***
	(0.116)	(0.116)	(0.122)
Lev	−0.596***	−0.591***	−0.578***
	(0.106)	(0.106)	(0.106)
MB	0.017***	0.017***	0.025***
	(0.005)	(0.005)	(0.005)
Board	−0.167***	−0.167***	−0.150***
	(0.030)	(0.030)	(0.030)
Age	0.563***	0.561***	0.582***
	(0.065)	(0.065)	(0.065)
Gender	−0.037	−0.038	−0.030
	(0.038)	(0.038)	(0.038)
State	−0.150*	−0.152**	−0.140*
	(0.076)	(0.076)	(0.076)
Constant	3.378***	3.369***	3.450***
	(0.356)	(0.356)	(0.355)
Observations	7,650	7,650	7,650
R-squared	0.182	0.182	0.187
Firms	1,689	1,689	1,689
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the results mirroring models in Table 4.6 except using the alternative measure of R&D expenditure — the expensed part of R&D spending. *Pay* is measured as the log value of the sum of salary, bonuses and commissions. Column (1) to (3) use *Relative*, *Duality* and *Dependence* to indicate a friendly board, respectively. The definition of other variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.7.2 Alternative Measures of a Friendly Board

In Section 4.6.2 and 4.6.3, one of the friendly board measures is whether a relative of the CEO is sitting on the board. However, according to Kang et al. (2018) and Wintoki & Xi (2019), a binary indicator of CEO social ties may be so weak to adequately capture a CEO's social connection. Following their methods, in this section, a friendly board measure is replaced with a stronger indicator which is calculated as the ratio of the number of relatives of the CEO sitting on the board to the total number of board members. The empirical work then is re-conducted using models both in Section 4.6.2 and 4.6.3.

The results are reported in Table 4.8. Column (1) mirrors the empirical work in Section 4.6.2. According to which, the coefficient at ROE is statistically significant and positive, showing a positive pay-for-performance link. Compared to the results in Section 4.6.2, the coefficient at $PerRela \times ROE$ is negative but much larger than the value reported in column (1) of Section 4.6.2. This indicates that the monitoring efficiency weakens as the friendliness of the boards becomes stronger, thus observing a larger attenuating effect of a friendly board on the pay-for-performance link.

Turning to the column (2) of Table 4.8 which mirrors the empirical work in Section 4.6.3, the results remain intact using the alternative measure of a friendly board.

Table 4.8
Alternative measure of a friendly board

VARIABLES	(1) *Pay*	(2) *Pay*
PerRela	0.002	0.255***
	(0.101)	(0.095)
PerRela × *ROE*	−15.408***	
	(2.635)	
PerRela × *RD*		0.073**
		(0.029)
ROE	3.507***	2.699***
	(0.289)	(0.257)
RD	−0.036*	−0.038*
	(0.020)	(0.022)
LnAssets	0.362***	0.360***
	(0.007)	(0.007)
Vol	−0.193**	−0.146*
	(0.081)	(0.081)
Lev	−0.460***	−0.455***
	(0.072)	(0.072)
MB	0.036***	0.034***
	(0.003)	(0.003)
Board	0.076***	0.069***
	(0.020)	(0.020)
Age	0.264***	0.249***
	(0.042)	(0.043)
Gender	0.016	0.010
	(0.022)	(0.022)
State	−0.066	−0.067
	(0.062)	(0.062)
Constant	4.063***	4.191***
	(0.204)	(0.208)
Observations	15,944	15,944
R-squared	0.223	0.215
Firms	2,466	2,466
Firm FE	YES	YES
Year FE	YES	YES

The table reports the results re-conducted in Section 4.6.2 and 4.6.3 using the alternative measure of a management-friendly board. A friendly board is measured as the ratio of the number of relatives of the CEOs on the board to the total number of board members. *Pay* is measured as the log value of the sum of salary, bonuses and commissions. The definition of other variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.7.3 Model Combination

To clearly show the distinct impact of friendly boards, the monitoring and advisory roles of friendly boards are examined separately in different models and in different sub-sections (Section 4.6.2 and 4.6.3, respectively). This section combines two groups of models (Eq.(4.1)-Eq.(4.4)) together, to examine whether the results remain intact. The models are as followed,

$$\begin{aligned} Pay_{i,t} = \psi_0 + \psi_1 Relative_{i,t-1} + \psi_2 \left(Relative_{i,t-1} \times RD_{i,t-1}\right) \\ + \psi_2 \left(Relative_{i,t-1} \times ROE_{i,t-1}\right) \\ + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{4.7}$$

$$\begin{aligned} Pay_{i,t} = \psi_0 + \psi_1 Duality_{i,t-1} + \psi_2 \left(Duality_{i,t-1} \times RD_{i,t-1}\right) \\ + \psi_2 \left(Duality_{i,t-1} \times ROE_{i,t-1}\right) \\ + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{4.8}$$

$$\begin{aligned} Pay_{i,t} = \psi_0 + \psi_1 Dependence_{i,t-1} + \psi_2 \left(Dependence_{i,t-1} \times RD_{i,t-1}\right) \\ + \psi_2 \left(Dependence_{i,t-1} \times ROE_{i,t-1}\right) \\ + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}. \end{aligned} \tag{4.9}$$

where *Pay* is the logarithm form of CEO total cash-based compensation, including salary, bonuses and commissions. *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly board measures: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. X represents a vector of firm-level control variables, including firm performance (*ROE*), measured as the return on the market value of equity; *RD* is the ratio of R&D expenditure to total sales; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Leverage*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; growth opportunities (*MB*), indicated as the ratio of the market value of equity to the book value of equity; board size (*Board*), measured as the logarithm form of the total number of directors on the board; CEO age (*Age*), calculated as the logarithm form of CEO age; CEO gender (*Gender*),

which equals one for a female CEO, and zero otherwise, and state (*State*), which coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period following the research of Makri et al. (2006), Chhaochharia & Grinstein (2009) and Banker et al. (2012).

According to Table 4.9, the findings are very similar to the findings found in Section 4.6.2 and 4.6.3 where the monitoring and advisory roles of a friendly board are examined separately. First, the coefficients at *ROE* are statistically significant and positive, showing a positive pay-for-performance link. The estimated parameters at *Relative* × *ROE*, *Duality* × *ROE*, and *Dependence* × *ROE* are statistically significant and negative, suggesting that the pay-for-performance link is attenuated by a friendly board. Second, the coefficients at *RD* are consistently negative, and at *Relative* × *RD*, *Duality* × *RD*, and *Dependence* × *RD* are positive, indicating that the negative links between CEO compensation and R&D expenditure are mitigated by friendly boards.

To sum up, the results using the combined models are qualitatively unchanged. The findings reveal that a friendly board has weaker monitoring efficiency, thus deepening agency problems. On the other hand, a friendly board serves better as an advisor, mitigating the negative impact of R&D expenditure on CEO compensation.

To complete analyses, mirroring Section 4.7.1 and 4.7.2, employing the alternative measures of friendly boards and R&D expenditure but using the combined models, the results are reported in the Appendix Table A2. The findings remain unchanged.

Table 4.9
Model combination

VARIABLES	(1) *Pay*	(2) *Pay*	(3) *Pay*
Relative	0.038*		
	(0.020)		
Relative × *ROE*	−2.945***		
	(0.471)		
Relative × *RD*	0.060**		
	(0.028)		
Duality		0.026**	
		(0.011)	
Duality × *ROE*		−0.713*	
		(0.422)	
Duality × *RD*		0.073**	
		(0.029)	
Dependence			0.023
			(0.114)
Dependence × *ROE*			−3.067*
			(1.823)
Dependence × *RD*			0.119*
			(0.065)
ROE	3.755***	2.947***	3.530***
	(0.309)	(0.299)	(0.373)
RD	−0.040*	−0.038*	−0.032**
	(0.022)	(0.022)	(0.015)
LnAssets	0.360***	0.361***	0.361***
	(0.007)	(0.007)	(0.007)
Vol	−0.165**	−0.142*	−0.141*
	(0.081)	(0.082)	(0.082)
Lev	−0.442***	−0.453***	−0.454***
	(0.072)	(0.072)	(0.072)
MB	0.035***	0.035***	0.034***
	(0.003)	(0.003)	(0.003)
Board	0.075***	0.074***	0.078***
	(0.020)	(0.020)	(0.020)
Age	0.255***	0.249***	0.261***
	(0.043)	(0.043)	(0.043)
Gender	0.009	0.008	0.008
	(0.022)	(0.022)	(0.022)
State	−0.068	−0.070	−0.067
	(0.062)	(0.062)	(0.062)
Constant	4.128***	4.143***	4.103***
	(0.206)	(0.208)	(0.210)
Observations	15,944	15,944	15,955
R-squared	0.217	0.215	0.214
Firms	2,466	2,466	2,466
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the results for Eq.(4.7). The definition of variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.7.4 Instrumental Approach

To overcome the potential endogeneity issue due to the reverse causality between CEO compensation and a friendly board in both Section 4.6.2 and 4.6.3, and between CEO compensation and R&D expenditure in Section 4.6.3, a Two-Stage-Least Square method is used in this section. Specifically, two instrument variables are used for a friendly board measure. Following Hochberg & Lindsey (2010), Kang et al. (2018) and Ren et al. (2021), the first instrument variables for friendly board measures (*Relative*,*Duality*, and *Dependence*) are measured as the average value of *Relative*, *Duality*, and *Dependence* of all other firms in the same industry and the same year, respectively. The intuition is that firms suffer from peer pressure from other firms in the same industry. Whether a firm has a friendly board is likely to be affected by whether the majority of other firms in the same industry have friendly boards, thereby satisfying the relevance condition. On the other hand, the exclusion condition is also satisfied as the CEO compensation from a particular firm is unlikely to be affected by the industry trend of having a friendly board. The second instrument involves both the CEO and directors' educational backgrounds. A dummy variable equals one if one of the directors and the CEO have attended the same university, and zero otherwise. This is inspired by the studies of Westphal (1999) and Adams & Ferreira (2007) that CEO personal ties increase information sharing, thus constructing a management-friendly board. However, whether the CEO and one of a director's have attended the same university is unlikely to affect a particular CEO's compensation.

Mirroring Section 4.6.2 but using 2SLS method, the results are shown in Table 4.10 and the corresponding first-state results are shown in Appendix Table A3. First, the scores for the Klerbergen-Paap rk LM under-identification tests suggest that all the P-values are less than 1%, thus, the null hypothesis that the equation is under-identified can be rejected. Second, the Hansen-J statistics are not statistically significant at any significance level, therefore, the null hypothesis that the instruments are valid instruments cannot be rejected. Taken together, both statistics show that the instruments are valid.

Focusing on the estimated parameters, the coefficients at *ROE* are statistically significant and positive, while those at the interaction terms of *Relative* $\times$ *ROE*,

Duality $\times$ *ROE*, and *Dependence* $\times$ *ROE* are significant and negative. The results are very similar to the results in Section 4.6.2 and the conclusions are the same. A management-friendly board has weaker monitoring efficiency which lessens the positive link between CEO pay and firm performance.

Table 4.10
Testing the monitoring role — Instrument variable approach

VARIABLES	(1) *Pay*	(2) *Pay*	(3) *Pay*
Relative	0.051		
	(0.032)		
Relative × *ROE*	−3.274***		
	(1.246)		
Duality		0.278	
		(0.271)	
Duality × *ROE*		−8.999*	
		(4.784)	
Dependence			13.982**
			(6.913)
Dependence × *ROE*			−1.620***
			(0.578)
ROE	4.574***	6.640***	5.917***
	(0.539)	(1.771)	(1.550)
LnAssets	0.170***	0.168***	0.323***
	(0.011)	(0.012)	(0.025)
Vol	0.297***	0.326***	−0.517**
	(0.096)	(0.098)	(0.231)
Lev	−0.290***	−0.276***	−0.305**
	(0.072)	(0.079)	(0.135)
MB	0.022***	0.022***	0.022***
	(0.003)	(0.004)	(0.003)
Board	0.064***	0.056**	0.505**
	(0.021)	(0.024)	(0.214)
Age	0.007	−0.148	0.251***
	(0.048)	(0.209)	(0.078)
Gender	−0.003	−0.012	−0.002
	(0.025)	(0.027)	(0.045)
State	0.025	0.009	0.077
	(0.062)	(0.065)	(0.144)
Observations	15,705	15,705	15,705
R-squared	0.283	0.254	0.229
Firms	2,227	2,227	2,227
Under-identification	151.510***	31.661***	6.602*
Hansen-J Statistics	0.115	0.847	0.388
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results using the two-stage Least Square approach. The corresponding first-stage results are shown in Table A3 in the Appendix. The definition of variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Turning to the estimations in Section 4.6.3 where the effect of advisory role of a friendly board is examined, apart from the potential reverse causality between CEO pay and a friendly board, Eq.(4.4) also faces the potential reverse causality between CEO pay and R&D spending. Hence, three additional instrument variables are employed in this model. First, a dummy variable (*RDBack*) equals one if one of the independent directors has the innovation-related working experience, and zero otherwise. Osma (2008) and Dalziel et al. (2011) show a negative association between independent directors' R&D working experience and R&D expenditure as they argue that independent directors with sufficient R&D-related working experience cut unnecessary R&D spending, thus promoting innovation efficiency. In contrast, Barker III & Mueller (2002) show that independent directors with R&D related working experience promote R&D spending by providing technical advice on R&D projects. Although these studies reached contradicted results, they prove that independent directors with R&D-related working experience significantly affect a firm's R&D investment level. Second, independent directors who work at a university also promote R&D investment due to having the access to cutting-edge technologies. Therefore, the second instrument variable (*Academic*) equals one if the board has an independent director who is working at a university, and zero otherwise. Third, if one of the independent directors has overseas studying or working experience, they are more risk-seeking and invest more in R&D projects (Xiang & Yi 2022). The third instrument variable (*Oversea*) takes a value of one if an independent director has overseas studying or working experience, and zero otherwise.

The 2SLS results are reported in Table 4.11. According to which, the results are consistent with the findings in Section 4.6.3. The coefficients at *RD* are statistically significant and negative across columns, while those at $Relative \times RD$, $Duality \times RD$ and $Dependence \times RD$ are significant and positive. These results indicate a bright side of a friendly board that a friendly board has information advantages over CEO's decisions, thus, weakening the negative association between CEO pay and R&D expenditure.

Table 4.11
Testing the advisory role — Instrument variable approach

VARIABLES	(1) *Pay*	(2) *Pay*	(3) *Pay*
Relative	0.250**		
	(0.100)		
Relative × *RD*	0.499***		
	(0.184)		
Duality		0.149*	
		(0.080)	
Duality × *RD*		0.272*	
		(0.155)	
Dependence			2.376***
			(0.759)
Dependence × *RD*			4.217***
			(1.431)
ROE	3.360***	3.182***	2.821***
	(0.406)	(0.399)	(0.285)
RD	−0.389**	−0.243*	−1.601***
	(0.152)	(0.135)	(0.542)
LnAssets	0.341***	0.349***	0.358***
	(0.011)	(0.011)	(0.008)
Vol	−0.041	−0.079	−0.124
	(0.097)	(0.093)	(0.088)
Lev	−0.359***	−0.425***	−0.451***
	(0.088)	(0.079)	(0.079)
MB	0.041***	0.036***	0.034***
	(0.004)	(0.004)	(0.003)
Board	0.073***	0.082***	0.079***
	(0.023)	(0.023)	(0.023)
Age	0.248***	0.256***	0.289***
	(0.052)	(0.052)	(0.051)
Gender	−0.010	0.015	−0.001
	(0.028)	(0.027)	(0.027)
State	−0.054	−0.034	−0.083
	(0.067)	(0.071)	(0.071)
Observations	15,507	15,507	15,507
R-squared	0.108	0.168	0.142
Firms	2,220	2,220	2,220
Under-identification	60.118***	70.416***	49.257***
Hansen-J Statistics	6.137	11.863	8.277
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results using the two-stage Least Square approach. The corresponding first-stage results are shown in Table A3 in the Appendix. The definition of variables can be found in Table A1. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.8 Extensions

In the above sections, empirical work has been done and find both the dark and bright side of a friendly board. On the one hand, a friendly board has weaker monitoring efficiency, thus weakening the pay-for-performance link. On the other hand, a friendly board better performs its advisory role and weakens a negative association between CEO compensation and R&D expenditure. Taken together, the above analyses may imply that firms with a friendly board invest more in R&D projects since the results indicate that CEOs supervised by a friendly board are reluctant to take risk as a friendly board assesses the CEO based less on firm performance, and also prevents CEOs from compensation risk facing the R&D investments. Therefore, in this section, empirical work is designed to examine whether the positive effect of a friendly board on a firm's level of investing in R&D projects exists, and also tests whether CEO pay indeed acts as the mechanism on this link. Besides, this section also involves examining whether the relatively higher R&D investments in management-friendly firms lead to better innovation outcomes. In addition, modern corporate governance mechanisms have been consistently emphasising the importance of independent boards with the belief that independent directors are good for firms. To coincide with the statement, finally, this section concludes with the examination of the effects of friendly boards on firm value.

4.8.1 R&D Expenditure and a Friendly Board

In the first step of this section, the empirical work is designed to examine the direct link of whether a friendly board increases R&D expenditure. The empirical models are as follows,

$$RD_{i,t} = \theta_0 + \theta_1 Relative_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{4.10}$$

$$RD_{i,t} = \theta_0 + \theta_1 Duality_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \tag{4.11}$$

$$RD_{i,t} = \theta_0 + \theta_1 Dependence_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}. \tag{4.12}$$

where *RD* is measured as the ratio of R&D expenditure to total sales. *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly board measures: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. Following R&D relevant literature (Scherer 1992, Cohen & Klepper 1996), a vector of control variables are selected, including firm performance (*ROE*), measured as the return on the market value of equity; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Lev*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; cash level (*Cash*), measured as the logarithm form of cash holding; firm age (*FirmAge*), measured as the number of years since the firm established, and state (*State*), which coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period.

The corresponding results are presented in Table 4.12. According to the table, although the coefficient at *Dependence* is not significant but positive, those at *Relative* and *Duality* are statistically significant and positive, showing a positive link between R&D expenditure and a friendly board.

Among the controls, the estimated parameters suggest that larger firms and firms with better performance invest more in R&D projects while those with higher leverage ratios and higher risk tend to decline the R&D investment. Besides, older firms get involved more in R&D. These results are consistent with the prior study of Lin et al. (2010).

Table 4.12
R&D expenditure and a friendly board

VARIABLES	(1) *RD*	(2) *RD*	(3) *RD*
Relative	0.082*		
	(0.046)		
Duality		0.090***	
		(0.028)	
Dependence			0.285
			(1.019)
ROE	2.359***	1.416**	1.416**
	(0.700)	(0.695)	(0.695)
LnAssets	0.286***	0.030	0.030
	(0.020)	(0.025)	(0.025)
Vol	−0.727***	−0.407*	−0.412*
	(0.224)	(0.223)	(0.223)
Lev	−1.107***	−0.805***	−0.794***
	(0.206)	(0.205)	(0.205)
Cash	−0.159	0.060	0.051
	(0.140)	(0.139)	(0.139)
FirmAge	0.079***	0.079***	0.080***
	(0.005)	(0.005)	(0.005)
State	−0.334*	−0.245	−0.241
	(0.177)	(0.175)	(0.175)
Constant	−3.671***	1.370**	1.754***
	(0.600)	(0.680)	(0.670)
Observations	14,878	14,878	14,878
R-squared	0.021	0.044	0.043
Firms	2,419	2,419	2,419
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results for Eq.(4.10). All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.8.2 R&D Expenditure, CEO Compensation and a Friendly Board

In the above section, empirical work has been done to find a positive link between R&D expenditure and friendly boards. It is expected that the mechanism which supports this positive association is CEO compensation. The reasons are as followed. In Section 4.6.2 where the effect of monitoring role played by friendly boards is examined, the results suggest that as a friendly board plays the weakened monitoring role, it reduces the positive link between CEO pay and firm performance. However, thinking of it from another way, the results also imply that a management-friendly board diminishes the ex-post riskiness of CEO's decisions that CEOs are less likely to be fired by the board after a poor performance, so that CEOs supervised by such a board are reluctant to take risks, thus making more R&D investment decisions. Similarly, Section 4.6.3 examines the effect of friendly boards' advisory role and finds the mitigated effect of a friendly board on the negative link between CEO pay and R&D outlay. This also indicates that CEOs receive additional remuneration from friendly boards when their compensation suffer from R&D investments. Therefore, from these perspectives, friendly boards promote firms to increase R&D investments by motivating CEOs through their compensation package.

Hence, in the second step, the empirical work is going to examine whether the increased R&D expenditure by a friendly board is enhanced by CEO compensation. To do so, the following model specifications are examined,

$$RD_{i,t} = \theta_0 + \theta_1 Relative_{i,t-1} + \theta_2 \left(Relative_{i,t-1} \times Pay_{i,t-1}\right) + \theta_3 Pay_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \quad (4.13)$$

$$RD_{i,t} = \theta_0 + \theta_1 Duality_{i,t-1} + \theta_2 \left(Duality_{i,t-1} \times Pay_{i,t-1}\right) + \theta_3 Pay_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \quad (4.14)$$

$$RD_{i,t} = \theta_0 + \theta_1 Dependence_{i,t-1} + \theta_2 \left(Dependence_{i,t-1} \times Pay_{i,t-1}\right) + \theta_3 Pay_{i,t-1} + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}. \quad (4.15)$$

where *RD* is measured as the ratio of R&D expenditure to total sales. *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly boards measure: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. *Pay* refers to the logarithms form of CEO total cash-based compensation, including cash, salary and bonuses. Three distinct friendly board measures are interacted with CEO pay to examine the effect of CEO pay on the links between R&D expenditure and friendly boards. A vector of control variables includes firm performance (*ROE*), measured as the return on the market value of equity; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Lev*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; cash level (*Cash*), measured as the logarithm form of cash holding; firm age (*FirmAge*), measured as the number of years since the firm established, and state (*State*), which coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period.

The results are shown in Table 4.13. According to which, the estimated θ_1 are statistically significant and positive at the first two columns, showing a positive link between R&D expenditure and friendly boards. Besides, the coefficients at *Relative* × *Pay* and *Duality* × *Pay* are significant and positive, suggesting that the positive link between R&D expenditure and friendly boards can be enhanced by CEO compensation. These results echo the results in Section 4.6.2 and 4.6.3 that by weakening the monitoring efficiency and preventing CEOs from compensation risk, CEOs supervised by friendly boards are more risk-seeking and make more R&D-related investment decisions.

Table 4.13
R&D expenditure, CEO pay and a friendly board

VARIABLES	(1) *RD*	(2) *RD*	(3) *RD*
Relative	0.656*		
	(0.379)		
Relative × *Pay*	0.054*		
	(0.030)		
Duality		0.600**	
		(0.278)	
Duality × *Pay*		0.038**	
		(0.018)	
Dependence			0.020
			(0.396)
Dependence × *Pay*			0.021
			(0.032)
Pay	0.159	0.169	0.134
	(0.130)	(0.136)	(0.110)
ROE	1.756**	1.743**	0.636**
	(0.698)	(0.697)	(0.261)
LnAssets	0.006	0.001	−0.023**
	(0.025)	(0.025)	(0.009)
Lev	−0.774***	−0.797***	−0.197***
	(0.205)	(0.205)	(0.076)
Vol	−0.416*	−0.413*	−0.223***
	(0.223)	(0.222)	(0.084)
Cash	0.047	0.065	0.015
	(0.139)	(0.139)	(0.051)
FirmAge	0.073***	0.073***	0.011***
	(0.005)	(0.005)	(0.002)
State	−0.233	−0.242	0.033
	(0.175)	(0.175)	(0.065)
Constant	0.480	0.037	0.207
	(0.735)	(0.769)	(0.256)
Observations	14,878	14,878	14,878
R-squared	0.045	0.046	0.007
Firms	2,419	2,419	2,419
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results for Eq.(4.13). All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.8.3 Innovation, Friendly Boards and R&D Expenditure

Till this point, the empirical work has examined that a friendly board increases R&D expenditure through CEO compensation. The intuition is that a friendly board is less likely to fire the CEO after a poor performance and also prevents CEO from his/her compensation risk, thus motivating CEOs to make some risky investment decisions such as R&D projects. However, it is still worthy to examine whether the relative higher R&D outlay in friendly-board firms is a good attribute to innovation outcomes. To do so, the following empirical models are examined:

$$\begin{aligned} Patents_{i,t} = \phi_0 + \phi_1 Relative_{i,t-1} + \phi_2 \left(Relative_{i,t-1} \times RD_{i,t-1}\right) + \phi_3 RD_{i,t-1} \\ + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{4.16}$$

$$\begin{aligned} Patents_{i,t} = \phi_0 + \phi_1 Duality_{i,t-1} + \phi_2 \left(Duality_{i,t-1} \times RD_{i,t-1}\right) + \phi_3 RD_{i,t-1} \\ + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{4.17}$$

$$\begin{aligned} Patents_{i,t} = \phi_0 + \phi_1 Dependence_{i,t-1} + \phi_2 \left(Dependence_{i,t-1} \times RD_{i,t-1}\right) + \phi_3 RD_{i,t-1} \\ + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}. \end{aligned} \tag{4.18}$$

where *Patent* is measured as the logarithm form of the number of patents a firm acquired in year t following Hirshleifer et al. (2012). *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly board measures: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. *RD* is measured as the ratio of R&D expenditure to total sales. Three distinct friendly board measures are interacted with CEO pay to examine whether the link between innovation outcomes (*Patent*) and innovation inputs (*RD*) is enhanced by a friendly board. A vector of control variables includes firm performance (*ROE*), measured as return on the market value of equity; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Lev*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; cash level (*Cash*), measured as the logarithm form of cash holding; firm age (*FirmAge*), measured

as the number of years since the firm established, and state (*State*), which coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period.

The corresponding results are shown in Table 4.14. The coefficients at *RD* are statistically significant and positive, showing a positive link between R&D investments and innovation outcomes. Most importantly, the coefficients at *Relative*$\times$*RD* and *Duality* $\times$ *RD* are also positive and significant, showing that a friendly board increases the link between innovation input and output, thus increasing innovation efficiency. These results are in line with the study of Kang et al. (2018) that a friendly increases a firm's innovation outcome by better performing its advisory role.

Table 4.14
Patents, a friendly board and R&D expenditure

VARIABLES	(1) *Patents*	(2) *Patents*	(3) *Patents*
Relative	0.147		
	(0.117)		
Relative × *RD*	4.569***		
	(1.021)		
Duality		0.220	
		(0.230)	
Duality × *RD*		6.653***	
		(1.825)	
Dependence			0.223
			(0.837)
Dependence × *RD*			5.020***
			(1.008)
RD	11.860***	12.373***	11.040***
	(3.532)	(1.556)	(2.032)
ROE	2.406**	2.691**	2.508**
	(1.065)	(1.066)	(1.126)
LnAssets	0.403***	0.371***	0.327***
	(0.042)	(0.042)	(0.047)
Lev	−0.038	−0.175	0.098
	(0.316)	(0.315)	(0.345)
Vol	−0.332	−0.333	−0.230
	(0.328)	(0.328)	(0.345)
Cash	−0.246	−0.271	−0.424*
	(0.214)	(0.214)	(0.228)
FirmAge	0.040***	0.044***	0.048***
	(0.007)	(0.008)	(0.008)
State	0.237	0.202	0.305
	(0.344)	(0.344)	(0.381)
Constant	−7.439***	−6.335***	−5.665***
	(1.121)	(1.129)	(1.270)
Observations	14,878	14,878	14,878
R-squared	0.198	0.198	0.162
Firms	2,419	2,419	2,419
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

The table reports the regression results for Eq.(4.16). All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.8.4 Firm Value, Friendly Boards and R&D Expenditure

To complete this section, the last analysis involves examining whether a friendly board increases firm value. Despite the widespread belief that independent board is good for firms, recent studies by Adams & Ferreira (2007), Harris & Raviv (2008) and Schmidt (2015) both theoretically and empirically show that a friendly board enhances corporate value by better providing valuable advice. Monitoring and advising CEOs are the opposite two sides of the board's functions. Whether one function dominates the other in determining firm value depends on the needs of information exchange between executives and the board. When boards are more independent, less friendly, CEOs are reluctant to share information with the board members because what they reveal to the board, in turn, will be used by the board to intensely monitor CEOs and intervene in CEOs' decisions. Therefore, CEOs face the trade-off of sharing information at the expense of receiving better advice. R&D projects are risky, long-term oriented and uncertain. At every stage of R&D investments, it is important for CEOs and the board to share information, and for the board members to offer timely feedback. It is expected that a friendly board can offer more valuable advice on these projects to help CEOs identify, clarify and evaluate them.

Therefore, the following models are employed to examine whether a friendly board contributes to the increased firm value by better providing advice on R&D investments.

$$\begin{aligned} Tobin's_q_{i,t} = {} & \zeta_0 + \zeta_1 Relative_{i,t-1} + \zeta_2 \left(Relative_{i,t-1} \times RD_{i,t-1}\right) + \zeta_3 RD_{i,t-1} \\ & + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{4.19}$$

$$\begin{aligned} Tobin's_q_{i,t} = {} & \zeta_0 + \zeta_1 Duality_{i,t-1} + \zeta_2 \left(Duality_{i,t-1} \times RD_{i,t-1}\right) + \zeta_3 RD_{i,t-1} \\ & + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}, \end{aligned} \tag{4.20}$$

$$\begin{aligned} Tobin's_q_{i,t} = {} & \zeta_0 + \zeta_1 Dependence_{i,t-1} + \zeta_2 \left(Dependence_{i,t-1} \times RD_{i,t-1}\right) + \zeta_3 RD_{i,t-1} \\ & + \lambda X_{i,t-1} + \upsilon_i + \gamma_t + \varepsilon_{it}. \end{aligned} \tag{4.21}$$

where $Tobin's_q$ represents firm value, measured as the book value of total assets minus book value of equity, plus the market value of equity, divided by the book value of total assets. *Relative*, *Duality* and *Dependence* refer to three distinct management-friendly board measures: whether one of the relatives of the CEO is sitting on the board, CEO duality, and board dependence, respectively. *RD* is measured as the ratio of R&D expenditure to total sales. Three distinct friendly board measures are interacted with R&D investments to examine whether friendly boards increase firm value by better serving their advisory roles on R&D projects. Following prior literature related to the determinants of firm value (Zhu et al. 2016, Kim et al. 2018), a vector of control variables includes firm performance (*ROE*), measured as return on the market value of equity; firm size (*LnAssets*), measured as the logarithm form of total assets; leverage ratio (*Lev*), measured as the ratio of the total debt to total assets; firm risk (*Vol*), measured as the standard deviation of monthly stock returns in the past year; cash level (*Cash*), measured as the logarithm form of cash holding; firm age (*FirmAge*), measured as the number of years since the firm established, board size (*LnBoard*), measured as the logarithm form of total number of individuals sitting on the board; and state (*State*), which coded to one if a firm is a state-owned firm, and zero otherwise. In addition, firm fixed effects (υ_i) and year fixed effects (γ_i) are included in the estimates to control for the unobserved heterogeneity. Standard errors are clustered at the firm level. All the independent variables are lagged for one period.

The corresponding results are reported in columns (1), (4), and (7) of Table 4.15. First, the coefficients at *Relative*, *Duality* and *Dependence* are not statistically significant at any significance level, showing that there is no direct link between firm value and friendly boards. However, the parameters of interests are *Relative* $\times$ *RD*, *Duality* $\times$ *RD* and *Dependence* $\times$ *RD*. The estimated coefficients at these parameters are statistically significant and positive, showing that by providing advice on R&D projects, a friendly board increases firm value.

In Adams & Ferreira (2007)'s theoretical work, a friendly board increases firm value by offering its advising function, especially for those firms to which board advising function is more important than board monitoring. Therefore, to complete this section, the full sample is divided into two groups based on

firm advisory needs and the empirical work of models (4.19) is re-examined using the subsample, separately. I define firm advisory needs based on the industry classification since Raheja (2005) states that R&D-intensive firms face higher costs of project verification and thus benefit more from the advisory function provided by the board members. Following Raheja (2005), firms in high-tech industries are deemed as having high advisory needs. Specifically, high-tech industries include biological and biochemical products, broadcast and television equipments, chemical medicine, computer peripheral equipments, communication equipments, domestic TV sets and radio receivers, electronic appliances, electronic components, entire computer, manufacturing of measuring instruments, repairing of airplanes, repairing of airplanes, spacecrafts and traditional Chinese medicines industry. The corresponding results using the sub-samples and three distinct friendly board indicators are reported in columns (2), (3), (5), (6), (8) and (9) of Table 4.15.

Taking the second and third columns as an example, the coefficient at *Relative* is statistically significant and positive in the second column where the sub-sample data are all high-tech firms. However, the coefficient at *Relative* in non-high-tech firms is not statistically significant at any significance level. The untabulated T-test statistics of the difference between these two coefficients are significant at 1%. Therefore, the results suggest that a friendly board increases firm value directly only for high-tech firms who have high advisory needs. This finding echoes studies of Adams & Ferreira (2007), Harris & Raviv (2008) and Schmidt (2015) that by functioning its advisory role, a friendly board can enhance corporate value under some circumstances. Besides, the coefficient at the interaction term of $Relative \times RD$ is only statistically significant and positive when firms are in high-tech industries, suggesting that the effect of a friendly board on the link between firm value and R&D projects is enhanced when firms are in the high-tech industry.

To sum up, findings in this section do not contradict to the "tenants" of modern corporate governance that independent boards enhance firm value. In fact, the results show that there is no direct link between firm value and a friendly board in general. However, the findings are in line with Adams & Ferreira (2007), Harris & Raviv (2008) and Schmidt (2015) that less independent boards still increase

firm value under certain circumstances as the results indicate that a friendly board increases firm value directly in high-tech firms and it also increases firm value by functioning its advisory duty.

Table 4.15
Firm value, a friendly board and R&D expenditure

VARIABLES	*Tobin's_q* Full	*Tobin's_q* Tech	*Tobin's_q* Non-Tech	*Tobin's_q* Full	*Tobin's_q* Tech	*Tobin's_q* Non-Tech	*Tobin's_q* Full	*Tobin's_q* Tech	*Tobin's_q* Non-Tech
Relative	0.020	0.292**	0.005						
	(0.046)	(0.123)	(0.096)						
Relative × *RD*	0.050**	0.112***	0.014						
	(0.024)	(0.040)	(0.022)						
Duality				0.089	0.116**	0.013			
				(0.095)	(0.054)	(0.085)			
Duality × *RD*				0.029***	0.033**	0.012			
				(0.011)	(0.015)	(0.018)			
Dependence							0.735	0.695*	0.666
							(0.819)	(0.410)	(0.498)
Dependence × *RD*							0.064	0.120**	0.003
							(0.050)	(0.060)	(0.032)
RD	−0.043***	−0.006	−0.107**	−0.023**	−0.016	−0.036***	−0.012	−0.033	−0.021
	(0.011)	(0.007)	(0.054)	(0.011)	(0.011)	(0.010)	(0.009)	(0.042)	(0.020)
Constant	−9.152***	−9.561***	−8.947***	−8.846***	−8.302***	−9.664***	−8.548***	−9.314***	−8.094***
	(0.480)	(0.850)	(0.731)	(0.511)	(0.678)	(0.849)	(0.537)	(0.907)	(0.704)
Observations	15,944	6,360	9,584	15,944	6,360	9,584	15,944	6,359	9,584
R-squared	0.071	0.081	0.066	0.069	0.062	0.081	0.069	0.082	0.062
Firms	2,466	987	1,479	2,646	987	1,479	2,646	987	1,479
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

The table reports the regression results for Eq.(4.19). All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.9 Conclusion

In this chapter, both the effects of monitoring and advisory roles of friendly boards on CEO pay are examined. Using three distinct management-friendly board indicators — whether one of relatives of the CEO is sitting on the board, CEO duality and board dependence, the robust results indicate that friendly boards mitigate a positive link between CEO pay and firm performance, and also weaken a negative link between CEO pay and R&D expenditure. These findings are generally in line with the view that friendly boards have weakened monitoring efficiency, thus lessening the pay-for-performance link. Besides, friendly boards are better at providing valuable advice, thus, to show their support, paying CEOs on their suitability of R&D investments.

Most importantly, the results suggest that driven by CEO compensation, friendly boards increase firms' level of R&D investments. Also, friendly boards increase innovation efficiency by showing their enhanced effect on a positive link between the number of patents and R&D investments. It is worth noting that these results do not contradict to earlier studies that friendly boards indicate the weakened corporate governance mechanisms which can be harmful to firm value. Empirical results in this chapter find that while there is an absent link between firm value and friendly boards in general, friendly boards increase firm value by serving their advisory functions on R&D projects.

To sum up, the findings are insightful for both practitioners and policymakers. The results imply that a friendly board helps CEOs avoid compensation risk in terms of R&D projects and better provides advice on these projects, as a result, it cures CEOs R&D myopic investment problems and promote innovation efficiency.

Appendix

Table A1
Variable definition

Symbol	Definition
Pay	CEO compensation is measured as the natural logarithm form of salary, bonus and commissions.
Relative	A dummy variable equals one if a relative of the CEO is on the board, and zero otherwise.
Duality	A dummy variable equals one if a CEO also serves as the chairman of the board, and zero otherwise.
Dependence	Board dependence is measured as the ratio of inside directors to the total number of directors on the board.
ROE	Firm performance is measured as the ratio of net income to the market value of equity.
RD	R&D expenditure is measured as the ratio of R&D expenditure to total sales.
LnAssets	Firm size is measured as the natural logarithm of total assets.
Vol	Firm risk is measured as the standard deviation of monthly stock returns in the last year.
Leverage	Firm leverage is measured as the ratio of total debt to total assets.
MB	Firm's future growth opportunity is measured by the market value of equity to the book value of equity.
Board	Board size is measured as the logarithm of the number of directors on the board.
Age	CEO age is measured as the logarithm of CEO age.
Gender	A dummy variable equals one if a CEO is female, and zero otherwise.
State	A dummy variable equals one if a firm is a state-owned firm, and zero otherwise.

The table describes the construction of variables in this chapter. Data are obtained from the CSMAR database from 2007 to 2021.

Table A2
Robustness checks: Model combination

VARIABLES	(1) *Pay*	(2) *Pay*
Per_Rela	0.004	0.223
	(0.116)	(0.252)
Per_Rela × *ROE*	−15.604***	−19.708***
	(2.675)	(4.756)
Per_Rela × *RD*	0.085***	
	(0.011)	
Per_Rela × *EXRD*		0.089***
		(0.024)
ROE	3.498***	3.848***
	(0.292)	(0.426)
EXRD		−0.028**
		(0.012)
RD	−0.024**	
	(0.010)	
LnAssets	0.359***	0.378***
	(0.007)	(0.014)
Vol	−0.166**	−0.157
	(0.081)	(0.130)
Lev	−0.446***	−0.595***
	(0.072)	(0.113)
MB	0.034***	0.027***
	(0.003)	(0.005)
LnBoard	0.072***	0.037
	(0.020)	(0.032)
Age	0.254***	0.301***
	(0.043)	(0.069)
Gender	0.010	0.046
	(0.022)	(0.040)
State	−0.067	−0.090
	(0.062)	(0.081)
Constant	4.187***	3.612***
	(0.207)	(0.382)
Observations	15,944	7,650
R-squared	0.216	0.165
Firms	2,466	1,689
Firm FE	YES	YES
Year FE	YES	YES

The table reports the regression results using the combined models with the alternative measures of friendly boards and R&D expenditure. All the independent variables are lagged for one period. Firm and year fixed effects are included and robust standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A3
Instrument variable approach - First-stage

VARIABLES	(1) *Relative*	(2) *Relative* × *ROE*	(3) *Duality*	(4) *Duality* × *ROE*	(5) *Dependence*	(6) *Dependence* × *ROE*
IvRela	0.520***	0.007***				
	(0.046)	(0.002)				
IvRela × *ROE*	3.028*	0.773***				
	(1.585)	(0.056)				
IvDua			1.516***	0.017***		
			(0.192)	(0.005)		
IvDua × *ROE*			1.355*	0.861***		
			(1.441)	(0.041)		
IvDp					0.006*	0.001
					(0.003)	(0.001)
IvDp × *ROE*					0.081***	0.991***
					(0.007)	(0.002)
Edu	0.955***	0.016*	0.709***	0.004***	0.018**	0.003
	(0.266)	(0.009)	(0.041)	(0.001)	(0.009)	(0.002)
Edu × *ROE*	15.119*	0.703**	17.479***	0.283*	0.335	0.041
	(8.968)	(0.317)	(5.880)	(0.167)	(0.513)	(0.133)
Other Controls	YES	YES	YES	YES	YES	YES
Observations	15,705	15,705	15,705	15,705	15,705	15,705

The table reports the first-stage results for table 4.10. *IvRela* is the average value of *Relative* for all other firms in the same industry and same year. *IvDua* is the average value of *Duality* for all other firms in the same industry and same year. *IvDp* is the average value of *Dependence* for all other firms in the same industry and same year. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A4
Instrument variable approach - First-stage

VARIABLES	(1) *Relative*	(2) *RD*	(3) *Relative* × *RD*
IvRela	0.941***	0.428***	0.000
	(0.005)	(0.030)	(0.012)
RDBack	−0.001	0.007***	0.006
	(0.002)	(0.002)	(0.004)
Academic	−0.008**	0.102***	0.001
	(0.003)	(0.017)	(0.007)
Overseas	−0.004*	0.025**	0.003
	(0.002)	(0.011)	(0.004)
Relative × *RDBack*	0.061***	0.058**	0.068***
	(0.005)	(0.025)	(0.010)
Relative × *Academic*	0.842***	0.049**	0.472***
	(0.004)	(0.024)	(0.010)
Relative × *Overseas*	0.063***	0.023	0.051***
	(0.005)	(0.027)	(0.000)
IvRela × *RD*	0.061***	1.208***	0.943***
	(0.005)	(0.012)	(0.005)
IvRela × *RDBack*	0.005***	0.058*	0.071***
	(0.002)	(0.030)	(0.012)
IvRela × *Academic*	−0.829***	0.087**	0.456***
	(0.007)	(0.037)	(0.015)
IvRela × *Overseas*	−0.058***	0.011	0.061***
	(0.006)	(0.031)	(0.013)
Other Controls	YES	YES	YES
Observations	15,507	15,507	15,507

The table reports the first-stage results for table 4.11. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A5
Instrument variable approach - First-stage

VARIABLES	(1) *Duality*	(2) *RD*	(3) *Duality* × *RD*
IvDua	0.980***	0.459***	0.011
	(0.006)	(0.029)	(0.013)
RDBack	−0.001	0.001	0.002
	(0.002)	(0.010)	(0.004)
Academic	−0.009**	0.045***	0.001
	(0.004)	(0.017)	(0.008)
Overseas	−0.001	0.001	0.000
	(0.002)	(0.010)	(0.005)
Duality × *RDBack*	0.058***	0.018	0.067***
	(0.005)	(0.023)	(0.010)
Duality × *Academic*	0.897***	0.018	0.952***
	(0.004)	(0.023)	(0.009)
Duality × *Overseas*	0.069***	0.023	0.090***
	(0.005)	(0.024)	(0.011)
IvDua × *RD*	0.005**	1.133***	0.980***
	(0.002)	(0.011)	(0.005)
IvDua × *RDBack*	0.056***	0.018	0.078***
	(0.006)	(0.023)	(0.013)
IvDua × *Academic*	−0.884***	0.103***	0.478***
	(0.007)	(0.035)	(0.016)
IvDua × *Overseas*	−0.067***	0.027	0.089***
	(0.006)	(0.029)	(0.013)
Other Controls	YES	YES	YES
Observations	15,507	15,507	15,507

The table reports the first-stage results for table 4.11. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A6
Instrument variable approach - First-stage

VARIABLES	(1) *Dependence*	(2) *RD*	(3) *Dependence* × *RD*
IvDp	0.903***	0.856***	0.029
	(0.010)	(0.044)	(0.021)
RDBack	−0.007***	0.005	0.003
	(0.002)	(0.010)	(0.005)
Academic	−0.029***	0.123***	0.007
	(0.004)	(0.017)	(0.008)
Overseas	−0.001	0.008	0.008
	(0.002)	(0.010)	(0.005)
Dependence × *RDBack*	0.072***	0.003	0.062***
	(0.005)	(0.033)	(0.010)
Dependence × *Academic*	0.887***	0.019	0.510***
	(0.004)	(0.018)	(0.009)
Dependence × *Overseas*	0.086***	0.645	0.066***
	(0.005)	(0.002)	(0.010)
IvDp × *RD*	0.001*	2.645***	1.004***
	(0.001)	(0.002)	(0.001)
IvDp × *RDBack*	0.053***	0.003	0.053***
	(0.008)	(0.033)	(0.016)
IvDp × *Academic*	−0.819***	0.358***	0.599***
	(0.011)	(0.050)	(0.023)
IvDp × *Overseas*	−0.082***	0.016	0.042***
	(0.008)	(0.034)	(0.016)
Other Controls	YES	YES	YES
Observations	15,507	15,507	15,507

The table reports the first-stage results for table 4.11. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Chapter 5

Concluding Remarks

This thesis contains three topics in relation to corporate finance. The impact of financial disclosure on the risk of default in the US market from 2008 and 2019 is investigated in the first topic. Employing a regression discontinuity design, the "Smaller Reporting Company Regulation and Simplification (SRC)" rule is explored as the exogenous source of variation. Under the SRC rule, firms that are eligible for scaled disclosure can opt to reduce the disclosure of certain information in their SEC filings. The results indicate a significant rise in default risk for companies qualified under the SRC rule, which suggests that permitting companies to disclose less financial information increases information asymmetry and, hence, default risk. These results are robust when applied to alternative measures of default risk, model specifications, and diagnostic tests. Furthermore, using Difference-in-Differences methods, the results suggest that smaller reporting companies see their default risk increase as soon as at the first time eligible for the SRC rule. The results also suggest that the effect of information loss due to reduced disclosure levels dominates the effect of loss of commitment effects to mandatory disclosures. Importantly, this research also demonstrates that, although the SRC rule was conceived from a desire to help small businesses to reduce their reporting burden, it exacerbates information asymmetry, which causes the risk of default to rise. Even if eligible smaller reporting companies voluntarily maintain the level of disclosure in their 10-K, they still experience an increase in default risk stemming from the loss of commitment to mandatory disclosure. Remedial actions that smaller reporting companies could take, such as increasing oversight mechanisms and strengthening

corporate governance, and improving audit quality, have been shown by the analysis to alleviate the impact of the reduced disclosure level on the risk of default. To sum up, the first chapter are important for policymakers and practitioners to pay attention to the side effect of the SRC rule, together with offering some actions that smaller companies can take to alleviate increased default risk risen from voluntarily reduced disclosure on 10-Ks.

Corporate culture has been proven to be a non-negligible facet which affects several aspects of firms' operations. The second chapter extends the research line and empirically examines the effects of the corporate culture on tax avoidance, together with the effect of managerial high-powered incentives on the relationship between corporate culture and tax avoidance. Corporate culture is classified into the four quadrants of collaborate, control, create and compete based on the "Competing Values Framework" and quantified by a textual analysis of 10-K reporting. Tax avoidance and high-powered incentives are measured as the book-tax gap not attributable to accounting accruals and the ratio of the value of option awards to total compensation, respectively. The robust results suggest that firms with a collaborative and competitive culture tend to avoid more tax, while firms with a control culture have a tendency to avoid less. When managerial incentives are taken into account, the results suggest that it weakens the associations between cultures and tax avoidance. Besides, the results also reveal that corporate culture affects tax avoidance by impacting on internal information environment and managerial incentive compensation affects the links between cultures and tax avoidance through the reduced agency problems. In all, the findings in this chapter fill the void in the literature and directly answer the question of whether and how corporate culture affects tax avoidance. The results are of great importance for regulators and practitioners who care about detecting a firm's engagement in tax avoidance.

In the third chapter, both the effects of monitoring and advisory roles of friendly boards on CEO pay are examined. Using three distinct management-friendly boards indicators — whether one of the relatives of the CEO is sitting on the board, CEO duality and board dependence, the robust results indicate that friendly boards mitigate a positive link between CEO pay and firm performance, and also weaken a negative link between CEO pay and R&D expenditure. These findings are generally

in line with the view that friendly boards have weakened monitoring efficiency, thus lessening the pay-for-performance link. Besides, friendly boards are better at providing valuable advice, thus, to show their support, paying CEOs on their suitability of R&D investments. Most importantly, the results suggest that driven by CEO compensation, friendly boards increase firms' level of R&D investment. Also, friendly boards increase innovation efficiency by showing their enhanced effect on a positive link between the number of patents and R&D investments. It is worth noting that these results do not contradict to earlier studies that friendly boards indicate the weakened corporate governance mechanisms which can be harmful to firm value. Empirical results in this chapter find that while there is an absent link between firm value and friendly boards in general, friendly boards increase firm value by serving their advisory functions on R&D projects. Taken together, the third chapter offers a new insight for the role played by friendly boards, which shows both the deficits and benefits of having management-friendly boards.

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