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Three essays on corporate governance and ESG investing

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Three essays on Corporate Governance and ESG Investing

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Abstract

This thesis consists of three essays investigating the effect of internal and external corporate governance on corporate behaviours, as well as investigating the topic of Environmental, Social and Governance (ESG) finance. Chapter 2 seeks to understand the effectiveness of board of directors on firms' environmental performance—a component of firm ESG metrics that has attracted increasing attention. We find that the busyness level of board directors has an important influence on corporate environmental performance. Exploiting the merger-induced exogenous shock to the number of board seats held by directors, we find that firms' environmental performance significantly improves following the reduction in directors' workload. The improvement is primarily driven by directors with relatively fewer commitments, greater environmental awareness, or larger formal capacity. In addition, the improvement is dependent upon firm-specific conditions including financial constraints, institutional ownership, and local stakeholders. Overall, this chapter highlights the importance of board commitment in shaping corporate environmental responsibility.

Chapter 3 investigates the effect of external governance by institutional investors in the M&A setting. We document important links between targets' institutional ownership and takeover outcomes. Firms' institutional ownership increases their likelihood of receiving stock-for-stock bids. The relationship becomes stronger when deals involve higher information asymmetries, suggesting that institutional ownership mitigates asymmetries. However, this stronger effect is not driven by the bidders with overpriced shares. Additionally, we show that institutions' share-retention decisions around mergers are motivated by their ex-ante estimations of synergies. Our findings suggest that institutions' information advantage facilitates rational payment design (Eckbo, Makaew and Thorburn, 2018), alleviating potential deadweight losses associated with stock-for-stock offers.

Chapter 4 explores the topic of ESG finance in the mutual funds setting. We find that funds with the highest level of ESG integration have monthly risk-adjusted returns that are 4 basis points higher than comparable funds with lower levels of integration. We find that the higher returns are concentrated in mutual funds with the highest level of ESG integration that are also exposed to firms where having superior information is most valuable, i.e., those with high disagreement in ESG ratings and those that experience incidents. Specifically, only funds with the highest level of ESG integration that over-weight high ESG uncertainty stocks (against their respective investment benchmark) outperform. Taken together, the results showcase the superior investment skill of ESG-aware fund managers.

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Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's *Regulations and Code of Practice for Research Degree Programmes* and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Chapter 2 and Chapter 3 are joint works in collaboration with, and with the assistance of Dr. Kirak Kim and Dr. Fangming Xu. Chapter 4 is a joint work in collaboration with, and with the assistance of Dr. Marco Ceccarelli, Dr. Richard Evans, Dr. Simon Glossner and Dr. Mikael Homanen. Any views expressed in the dissertation are those of the author.

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Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Background

The global governance practices have changed significantly in the last few decades, partly due to the evolution of corporate ownership structure and the growing attention to corporate social responsibility associated with various stakeholders. Given the changing dynamics in the market for corporate control and the increasing attention to the ESG matters, my dissertation aims to explore new dimensions of the role of internal and external corporate governance in shaping firms' outcomes, as well as to examine the topic of ESG investing. Accordingly, this thesis investigates two broad topics: (i) how board of directors and institutional investors play a role in shaping firms' decisions and performances and (ii) whether there exists value creation of incorporating ESG matters into institutions' investment decisions.

Regarding the first topic of this thesis, the presence of effective internal and external corporate governance can alleviate the principle-agent conflicts.[1] This is because each agent might not act in the best interest of the firm. However, establishing effective corporate governance is challenging due to various factors. For example, the effectiveness of board of directors as an internal corporate mechanism, whom act as delegated monitors and advisers, is dependent on factors including

[1]The principle-agent problem may occur as a result of a conflict of interests between managers and shareholders, and/or a conflict between shareholders and firms' other stakeholders regarding value maximization (Jensen and Meckling, 1976).

time constraint (Falato, Kadyrzhanova, and Lel, 2014; Hauser, 2018; Brown, Dai, and Zur, 2019), board composition (Rao and Tilt, 2016), or the design of compensation structure (Ryan Jr and Wiggins III, 2004; Coles, Daniel, and Naveen, 2014). In addition, whether the presence institutional owners in portfolio firms is a fitting external corporate governance mechanism depends greatly on the incentive of institutional investors to intervene. Two chapters of this thesis, chapter 2 and 3, investigate this topic in great detail.

The second topic focuses on the financial returns to ESG incorporation by institutional fund managers. Taking a step back from prior chapters, chapter 4 asks whether financial gains exist when investors take ESG matters into investment consideration. One possible reason that ESG incorporation is of interest to firms' investors is the value relevance (Krueger, Sautner, and Starks, 2020). The extant literature does not provide consensus view on the topics of *if*, *why*, and *how* ESG integration impacts financial investment returns. On the one hand, ESG incorporation could come at the expense of financial returns due to factors including supply and demand imbalance (Hong and Kacperczyk, 2009; Pástor, Stambaugh, and Taylor, 2021a; Zerbib, 2021). On the other hand, sustainable firms will out-perform when there is an increase in attention towards sustainability (Pástor, Stambaugh, and Taylor, 2021b), when ESG rating uncertainty is high for highly rated ESG stocks (Avramov, Cheng, Lioui, and Tarelli, 2021), or during periods of positive macroeconomic outlook (Bansal, Wu, and Yaron, 2021). Chapter 4 of this thesis explores this topic and seeks to reconcile the contradicting findings of prior studies in the setting of global mutual funds.

1.2 Three essays

This thesis, consisting of three self-contained essays, attempt to explore the two broad questions from various perspectives. Chapter 2 examines the impact of the board of directors' workload on corporate environmental performance in the U.S. Chapter 3 investigates the role played by institutional investors in the U.S. takeover market. Chapter 4 focuses on the widely debated topic of whether ESG investment strategies of institutional fund-families outperform. Overall, the thesis extends the literature on the role of internal and external corporate governance in shaping both firms' financial and non-financial decisions. It also complements the voluminous and still growing literature on ESG finance by providing evidence on the implications of ESG incorporation for institutional fund managers. The content of each chapter is presented in greater details below.

Chapter 2: Time (needed) for the Board of Directors to Protect the Environment: Evidence from Mergers.

This chapter, joint work with Dr. Kirak Kim and Dr. Fangming Xu, examines the influence of board of directors' workload on corporate environmental performance. We hypothesize that some directors may be too busy to devote enough attention to corporate environmental management and that they can make positive influence on environmental performance when their workload is reduced. We consider directors' workload as their capacity to make influences on firms may be affected. Prior literature documents mixed evidence how the board commitment is associated with the boards' monitoring effectiveness and firm performance. Given the complicated nature of overseeing large public corporations, the board of directors arguably face

time constraints over various tasks related to both financial and non-financial performances. This chapter is the first to empirically investigates one friction—directors' time constraint—that would deter board of directors from their monitoring role over corporate environmental matters.

The key concern related to the empirical test is the endogenous choice of a firms' board of directors. To address this concern, we exploit the merger-induced termination of target board seats as an exogenous shock that reduces director busyness. Using the U.S. sample of S&P 1500 firms over the period from 1996 to 2018, we find that a reduction in director workload has a positive and strong impact on the environmental performance of the firms for which they continue to serve as a board member. We next inspect plausible underlying mechanisms that enable the board of directors to exert their influences.

We analyze various board attributes that fall in two broad categories in light of environmental performance: first, directors' attributes and prior experience in firms with positive environmental performance and second, directors' formal capacity to create changes. First, our findings suggest that the channel through which directors can influence corporate environmental performance following the reduction in workload is related to directors' attributes. While workload is a crucial factor that allows the board of directors to raise corporate environmental standards, directors' personal awareness and formal capacity are factors determining whether affected directors allocate additional time to influence firms' environmental performance. In particular, the improvement is driven by relatively less committed directors, the directors with greater environmental awareness, that is, those connected to environmentally conscious firms (Iliev and Roth, 2021) and female directors (Cronqvist

and Yu, 2017). Similarly, the directors with formal capacity, such as independent directors (Braun, 2010; Post, Rahman, and McQuillen, 2015; Rao and Tilt, 2016) and committee-serving ones (Shaukat, Qiu, and Trojanowski, 2016), make a larger impact on environmental performance when they are relieved of workload.

Second, the influence of the reduction in director busyness on corporate environmental performance varies with firm-specific characteristics, including institutional ownership, local political orientation and firms' financial constraints. We expect that the directors' capacity to improve firm environmental performance is strengthened with a higher fraction of long-term institutional ownership and the local stakeholders' orientation towards more environmentally and socially friendly policies. We document that the improvement in firm environmental performance is most pronounced for firms with more active and long-term institutional owners, who are more likely to push the directors harder to improve environmental performance (Dyck, Lins, Roth, and Wagner, 2019; Chen, Dong, and Lin, 2020; Krueger et al., 2020). Our findings also suggest that affected directors make greater effort to go green if their firms are located in the regions where local voice for environment is stronger (Di Giuli and Kostovetsky, 2014). Additionally, the directors' attempt to make a positive impact on environment may be hindered by firms' financial constraints (Kim, Wan, Wang, and Yang, 2019; Goetz, 2019; Iliev and Roth, 2021). Our results is consistent with the view that the board of directors allocate additional time to ameliorate corporate environmental performance is conditioned on the firm non-financial constrained state.

Overall, we show that the presence of the more engaged board of directors is an important determinant of firm environmental behavior. Out findings suggest that

a better outcome is achievable when such a condition is coupled with the directors' awareness and formal capacity to make influences on non-financial matters (Di Giuli and Kostovetsky, 2014; Cronqvist and Yu, 2017; Amin, Chourou, Kamal, Malik, and Zhao, 2020; Iliev and Roth, 2021), as well as firm-specific attributes that foster corporate attention to environmental management (Chen et al., 2020; Hong, Kubik, and Scheinkman, 2012; Krueger et al., 2020). This chapter provides important evidence that speaks to the growing attention to the impact of corporate actions on climate change and environmental problems, as well as the long-standing debate on the effectiveness of multiple directorship.

Chapter 3: Do Institutional Investors Process and Act upon Information? Evidence from Mergers and Acquisitions.

This chapter examines the longstanding question of the role played by institutional shareholders in influencing portfolio firms. Specifically, we focus on the impact of institutional owners in target firms in the mergers and acquisitions setting. Different from studies that focus on institutional investors of bidding firms (Chen, Harford, and Li, 2007; Schmidt and Fahlenbrach, 2017) or cross-owners (Brooks, Chen, and Zeng, 2018), we investigate the importance of institutional shareholders for the acquisition targets in M&A. This is because the valuation and information processing by target shareholders is dissimilar to the actions taken by bidder shareholders. In particular, we ask whether an increase of a firm's institutional ownership reflects higher acquisition targetivesness (i.e., the probability of receiving takeover offers). More importantly, we explore whether the monitoring effort exerted by institutional owners of target firms help alleviate information asymmetry (Hansen, 1987; Fish-

man, 1989; Eckbo, Giammarino, and Heinkel, 1990; Eckbo, Makaew, and Thorburn, 2018) and facilitate M&A transactions, especially for takeover offers paid with bidders' stocks. This chapter focuses on the information advantage and monitoring effectiveness of institutional shareholders as well as the economic benefits of their monitoring effort.

We find that an increase in a firm's institutional ownership raises its likelihood of receiving takeover bids, specifically concentrated in the likelihood of receiving stock-for-stock bids. However, firms with high takeover probabilities may exhibit certain attributes that attract certain type of bidders and institutional investors. To address this endogeneity concern, we exploit exogenous variation in institutional ownership associated with Russell index annual reconstitutions and employ an instrumental variable (IV) estimation approach. As Russell's index membership assignment relies only on the market capitalization of stocks, an event of Russell 1000/2000 membership switch is plausibly exogenous to firm characteristics and other confounding factors, conditional on the end-of-May market value (Wei and Young, 2019; Ben-David, Franzoni, and Moussawi, 2019). Our IV results support the causal interpretation of our main findings that the likelihood of receiving takeover bids, in particular stock offers, increases with a firm's institutional ownership.

Our findings suggest that the mechanism through which institutional owners affect the targetiveness of a public firm and the deal payment structure is their information advantage. Our analysis shows that institutional investors help mitigate the information asymmetry between bidders and targets, allowing target firms to accept stock-based offers. The positive relationship between a target's institutional ownership and the fraction of stock payment is more pronounced when the information

asymmetry associated with bidding firms or takeover deals is higher. To corroborate the notion that institutional owners can better assess bidders' offers, making stock-based offers more feasible due to information advantage, we examine whether institutions have the ability to identify when bidders' shares are misvalued (Shleifer and Vishny, 2003; Rhodes-Kropf, Robinson, and Viswanathan, 2005). Our evidence indicates that the targets are more resilient to the overpriced stock offers following the increase of institutional ownership, because the positive relationship between institutional ownership and stock payments is more prominent when the bidder's shares are less mispriced. In addition, evidence from examining the institutional holding level before and after deal announcement event (and deal completion event) further supports the conjecture that target institutional investors have incentives to acquire information and make rational ex-post decisions on equity holdings, in accordance with their expectation of the value of bidder/merged firms.

Overall, the findings documented in this chapter suggest that institutional investors play an important role in alleviating information asymmetry and assessing the associated values during takeover transactions. Targets' institutional owners are informed investors that allows for higher fraction of stock payment in deal consideration process (Eckbo et al., 2018), where the problems of information asymmetry and the mis-valuation of bidder's shares are more severe.

Chapter 4: The Investment Skills of ESG-Aware Mutual Funds.

Regarding the topic of ESG finance, this chapter, joint work with Marco Ceccarelli, Richard Evans, Simon Glossner and Mikael Homanen examines *if, why* and *how* ESG information could be valuable to mutual fund managers to generate superior

returns. At the stock-level, some studies document that stocks with higher ESG scores outperform (Lins, Servaes, and Tamayo, 2017; Bansal et al., 2021; Pástor et al., 2021b) while other support the view that high ESG stocks underperform (Pástor et al., 2021b; Zerbib, 2021). It is unclear whether and to what extent the concept holds at the fund-level. Are mutual funds that have higher level of ESG integration outperform their peers? If so, can the outperformance be explained by superior ESG-specific skills? This chapter provides some empirical evidence as answers to the above questions.

To investigate those questions, we employ the "Reporting & Assessment" (R&A) framework, a yearly survey on practices related to sustainability that all signatories of the Principles for Responsible Investment (PRI) are obliged to fill out and that is assessed and scored by the PRI (Ceccarelli, Glossner, and Homanen, 2022). As of 2021, more than 3000 institutional managers and asset owners across the globe have signed up (PRI signatories). We categorize institutions into scoring bands based on their scores from the PRI private assessment reports, where highest scoring band group consists of institutional signatories with best practices in ESG incorporation.

We show that PRI signatories with the highest reporting and assessment (R&A) scores outperform low-rated PRI signatories and non-PRI mutual funds by approximately 4 bps per month in terms of risk-adjusted returns. We employ several measures of performance including gross returns, Morningstar category-adjusted returns (Christoffersen, Evans, and Musto, 2013), and funds' alpha over the CAPM, the Fama-French 3-factor, and the Fama-French-Carhart 4-factor model (Carhart, 1997; Fama and French, 1993). The finding is robust to controlling for time-invariant unobservables. The interpretation of our main result remains unchanged after a bat-

tery of robustness tests including using only a subset of the R&A survey to identify ESG integration, or adjusting the fund returns for the regional ESG-factor (Pástor et al., 2021b).

We next investigate the economic channels underlying the documented effect by examining the institutional difference in fund investment skill that could be ESG-related. However, the main challenge to identify investment skill remains challenging due to noise and random shocks to stock returns. To test for ESG-specific investment skill, we adapt the measure of Active Fundamental Performance (AFP) of mutual funds (Jiang and Zheng, 2018) to ESG-specific events. Our findings suggest that mutual funds with a high degree of ESG integration exhibit ESG-specific investment skill. In particular, the outperformance of the ESG-aware mutual funds is concentrated in the part of funds' investment into stocks with high ESG ratings disagreement (AFP with high ESG uncertainty) around earnings announcements—those that the market cannot be easily evaluate but mutual funds with superior ESG-related skill may utilise their information to identify profitable investment opportunities. In a similar fashion, we also show that superior returns to ESG integration is concentrated in funds with higher AFP measured around severe ESG incidents.

To provide evidence to how fund managers with higher level of ESG integration outperform, our findings suggest that the documented superior returns are concentrated in funds with the highest level of ESG integration that over-expose to firms with high ESG uncertainty, and hold those firms for relatively longer period. Overall, we show that there exists superior financial returns to ESG integration at the mutual fund level, and such outperformance is related to ESG-specific skill of

mutual fund managers.

1.3 Structure of the thesis

This thesis structure follows the formatting criteria outlined in Annex 4 of the regulations and code of practice for research degrees by the University of Bristol. The remainder of this thesis is organized as follows. Chapter 2 focuses the topic of the workload of board of directors and corporate environmental performance. Chapter 3 investigates the influence of institutional investors in the target firms on takeover payment structure. Chapter 4 examines on the financial implications of ESG incorporation by international mutual funds. Chapter 5 concludes.

Chapter 2

Time (needed) for the Board of Directors to Protect the Environment: Evidence from Mergers

Abstract

This chapter shows that the busyness level of board directors has an important influence on corporate environmental performance. Exploiting the merger-induced exogenous shock to the number of board seats held by directors, we find that firms' environmental performance significantly improves following the reduction in directors' workload. The improvement is primarily driven by directors with relatively fewer commitments, greater environmental awareness, or larger formal capacity. Our results further reveal that the positive influence on environmental performance also depends on firms' financial constraints, institutional ownership, and local political orientation. Overall, our study highlights the importance of board commitment in shaping corporate environmental responsibility.

Keywords: environmental performance; board busyness; mergers and acquisitions.

JEL classification: G30, G34, M14

2.1 Introduction

Corporate responsibility for environmental issues and climate changes has received growing attention from investors, stakeholders, and the press. Nowadays, corporate managers have compelling reasons to place the environmental issues among their agenda items. First, the regulating bodies in the US have called for stricter supervision and oversight of corporate environmental risk following President Biden's administration.[1] Second, growing investor concerns on environmental matters put firms under sizeable pressure to oversee their management of environmental performance (Choi, Gao, and Jiang, 2020; Krueger et al., 2020). For instance, institutional investors have been pressuring firms to disclose more material climate-related matters and improve environmental management.[2] Third, firms are subject to greater scrutiny over their progress on environmental performance from other stakeholders, including contractors, customers, competitors, and employees (Cao, Liang, and Zhan, 2019; Dai, Liang, and Ng, 2021). In response to the new focus of climate change and sustainability, addressing corporate environmental risk has become an important issue in the board meeting agenda.

The annual survey conducted by the National Association of Corporate Directors (NACD) recognizes that directors are under pressure from the increasing number of tasks associated with each board position, including overseeing both

[1] In November 2020, the US Securities and Exchange Commission (SEC) amended Regulation S-K Items 101, 103, and 105 about disclosure of environmental penalties and other related material environmental impacts in firms' financial statements. In addition, the Commission has published series of public statements, speeches and press releases on the policy-making process of climate-related disclosure, with a specific topic of the role of executives and c-suite members. See "Climate, ESG, and the Board of Directors: You Cannot Direct the Wind, But You Can Adjust Your Sails". Available here

[2] The successful investor activist campaign in electing three new board seats of the oil giant ExxonMobil Corp, led by hedge fund Engine No. 1 and ended in June 2021, is an exemplar of the actions taken by investors regarding growing concerns on environmental issues.

corporate financial and non-financial performances.[3] The commitment problem exaggerates when directors hold multiple board positions. Nevertheless, this practice is not uncommon. As reported by the Institutional Shareholder Services (ISS) Director database, between 1996 and 2018, more than 23% of all directors of the S&P 1500 firms held multiple concurrent directorships. Given the concern regarding busy directors' time constraints, the ISS Governance recommends a maximum of five or fewer directorships when directors also hold the executive or chair position.[4]

We hypothesize that the effectiveness of directors' monitoring role is prone to their time constraints. We consider directors' workload in terms of their capacity to shape firms' financial and non-financial strategies. The extent to which the board of directors can influence firms' environmental performance (part of the non-financial strategies) when subjected to limited capacity due to concurrent directorships is not easily understood. Thus, we examine the following questions: Can directors internalize the growing attention and pressure on firms' environmental performance? Which director and firm characteristics can explain the potential change in environmental strategies when the time constraint of directors is released? Answers to these questions have important implications on firm policies about the oversight of corporate sustainability matters.

The extant literature has suggested conflicting theoretical predictions on the role of board directors in influencing firms' environmental strategies. On the one hand, the incentive for the board to be pro-social can be explained by the theory of

[3]The summary of the 2019 NACD annual survey on "Leader Engagement" and "ESG Matter". Available here

[4]A recent report by EY proposes that directors should be required by law to set up adequate procedures and where relevant, measurable targets to ensure that possible risks and adverse impacts are identified. Large asset managers including BlackRock, Vanguard and AGM among others set out more stringent criteria on this issue in their voting guidelines.

maximizing shareholders' welfare rather than merely their wealth (Bénabou and Tirole, 2010; Hart and Zingales, 2017). Despite the extra workload, holding concurrent board seats allows directors to cultivate experience and knowledge about effective environmental practice through their board connections, potentially leading to actions of shareholder wealth maximization. In particular, several recent studies have documented that board social networks can create positive externalities, enabling access to valuable information and resources that promote CSR practices (Amin et al., 2020) and improving firms' operating performance and productivity (Iliev and Roth, 2021). Busy boards can be an indicator of reputable and connected boards that offer beneficial advice to firms, especially financial advice to younger firms (Ferris, Jagannathan, and Pritchard, 2003; Field, Lowry, and Mkrtchyan, 2013)

On the other hand, the increasing pressure of overseeing non-financial matters may distract directors from the more prominent and measurable metric of board effectiveness-—firms' financial performance. Non-financial strategies have no one-size-fits-all practices and may require a longer realization horizon. In addition, it is difficult to quantify the amount of time and effort exerted by individual directors in addressing environmental issues and their effectiveness. As a result, busy directors tend to pay less attention to sustainability matters. Existing studies have documented mixed evidence on the relationship between board busyness and firm' financial performance, further increasing the difficulties of predicting the impact of board busyness on the short-term, intangible environmental outcomes.[5] In this study, we investigate the association between board busyness and firm environmen-

[5]Firms with busy boards exhibit lower market-to-book ratios, reduced profitability, lower investment returns, a weakened sensitivity of CEO turnover to firm performance (Fich and Shivdasani, 2006; Cashman, Gillan, and Jun, 2012; Hauser, 2018; Banerjee, Dai, Humphery-Jenner, and Nanda, 2020; Renjie and Verwijmeren, 2020).

tal performance.

However, establishing a causal relationship between director workload and firms' environmental performance is challenging due to potential endogeneity concerns. For example, causation can be reversed because directors who wish to avoid the risk associated with environmental lawsuits can refuse to hold multiple directorships but decide to work only for the firms with good environmental performance. The reputational concern applies to all directors, not just those with greater environmentally consciousness. Similarly, unobservable factors can affect both firms' environmental performance and the number of directorships held by the directors. For instance, the pressure from shareholders and institutional proxy advisors can improve a firm's environmental performance and, at the same time, decrease the number of directors' board seats. Prior literature recognizes these problems in the context of firms' financial performance (Falato et al., 2014; Hauser, 2018; Brown et al., 2019).

To support a causal interpretation of the relationship between director workload and firm environmental performance, we exploit mergers and acquisitions (M&A) transactions that lead to the termination of board membership in target firms. Suppose a director sitting on the board of two firms (say firms A and B) is removed from the board of firm B after firms B and C are merged, the removed director then gain more time for overseeing the activities of firm A. Importantly, the board-eliminating merger is unrelated to the characteristics of firm A, and this empirical strategy allows us to examine the impact on firms' environmental performance of a sudden reduction of director workload. Recent studies by Hauser (2018) and Brown et al. (2019) similarly use the target board-eliminating mergers to study the link

between multiple directorships and firms' financial performance. Following Hauser (2018), we estimate the difference between the treated and control firms in the inter-temporal changes in firms' environment performance around the termination event, i.e., treatment. Additionally, we use the instrumental variable (IV) approach and employ the termination event as the instrumental variable for the change of directors' total number of board seats in any given firm-year.

Using the US sample of S&P 1500 firms for 1996 to 2018, we find that reduction in directors' workload has a significantly positive impact on the environmental performance of the firms where the board membership of directors is unaffected. In particular, our results show that following a board-eliminating merger, the adjusted MSCI ESG KLD environmental score of the affected firms rises by 110 bps, which translates to a 36% increase in the adjusted score. Given that each point increase in a raw CSR indicator can be translated into a nontrivial cost, the effect of board busyness is economically meaningful. The IV estimation yields similar results. Our results are also robust to using various alternative environmental proxies in lieu of the KLD environment score, such as the most material environmental risk factors, the scores of strengths and concerns, and the environmental innovation score of Thomson Reuters ASSET4. Moreover, we show that the merger shock to director workload leads to a decline in the EPA violations. These results collectively suggest that the board of directors plays crucial roles in improving corporate environmental performance. The additional time freed up for directors due to the reduced board seats arguably enables them to pay more attention to their firms' environmental issues and commit themselves to addressing the problems.

To bolster our baseline finding, we inspect plausible underlying mechanisms

that enable the board of directors to exert their influences. First, we ensure that the time constraint faced by the board of directors is the channel through which a reduction in directors' board seats improves firms' environmental performance. If this premise is correct, relatively less committed directors should have a strong impact. Consistent with this intuition, we find that the positive effect of the board is driven by directors with three or fewer concurrent board positions. This result suggests that when committed to multiple board positions, the directors hardly can make an impact on the environmental issue for their firms.

Additionally, we analyze various board attributes belonging to two broad categories: environmental awareness and formal capacity. Presumably, individuals' environmental awareness is an important factor. Although such an attribute is not directly observable, prior literature documents that high scores in ethical and environmental issues are associated with directors with prior experience in firms of good environmental performance (Dixon-Fowler, Ellstrand, and Johnson, 2017; Homroy and Slechten, 2019; Iliev and Roth, 2021) and female directors (Braun, 2010; Cronqvist and Yu, 2017). We show that the affected directors with experience in high environmental performers lead to a positive effect three times as large as the one generated by the directors with experience in poor performers. Similarly, when the merger-affected directors are female, the positive effect is twice as large as that of the male counterparts. Furthermore, we examine directors' formal capacity that is likely to facilitate their influence, such as independent directors (Braun, 2010; Post et al., 2015; Rao and Tilt, 2016) and committee-serving directors (Shaukat et al., 2016). We confirm that the positive effect is more pronounced among these directors. Together, these results suggest that while personal awareness or formal capacity is a

board attribute closely linked to firms' environmental performance, their workload is a crucial factor that allows the board of directors to raise corporate environmental standards.

We further investigate heterogeneities across firms in the extent to which the affected directors can influence environmental performance. Like the board of directors, institutional investors can play a monitoring role, and these institutions, more engaged and active ones, in particular, are likely to push harder the directors to improve environmental performance (Dyck et al., 2019; Chen et al., 2020; Krueger et al., 2020). Similarly, the directors are likely to make a more significant effort to go green if their firms are located in the regions where the local voice for the environment is more potent, for example, in Democratic-leaning states (Di Giuli and Kostovetsky, 2014). Additionally, if firms are financially constrained, the directors' attempt to make a positive impact on the environment may be limited (Goetz, 2019; Iliev and Roth, 2021). We conduct cross-sectional analyses based on these characteristics and find the results consistent with the discussed intuitions.

Our study contributes to the literature in three important ways. First, we shed new light on the role played by the board of directors in overseeing firms' nonfinancial performance. Prior work has mainly revolved around the traditional role of the boards in assisting firms' financial metrics, while recent studies focus their investigation on the board busyness in particular (Field et al., 2013; Falato et al., 2014; Hauser, 2018; Brown et al., 2019). To our knowledge, ours is the first to provide evidence that over-committed board has a detrimental effect on firm environmental performance.

Second, this chapter extends the literature concerning whether holding multi-

ple directorships is effective in overseeing firms' activities. Particularly, our finding underscores the adequate time allocated to their board positions as an important condition for corporate boards to make a positive impact on environmental issues. It also suggests that a better outcome is achievable when such a condition is coupled with the directors' awareness and formal capacity to make influences (Di Giuli and Kostovetsky, 2014; Cronqvist and Yu, 2017; Amin et al., 2020; Iliev and Roth, 2021). Our study thus has an important policy implication for the debate on regulating multiple directorships.

Third, our work contributes to the voluminous literature concerned with environmental issues and corporate social responsibility (CSR) in general. In addition to the determinants of these CSR performances documented in prior studies, such as financial constraint, institutional investor engagement (Chen et al., 2020; Krueger et al., 2020), we show that the presence of the more engaged board of directors is an important determinant of firm environmental behavior.

The remainder of this chapter proceeds as follows. Section 2.2 describes the empirical approach and the sample construction. Section 2.3 presents the main results of the effect of director busyness on firm environmental performance. Section 2.4 inspects the economic mechanisms underlying our main finding, and Section 2.5 assesses heterogeneous effects across firm characteristics. Section 6 concludes.

2.2 Sample selection and empirical methods

2.2.1 Proxies for environmental performance and sample selection

We obtain the environmental component scores from the MSCI KLD ESG database (Flammer, 2015; Boone and Uysal, 2020; Chen et al., 2020). We analyze the environ-

mental concerns and strengths separately since controlling environmental concerns is perceived differently from improving strengths.[6] The environmental strength score is constructed from 5 dimensions of environmental strengths, including beneficial products and services, pollution prevention, recycling, clean energy, and other environmental strengths. The environmental concern score is constructed from 7 dimensions of environmental concerns, including hazardous waste, regulatory problems, ozone-depleting chemicals, substantial emissions, agricultural chemicals, climate change, and other environmental concerns.

The raw environmental score may be problematic for evaluating corporate environmental performance over years as the number of strengths and concerns within each category can differ. Since we examine the change in the overall environmental performance, the difference in the raw score could result from the new inclusion of environmental dimensions and thus bias the interpretation of our findings. To obtain consistent comparisons in both the cross-sectional and time-series analyses, we scale the scores of environmental strength and concern for each firm-year to a range of 0 to 1. We divide the number of strengths (or concerns) for each firm-year within each CSR category by the maximum possible number of strengths (or concerns) in the environmental category in each year to get the adjusted strength (or concern) score (Lins et al., 2017; Cao et al., 2019). The overall Env Score is defined as the difference between the adjusted environmental strength score and the adjusted environmental concern score.[7]

[6]KLD provides scores for multiple dimensions of environmental concerns and environmental strengths based on information gathered from newspaper articles, NGO report, regulatory reports, and company rankings. Details of MSCI KLD ESG Environmental indicators can be found from the WRDS MSCI ESG data manual. Available here.

[7]As a robust check, we also examine the effect of directors' workload on the change in the raw environmental score.

We also consider more direct environmental metrics related to environmental regulatory problems by examining the number of environmental violations at the firm- and facility-level using EPA ECHO data (Shive and Forster, 2020). Since one important task of environmental management is overseeing the environmental risks that may cause financial and reputation damage, we investigate how the reduction in board busyness can enhance firm environmental risk management. We use the EPA's Enforcement and Compliance History Online (ECHO) – the FE&C data sets to identify firms with environmental violation cases.[8] The data files include data on the environmental permits, inspection, violation, enforcement action, and penalty information on EPA-regulated facilities. These dimensions of environmental performance enable us to investigate the KLD concern of regulatory problems in greater detail. We match the data files to the firm-level identifiers by name following the step-by-step procedure explained in (Shive and Forster, 2020). We expect that a firm with a busy board would perform worse on the management of environmental risk management, captured by the probability of committing violation cases. $p(AFR)$ is the probability of a firm (or its facility) committing a formal administrative violation case in a given year. $p(JDC)$ is the probability of a firm (or its facility) committing a judicial violation case in a given year. Judicial actions are resolved by the courts outside the EPA thus they have stronger negative implications for violated firms.

We obtain directors' data from Institutional Shareholder Services (ISS Directors) for the period from 1996–2018. Since the ISS Directors database keeps the legacy and the current data files separately, we correct for data entry issues when

[8]Data from the publicly available EPA data download site only provide the current name of each facility. I thank Sophie Shive for providing the EPA data of historical facility names via Freedom of Information Act request and giving comments on the data sample details.

appending the two data files following (Coles et al., 2014). We then merge the director-level data with firm-level data, which comes from Compustat annual data file, and stock market data from Centre for Research in Security Prices (CRSP) daily returns file.

We collect the M&A data from the Thomson Reuters Securities Data Corporation (SDC) Mergers and Acquisitions database. We start with all U.S. domestic M&A deals announced between 1985 and 2018 with the standard selection criteria: (1) targets are U.S. public firms; (2) bidders are U.S. public, private, or subsidiary firms; (3) the deal value is no less than $1 million and accounts for at least 1% of the bidder's market value of equity at the fiscal-year end prior to the announcement date; (4) deals are completed; (5) deals are classified as mergers (6) successful deals are completed in less than 1,000 days, and (7) Targets have accounting data available on Compustat Annual File and stock market data from the Center for Research in Security Prices (CRSP).[9] Following Hauser (2018), we then match the M&A sample to the ISS Director data where the acquired firms can be identified. We allow a gap of one calendar year between the target's last year recorded by the ISS database and the year of deal completion provided by the SDC M&A database. This is because the final year of the acquired firm in ISS precedes the year of merger completion for most deals, where targets were no longer covered by ISS following issue Hauser (2018).

Our final sample identifies 687 mergers involving 1,270 affected directors who were serving on target firms' board before deal completion. Our sample includes

[9]Our M&A sample starts from 1985 because some deals announced in 1985 were completed in 1986. We restrict the sample to firms with positive book value of assets and total sales and with U.S. common shares only (share code 10 or 11). For the matching process, the initial match was based on the historical CUSIP from CRSP. For the remaining unmatched firms, I manually matched them using Ticker codes and company names.

655 unique treated firms—firms that have treated directors in the following year after merger completion—with 1,281 firm-year observations, coded as $Treat_{i,t}$ equals one.[10] The final sample includes a total of 2,112 unique firms (both treated and non-treated firms but not including target firms) with non-missing KLD E-score and other control variables, consisting of 15,761 firm-year observations for the period from 1986 to 2018.

2.2.2 Empirical approach

We exploit an exogenous shock to director workload when a target board is terminated due to M&A to examine the effect of a reduction in board busyness (Hauser, 2018) and firm environmental performance. The board of directors is almost always terminated from the board positions in the newly merged firms (Harford, 2003); thus, these directors experience a negative shock on their workload that can allow them to commit to their other board positions. This empirical design allows us to separate the reputation effect from the busyness effect.

By examining the effects of a shock to multiple directorships due to M&A, this approach can alleviate the endogenous concern of firm environmental performance and board busyness. It also offers a way to distinguish the director workload channel from the reputational effect in examining firm environmental policies or environment-related violations. Following Hauser (2018), we rely on the merger-shock events as the treatment effects to director-interlocked boards, captured by the variable $Treat_{i,t}$. We then define our main explanatory variable $Treat_{i,t}(num)$ as the aggregate number of directors experience merger shocks in firm i in year t,

[10] Over the same period, our final sample is smaller than that employed in Hauser (2018) since the KLD database does not cover all firms in the ISS Director data.

measuring the intensity of the treatment effect.

We first implement the Reduced form specification for empirical tests of comparing the director-interlocked firms to non-treated firms. The first reason is that there is a direct link between the main explanatory variable $Treat_{i,t}(num)$ and the change in the number of board seats, instead of the level of board seats held by affected directors. At the firm-level, the first-difference measures can also tease out the effect of newly-joined or just-left directors in the treatment year from the effect of shocks on treated directors. Thus, the first-differenced regressions allow one to consider both the within-firm and within-directorship in the affected firms and control for unobservable director-level time-invariant characteristics that could bias our interpretation of the results. The first-difference regression is as follows:

$$\Delta EnvScore_{i,t} = \beta_1 Treat_{i,t} + \gamma \Delta X_{i,t} + \lambda_t \times \mu_j + \epsilon_{i,t} \tag{2.1}$$

where $\Delta EnvScore_{i,t}$ includes firm-level control variables measured in first difference. These control variables are employed in prior studies about determinants of firm environmental performance (Ferrell, Liang, and Renneboog, 2016; Chen et al., 2020), including firm size, leverage, returns on assets, cash holdings, sales growth, dividends, advertising, stock volatility, research and development (R&D), board size, and the fraction of independent directors (Dyck et al., 2019; Chen et al., 2020). Firm size is positively associated with both strength and concerns scores. (Hong et al., 2012) document that firm financial conditions predict E&S adoption, thus we control for leverage and cash holdings. We further control for time-varying firm-level characteristics that influence firm environmental performance, consisting of sales growth, ROA, advertising expenses, R&D intensity, dividend payment (Chen et al., 2020), and firm stock return volatility (Albuquerque, Koskinen, Yang, and

Zhang, 2020). In addition, other than board busyness, firm governance characteristics including board size and fraction of independent directors, have positive effect on firm environmental performance (Duchin, Matsusaka, and Ozbas, 2010). We also control for the industry-by-year fixed effects $\lambda_t \times \mu_j$ to allow for interpretation of the treatment effect as the change in firm environmental performance for a treated firm in the same industry in any given year following the shock to the directors' workload. Detailed descriptions of all variables are provided in Appendix 2.A1.

To further investigate whether the merger shock reduces board busyness through the workload channel, we next rely on the IV approach. Specifically, we employ the target board termination events as an instrument for the aggregate change in board seats by all board members of a firm. We then examine whether the predicted reduction in the overall board workload on a firm's environmental performance. If our premise is true that director workload is an important determinant of firms' environmental performance, each concurrent board seats should incur a cost to each director-interlocked firm, and thus the reduction in workload can lead to improvement in management of environmental matters.

In terms of specification, we use $Treat_{i,t}$ as an instrument for $\Delta N.Boards_{i,t}$, where $\Delta N.Boards_{i,t}$ is the total number of changes in board seats by each director at the firm level. For a firm with only one treated director and no changes for all other directors, $\Delta N.Boards_{i,t}$ equals to one. The first stage regression is as follows:

$$\Delta N.Boards_{i,t} = \pi_1 Treat_{i,t} + \gamma \Delta X_{i,t} + \lambda_t \times \mu_j + \epsilon_{i,t} \tag{2.2}$$

The second stage is the regression of the change in environmental performance on the predicted change in the number of board seats at the firm level. We expect a negative relationship between the estimated $\Delta N.Boards_{i,t}$ from the first stage

regression and $\Delta EnvScore_{i,t}$. That is, a reduction in the director's workload can lead to an increase in firms' environmental performance. The second stage regression is as follows:

$$\Delta EnvScore_{i,t} = \pi_2 \Delta \widehat{N.Boards}_{i,t} + \gamma \Delta X_{i,t} + \lambda_t \times \mu_j + \epsilon_{i,t} \tag{2.3}$$

where we include the same sets of control variables and industry-by-year dummy variables as in the reduced form regression (2.1).

2.2.3 Summary statistics

Table 2.1 shows the summary statistics for the firm- and director-level characteristics. The 7.86 mean firm size suggests our full sample covers medium to large US firms. The sample mean of leverage is 2.22, with the mean annual ROA of 0.10 and cash holdings of 0.15. The summary statistics for main control variables are comparable to those reported in Hauser (2018) and Chen et al. (2020). The main difference to the sample used in Chen et al. (2020) arises from the sample restriction to S&P 1500 firms with available ISS Directors data.[11] Panel B of Table 2.1 shows the comparison between the treated and non-treated groups. On average, treat firms are bigger in firm size and board size. The treated firms also have a larger average KLD environmental score, but the difference is not significantly different. The summary statistics also show that, on average, the treated firm's board of directors is busier than the board of directors of the control firm (0.15 vs 0.06). Note that we use the first difference of these variables as control variables in our main regression analyses, which reduces the time fixed-effect difference between treated and control firms. Panels C and D of Table 2.1 show the summary statistics at the

[11] We also perform a battery of robustness tests using the BoardEx sample covering Russell 3000 firms. The interpretation of the main results is robust to using the BoardEx sample.

director level, and the distributions are similar to the results of (Hauser, 2018). In particular, approximately 77.4% of treated directors have a reduction of one board seat, and this pattern is not apparent for the non-treated directors.

Table 2.1 – Descriptive statistics

This table presents the summary statistics for the main variables used in our analysis and the number of board seats. Panels A and B show the variable statistics for the full sample over 1996-2018 and the treated and non-treated groups, respectively. Panel C shows the distribution of concurrent directorships in the final director sample. Panel D shows the change in board seats held by directors affected by the merger-induced termination of board positions (treated directors) and those directors who are not affected (non-treated directors). All variables are defined in Appendix 2.A1. All continuous independent variables are measured at the fiscal year-end and winsorized at 1st and 99th percentiles.

Panel A: Full sample

	Obs	Mean	S.D.	p25	p50	p75
Env Score	15,761	0.03	0.22	0.00	0.00	0.00
Env Score (Strengths)	15,761	0.09	0.20	0.00	0.00	0.00
Env Score (Concerns)	15,761	0.05	0.15	0.00	0.00	0.00
Busy	15,761	0.07	0.25	0.00	0.00	0.00
Firm Size	15,761	7.86	1.49	6.73	7.72	8.84
Leverage	15,761	0.22	0.17	0.08	0.21	0.33
ROA	15,761	0.10	0.08	0.06	0.10	0.14
Cash	15,761	0.15	0.15	0.03	0.09	0.21
Sales growth	15,761	0.08	0.19	-0.00	0.06	0.15
Dividends	15,761	0.60	0.49	0.00	1.00	1.00
Advertising	15,761	0.01	0.03	0.00	0.00	0.01
Stock volatility	15,761	0.02	0.01	0.02	0.02	0.03
R&D	15,761	0.03	0.04	0.00	0.00	0.04
Board Size	15,761	9.32	2.19	8.00	9.00	11.00
Independent board	15,761	0.75	0.14	0.67	0.78	0.88

Panel B: Treated and non-treated groups

	Treated			Non-treated		
	Obs	Mean	S.D.	Obs	Mean	S.D.
Env Score	1,281	0.05	0.26	14,480	0.03	0.22
Env Score (Strengths)	1,281	0.13	0.24	14,480	0.08	0.19
Env Score (Concerns)	1,281	0.08	0.19	14,480	0.05	0.15
busy	1,281	0.15	0.36	14,480	0.06	0.24
Firm Size	1,281	8.51	1.45	14,480	7.81	1.48
Leverage	1,281	0.25	0.16	14,480	0.22	0.17
ROA	1,281	0.10	0.07	14,480	0.10	0.08
Cash	1,281	0.12	0.13	14,480	0.15	0.15
Sales growth	1,281	0.06	0.18	14,480	0.08	0.19
Dividends	1,281	0.72	0.45	14,480	0.59	0.49
Advertising	1,281	0.01	0.03	14,480	0.01	0.03
Returns	1,281	0.02	0.01	14,480	0.02	0.02
R&D	1,281	0.03	0.04	14,480	0.03	0.04
Board Size	1,281	10.30	2.19	14,480	9.24	2.17
Independent board	1,281	0.77	0.14	14,480	0.75	0.14

Table 2.1: [con'd]

Panel C: Distribution of the number of board seats

N.Boards	Obs	Percent	Cum.
1	98,244	66.15	66.15
2	34,278	23.08	89.22
3	12,081	8.13	97.36
4	2,961	1.99	99.35
5 or more	963	0.65	100.00
Total	148,527	100.00	100.00

Panel D: Change in the number of board seats held by treated and non-treated directors

Treated directors			Non-treated directors		
$\Delta N.Boards$	Obs	Percent	$\Delta N.Boards$	Obs	Percent
-3	10	0.6%	-3	16	0.0%
-2	99	6.3%	-2	263	0.2%
-1	1,218	77.4%	-1	5,017	3.4%
0	232	14.8%	0	134,137	91.3%
1	11	0.7%	1	7,035	4.8%
2	1	0.1%	2	442	0.3%
3	1	0.1%	3	44	0.0%

2.3 The effect of board busyness on firms' environmental performance

2.3.1 OLS Estimation

We begin our analysis by using the widely recognized proxy for board busyness, first suggested in (Fich and Shivdasani, 2006), to investigate the relationship between board busyness and a firm's environmental performance. Busy boards are those with at least half of the independent directors identified as busy directors (have three or more concurrent external directorships). We employ the KLD overall CSR score and its five components, including Environmental, Community, Diversity, Employment, and Product, to measure firms' environmental performance. Table 2.2 presents the OLS regression results.

Table 2.2 – Busy board and CSR performance: OLS specification

This table presents the OLS regression results showing the effect of busy board on the overall CSR score and its five categories. Busy Board equals one if at least half of the independent directors are identified as busy directors (have three or more concurrent external directorships). ENV, COM, DIV, EMP, and PRO are the MSCI KLD Scores on Environment, Community, Diversity, Employment, and Products, respectively. The number of observations for community score is lower because the MSCI ESG KLD database does not provide all dimensions of community score over our sample period. All variables are defined in Appendix 2.A1. Continuous control variables are measured at the end of the previous fiscal year and winsorized at 1st and 99th percentiles. Standard errors are clustered at the firm level. t-statistics are shown in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

	CSR	ENV	COM	DIV	EMP	PRO
Busy Board	-0.096**	-0.049***	0.002	0.012	-0.008	-0.051***
	(-2.119)	(-3.357)	(0.090)	(0.665)	(-0.552)	(-2.873)
L.Firm Size	0.086***	0.022***	0.025***	0.061***	0.020***	-0.024***
	(5.412)	(4.885)	(4.919)	(12.075)	(4.208)	(-6.187)
L.Leverage	-0.060	0.021	-0.007	-0.071**	-0.019	0.026
	(-0.690)	(0.892)	(-0.264)	(-2.006)	(-0.779)	(1.230)
L.ROA	0.999***	0.190***	0.163***	0.136**	0.360***	0.081*
	(6.196)	(5.075)	(3.763)	(2.046)	(6.843)	(1.920)
L.Cash	0.180**	0.034	0.012	0.038	0.126***	0.010
	(2.099)	(1.594)	(0.522)	(0.950)	(4.718)	(0.466)
L.Sales growth	-0.078*	-0.027**	-0.021	-0.064***	0.011	0.015
	(-1.667)	(-2.214)	(-1.249)	(-3.205)	(0.784)	(1.350)
L.Dividends	0.062**	0.009	0.009	0.040***	0.004	0.000
	(2.215)	(1.444)	(1.058)	(3.256)	(0.516)	(0.036)
L.Advertising	1.977***	0.454***	0.688***	0.847***	0.325**	-0.315*
	(3.323)	(2.901)	(3.302)	(3.904)	(1.965)	(-1.916)
L.Returns	-1.600	-0.778**	0.172	-0.211	0.162	-0.448
	(-1.173)	(-2.074)	(0.413)	(-0.348)	(0.356)	(-1.293)
L.R&D	2.166***	0.307***	0.483***	0.477***	0.589***	0.180*
	(5.679)	(3.543)	(4.476)	(2.909)	(5.505)	(1.877)
L.Board Size	0.033***	0.004**	0.005**	0.026***	-0.001	0.002
	(4.808)	(2.103)	(2.534)	(8.414)	(-0.577)	(1.060)
L.Indep board	0.303***	0.009	0.036	0.374***	-0.035	-0.026
	(3.588)	(0.409)	(1.333)	(9.362)	(-1.179)	(-1.097)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13,154	17,728	13,154	16,761	17,728	17,728
Adjusted R2	0.231	0.201	0.143	0.285	0.190	0.174

Our findings suggest that the busyness of board directors is significantly negatively associated with the KLD overall CSR score and the scores for environment and product. But we do not find any statistically significant association between board busyness and the community, employment, and diversity scores. It is possible

that these indicators are either accessed in more immediate terms (e.g., employment, diversity), thus receiving more attention from directors even when they are relatively busy, or are difficult to measure (e.g., community).

Our results are robust to using alternative definitions of *Busy Board*. First, we measure the percentage of busy directors with three or more board positions out of the total number of director seats in a firm's board (Fich and Shivdasani, 2006). Regression results reported in Appendix 2.A2 show that board busyness is negatively associated with ENV and PRO. Second, we find that busy boards are more likely to be associated with EPA violations and subsequent environmental related penalties. The positive coefficients on *Busy Board* reported in Appendix 2.A3 indicate serious implications of board busyness on firm management of environmental issues. Overall, our preliminary results suggest that board busyness imposes a significant cost to firms' oversight of environmental performance.

2.3.2 Merger shocks to board workload

2.3.2.1 Reduced form results

Our main analysis relies on the M&A setting that introduces an exogenous reduction in the busyness of directors whose board seat at the acquired firms is terminated. We first examine whether treated directors who experience a reduction in workload would allocate additional time to other concurrent board appointments. Similar to (Hauser, 2018), we test for the propensity of treated directors to become a member or a chair of any board committees in director-interlocked firms. We find that treated directors are significantly more likely to take more responsibility in the treated firms by becoming committee members or chairs of any board committee, as shown

by the positive coefficients of Treated directors in Appendix 2.A4, consistent with Hauser (2018); Brown et al. (2019). The significant positive relationship between the reduction in directors' workload and treated firms' financial performances (measured by the change in returns on assets and the change in Tobin's Q) provides support to the argument that treated directors experiencing a reduction in workload due to M&A choose to reallocate at least some of this extra time to director-interlocked firms.

Next, we document the extra time allocation to the linked firms has an observable impact on the firm's environmental performance, suggesting the stark effect of the board of directors' attention in driving firm environmental management. Results in Table 2.3 show the statistically significant treatment effect on the positive change in firm environmental performance. Columns (1) to (3) show that compared to non-treated firms, treated firms experience a significant improvement in environmental performance measured in the treatment year and for one-year and two-year periods following the treatment year, not controlling for any fixed effects. Results presented in columns (4) to (6) show that the interpretation holds after controlling for industry-by-year fixed effects. On average, there is an improvement of 0.011 increase in the adjusted environmental score that translates into 37% increase from the mean of 0.03, which could lead to positive implications for the treated firm.

We also check the baseline results using the treatment indicator variable, *Treat (dummy variable)*, instead of the intensity of treatment, *Treat (num)*. In untabulated tests, we find that treated firms (dummy) experience a significant improvement of over 0.013 increase in the adjusted environmental score compared to the non-treated firms following the merge events. The results are robust to using the change in the

Table 2.3 – Merger-shock and environmental performances: Reduced-form regressions

This table presents the reduced-firm regression results of the treatment effect of the reduction to director workload on the change in firm environmental score. ΔE-Score (Δ_1E-Score, Δ_2E-Score) are the change in environmental performance between the treatment year (t+1 treatment year, t+2 treatment year) and the pre-treatment year. *Treat (num)* is the number of cases where a director was on the board of acquired firms in the pre-treatment year and lost the directorship in the treatment year. All control variables included in the regressions are the first difference and defined in the Appendix 2.A1. All regressions include industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

	ΔENV	Δ_1ENV	Δ_2ENV	ΔENV	Δ_1ENV	Δ_2ENV
Treat (Num)	0.009**	0.009**	0.010**	0.011***	0.011***	0.014***
	(2.446)	(2.284)	(2.081)	(2.904)	(2.667)	(3.000)
ΔFirm Size	-0.019***	-0.024***	-0.045***	-0.006	-0.005	-0.011
	(-2.605)	(-2.847)	(-4.601)	(-0.818)	(-0.598)	(-1.116)
ΔLeverage	0.014	0.010	0.021	0.008	0.007	0.007
	(0.821)	(0.558)	(1.011)	(0.507)	(0.400)	(0.360)
ΔROA	0.002	-0.012	-0.024	-0.020	-0.033	-0.016
	(0.087)	(-0.534)	(-1.046)	(-0.961)	(-1.513)	(-0.725)
ΔCash	-0.010	0.014	0.004	-0.014	-0.014	-0.032*
	(-0.625)	(0.865)	(0.230)	(-0.881)	(-0.850)	(-1.713)
ΔSales growth	0.041***	0.030***	0.030***	0.005	0.007	0.006
	(6.523)	(4.597)	(4.395)	(0.817)	(0.976)	(0.886)
ΔDividends	-0.015***	-0.016***	-0.018***	-0.008	-0.005	-0.003
	(-2.811)	(-2.830)	(-3.055)	(-1.404)	(-0.770)	(-0.509)
ΔAdvertising	0.516***	0.391*	0.236	0.467***	0.429**	0.414**
	(2.865)	(1.905)	(1.104)	(2.670)	(2.118)	(1.985)
ΔStock volatility	0.114	0.068	-0.188	-0.264	-0.084	-0.187
	(0.916)	(0.541)	(-1.379)	(-1.602)	(-0.439)	(-0.852)
ΔR&D	-0.115*	-0.225***	-0.298***	-0.080	-0.130*	-0.130
	(-1.768)	(-3.090)	(-3.304)	(-1.252)	(-1.812)	(-1.558)
ΔBoard Size	0.001	0.000	-0.000	0.001	-0.000	-0.001
	(0.644)	(0.076)	(-0.040)	(0.486)	(-0.081)	(-0.479)
ΔIndep board	0.013	0.012	0.031*	0.018	0.023	0.041**
	(0.922)	(0.818)	(1.800)	(1.337)	(1.553)	(2.342)
Indus×Year FE	No	No	No	Yes	Yes	Yes
N	13,893	12,754	11,022	13,893	12,754	11,022
Adjusted R2	0.004	0.002	0.003	0.105	0.119	0.132

raw MSCI KLD unadjusted environmental score. Since the change in firm environmental score is not frequent, observing a change in environmental score following to shock to directors' workload suggesting a considerable influence of board of directors in shaping this aspect of firms' operation.

Combining with the results reported in Table 2.2, our findings suggest that busy directors are detrimental to firm environmental performance, possibly because of the lack of environmental monitoring effort. Thus, a reduction in board busyness allowing additional time commitment to treated firms may cure low responsibility in environmental matters. Our results are also robust controlling for state-by-year fixed effects to account for the variation in state-level environmental regulation driving the results (Iliev and Roth, 2021).

2.3.2.2 Environmental strengths and environmental concerns

An increase in environmental concern can have stronger implications for firm than an increase in environmental strength, and thus using proxies based on the combination of environmental strengths and concerns might not be fully informative. Thus, we examine whether an improvement in firm environmental performance induced by the reduction in directors' workload stems from either improvement in strengths or from reduction in concerns, or both.

Table 2.4 presents the results of the association between the reduction in board busyness and each strength and concern component of environmental score. Our results reveal that the reduction in board busyness has a significantly positive effect on the environmental strength score (column 1-3) and a negative effect on the concern score (column 4-6), suggesting that the reduction in board busyness is beneficial, both in improving firm management of environmental matters and in addressing concern issues with more direct financial impacts.

Table 2.4 – The effect of merger-shocks on environmental strengths and concerns

This table presents the reduced-firm regression results of the treatment effect of the reduction of director workload on the change in firms' environmental strengths and concerns. Panel A presents the treatment effect on environmental strengths and concerns changes between the treatment (t+1, t+2) year and the pre-treatment year. Panels B and C present the components of environmental strengths and concerns, respectively. Treat (num) is the number of cases where a director was on the board of acquired firms in the pre-treatment year and lost the directorship in the treatment year. All control variables are the first difference and defined in Appendix 2.A1. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: Environmental strengths versus environmental concerns

	Strengths			Concerns		
	ΔENV	Δ_1ENV	Δ_2ENV	ΔENV	Δ_1ENV	Δ_2ENV
Treat (Num)	0.006*	0.006*	0.008*	-0.005***	-0.005**	-0.007***
	(1.821)	(1.654)	(1.821)	(-2.642)	(-2.293)	(-2.634)
ΔFirm Size	0.003	0.009	0.011	0.009**	0.014***	0.022***
	(0.509)	(1.181)	(1.258)	(2.024)	(2.885)	(4.065)
ΔLeverage	0.006	0.003	0.008	-0.002	-0.004	0.001
	(0.475)	(0.177)	(0.446)	(-0.208)	(-0.458)	(0.055)
ΔROA	-0.042***	-0.044***	-0.030*	-0.022	-0.010	-0.014
	(-2.694)	(-2.618)	(-1.720)	(-1.425)	(-0.669)	(-0.939)
ΔCash	-0.016	-0.015	-0.027*	-0.002	-0.001	0.005
	(-1.141)	(-1.074)	(-1.670)	(-0.226)	(-0.115)	(0.539)
ΔSales growth	0.003	-0.001	-0.002	-0.002	-0.008**	-0.008**
	(0.544)	(-0.235)	(-0.305)	(-0.679)	(-2.011)	(-2.179)
ΔDividends	-0.005	-0.006	-0.005	0.002	-0.001	-0.002
	(-1.215)	(-1.171)	(-1.013)	(0.672)	(-0.371)	(-0.533)
ΔAdvertising	0.311**	0.248*	0.302*	-0.156	-0.180	-0.112
	(2.454)	(1.650)	(1.670)	(-1.477)	(-1.541)	(-1.256)
ΔStock volatility	-0.275**	-0.139	-0.174	-0.011	-0.055	0.013
	(-2.061)	(-0.848)	(-0.968)	(-0.109)	(-0.450)	(0.089)
ΔR&D	-0.066	-0.107*	-0.083	0.014	0.023	0.048
	(-1.243)	(-1.671)	(-1.068)	(0.367)	(0.580)	(1.214)
ΔBoard Size	0.001	-0.000	0.000	0.000	0.000	0.001
	(0.805)	(-0.014)	(0.296)	(0.296)	(0.135)	(1.338)
ΔIndep board	0.005	0.009	0.015	-0.014	-0.014*	-0.026***
	(0.420)	(0.676)	(0.986)	(-1.645)	(-1.840)	(-2.762)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13,893	12,754	11,022	13,893	12,754	11,022
Adjusted R2	0.103	0.120	0.121	0.102	0.109	0.137

Table 2.4: [con'd]

Panel B: Environmental strength components

	Beneficial products &services	Pollution prevention	Recycling	Clean energy	Other Strengths
Treat (Num)	0.005	0.000	0.007***	0.010*	-0.005
	(1.237)	(0.118)	(3.021)	(1.764)	(-0.989)
Controls	Yes	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes	Yes
N	13,893	13,893	13,893	13,893	13,893
Adjusted R2	0.025	0.059	0.043	0.055	0.250

Panel C: Environmental concern components

	Hazardous waste	Regulatory problems	Ozone depleting	Substantial emissions	Agricultural waste	Climate change	Other concerns
Treat (Num)	-0.010***	-0.009**	-0.001**	-0.003	-0.001	0.000	0.001
	(-4.265)	(-2.382)	(-2.254)	(-0.580)	(-0.946)	(0.114)	(0.552)
Controls	Yes	Yes	Yes	Yes	Yes		
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13,893	13,893	13,893	13,893	13,893	13,893	13,893
Adjusted R2	0.099	0.069	0.033	0.094	0.018	0.177	0.125

Panel B and C of Table 2.4 presents the effect of the reduction in multiple directorships on each strength and concern dimension. Panel B shows the decomposition of the effect across each category of environmental strengths. Specifically, a reduction in board busyness can encourage directors to engage and initiate policies related to 'Recycling' and 'Clean energy' components.[12] Panel C presents results of the effect of the reduction in multiple directorships on environmental concern indicators. We document that additional time to directors is allocated to reducing concerns about "Hazardous waste" and "Regulatory compliance problems" and "Ozone-depleting problem". In particular, these concern indicators evaluate whether a firm has recently paid fines, penalties, or settlements for waste management or

[12]The definition of these components changes slightly with each data release. According to the MSCI KLD ESG manual, since the 2012 data release, the updated 'Recycling' indicator evaluates corporate compliance with environmental regulations related to packaging, recycling, or disposal of packaging materials. The 'Clean energy' indicator evaluates a broader concept of a firm's policies, programs and initiatives regarding climate change.

other non-compliance with the US environmental regulations.

Given that time allocation by the board of directors is unobservable, the results provide insight into how the board of directors prioritizes various aspects of environmental management to make changes when one of their attributes changes (time commitment). Overall, our findings suggest that focused directors play a positive part in shaping firm environmental performance, reflected by the increase in strength of environmental performance such as launching new initiatives related to Clean energy and Recycling; and targeting the most material environmental concerns that require compulsory response such as addressing the regulatory compliance concerns.

2.3.2.3 IV results

In this subsection, we employ the target board termination event as an instrument for the aggregate change in board seats by all board members of a firm. We expect that the merger events induce a reduction in aggregate change in directors' board seats, thus relax the average board workload. If the reduction in directors' workload can create an improvement in firms' environmental performance, we expect that the opposite is true, meaning the predicted increase in workload can worsen the firms' environmental performance. Hence, we expect a negative sign of predicted change in board seats on firms' environmental performance in the specification (2.3).

Table 2.5 presents the results from instrumental variable regressions to test for the workload channel of directors. The first stage of IV regression shows that director-linked treated firm is significantly associated with the reduction in the firm-level aggregation of change in director's workload, with the F-stat for the weak

Table 2.5 – The effect of merger-shocks on environmental performance: IV regressions

This table presents the instrumental variable regression results of the treatment effect of the reduction to director workload of the change in the total number of board seats on the change in firm environmental score. *Treat (num)* is the number of cases where a director was on the board of acquired firms in the pre-treatment year and lost the directorship in the treatment year. The second-stage regressions (Column (2), (4), and (6)) are for the change in environmental score on predicted change in the number of total board seats, fitted from the first-stage regression (Column (1), (3) and (5), respectively). All control variables included in the regressions are the first difference and defined in the Appendix 2.A1. All regressions include industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5 and 1% level, respectively.

	ΔENV		Δ_1ENV		Δ_2ENV	
	1 Stage	2 Stage	1 Stage	2 Stage	1 Stage	2 Stage
	(1)	(2)	(3)	(4)	(5)	(6)
Δ*N.Boards*		-0.011**		-0.013***		-0.016***
		(-2.567)		(-2.615)		(-3.018)
Treat (Num)	-0.889***		-0.889***		-0.895***	
	(-21.842)		(-20.472)		(-19.164)	
ΔFirm Size	-0.249***	-0.012	-0.308***	-0.012	-0.341***	-0.020**
	(-2.811)	(-1.608)	(-3.134)	(-1.385)	(-3.030)	(-2.073)
ΔLeverage	0.125	0.014	0.033	0.009	-0.011	0.007
	(0.729)	(0.880)	(0.176)	(0.484)	(-0.051)	(0.350)
ΔROA	-0.363**	-0.020	-0.325*	-0.033	-0.428**	-0.018
	(-2.164)	(-1.011)	(-1.783)	(-1.427)	(-2.102)	(-0.648)
ΔCash	0.009	-0.000	0.005	-0.001	0.000	-0.002
	(0.492)	(-0.127)	(0.272)	(-0.649)	(0.004)	(-0.919)
ΔSales growth	0.073	-0.009	0.082	-0.011	0.094	-0.028
	(0.564)	(-0.541)	(0.572)	(-0.645)	(0.601)	(-1.414)
ΔDividends	0.153**	0.007	0.178***	0.009	0.156**	0.009
	(2.553)	(1.061)	(2.730)	(1.276)	(2.162)	(1.170)
ΔAdvertising	-0.001	-0.008	0.011	-0.004	0.043	-0.003
	(-0.015)	(-1.529)	(0.193)	(-0.697)	(0.718)	(-0.362)
ΔStock volatility	1.282	0.512***	1.849	0.451**	3.441	0.466**
	(0.721)	(3.172)	(0.839)	(2.485)	(1.469)	(2.427)
ΔR&D	-2.161***	-0.080	-2.471***	-0.158**	-2.380**	-0.164*
	(-2.635)	(-1.247)	(-2.850)	(-2.053)	(-2.430)	(-1.788)
ΔBoard Size	0.062***	0.002	0.055***	0.001	0.048***	0.000
	(4.899)	(1.606)	(4.101)	(0.534)	(3.242)	(0.089)
ΔIndep board	0.576***	0.024*	0.545***	0.026*	0.536***	0.046**
	(3.888)	(1.749)	(3.415)	(1.660)	(3.071)	(2.472)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13,893	12,754	11,022	13,893	12,754	11,022
Adjusted R2		0.096		0.113		0.121
Kleibergen-Paap Fstat	477.08		419.121		367.278	

instrumental variable is 300. The second stage of the regression shows that a reduction in the firm-level number of board seats leads to an increase in environmental score for treatment firms, as shown by the significantly negative coefficients. The magnitude of estimated coefficients shown in Table 5 resembles the value estimated from the reduced-form regression results in Table 2.3, hence confirms our conjecture of the negative impact of director busyness on firm environmental performance via the workload channel. Our findings further extend the line of literature on the detrimental consequences of director busyness, not only on operating and financial performance Hauser (2018); Brown et al. (2019), but also on corporate non-financial strategies.

2.3.3 Robustness tests

2.3.3.1 Alternative measures of environmental performance

There is significant disagreement among ESG data providers on firm ESG ratings because different data vendors employ different set of metrics and dissimilar methodologies to construct a single environmental score for each company Berg, Koelbel, and Rigobon (2019); Gibson, Krueger, and Schmidt (2019). Using the ESG data for the S&P 500 sample from six main ESG data providers, Gibson et al. (2019) show that although the correlation between environmental ratings is highest among the three E, S and G dimensions, the average correlation is only 0.43. Thus, we investigate whether our main premise is robust to using alternative environmental performance measures.

First, the direct and hard metric related to firm environmental concerns is the number and probability of committing EPA violation cases by firms, since those

violations often result in penalty fees borne by firms. Panel A of Table 2.6 shows that the reduction in board busyness is associated with a lower probability of director-interlocked firms committing environmental violation cases as reported by the EPA. The negative association is most pronounced for environmental juridical violations which often results in stronger material implications for violated firms in both the short and long term. The results are consistent with the negative association between the treatment effect and the "Regulatory problems" indicator as shown in Panel B of Table 2.4. Overall, our findings further support the argument that the relaxation in board directorship can allow directors to spend time to address the most detrimental effect of firm environmental practices.

Second, to ensure the robustness of our findings of the effect of the busy board on environmental performances, we employ Thomson Reuters' ASSET4 database on the Environmental pillar score. Since the data provided by Eikon is not available until 2002, the sample for this test is smaller.[13] Results presented in panel B of Table 6 show that there is a significantly positive effect of the reduction in board busyness and the change in Thomson Reuters environmental innovation score. We find that there is a positive but insignificant effect of the treatment effect on the overall environmental pillar score and other two environmental dimensions including Emission Reduction and Resource Use. One possible explanation for this finding is that a significant difference in sample size arises due to the irregular coverage of this score for many firms. The results from using this alternative measure of E performance complement those shown in Table 2.4, suggesting that the additional

[13]We merge data by matching the ISIN provided by Eikon to the historical CUSIPS in CRSP and check name-matching for the remaining unmatched. Since the Thomson Reuters ESG database tracks a much smaller cross-section of U.S firms over a shorter period, we use this small sample only to provide corroborative evidence for the overall effects.

time resulting from the reduction in board busyness allows directors to dedicate to the discussion of new environmental initiatives to solidify firm environmental strengths.

Table 2.6 – Alternative measures for environmental performance

This table presents the reduced-form regression results of the effect of the change in the total number of board seats on the probability of a firm committing an environmental violation case, whether it is a formal administrative environmental violation case (AFR) or judicial environmental violation case (JDC). *Treat (num)* is the number of cases where a director was on the board of acquired firms in the pre-treatment year and lost the directorship in the treatment year. The dependent variable in Columns (1) and (3) is the probability of a firm committing an AFR violation in the treatment-year and 1-year-post treatment year. The dependent variable in Columns (2) and (4) is the probability of a firm committing a JDC violation in the treatment-year and 1-year-post treatment year. All control variables included in the regressions are the first difference and defined in the Appendix 2.A1. All regressions include industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: EPA environmental violations

	$Prob(x)_t$			$Prob(x)_{t+1}$		
	Total EPA	AFR	JDC	Total EPA	AFR	JDC
	(1)	(2)	(3)	(4)	(5)	(6)
Treat (Num)	-0.009	-0.008	-0.039***	-0.022*	-0.020*	-0.057***
	(-0.886)	(-0.799)	(-4.999)	(-1.860)	(-1.749)	(-5.944)
ΔFirm Size	-0.114***	-0.123***	-0.106***	-0.136***	-0.143***	-0.133***
	(-5.308)	(-5.808)	(-6.736)	(-5.726)	(-6.013)	(-6.793)
ΔLeverage	0.127**	0.135**	0.091**	0.118*	0.125**	0.115**
	(2.247)	(2.413)	(2.189)	(1.881)	(2.004)	(2.217)
ΔROA	-0.119**	-0.111*	-0.132***	-0.116*	-0.098	-0.139**
	(-1.968)	(-1.845)	(-2.952)	(-1.724)	(-1.455)	(-2.500)
ΔCash	0.062	0.055	0.036	-0.009	-0.012	-0.065
	(1.162)	(1.032)	(0.900)	(-0.143)	(-0.204)	(-1.320)
ΔSales growth	0.019	0.014	0.017	0.017	0.012	-0.005
	(0.948)	(0.710)	(1.156)	(0.771)	(0.565)	(-0.252)
ΔDividends	-0.003	-0.001	-0.027*	-0.000	-0.002	-0.029
	(-0.167)	(-0.053)	(-1.806)	(-0.005)	(-0.097)	(-1.601)
ΔAdvertising	-0.706	-0.690	-0.507	0.003	0.047	-0.364
	(-1.224)	(-1.207)	(-1.193)	(0.005)	(0.073)	(-0.689)
ΔStock volatility	2.047***	1.976***	2.835***	2.990***	2.981***	4.773***
	(3.452)	(3.362)	(6.486)	(4.537)	(4.536)	(8.784)
ΔR&D	-0.511*	-0.472	-0.441*	-0.605*	-0.617*	-0.231
	(-1.653)	(-1.540)	(-1.938)	(-1.762)	(-1.801)	(-0.815)
ΔBoard Size	-0.002	-0.002	0.001	-0.001	0.001	-0.001
	(-0.622)	(-0.679)	(0.399)	(-0.134)	(0.199)	(-0.380)
ΔIndep board	-0.045	-0.036	0.027	-0.099*	-0.083	0.026
	(-0.882)	(-0.702)	(0.724)	(-1.735)	(-1.471)	(0.557)
Indus×Year FE	No	No	No	Yes	Yes	Yes
N	13,473	13,473	13,473	13,473	13,473	13,473
Adjusted R2	0.080	0.075	0.039	0.174	0.173	0.250

Table 2.6: [con'd]

Panel B: Sustainability score: Dependent variable is ΔEnvironmental innovation score

	ΔENV	Δ_1ENV	Δ_2ENV
Treat (Num)	1.569***	1.418*	1.817*
	(2.141)	(1.829)	(1.896)
Controls	Yes	Yes	Yes
Yes	Yes		
Indus×Year FE	Yes	Yes	Yes
N	4,720	4,720	4,720
Adjusted R2	0.050	0.094	0.075

Finally, we also examine the effect of treat firms on the materiality of environmental issues. Prior studies show that the categories that are financially material for firms vary across industries (Khan, Serafeim, and Yoon, 2016). For example, hazard waste can be a material issue for utility firms but are immaterial for the consumer goods industry (SASB). To shed light on the specificity of environmental pressure on firms, we investigate whether treat firms focus on material or immaterial categories. To distinguish the material environmental issues from the immaterial issues, we use the materiality classification from SASB.[14] We map SASB's industry/sectors classification to Fama-French 48 industries.[15] Then, to determine the firm-level materiality of environmental rating from the MSCI KLD database, the material environmental components are the product of those components and materiality score (1 for material and 0 for non-material). We construct the material environmental score in a similar fashion as the environmental score described in section 3, as the difference between material strength minus material concern. We find that the board of directors concentrate on addressing material environmental risks when they have more time dedicated to these issues.

[14]SASB materiality by industry classification is available here

[15]We map the each KLD subcategories from the 48 Fama-French industries to the SASB's industry materiality based on the industry definitions.

2.3.3.2 Falsification tests: Withdrawn deal sample

In this section, we present falsification test results using the withdrawn takeover bids. Directors of firms receiving withdrawn takeover offers do not experience a reduction in workload since the target board was not dissolved. There is no obvious reason why the takeover effect can drive the change in the environmental performance of director-linked firms, except for cases where acquisitions are initiated primarily due to environmental issues of target firms. In the latter scenario, directors of firms experiencing the takeover announcement purely due to environmental reasons, might spend more effort to tackle the environmental issues in director-interlocked firms even without reduction in their workload. The placebo test however allows us to examine the possibility of the spill-over effect of environmental performance via the takeover channel.

Table 2.7 presents the results using the withdrawn deals as falsification tests. The first stage estimated regression coefficients in all three placebo test regressions are not significant, with the Kleibergen-Paap F-statistics of 0.311, indicating that the $Treat_{i,t}$ variable is not an adequate instrument for the change in the board of director workload. Therefore, the second-stage regression results do not give rise to meaningful interpretation. The findings obtained from the falsification tests also alleviate the concern that the direct-takeover effect is the main channel driving the positive effect of the reduction of directors' workload and firm environmental performance. Overall, we provide evidence consistent with the argument that reduction in director workload is the main driver of the change in corporate environmental performance in director-linked firms.

Table 2.7 – Falsification test: Withdrawn deals

This table presents the regression results from placebo tests using withdrawn mergers in which directors are not terminated from their target-firm directorship. The observable characteristics used for propensity score are the control variables in Table 2.3. *Treat (num)* is the number of cases where a director was on the board of acquired firms in the pre-treatment year and lost the directorship in the treatment year. The second-stage regressions (columns (2), (4), and (6)) are the change in environmental score on predicted change in the total number of board seats, fitted from the first-stage regression (columns (1), (3), and (5), respectively). All control variables included in the regressions are the first difference and defined in the Appendix 2.A1. All regressions include industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

	ΔENV		Δ_1ENV		Δ_2ENV	
	1 Stage	2 Stage	1 Stage	2 Stage	1 Stage	2 Stage
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta N.Boards$		-0.280		-0.391		-0.338
		(-0.872)		(-1.000)		(-1.300)
Treat (Placebo)	-0.074		-0.085		-0.124	
	(-0.951)		(-1.028)		(-1.366)	
ΔFirm Size	-0.288***	-0.091	-0.365***	-0.154	-0.413***	-0.160
	(-3.205)	(-0.952)	(-3.694)	(-1.045)	(-3.719)	(-1.409)
ΔLeverage	0.224	0.068	0.117	0.051	0.071	0.035
	(1.171)	(0.767)	(0.558)	(0.560)	(0.305)	(0.442)
ΔROA	-0.112	-0.033	0.008	-0.016	-0.019	-0.017
	(-0.653)	(-0.535)	(0.042)	(-0.219)	(-0.095)	(-0.243)
ΔCash	0.015	0.005	0.006	0.003	0.209	0.042
	(0.812)	(0.689)	(0.277)	(0.418)	(1.257)	(0.525)
ΔSales growth	0.082	0.009	0.144	0.042	0.103	0.036
	(0.586)	(0.188)	(0.933)	(0.514)	(1.392)	(0.998)
ΔDividends	0.101	0.030	0.118*	0.049	0.050	0.014
	(1.645)	(0.809)	(1.761)	(0.930)	(0.815)	(0.574)
ΔAdvertising	-0.010	-0.008	0.016	0.005	5.236*	2.156
	(-0.199)	(-0.551)	(0.288)	(0.239)	(1.936)	(1.336)
ΔStock volatility	3.541**	1.544	4.773**	2.292	7.555***	2.382
	(2.069)	(1.256)	(2.168)	(1.124)	(3.078)	(1.120)
ΔR&D	-1.867**	-0.589	-1.816*	-0.842	-1.744*	-0.793
	(-2.100)	(-0.899)	(-1.947)	(-1.043)	(-1.697)	(-1.377)
ΔBoard Size	0.069***	0.020	0.064***	0.025	0.060***	0.020
	(5.321)	(0.887)	(4.579)	(0.981)	(3.954)	(1.223)
ΔIndep board	0.594***	0.188	0.561***	0.243	0.537***	0.236
	(3.987)	(0.957)	(3.512)	(1.064)	(3.107)	(1.553)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N		11,305		9,729		8,345
Adjusted R2		-3.632		-6.418		-4.294
Kleibergen-Paap Fstat	0.905		1.057		1.866	

2.3.3.3 Matched control sample and alternative sample of directors

First, we replicate the main tests using the more controlled setting where each treated firm is matched to a control firm in the same industry year based on the observable firm characteristics. These characteristics are used as control variables in the regression in Table 2.3. We use the propensity score matching method to match each treated observation to one control observation using the nearest neighbor method. Panel A of Table 2.8 shows that magnitude of estimated coefficients is comparable to the reported IV estimates as shown in columns (4) to (6) of Table 5, and thus ensuring that our prior findings uphold in a more controlled setting. Overall, our findings corroborate the argument that the workload of directors is imperative for defining firm environmental policies and performance.

Next, we re-examine and reproduce the findings using the BoardEx sample of the director data. BoardEx sample covers approximately 1,500-1,900 firms from 2000-2002 and has expanded their coverage to more than 3,000 firms since 2003, thus cover a broader range of firms compared to the ISS Director sample. Panel B of Table 2.8 presents the regression results using an BoardEx director data. Our results here are consistent with the baseline results, showing that the increase in board appointments at the firm level reduces the adjusted environmental performance by 0.004 point of adjusted environmental score. The magnitude of the effect using the BoardEx sample is approximately 2.5 times smaller compared to the magnitude of the effect using the ISS Director sample. The smaller magnitude of the observed effect can be attributed to the difference in the characteristics of firms covered by each database.[16]

[16]Our findings are also robust to restricting the final sample to 2010 before MSCI changed its data collection method.

Table 2.8 – Robustness checks: Merger-shocks and directors' workload

This table presents the instrumental variable regression results for robustness checks. Panel A shows the regression results using the matched-control groups, where the control group is defined using the propensity score matching method to match each treated observation to a control observation with the closest propensity scores in the same industry and year. Panel B shows the regression results using the BoardEx sample of directors' data. The observable characteristics used for propensity score are the control variables in Table 2.3. *Treat (num)* is the number of cases where a director was on the board of acquired firms in the pre-treatment year and lost the directorship in the treatment year. The second-stage regressions (columns (2), (4), and (6)) are the change in environmental score on predicted change in the total number of board seats, fitted from the first-stage regression (columns (1), (3), and (5), respectively). All control variables included in the regressions are the first difference and defined as in the Appendix 2.A1. All regressions include industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: Matched control firms of nearest neighbors

	ΔENV		Δ_1ENV		Δ_2ENV	
	1 Stage	2 Stage	1 Stage	2 Stage	1 Stage	2 Stage
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta N.Boards$		-0.012**		-0.012**		-0.015**
		(-2.269)		(-2.003)		(-2.276)
Treat (num)	-0.841***		-0.827***		-0.887***	
	(-14.659)		(-13.266)		(-12.704)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2,506	2,506	2,190	2,190	1,920	1,920
Adjusted R2		0.116		0.169		0.159
Kleibergen-Paap Fstat					161.395	

Panel B: Using BoardEx database for directors' sample

	ΔENV		Δ_1ENV		Δ_2ENV	
	1 Stage	2 Stage	1 Stage	2 Stage	1 Stage	2 Stage
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta N.Boards$		-0.004**		-0.005**		-0.007***
		(-2.091)		(-2.360)		(-2.682)
Treat (num)	-1.288***		-1.287***		-1.268***	
	(-28.419)		(-24.990)		(-21.844)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	19,278	19,278	16,080	16,080	13,475	13,475
Adjusted R2		0.076		0.082		0.089
Kleibergen-Paap Fstat	807.615		624.503		477.147	

2.4 Inspecting economic mechanisms

This section investigates the heterogeneity of directors' influence on firm environmental management. Previous studies show that there is a positive correlation between CSR score and independent directors (Braun, 2010; Post et al., 2015; Rao and Tilt, 2016), and the fraction of female board members (Cronqvist and Yu, 2017). We further examine the variation in the impact of board of directors on firm environmental score across other dimensions of directors' characteristics. Since we separate treated directors into multiple groups based on directors' characteristics and firms' characteristic for the following tests, we employ the reduced-form regressions instead of the IV regressions (where only one instrument is available).

2.4.1 Inspecting the directors' time constraint and network channels

To ensure that the time constraint faced by the board of directors is the channel through which a reduction in directorships leads to an improvement in firm environmental performance, we examine the effect of relatively less committed directors versus that of more committed directors. Table 2.9 presents the regression results of the effect of very-busy vs less-busy directors. We find that the shock to multiple directorships for very-busy directors do not guarantee that these directors allocate more time to board appointment in director-linked firms over environment-related management or discussion. The results here suggest different implications of a reduction in the workload of busy directors over the firm financial management in (Brown et al., 2019), where busy directors are likely to allocate extra time to board reductions following merger shocks. On the environmental aspect, our results are intuitive for two reasons. First, environmental matters tend to not be prioritized

over the financial matters as discussed earlier, thus the extra time for very-busy directors might have been allocated for financial tasks in the treated firms. Less-busy directors, however, have more capacity to create changes on the issues following the reduction in their workload. Second, time dedicated to addressing the environmental issues is longer than that to improve in financial measures because of the long-term nature of the environment. Consistent with the time constraint channel, our findings suggest that the shock to a reduction in workload the directors with three or more concurrent board positions might not be sufficient for them to create significant change on environmental matters.

Table 2.9 – Inspection of the directors' time constraint and connection channels

Panel A presents the reduced-form regression results of inspection of the time constraint channel. *Treat (Less Busy)* is the number of cases a treated director is completely free from acquired firm responsibility in the treatment year and has less than or equal to three concurrent directorships in a given year (or more than three for *Treat (Very Busy)*). Panel B presents the reduced-form regression results of inspection of the director connection channel. *Treat (TC3) [Treat (TC2), Treat (TC1]* is the number of cases a treated director is completely free from acquired firm responsibility in the treatment year and is connected to the target firms in the top/middle/bottom tercile of target board connection in the year before merger events. ΔE-Score (Δ_1E-Score, Δ_2E-Score) are the change in environmental performance between the treatment year (t+1 treatment year, t+2 treatment year) and the pre-treatment year. All control variables included in the regressions are first-difference and defined as in the Appendix 2.A1. All regressions include control variables as shown in Table 2.3 and industry-by-year dummies. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: Time constraint channel

	ΔE-Score	Δ_1E-Score	Δ_2E-Score
Treat (Less Busy)	0.013***	0.013***	0.015***
	(2.905)	(2.823)	(2.807)
Treat (Very Busy)	-0.000	-0.002	-0.011
	(-0.017)	(-0.127)	(0.790)
Controls	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes
N	13,893	12,754	11,022
Adjusted R2	0.105	0.119	0.131

Panel B: Director connection channel

	ΔE-Score	Δ_1E-Score	Δ_2E-Score
Treat (TC3)	0.013*	0.016*	0.021**
	(1.73)	(1.84)	(2.21)
Treat (TC2)	-0.005	0.000	-0.001
	(-0.71)	(0.03)	(-0.08)
Treat (TC1)	0.009	-0.002	-0.004
	(1.27)	(-0.25)	(-0.45)
Controls	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes
N	13,893	12,754	11,022
Adjusted R2	0.098	0.114	0.128

We also investigate whether board connection impact the documented positive relationship between reduction in busyness and improvement in firms' environmental performance (Brown et al., 2019). This is because there is a trade-off between busyness and board connection argument. We show that treated directors who departed from target board with largest network connection can improve environmental performance of the treated firms the most. Combined with the results in Panel A, our findings support the argument that treated directors with sufficient time (less busy) and sufficient past network (connected to target with largest network) seem to help firms to improve the environmental performance the most. Our findings thus support the view that the combination of time and network of directors benefit the management of environmental performance.

2.4.2 Directors' environmental awareness

To examine whether directors' expertise related to environmental aspects can influence their affected firms' environmental performance, we separate directors into those who work in firms with overall non-negative (good and neutral) and negative (poor) environmental performance. Since we examine environmental performance as the outcome, we design an empirical approach to tease out the ef-

fect of connection/experience that directly linked to environmental matters, from the effect of director workload. Within the treated firm group, we rank directors into groups connected to the overall environmental performances. The $Treat_{Env>0}$, $Treat_{Env>=0}$, and $Treat_{Env<0}$ are created in a similar fashion as *Treat (num)*. Variables $Treat_{Env>0}$, $Treat_{Env>=0}$, and $Treat_{Env<0}$ are defined as the total number of cases where a board member is terminated from an acquired firm board position and the treated director(s) is linked to firms with overall good, neutral and bad environmental performance, respectively. Detailed descriptions of these variables are provided in Appendix 2.A1.

Results presented in Panel A of Table 2.10 show that the improvement in firm environmental performance is driven by the reduction in workload of directors with exposure to overall good environmental practices. Directors who are linked to other firms with good environmental performance can utilize their experience to help treated firms following the reduction of their workload. This effect is not significant when directors are linked to overall toxic firms. The results here spark an interesting heterogeneity of the strategic connection on the environmental management via director-channel: among treated firms, treated directors increase their influence over the environmental matters only if they are exposed to good environmental practice.

In addition to that, we perform analysis using directors' prior experience with EPA environmental violations as proxy for exposure to environmental practice. Consistent with the above results, we find that directors who are exposed to good environmental practice, meaning that who work in firms with no environmental violations as recorded by EPA, contribute to the lower probability of firms committing serious judicial environmental cases when they allocate additional time to the man-

agement of those firms.[17] However, prior experience with environmental violations does not lead to significantly lower probability of committing any formal administrative environmental violation cases given additional time. The results here suggest that directors only allocate time to oversee the most serious aspect of environmental management of the firms, instead of making significantly improve in environmental risk management of the firms.

Table 2.10 – Directors with better awareness about environmental issues

This table presents the reduced-form regression results of the heterogeneous treatment effect of the reduction to directors' workload on firm environmental score.ΔE-Score (Δ_1E-Score, Δ_2E-Score) are the change in environmental performance between the treatment year (t+1 treatment year, t+2 treatment year) and the pre-treatment year. Panel A presents the results of the effects of directors with previous experience linked to firm environmental management on the changes in environmental performances. $Treat_{Env>0}$ [$Treat_{Env=0}$/ $Treat_{Env<0}$] is the number of cases a treated director is completely free from acquired firm responsibility in the treatment year and is linked to other firms with good [neutral/poor] environmental performances, respectively, where $Env > 0$ [$Env = 0$/ $Env < 0$] takes a value of one if the average environmental score of other director-linked firms is positive [zero/negative]. $Treat_Env >= 0$ is constructed in a similar fashion where $Env >= 0$ equals one if the average environmental score of other director-linked firms is non-negative. Panel B presents the results of the effects of female vs male directors on the changes in environmental performances. *Treat (female/male)* is the number of cases when a treated director is completely free from acquired firm responsibility in the treatment year and is a female (male) director. All control variables included in the regressions are first different and defined as in the Appendix 2.A1. All regressions include control variables as shown in Table 2.3 and industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: Directors' experience in director-interlocked firms

	ΔENV	Δ_1ENV	Δ_2ENV	ΔENV	Δ_1ENV	Δ_2ENV
$\text{Treat}_{Env>0}$	0.034*	0.033*	0.032			
	(1.790)	(1.689)	(1.552)			
$\text{Treat}_{Env=0}$	0.029**	0.029**	0.035**			
	(2.271)	(2.362)	(2.552)			
$\text{Treat}_{Env>=0}$				0.033***	0.032***	0.036***
				(3.124)	(3.032)	(3.107)
$\text{Treat}_{Env<0}$	0.010	0.021	0.020	0.010	0.021	0.021
	(0.753)	(1.287)	(1.190)	(0.752)	(1.292)	(1.200)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13,893	12,754	11,022	13,893	12,754	11,022
Adjusted R2	0.106	0.120	0.132	0.106	0.120	0.132

[17]There are 278 treated firms in our sample linked to treated directors who did not have exposure to environmental violations, whereas there are 198 treated firms linked to treated directors who previously worked in firms committed EPA environmental violations.

Panel B: Female vs Male directors

	ΔENV	Δ_1ENV	Δ_2ENV
Treat (Female)	0.027*	0.021*	0.030*
	(1.915)	(1.401)	(1.700)
Treat (Male)	0.009**	0.010**	0.012**
	(2.187)	(2.238)	(2.448)
Indus×Year FE	Yes	Yes	Yes
N	13,893	12,754	11,022
Adjusted R2	0.107	0.122	0.137

We further explore a different dimension of environmental awareness that is proxied by directors' gender. Prior studies also show that female directors are more committed to the environmental program and are more engaged with firm environmental initiatives (Braun, 2010; Cronqvist and Yu, 2017; Dyck, Lins, Roth, Towner, and Wagner, 2021). Braun (2010) provides evidence to support the argument that female directors have stronger commitment and engagement to environmental issues. Dyck et al. (2021) document that firms with better governance mechanisms that focus on board renewal and appointment of female directors can facilitate better environmental performance. Taken together, we hypothesize that female directors have relatively higher awareness and motivation to monitor firm environmental practice. Thus, we investigate the effect of the shock to female directors' workload separately from the effect of the shock to male directors on firm environmental performance.

We find that female directors might dedicate more time to board appointments to address the environmental matters. Results in Panel B of Table 2.10 show an improvement of over nearly 0.03 point increase in the adjusted environmental score (or 100% increase from the sample mean of adjusted environmental score of 0.03) compared to the average of 0.01 point increase by the effect of workload reduction to male directors. Overall, our findings suggest that the intersection between board busyness and experience as well as awareness can greatly impact corporate

environmental performance.

2.4.3 Directors' time and capacity to make influences

Directors are not homogeneous in their approach to environmental changes when they experience a reduction in workload. The impact of a reduction of busyness varies with the role of each director in director-interlocked firm. Thus, we examine how the difference in directors' characteristics can lead to a difference in the potential implementation of firms' environmental policies given additional time.

First, independent directors play an important role in monitoring firms' activities, especially in monitoring sustainability issues. When independent directors cannot afford as much time in acquiring information about the firm, they might become less independent (Masulis, Wang, and Xie, 2007) and thus weaken their monitoring role. We expect a shock to the workload of independent directors would lead to more pronounced impact on firms' environmental metrics.

Results presented in Panel A of Table 2.11 show that a reduction in workload of independent directors are associated with more pronounced improvement in environmental performance of treated firms. Our findings support the important role of independent directors given sufficient time to be involved in management of environmental matters.

Table 2.11 – Directors' time and capacity to make changes to environmental performance

This table presents the reduced-form regression results of the heterogeneous treatment effect of the reduction to directors' workload on firm environmental score. ΔE-Score (Δ_1E-Score, Δ_2E-Score) are the change in environmental performance between the treatment year (t+1 treatment year, t+2 treatment year) and the pre-treatment year. Panel A presents the results of the effects of independent vs dependent directors on the changes in environmental performances. Treat (Independent) [Treat (Dependent)] is the number of cases a treated director is completely free from acquired firm responsibility in the treatment year and is an independent (a dependent) director. Panel B presents the results of the effects of shocks linked with directors who are committee vs non-committee members on the changes in environmental performances. Treat (Committee) [Treat (Non-Committee)] is the number of cases a treated director is completely free from acquired firm responsibility in the treatment year and is a member of any committee. All control variables included in the regressions are first-difference and defined as in the Appendix 2.A1. All regressions include control variables as shown in Table 2.3 and industry-by-year dummies. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: Independent vs Dependent directors

	ΔENV	Δ_1ENV	Δ_2ENV
Treat (Independent)	0.015***	0.014***	0.016***
	(3.248)	(2.865)	(3.034)
Treat (Dependent)	-0.008	-0.002	-0.004
	(-0.677)	(-0.159)	(0.301)
Indus×Year FE	Yes	Yes	Yes
N	13,893	12,754	11,022
Adjusted R2	0.106	0.119	0.132

Panel B: Committee-serving directors

	ΔENV	Δ_1ENV	Δ_2ENV
Treat (Committee)	0.013***	0.013***	0.015***
	(2.721)	(2.528)	(2.672)
Treat (Non-Committee)	0.006	0.006	0.010
	(0.664)	(0.629)	(0.926)
Indus×Year FE	Yes	Yes	Yes
N	13,893	12,754	11,022
Adjusted R2	0.105	0.119	0.131

Panel B presents the regression results of the effect of committee directors versus non-committee members who experience an exogenous reduction to their workload. We find that the improvement of treated firm environmental performance is primarily driven by the reduction in workload to committee members, as shown in columns (1) to (3) of Panel B of Table 2.11. We further study the effect of directors

who are a member of the audit or compensation committee separately from the effect of directors who are not a member of the nominating or corporate governance committees, since data of the latter is not available for many firms until 2004 (Field et al., 2013). Column (4) to (6) show that an improvement in firm environmental performance is more likely to be driven by the shock to the workload of directors who are a member of audit or compensation committee. Together, our results suggest that directors can exert greater influence on firm environmental management given the capacity to influence based on their unique position and the necessary time capacity.

2.5 Firm heterogeneities

2.5.1 Institutional ownership

In this section, we examine the cross-sectional variation of the documented effect of the reduction in board busyness in the presence of firm's institutional investors. This is because shareholder engagements can induce impactful environmental, social, and governance changes (Dimson, Karakaş, and Li, 2015).

Long-term and focused institutional investors can foster firms' environmental performance. Specifically, Chen et al. (2020) document that firms with more distracted institutional investors have lower CSR scores and Environmental scores. Liu, Low, Masulis, and Zhang (2020) focuses on the relationship between institutional distraction and incentives of board and directors and find that limited investor attention weakens board oversight. Akey and Appel (2019); Naaraayanan, Sachdeva, and Sharma (2021) also show that activism by attentive institutions, including those with financial focus-only in their activism mandates, can have positive environmen-

tal externalities. Kecskés, Mansi, and Nguyen (2020) argue that long-term investors can ensure the appropriate level of CSR investment by directors. Following this line of reasoning, we expect that the positive effect of the reduction in board busyness on a firm environmental score is more pronounced when a firm has a higher level of monitoring or long-term institutional investors.

Panel A of Table 2.12 presents the results from subsample tests based on the characteristics of institutional investors. Columns (1) to (6) present subsample tests based on the fraction of monitoring institutional ownership (Fich, Harford, and Tran, 2015). Our results reveal that the shock to multiple directorships has a more pronounced effect on firm environmental performance for firms with higher fraction of monitoring institutional ownership. The findings corroborate the argument that directors are more incentivized to focus on environmental matters when they are exposed to higher pressure from shareholders to monitor. Columns (7) to (12) of Table 2.12 show subsample test results based on the fraction of long-term institutional ownership. Our results suggest that the improvement in firm environmental performance following the shock to directors' workload is more pronounced for firms with higher fraction of long-term institutional investors. Since firm environmental initiatives require a long-term commitment, the presence of more long-term investors allow directors to take more proactive steps towards the adaptation of environmentally friendly projects when payoffs are unlikely to be realized in the short horizon. Overall, our findings suggest that the motivation of directors to make changes to non-financial targets given time capacity depends on greatly on the type of ultimate owners of firms, the shareholders.

Table 2.12 – External pressure: Institutional ownership and Local political orientation

Panel A presents the regression results using subsample partitioned by monitoring institutional ownership, and long-term institutional ownership. High/Low monitoring (long-term) IO is defined as above/below the sample median of monitoring ownership (long-term ownership, defined as the sum of quasi-indexed and dedicated IO). Panel B presents the regression results using subsample partitioned by partisan leaning in states where a firm is headquartered, including the fraction of Democrat Congress delegation, and the fraction of votes received by the Democratic presidential candidate. The dependent variable in columns (1) and (4) are the first difference between the treatment year and the pre-treatment year of environmental performance. ΔE-Score (Δ_1E-Score, Δ_2E-Score) are the change in environmental performance between the treatment year (t+1 treatment year, t+2 treatment year) and the pre-treatment year. All regressions include control variables as shown in Table 2.3 and industry-by-year dummies. Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: Institutional ownership

	Monitoring institutional ownership						Long-term institutional ownership					
	High monitoring IO			Low monitoring IO			High long-term IO			Low long-term IO		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treat (Num)	0.012**	0.011**	0.015**	0.006	0.010	0.012	0.013**	0.014**	0.019**	0.010*	0.007	0.008
	(2.444)	(2.027)	(2.428)	(0.926)	(1.430)	(1.513)	(1.981)	(2.033)	(2.383)	(1.845)	(1.147)	(1.107)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6,965	6,485	5,766	6,802	6,111	5,138	7,362	6,737	5,784	6,371	5,894	5,152
Adjusted R2	0.136	0.156	0.174	0.100	0.111	0.107	0.125	0.134	0.147	0.099	0.111	0.124

Panel B: Local political orientation in firm's state of headquartered

	Congress delegation D%						President vote D%					
	Democratic-leaning states			Non-Democrat-leaning states			Democratic-leaning states			Non-Democrat-leaning states		
Treat (Num)	0.012***	0.015***	0.019***	0.005	0.005	0.007	0.013***	0.016***	0.020***	0.005	0.008	0.011
	(2.664)	(3.010)	(3.464)	(0.720)	(0.625)	(0.900)	(2.711)	(2.964)	(3.510)	(0.727)	(0.965)	(1.298)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9,046	8,347	7,268	4,605	4,202	3,580	8,712	8,029	6,958	4,294	3,930	3,351
Adjusted R2	0.110	0.122	0.124	0.092	0.108	0.151	0.104	0.111	0.111	0.125	0.154	0.196

2.5.2 Local political orientation

Firms do not only subject to pressure from their institutional owners but also face increasing pressure from other stakeholders such as employees, competitors, customers, who are often concentrated by geographic clustering in the state where a firm is headquartered. In this subsection, we investigate the potential effect of the external stakeholders on directors' influence over firm environmental performance.

Previous studies show that Blue states are more proactive with their approach to environmental policies and the involvement of firms situated in the state. Di Giuli and Kostovetsky (2014) document that there is a significantly positive effect of more pro-environmental communities, i.e. Democratic-leaning states, on firm CSR policies. The local perspectives of stakeholders about the environment can attenuate or magnify a firm's reaction to its environmental policies. In particular, Kim et al. (2019) show that the negative association between local institutional ownership and the facility-level of toxic emission is more pronounced in local communities that prefer stronger environmental policies, as proxied as the fraction of Democrat/Republican ratio of votes for the Democratic presidential candidate. Thus, we expect that the influence of directors' attention on firm environmental performance is more pronounced in the area where local stakeholders are more conscious about environmental impacts.

Panel B of Table 2.12 shows that the positive relationship between a reduction in directors' workload and firm environmental performance is more pronounced in Democratic-leaning states. Columns (1) to (6) show the subsample test results based on *Congress delegation D%*, defined as the fraction of Democrats U.S. congressmen presenting a state where a firm is headquartered. A state is defined as

a Democratic-leaning state if *Congress delegation D%* is at least 50%. The results show that the improvement in firm environmental performance following the reduction in board busyness is more pronounced in Democratic-leaning states, possibly because of the pressure from state regulations and firms' stakeholders. In the same spirit, we use an alternative proxy for the external political environment for our subsample tests. Columns (7) to (12) present the subsample test results based on the state proportion of votes to a Democrats presidential candidate. Consistent with the above argument, our findings suggest that directors devote more time to firm environmental performance if there is higher pressure from the environmental-conscious stakeholders or stricter regulatory environment.

2.5.3 Financial constraints

Firms with financial constraints require more directors' attention on financial pressure, and thus directors' attention may be diverted from environmental matters. Hong et al. (2012) show that less constrained firms have a higher CSR score, and 'doing goodness' is costly and determined by a firm's financial status. We expect that directors' ability to make changes to firm environmental performance is positively correlated with firm financial strengths, thus the positive effect as shown in Table 2.3 is more pronounced for less financially constrained firms.

We employ several proxies for financial constraints including the SA index and credit ratings. We use data from Compustat S&P issuer credit ratings of long-term bonds for assessing the credit strength of a firm, measuring how easy and costly it is for firms to access the external capital market. The sample used for analysis using long-term bond ratings is smaller than other analyses due to the unavailability of

ratings for some firms.

Results presented in Table 2.13 confirms our conjecture that the positive relationship between a reduction in directors' workload and an improvement in firm environmental performance is more pronounced for non-financially constrained firms. We employ several proxies for financial constraint including *SA index*, *WW index* and *Credit rating*. Detailed definitions of variables are provided in Appendix 2.A1.

Table 2.13 – Financial constraints

Panel A presents the regression results from subsample partitioned by SA index of financial constraint. Non-Financially (Financially) constrained group includes firms that are not (in) the annual top quartile of SA index. Panel B presents the regression results from subsample partitioned by WW index of financial constraint. Non-financially [Financially] constrained group includes firms that are not (in) the annual top quartile of WW index. Panel C presents the regression results from a subsample partitioned by firm credit ratings. Non-Financially (Financially) constrained group includes firms with available credit ratings with the rating above (below) BBB. ΔE-Score (Δ_1E-Score, Δ_2E-Score) are the change in environmental performance between the treatment year (t+1 treatment year, t+2 treatment year) and the pre-treatment year. All regressions include control variables as shown in Table 2.3 and industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

Panel A: SA Index

	Non-Financially constrained (Lower SA index)			Financially constrained (Top annual quartile SA index)		
Treat (num)	0.012***	0.013***	0.017***	0.003	-0.003	-0.010
	(2.693)	(2.653)	(3.086)	(0.449)	(-0.331)	(-1.011)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	10,515	9,755	8,528	3,378	2,999	2,494
Adjusted R2	0.126	0.141	0.155	0.069	0.110	0.134

Panel B: WW Index

	Non-Financially constrained			Financially constrained		
Treat (num)	0.012***	0.012**	0.015***	0.006	0.001	0.001
	(2.796)	(2.559)	(2.858)	(0.934)	(0.145)	(0.144)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	10,557	9,844	8,651	3,336	2,910	2,371
Adjusted R2	0.125	0.137	0.149	0.101	0.144	0.207

Panel C: Credit Rating

	Non-Financially constrained (>BBB rating)			Financially constrained (<= BBB rating)		
Treat (num)	0.018**	0.018**	0.017**	0.007	0.002	0.007
	(2.552)	(2.504)	(2.388)	(0.893)	(0.246)	(0.751)
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	10,557	9,844	8,651	3,336	2,910	2,371
Adjusted R2	0.125	0.137	0.149	0.101	0.144	0.207

Overall, the results presented in Panel A of Table 2.13 show that firms that are in the top quartile of the SA index do not see a significant change in environmental performance, while the results presented in Panel B show that firms that are in the top quartile of the WW index do not see a significant change in environmental performance. In Panel C, we observe a consistent pattern that firms with good credit ratings have more capacity to implement environmental policies. In sum, our findings corroborate the argument that a firm financial constraint is an important factor that can hinder the ability of directors to influence a firm commitment to the new environmental strategies.

2.6 Conclusion

This chapter examines the role of the board of directors in influencing firm environmental policies via the time capacity channel. Using mergers that terminate board positions of acquired firms, we examine the exogenous reduction in directors' workload and firm environmental performance. Our findings support the argument that the board of directors plays an important role in shaping corporate environmental strategies given sufficient time allocation. The engagement of the board of directors can enhance the implementation of new environmental innovations and improve the overall environmental strengths of firms. We offer compelling evidence that a more

focused board can help firms to address environmental problems.

Moreover, our analysis of various board attributes reveals that directors' environmental awareness and formal capacity to make influences need to be coupled with adequate time, for them to contribute to firm environmental performance. When the affected directors have more experience and awareness about environmental practice, the positive effect of the workload reduction becomes stronger. Similarly, the effect is more pronounced when the affected directors are independent directors or committee-serving ones. In addition, firms' local stakeholder political orientation, firms' institutional owners and firms' financial constraint are factors that significantly influence the ability and incentive of directors to create changes to environmental performance.

Overall, this study highlights a crucial role played by the board of directors in shaping corporate environmental strategies. Our findings provide novel insights into the policy debate on the effectiveness of multiple directorships and the incentive of firms to protect the environment.

Appendices: Chapter 2

Table 2.A1 – Variable definitions

Variable	Definition (Data source)
Firm-specific characteristics	
Firm size	Natural log of the total book value of assets (Source: Compustat)
Leverage	Long-term debt divided by book value of assets (Source: Compustat)
ROA	Returns on assets is calculated as earnings before interest divided by book value of assets (Source: Compustat)
Cash	Cash holdings divided by the total book value of assets (Source: Compustat)
Sale growth	Calculated as $(Sales_t - Sales_{t-1})/Sales_{t-1}$ (Source: Compustat)
Dividend	An indicator variable equals one if a firm pays dividend in a certain year (Source: Compustat)
Advertising	Total advertising expenses divided by the total book value of assets (Source: Compustat)
Stock volatility	Annual stock volatility from daily returns (Source: CRSP Daily)
R&D	Research and Development expense divided by the total book value of assets (Source: Compustat)
Board size	The number of current board members in a firm in a certain year (Source: ISS Directors)
Indep board	Fraction of independent directors (classification "I") over the total number of board members (Source: ISS Directors)
Busy Board	An indicator variable which equals one if at least half of independent directors are busy. A busy director is defined as a director who concurrently holds at least three external board positions.
Environmental-performance measures	
Env score (strengths)	The total number of environmental strengths for each firm-year divided by the maximum possible number of strengths in the same year. The environmental strengths include (1) Beneficial products and services, (2) Pollution prevention, (3) Recycling, (4) Clean energy, and (5) Other strengths (Source: MSCI KLD database).
Env score (concerns)	The total number of environmental concerns for each firm-year divided by the maximum possible number of concerns in the same year. The environmental concerns include (1) Hazardous waste, (2) Regulatory problems, (3) Ozone-depleting chemicals, (4) Substantial emissions, (5) Agricultural chemicals, (6) Climate change, and (7) Other concerns (Source: MSCI KLD database)
Env score	The difference between Env strength score and Env concern score (Source: MSCI KLD database)
Prob(EPA)	Probability of a firm committing any environmental violation case in a given year (Source: EPA ECHO database)
Prob(AFR)	Probability of a firm committing a formal administrative environmental violation case in a given year (Source: EPA ECHO database)
Prob(JDC)	Probability of a firm committing a judicial environmental violation case in a given year (Source: EPA ECHO database)

Appendix 2.A1. [con'd]

Variable	Definition (Data source)
M&A shock: Treatment variables	
Treat(dummy)	An indicator variable equals one when any board member is affected by a merger that terminated his/her board positions and zero otherwise (Source: ISS Director database)
Treat (num)	The total number of cases where a board member is terminated from an acquired firm board position. (Source: ISS Director database)
$Treat_{Env>0}$/ $Treat_{Env=0}$/ $Treat_{Env<0}$	defined as the total number of cases where a board member is terminated from an acquired firm board position and the treated director(s) is linked to firms with overall good (or neutral/bad) environmental performance, where $Env > 0$ [$Env = 0$/ $Env < 0$] takes a value of one if the average environmental score of director-linked firms is positive (zero/negative). (Source: ISS Director database)
Treat (female/ male)	The total number of cases where a board member is terminated from an acquired firm board position and the treated directors are female (male) directors. (Source: ISS Director database)
Treat (indep/ dep)	The total number of cases where a board member is terminated from an acquired firm board position and the treated directors are independent (dependant) directors. (Source: ISS Director database)
Treat (less/ more-busy)	The total number of cases where a board member is terminated from an acquired firm board position and the treated directors are less-busy (more-busy) directors. (Source: ISS Director database)
Treat (committee/ non-committee)	The total number of cases where a board member is terminated from an acquired firm board position and the treated directors are committee-serving/non-committee-serving directors directors. (Source: ISS Director database)
N.Boards	Change in the total number of seats on any S&P1500 held by a firm's board members. This firm-level variable is calculated as the aggregate change in the number of board positions of treated directors in a firm in a certain year. (Source: ISS Director database)
Other variables	
SA index	Hadlock and Pierce (2010) Size-Age proxy for firm financial constraint. A firm is (is not) financially constrained if its SA index is in the top quartile of the sample in a given year. SA index is calculated as (-0.737×$Size^2$) + (0.043×$Size^2$) (0.040×Age), where Size equals the log of inflation-adjusted book assets (2004 value) and Age is the number of years the firm is listed with a non-missing stock price on Compustat. We impose the same criteria used in their study: Size is winsorized (i.e., capped) at (the log of) $4.5 billion, and Age is capped at 37 years. (Source: Compustat)
WW index	Whited and Wu (2006) proxy for firm financial constraint. A firm is (is not) financially constrained if its WW index is in the top quartile of the sample in a given year. WW index is calculated as WW Index = - 0.091 × (ib+dp)/at - 0.062 × dvpd[0,1] + 0.021 × dltt/at - 0.044 × ln(at) + 0.102×ISG - 0.035×SGL, where dvpd is dvc + dvp, SGL is firm sale growth, ISG the firm's three-digit SIC industry sales growth, and other italic variables are Compustat variables. To construct WW Index, each measure (except dvdp[0,1]) is winsorized at 5% level. (Source: Compustat Quarterly)
Credit rating	A proxy for firm financial constraint. A firm is (is not) financially constrained if the S&P Domestic Long Term Issuer Credit Rating (SPLTICRM) is below (above) BBB rating. (Source: Compustat S&P Ratings)

Appendix 2.A1. [con'd]

Variable	Definition (Data source)
Other variables	
Monitoring institutional ownership	Fraction of monitoring institutional ownership out of total institutional ownership. An institution is classified as a monitoring institution if the firm is in the top 10% of the institutional portfolio. (Source: Thomson Reuters S34 database)
Long-term institutional ownership	Fraction of long-term institutional ownership out of total institutional ownership. An institutional is a long-term institution if it is classified as 'quasi-indexer' or 'dedicated' managers by Bushee's classification. (Source: Thomson Reuters S34 database, Brian Bushee's website)
Congress delegation D%	Calculated as 0.5×proportion of Senators who are Democrats + 0.5× proportion of House of Representatives Congressmen who are Democrats in a state where a firm is headquartered. A firm is defined as headquartered in Democrat-leaning states if Congress delegation D% is at least 50%. (Source: MEDSL Election Returns Dataverse)
President vote D%	Proportion of the vote received by the Democratic presidential candidate in the election in the state where a firm is headquartered. A firm is defined as headquartered in Democrat-leaning states if President vote D% is at least 50%. (Source: MEDSL Election Returns Dataverse)

Table 2.A2 – Percentage of busy directors and CSR performance

This table presents the OLS regression results showing the effect of board busyness on the overall CSR score and its five categories. Busy Board (%) is measured as the percentage of busy directors with three or more concurrent board positions out of the total number of director seats in a firm's board. ENV, COM, DIV, EMP, and PRO are MSCI KLD Score on Environment, Community, Diversity, Employment, and Products, respectively. The number of observations for community score is lower because the MSCI ESG KLD database does not provide all dimensions of community score over our sample period. All variables are defined in Appendix 2.A1. All continuous independent variables are measured at the end of the previous fiscal year and winsorized at 1st and 99th percentiles. Standard errors are clustered at the firm level. t-statistics are shown in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

	CSR	ENV	COM	DIV	EMP	PRO
Busy Board (%)	-0.092	-0.053**	-0.025	-0.009	0.115***	-0.077***
	(-1.133)	(-2.245)	(-1.022)	(-0.330)	(3.726)	(-3.044)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13,162	17,739	17,739	13,162	16,771	17,739
Adjusted R2	0.232	0.199	0.191	0.143	0.287	0.176

Table 2.A3 – Board busyness and EPA violations

This table presents the OLS regression results showing the effect of board busyness on the probability of a firm committing an environmental violation – an EPA violation (EPA), a formal administrative environmental violation case (AFR), or a judicial environmental violation case (JDC). Penalty is the total EPA penalties paid by firms. Busy Board equals one if at least half of the independent directors are identified as busy directors (have three or more concurrent external directorships). All variables are defined in Appendix 2.A1, and all continuous independent variables are measured at the end of the previous fiscal year and winsorized at 1st and 99th percentiles. Standard errors are clustered at the firm level. t-statistics are shown in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

	Total EPA	AFR	JDC	Penalty
Busy Board	0.132***	0.085*	0.046***	0.089
	(2.916)	(1.946)	(5.061)	(1.287)
Controls	Yes	Yes	Yes	Yes
Indus×Year FE	Yes	Yes	Yes	Yes
N	14,102	14,102	14,102	14,102
Adjusted R2	0.235	0.204	0.090	0.306

Table 2.A4 – Treated directors' participation in the treated firms

This table presents the probit regression results showing the relationship between the merger-driven change in directors' board appointments and the likelihood of a director's participation in time-intensive board activities. Following the similar setting in Hauser (2018), we explore the commitment of affected directors to the treated firms by acquiring a committee position or chair of a committee. The higher probability of a treated director acquiring a new position in a firm suggests that an affected director can devote at least a proportion of their additional time to other connected firms (treated firms). This is because a committee or chair position demands substantially more time commitment on the part of directors. All regressions include industry-by-year dummies (Fama-French 48 industry classification). Standard errors are clustered at the firm level. t-statistics are in parentheses. *, **, *** denote statistical significance at 10%, 5% and 1% level, respectively.

	Prob(Becoming a committee member)	Prob(Becoming chair of a committee)
Treat directors	0.057**	0.080***
	(2.175)	(2.754)
ΔFirm Size	-0.073*	-0.087**
	(-1.856)	(-2.163)
ΔLeverage	0.134	0.227**
	(1.374)	(2.163)
ΔStock volatility	-0.530	0.260
	(-1.007)	(0.406)
ΔR&D	-0.487	-0.273
	(-0.832)	(-0.565)
ΔBoard size	-0.072***	-0.049***
	(-10.554)	(-7.238)
ΔIndep board	0.018	-0.117
	(0.169)	(-1.135)
Indus x Year FE	Yes	Yes
N	126,132	120,252
Adjusted R2	0.199	0.059

Chapter 3

Do Institutional Investors Process and Act Upon Information? Evidence from M&A Targets

Abstract

We document important links between targets' institutional ownership and takeover-bid outcomes. Firms' institutional ownership increases the likelihood of receiving stock-for-stock bids. The relationship becomes stronger when deals involve higher information asymmetries, suggesting that institutional ownership mitigates asymmetries. An analysis of Reg-FD further supports the information channel. However, this stronger effect is not driven by the bidders with overpriced shares. Additionally, we show that institutions' share-retention decisions around mergers are motivated by their ex-ante estimations of synergies. Our findings suggest that institutions' information advantage facilitates rational payment design (Eckbo, Makaew and Thorburn, 2018), alleviating potential deadweight losses associated with stock-for-stock offers.

Keywords: institutional ownership; mergers and acquisitions; payment methods; information asymmetry.

JEL classification: G23, G32, G34.

3.1 Introduction

A volume of research has investigated the economic impacts of institutional ownership on corporate policies and performance. One of the central questions in this line of research is whether professional investment managers have enough motivation and resources to influence the firms held in their portfolios. It is a common perception that institutional investors, with their skills, can act as a delegated monitor in the capital markets (Jensen, 1993), but empirical support to this notion has been inconclusive. Although the increased importance of institutional investors in corporate ownership has spurred on both academic researchers and commentators to revisit their roles, new evidence from recent studies pursuing this inquiry is still mixed, and the longstanding debate seems to remain.[1] Some show that institutional investors can exert positive effects on innovation (Aghion, Van Reenen, and Zingales, 2013), voluntary disclosure (Boone and White, 2015), payout (Crane, Michenaud, and Weston, 2016), and board independence (Appel, Gormley, and Keim, 2016). On the contrary, others argue that the increase in indexed institutional ownership has been detrimental to corporate governance (Bebchuk and Hirst, 2019; Schmidt and Fahlenbrach, 2017; Heath, Macciocchi, Michaely, and Ringgenberg, 2021).[2]

The mixed evidence, we believe, points to the need of a different lens through which to view the debate on institutional ownership. In this regard, Schmidt and

[1] Recent years have seen a notable increase in institutional ownership in the U.S. market that is attributed largely to the rise of index strategies. While indexed institutions have received a growing attention recently, we do not restrict our investigation to this particular type of institutions.

[2] Bebchuk and Hirst (2019) argue that highly diversified institutions have limited resources to interact with their portfolio firms, pointing out that the "Big Three" managers—Blackrock, Vanguard, and State Street—for example, hold over 17 thousand stocks globally, whereas the number of their stewardship personnel ranges from 11 to 33 (Table 1, Bebchuk and Hirst (2019)). Schmidt and Fahlenbrach (2017) find that an increase in indexed ownership leads to fewer independent directors and worse acquisition outcomes.

Fahlenbrach (2017) and Appel et al. (2016) point out the engagement cost as an element, arguing that the cost must be low for indexed institutions to pursue an intervention that improves the value of their portfolio firms.[3] In a similar vein, if the consequence is material and far-reaching for them, institutional investors may selectively engage in a firm's decision-making process although such an engagement is costly and firm-specific. This view points out that a right question to ask may be when—rather than whether—institutional investors are incentivized to exert effort to play a monitoring role. In this chapter, by zooming in on one such setting, namely, mergers and acquisitions (M&As), we offer a novel insight into this debate.

Most prior studies in this stream of literature examine the role of institutional investors in firms' acquisition decision (see, e.g., Chen et al. (2007) and Schmidt and Fahlenbrach (2017)). Unlike these studies, we focus our investigation on M&A targets and their institutional shareholders. The scenario where a firm becomes a takeover target provides an ideal setting to assess whether institutions' information advantage, if any, comes into play. To wit, a takeover decision carries significant yet distinct weights for shareholders on the two sides of the deal. An acquisition decision for bidder shareholders is analogous to an investment project with a relatively large scale, whereas target shareholders' decision involves an irrevocable action, namely, whether to tender their ownership permanently. In other words, the materiality of an M&A decision is more prominent for target shareholders than bidder ones. A target firm's shareholders, in particular, informed ones like institutional owners, are thus incentivized to process information to assess the value of the offer to be made

[3]For example, supporting the removal of poison pills or staggered boards can be considered low-cost engagement (Schmidt and Fahlenbrach, 2017), whereas interventions aimed to change individual firm-specific policies may be too costly to execute even if such a change improves firm value. Appel et al. (2016), although documenting a positive effect of indexed ownership on board independence, find little evidence as to the effect on investment and cash-holding policies.

to them. In fact, the legal setting in the U.S. is consistent with this expectation as the laws reflect a greater significance of M&A decisions for target shareholders.[4] Accordingly, when preparing their offers, rational bidders are likely to take into account the presence of institutional shareholders in target firms (see, e.g., Eckbo et al. (2018) for the rational payment argument and the related evidence, for which we provide more details below). Therefore, one can expect a salient presence of institutional ownership in target firms to have important implications for M&A offers.

Our empirical setting, which relies primarily on M&A targets, allows for a unique way to study the impact of institutional shareholders on takeover transactions. Does an increase in institutional ownership lead to higher targetiveness, namely, a higher probability that a firm receives a takeover offer? In particular, does it tend to attract offers with the bidder shares as the payment? If so, does a higher likelihood of receiving stock offers indicate that targets' institutional shareholders help mitigate information asymmetries associated with bidders (Eckbo et al., 2018) or does it imply that they end up inviting the bidders with even overpriced shares? By examining these questions, we shed new light on the assessment as to institutional investors' information advantage, or lack thereof, as well as the determinants of the M&A targetiveness and consideration structure.

To the extent that these institutions have superior information about bidders and merger synergies than do average investors, they are likely to have an incentive to use this advantage in evaluating takeover offers, in order to ensure a fair price for

[4]In most states, the law requires that a takeover proposal be evaluated by the board and approved by shareholders. In contrast, submitting a bid is not subject to a shareholder approval unless the bidder chooses to issue new shares as much as 20% or more of total shares outstanding to finance its acquisition.

their ownership. In particular, theory suggests that such an information advantage should manifest itself in the design of merger payment. Eckbo et al. (2018) show that the more the target knows about the bidder, the higher is the fraction of stock in the merger payment. Consistent with this rational payment design argument, we hypothesize that when a target's institutional owners are correctly informed about a bidder, the bidder in equilibrium should be more willing to use its shares as the payment, provided that the shares are fairly priced. Similarly, the presence of well-informed institutional shareholders on the target side should drive away the bidders with overpriced shares. In addition, we expect such an information advantage, if any, to enable the institutions to benefit from selectively holding the shares of the post-merger combined entities whose synergies are expected to be larger.

Using a large sample of the U.S. firms from 1984 through 2018, we find strong empirical support to our hypotheses.[5] We show that following an increase in firms' institutional ownership, the probability of receiving takeover bids increases. Importantly, the increased targetiveness is driven primarily by the bids with stocks as the payment. The significant impact of targets' institutional shareholders on stock-based offers holds whether we use the entire firm-year panel or focus on a sample of merger targets. Moreover, to address the endogeneity concern that firms with high targetiveness may have attributes that attract institutional investors and certain types of bidders, we exploit exogenous variation in institutional ownership associated with Russell index annual reconstitutions (Fich et al., 2015; Appel et al., 2016; Crane et al., 2016; Schmidt and Fahlenbrach, 2017; Cremers, Pareek, and Sautner, 2020). The results from the instrumental variable (IV) estimation support

[5]Our M&A sample consists of 5,706 transactions by the U.S. firms. It reduces to 3,236 transactions between public bidders and targets when we conduct various deal-level tests that require bidder characteristics.

the causal interpretation of our main findings.

We then investigate the economic mechanism through which a firm's institutional ownership affects its targetiveness and the design of merger consideration. Prior literature on stock-based mergers has devoted a great deal of attention to the issues of information asymmetry (see, e.g., Hansen (1987), Fishman (1989), and Eckbo et al. (1990) for theoretical analyses of the design of payment under two-sided information asymmetry). In a recent study, Eckbo et al. (2018) show that targets are more likely to accept bidders' shares as the merger payment when they are more informed about bidders. Our work complements this line of research by showing that the positive relationship between targets' institutional ownership and the likelihood of stock-based offers is more pronounced when the information asymmetry associated with bidders or M&A deals is high. Consistent with the rational payment design (Eckbo et al., 2018), our evidence thus suggests that institutional investors, with their information advantage, can help mitigate the asymmetric information problems that otherwise would discourage the use of the bidder's shares as the payment. We ensure the robustness of this finding by using different measures of information asymmetry, including the bidder-level composite proxy (Karpoff, Lee, and Masulis, 2013), bidders' recent M&A and issue activities, and the transaction-level measures (Eckbo et al., 2018). Additionally, by exploiting Regulation Fair Disclosure (Reg FD) as a positive shock to the information environment, we find that the influence of target institutional ownership on stock-based offers is stronger before the Reg FD is adopted, that is, when the information is less transparent.

To buttress the notion that institutional shareholders' information advantage renders stock-based offers more feasible, we examine whether targets' institutional

ownership drives away the bidders whose shares are overvalued. Prior literature documents that firms with overvalued shares tend to engage in acquisitions to take advantage of mispricing. Contrary to the rational payment design hypothesis, the bidder opportunism argument posits that bidders use their stocks as the merger consideration in an attempt to sell overvalued shares to targets and reap the benefit at the expense of targets' shareholders (Shleifer and Vishny, 2003; Rhodes-Kropf et al., 2005; Ang and Cheng, 2006; Dong, Hirshleifer, Richardson, and Teoh, 2006). We therefore ensure that the bidder opportunism is not the factor driving the positive relationship between targets' institutional ownership and stock-based offers we find. Using various measures of misvaluation—mispricing decomposition (Rhodes-Kropf et al., 2005) and the short-selling interest (Ben-David, Drake, and Roulstone, 2015)—we show that the effect of institutional ownership on stock-based offers only holds for the subset of bidders whose shares are less prone to mispricing. These results thus rule out the possibility that target firms' institutional shareholders merely encourage the bidders to offer their overpriced shares as the payment.

Moreover, by analyzing the share retention patterns at the individual institution level, we provide further corroborating evidence for institutional investors' information advantages in evaluating bidders and merger synergies. With a stock-for-stock merger, a target's shareholders may hold on to the shares of the post-merger combined company if they choose to, rather than selling the shares to realize gains. Presumably, such a decision requires a careful assessment of the bidder's offer and merger synergies. We find that institutions that have increased the share ownership of a target firm before the merger announcement, tend to hold more shares of the combined firm post deal completion—say, high share retention.[6] More importantly,

[6]Following Burch, Nanda, and Silveri (2012), we examine both pre-completion retention (be-

we show that the high share retention is concentrated in the subset of stock mergers with larger synergies, proxied for by short- and long-term performance measures. The results suggest that target firms' institutional shareholders are well informed about merger synergies and thus make the share-retention decisions in accordance with their expectation about the value of the merged firms.[7]

Our study extends the extant literature in three important ways. First, it adds to the large literature examining whether the presence of institutional investors in firms' ownership structure implies a better or worse monitoring function that leads to different outcomes for their portfolio firms (see, e.g., Chen et al. (2007) and Fich et al. (2015)). By providing evidence that the ability and the incentive of institutional shareholders of target firms to process information can change the bidding behaviors of acquirers, we shed new light on the motivation for institutional investors to exert effort when the issue in question is material. Second, we contribute to the stream of research concerned with the design of merger payment under information asymmetry (Hansen, 1987; Fishman, 1989; Eckbo et al., 1990). Stock-based mergers are prone to the problems of information asymmetry and the misvaluation of bidder shares. We show that with their information advantage, target firms' institutional owners help mitigate these problems, thus encouraging the use of bidder shares as a rational payment for mergers (Eckbo et al., 2018). Third, our work extends the literature examining the role of institutional ownership in M&As (see, e.g., Gaspar, Massa, and Matos (2005) and Harford, Jenter, and Li (2011)). Unlike most studies analyzing the effect of institutional ownership on bidders' decision, we focus our analysis on M&A

tween the announcement and the completion of a merger) and post-completion retention.

[7]The announcement returns, although widely examined in various contexts, are known to have poor predictability for actual post-merger synergies (Ben-David, Bhattacharya, and Jacobsen, 2021).

targets to show that institutional ownership significantly affects the targetiveness of firms and the consideration structure of M&A deals. Our findings, collectively, support the notion that institutional investors can play the monitoring role in capital markets by capitalizing upon their information advantage.

The remainder of the chapter proceeds as follows. Section 3.2 describes our data and sample. Section 3.3 presents our main empirical results and Section 3.4 further robustness results. Section 3.5 concludes.

3.2 Data and empirical methods

3.2.1 Sample

We collect all M&A transactions between the U.S. firms announced between 1984 and 2018 from the Thomson Reuters Securities Data Corporation (SDC) database. Our sample period begins in 1984 given the concern that the SDC M&A data may be less reliable (Chen et al., 2007). We then keep the deals that meet the following criteria: the ones that (1) are coded as merger "M" or acquisition of majority interest "AM"; (2) have acquired or sought more than 50% of the target ownership; (3) have a deal value greater than $1 million and the ratio of the deal value to the bidder's market equity (relative size) greater than 1%; (4) are either completed or withdrawn within 1,000 days from the announcement; (5) involve public targets with the data available from the Compustat, CRSP, and Thomson Reuters Institutional Holdings 13F, respectively; and (6) involve firms in nonfinancial and non-utility industries (SIC codes outside the intervals of 6000–6999 and 4900–4999).[8] In addition, for

[8]While we begin our investigation with all types of bidders (public, private or subsidiaries), we require bidders to be public firms in order to control for bidders' characteristics in our deal-level analyses. The deal size filters are applied to exclude M&A offers that are too small to matter to institutional shareholders of target firms.

our analysis of payment methods, we require the merger consideration to be clearly defined as stock only, cash only, or a combination of stock and cash. Applying these sample filters, we obtain our M&A sample that consists of 5,706 deals, although the sample size reduces to 3,236 deals when our analysis requires characteristics of bidders (i.e., public bidders). Appendix 3.A1 describes our sample selection criteria in detail.

Figure 3.1 – Time trends in M&A offers by payment methods

This figure plots time trends in M&A bids by different payment methods from 1984 to 2018. The bar graph represents the total number of bids, whereas solid line, dash-dotted line, and dashed line, respectively, represent the numbers of bids with stock-only, cash-only, and mixed payments. The sample consists of 3,236 completed or withdrawn offers with a transaction value of no less than $1 million and target firms with institutional ownership data on Thomson Reuters 13F. Both targets and bidders are U.S. non-financial and non-utility firms publicly traded on U.S. stock exchanges. Appendix 3.A1 describes the sample construction procedure in detail.

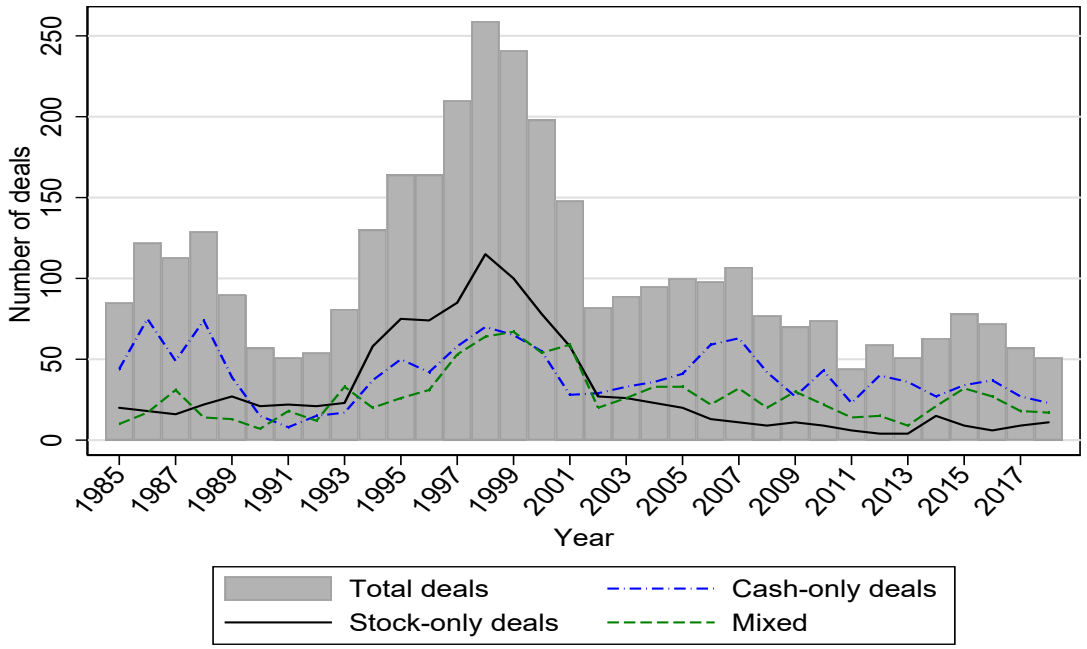


Figure 3.1 presents the time-series distribution of M&A deals across payment methods over our sample period. For ease of comparison with prior studies, these series are plotted based on our public-bidder sample (i.e., 3,236 deals between public bidders and targets). As is well known, the takeover market in the U.S. has reached

a peak in the late 1990s and since then, the number of M&A deals has declined. The share of stock-only deals likewise has dropped significantly since this peak, from 120 deals in 1998 to below 25 in 2000 and thereafter on an annual basis. The trends observed in our sample are similar to those reported by other studies (Boone, Lie, and Liu, 2014; Fich et al., 2015; Eckbo et al., 2018).

3.2.2 Variables and summary statistics

This subsection discusses the variables employed in our empirical analyses. Appendix 3.A2 provides detailed description of all variables introduced and any additional ones used in our study.

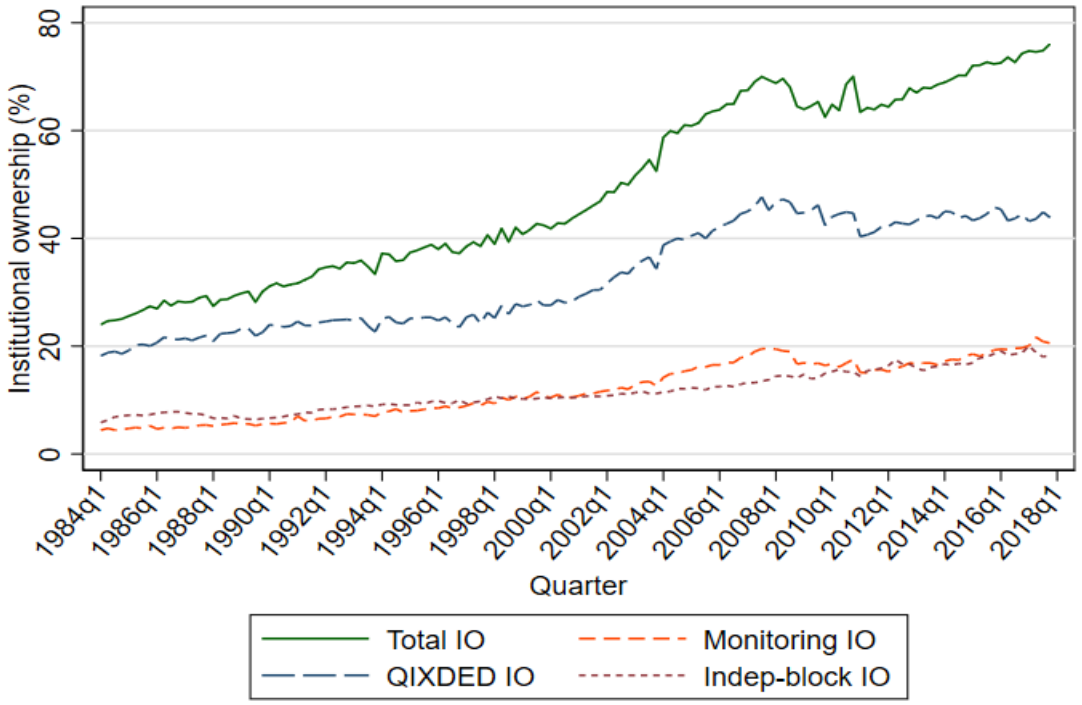
3.2.2.1 Variables for the baseline targetiveness model and the payment structure model

Our main variable of interest is the change in institutional ownership ΔIO, defined as the change in the fraction of institutional ownership in a target firm over the fiscal year prior to a deal announcement (Schmidt and Fahlenbrach, 2017). Because institutional ownership may be inherently associated with certain firm characteristics (e.g., firm size), a comparison of the level of institutional ownership across firms can lead to biased inferences. Moreover, the within-firm estimation is not applicable to an M&A target sample, which is absent of the firm-year panel structure. Therefore, our choice of the differenced variable ΔIO is a robust way to uncover the effect of institutional investors that we want to capture (Sias, Starks, and Titman, 2006). We also check our results using different institution types, such as monitoring institutions (*Monitoring IO*, Fich et al. (2015)), long-term institutions (*QIX-DED IO*, Bushee (1998)), and independent blockholders (*Indep-Block IO*, Chen et al. (2007)).

Figure 3.2 plots the time-series change in institutional ownership over our sample period. Institutional ownership for our sample firms has continued to increase since 1984, reaching near 70% in 2018. Similar upward trends appear in different types of institutional ownership.

Figure 3.2 – Time trends in institutional ownership

This figure plots time trends in institutional ownership (IO) by different types of institutional investors from 1984 and 2018. The sample consists of M&A target firms that are involved in 3,236 completed or withdrawn offers with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Both targets and bidders are U.S. non-financial and non-utility firms publicly traded on U.S. stock exchanges. Appendix 3.A1 describes the sample construction procedure in detail. The solid line represents total IO, whereas long-dashed, dashed, and short-dashed lines, respectively, represent QIX-DED IO, Monitoring IO, and Indep-Block IO. Appendix 3.A2 provides variable definitions in detail.



To examine how firms' institutional ownership affects their probability of receiving a takeover offer, we employ the acquisition probability model, along with a sample of 110,983 firm-year observations in 1984–2018 from the Compustat (Palepu, 1986; Moeller, Schlingemann, and Stulz, 2004; Brar, Giamouridis, and Liodakis, 2009; Phillips and Zhdanov, 2013; Lin and Wang, 2016). Following this literature,

we control for a well-established set of predictors for the takeover likelihood, including firm size, Tobin's Q, leverage, cash flows, R&D expenses, sales growth, return on assets, excess returns, industry acquisition dummy, and growth-resource mismatch dummy. Extant studies show that firms with small size, low Tobin's Q, poor operating performance, high R&D intensity, and in industries with any takeover episode in the previous year, tend to experience a higher takeover probability (Cremers, Nair, and John, 2008; Phillips and Zhdanov, 2013; Lin and Wang, 2016). In our sample of the entire Compustat panel, 5,447 firm-years are identified as a takeover target, accounting for 5,706 deals as aforementioned.

When investigating the impact on the merger consideration structure, we focus on our "public bidder sample", namely, 3,236 M&A deals in which both bidders and targets are U.S public firms that satisfy the sample filters described above. Our payment structure model follows Fich et al. (2015) to control for both deal characteristics (relative size and binary indicators, respectively, for hostile attempt, competed bid, tender offer, same 4-digit SIC industry, and target termination fee) and target and bidder characteristics (firm size, leverage, cash flow, R&D, and market-to-book).

3.2.2.2 Proxies for information asymmetry

To examine the role of institutional shareholders in alleviating information asymmetry (i.e., the rational payment hypothesis), we employ several measures of information asymmetries associated with bidders and merger transactions. First, Karpoff et al.'s (2013) composite index of various bidder characteristics is constructed based on the principle-component analysis of the following eight variables: firm size, tangible assets, firm age, number of analysts following, number of IPOs and SEOs, daily

bid-ask spreads, daily return volatility, and abnormal accruals. The detailed procedure is provided in Appendix 3.A3, while the definitions of each component are in Appendix 3.A2.

Our second set of bidder-level proxies is based on bidders' recent acquisition and SEO activities. Eckbo et al. (2018) point out that the information disclosed and transmitted with respect to a firm's stock market activities allows outside investors to assess the firm more accurately. Thus, the information asymmetry is low for firms that recently have undergone acquisitions or SEOs. We prepare a dummy variable *Recent acquisition* (*Recent SEO*) that takes a value of one if the bidder announced another takeover (issued seasoned equity) within the past two years.[9]

Furthermore, we follow Eckbo et al. (2018) to construct the deal-level measures. A dummy *Local deal* captures the geographical proximity (headquarters within 30 miles), which is calculated using the spherical law of cosine following Cai, Tian, and Xia (2016).[10] *Industry complementarity* measures the extent to which the input-output flows overlap between bidders and targets at the industry level.[11] The M&A deals between bidders and targets that are geographically close to each other are expected to have a relatively low level of information asymmetry. Similarly, high industry complementarity indicates a low level of information asymmetry.

[9]Our results are robust to using the 18-month window (Eckbo et al., 2018).

[10]The latitude and longitude coordinates are from the 2000 U.S. Census Gazetteer Files. The coordinates are matched with the firm's zip code or the location of its city center if the former is missing. Our results hold when we use alternative cut-off values for distance (e.g., 100 km, Kedia, Panchapagesan, and Uysal (2008)).

[11]Following Fan and Lang (2000), for each BEA industry i, we compute the percentage $b_{ik}(v_{ik})$ of output (input) supplied to (purchased from) each intermediate BEA industry k. For each pair of industries, we then calculate the correlation coefficient between b_{ik} and b_{jk} across all k except i and j. We then map the BEA industries with the 4-digit SIC codes of the target and bidder firms, and for each target-bidder pair, we calculate the average input and output correlation and our measure of complementarity.

3.2.2.3 *Proxies for stock misvaluation*

In order to check whether the bidder opportunism associated with share mispricing might play out in facilitating stock-based offers, we employ two sets of misvaluation measures. Rhodes-Kropf et al. (2005) decompose market to book ratio MTB into firm-specific error and current-sector deviation from the firm long-run value. We take the median of the misvaluation component of $ln[MTB]$ to partition our sample into high and low misvaluation groups. Appendix 3.A4 provides the procedure and related statistics in detail.

Our second measure is the short interest ratio of bidders' stocks prior to the deal announcement. Ben-David et al. (2015) argue that stocks' short position is a superior measure of overvaluation because a mispricing measure derived in firm fundamentals indicative of future productivity may lead to confounding factors in one's analysis (Rhodes-Kropf et al., 2005; Dong et al., 2006). Moreover, short positions are costly to build and are usually held by informed investors. Ben-David et al. (2015) show that a large short position in a bidder prior to deal announcement coincides with overvaluation of its shares and is associated with a higher probability of using shares as a means of payment. The short interest rate is calculated as short positions on the settlement date (15^{th} each month) divided by the number of shares outstanding at the end of month reported in CRSP. We then follow Ben-David et al. (2015) and Rapach, Ringgenberg, and Zhou (2016) to construct *Adjusted short interest* six months prior to the announcement date to account for the trend of short interest over time.[12] We use the median to split our sample.

[12]The adjusted short interest takes the difference between a firm's short interest ratio and the mean ratio for all firms traded on NYSE, AMEX, and NASDAQ. Our results are robust to using the adjusted short interest one month prior to announcement. The short interest data come from Compustat Monthly Securities Database.

3.2.2.4 Summary statistics

Table 3.1 reports the summary statistics for the variables introduced. Overall, the distributions of the variables are in line with those documented in prior studies (see, e.g., Cremers et al. (2008) and Fich et al. (2015)). The average fraction of stock in deal consideration is 46%. More than 37% of deals in our sample have both targets and bidders operating in the same 4-digit SIC industry. The proportion of tender offers in our sample is approximately 24%, comparable to 18% documented in Officer (2003) and Fich et al. (2015) who include financial and utility firms. Consistent with the literature, bidders tend to be larger and have higher average market-to-book and cash flows than targets. Bidders and targets however have similar leverage ratios and R&D expenditures.

Table 3.1 – Summary statistics

This table reports summary statistics for the variables used in our analysis. Panel A reports the statistics for a sample of 110,983 U.S. firm-year observations from the Compustat, and Panel B a sample of M&A target firms that are involved in 3,236 completed or withdrawn offers with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Both targets and bidders are U.S. non-financial and non-utility firms publicly traded on U.S. stock exchanges. The sample period spans from 1984 to 2018. Appendix 3.A1 describes the sample construction procedure in detail. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles. Appendix 3.A2 provides variable definitions.

Panel A: The panel sample

	N	Mean	p25	p50	p75	S.D.
ΔIO	110,983	0.016	-0.023	0.005	0.051	0.096
Size	110,983	5.256	3.715	5.125	6.684	2.108
Tobin's Q	110,983	1.983	1.087	1.450	2.193	1.601
Leverage	110,983	0.179	0.004	0.124	0.288	0.195
Cash flow	110,983	0.001	-0.004	0.071	0.119	0.250
R&D	110,983	0.054	0.000	0.002	0.063	0.104
Sale growth	110,983	0.188	-0.028	0.082	0.237	0.574
Return on assets	110,983	0.053	0.027	0.107	0.167	0.226
Compounded excess returns	110,983	0.121	0.016	0.148	0.238	0.161
Industry acquisition [0/1]	110,983	0.039	0.000	0.000	0.000	0.195
Growth-resource mismatch [0/1]	110,983	0.330	0.000	0.000	1.000	0.470

Panel B: M&A sample

	N	Mean	p25	p50	p75	S.D.
Deal characteristics						
Cash-only deals [0/1]	3,236	0.396	0.000	0.000	1.000	0.489
Stock-only deals [0/1]	3,236	0.300	0.000	0.000	1.000	0.458
Hostile deal [0/1]	3,236	0.095	0.000	0.000	0.000	0.294
Termination fee [0/1]	3,236	0.592	0.000	1.000	1.000	0.492
Competed Bid [0/1]	3,236	0.116	0.000	0.000	0.000	0.321
Tender offer [0/1]	3,236	0.239	0.000	0.000	0.000	0.426
Same industry [0/1]	3,236	0.378	0.000	0.000	1.000	0.485
Relative size	3,236	0.387	0.064	0.186	0.474	0.614
Target characteristics						
Size	3,236	5.379	4.082	5.218	6.571	1.794
Market-to-book	3,236	2.886	1.187	1.947	3.300	4.448
Leverage	3,236	0.191	0.004	0.134	0.314	0.206
Cash flow	3,236	0.016	0.008	0.074	0.119	0.220
R&D	3,236	0.063	0.000	0.006	0.086	0.108
Bidder characteristics						
Size	3,236	6.949	5.508	6.985	8.353	2.078
Market-to-book	3,236	3.760	1.621	2.512	4.140	4.934
Leverage	3,236	0.200	0.034	0.167	0.300	0.185
Cash flow	3,236	0.066	0.047	0.090	0.132	0.140
R&D	3,236	0.042	0.000	0.006	0.058	0.068
Information asymmetry						
Composite index	3,229	-0.030	-0.684	-0.007	0.636	0.995
Recent acquirer [0/1]	3,236	0.229	0.000	0.000	0.000	0.420
Recent SEO [0/1]	3,236	0.222	0.000	0.000	0.000	0.416
Local deal [0/1]	3,236	0.190	0.000	0.000	0.000	0.392
Industry complementary	3,202	0.656	0.280	1.000	1.000	0.375
Misvaluation of bidder shares						
RRV Model I	2,985	0.308	-0.157	0.272	0.737	0.722
RRV Model II	2,985	0.248	-0.200	0.202	0.642	0.686
RRV Model III	2,985	0.248	-0.200	0.203	0.649	0.683
Short Interest Ratio	3,236	0.021	0.000	0.006	0.025	0.038

3.3 Empirical results

3.3.1 Institutional ownership and the takeover targetiveness

We begin our analysis by estimating the unconditional probability of becoming a takeover target, using the firm-year panel sample described in Section 3.2. The first two columns of Table 3.2 report the targetiveness results estimated from the logit model, where the dependent variable takes the value of one if a firm receives a takeover offer in a given year and zero otherwise. The regression includes industry and year fixed effects, to account for variations in merger activities across industries

and time, and the common determinants introduced in Section 3.2. The coefficient on institutional ownership ΔIO, our main variable of interest, is 0.295, with the average marginal effect of an increase of 1.3% probability of receiving a takeover bid. The estimated signs of our control variables are in line with prior literature. Overall, our results show that firms are more likely to become an acquisition target following an increase in institutional ownership.

We then consider whether the positive relationship between targetiveness and institutional ownership we find varies across different merger payment methods, namely, stock only, cash only or a mix of both. Columns 3–5 report the results estimated from the multinomial logit model, where the three outcomes are evaluated against no offer, the base outcome. Although the impact on targetiveness is positive across all cases, the effect is much stronger when the offer comes with stock-only payment. The coefficient on institutional ownership is 0.666 for the stock-only subsample, compared with 0.324 and 0.08 for the cash-only and mixed payment subsamples, respectively. The estimate is statistically significant only for the stock-payment case, which likely drives the significance in our full sample. The results suggest that firms with increased institutional ownership are more likely to attract M&A offers, particularly the ones paid with bidders' shares.

3.3.2 Probability of receiving stock-based offers

In this subsection, we further assess the potential link between merger payment methods and targets' institutional ownership. We first conduct an unconditional comparison between the firms that have experienced the largest increase (top quintile) in institutional ownership in the fiscal year prior to the deal announcement

Table 3.2 – Institutional ownership and the targetiveness

This table reports the regression results of testing the impact of targets' institutional ownership on the likelihood of receiving a takeover offer. The sample consists of firm-year observations from 1984 to 2018 from the Compustat. The M&A targets in the sample are the firms that are involved in completed or withdrawn offers with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public or private firms or subsidiaries. Appendix 3.A1 describes the sample construction procedure in detail. In columns 1 and 2, the logit model is estimated, where the dependent variable is a dummy that equals one if a firm receives a takeover bid in a given year and zero otherwise. In columns 3–5, the multinomial logit is estimated, where the dependent variable is set to 1, 2, and 3, respectively, if a firm receives a cash-only bid, a cash-stock mixed bid, and a stock-only bid, each evaluated against the base case (firm-years without a bid). Appendix 3.A2 provides variable definitions. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

	Logit		Multinomial logit		
	Target [0/1]		Cash-only	Mixed	Stock-only
ΔIO	0.290*	0.295*	0.324	0.080	0.666**
	(0.078)	(0.067)	(0.103)	(0.806)	(0.027)
Size	−0.009	−0.005	−0.056***	0.192***	0.011
	(0.238)	(0.545)	(0.000)	(0.000)	(0.569)
Tobin's Q	−0.167***	−0.192***	−0.400***	−0.181***	−0.036*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.063)
Leverage	0.387***	0.221***	0.247**	0.857***	−0.472***
	(0.000)	(0.008)	(0.017)	(0.000)	(0.009)
Cash flow	−0.636***	−0.528***	−0.509***	−0.815***	−0.311
	(0.000)	(0.000)	(0.003)	(0.004)	(0.227)
R&D	1.457***	1.797***	2.472***	1.363**	1.934***
	(0.000)	(0.000)	(0.000)	(0.014)	(0.000)
Sale growth	−0.016	−0.071**	−0.266***	−0.044	0.105**
	(0.536)	(0.011)	(0.000)	(0.484)	(0.014)
Return on assets	1.181***	1.122***	1.982***	0.966***	0.644**
	(0.000)	(0.000)	(0.000)	(0.008)	(0.032)
Compounded excess returns	0.518***	0.216	0.319	0.332	0.283
	(0.000)	(0.228)	(0.147)	(0.444)	(0.515)
Industry acquisition [0/1]	0.293***	0.048	0.134	−0.121	−0.010
	(0.000)	(0.472)	(0.116)	(0.475)	(0.940)
Growth-resource mismatch [0/1]	0.070**	0.034	0.083**	0.132**	−0.112*
	(0.020)	(0.258)	(0.028)	(0.043)	(0.091)
Industry & Year FE	No	Yes		Yes	
N	110.983	110.983		110,983	
Pseudo R^2	0.01	0.03		0.06	

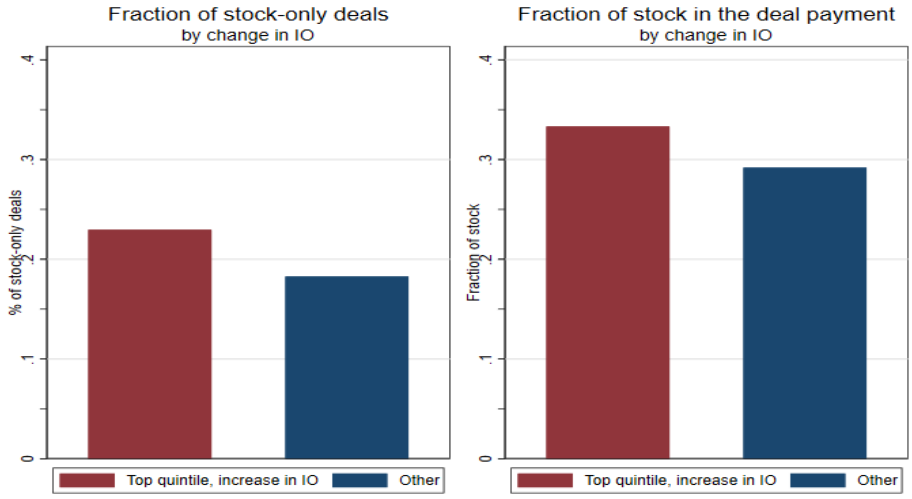
and the rest. Figure 3.3 reports the univariate results in terms of the proportion of stock-only offers and the mean fraction of stocks in the payment structure, using our whole M&A sample (Panel A) and the public bidder sample (Panel B), respectively. Panel A of Figure 3.3 shows that both the proportion of stock-only deals (26%) and the mean fraction of stocks in the payment structure (33%) are higher for the tar-

gets in the top quintile, compared with others (17% and 29%, respectively). Panel B displays similar patterns for the public bidder sample (34% vs. 28% and 49% vs. 44%).

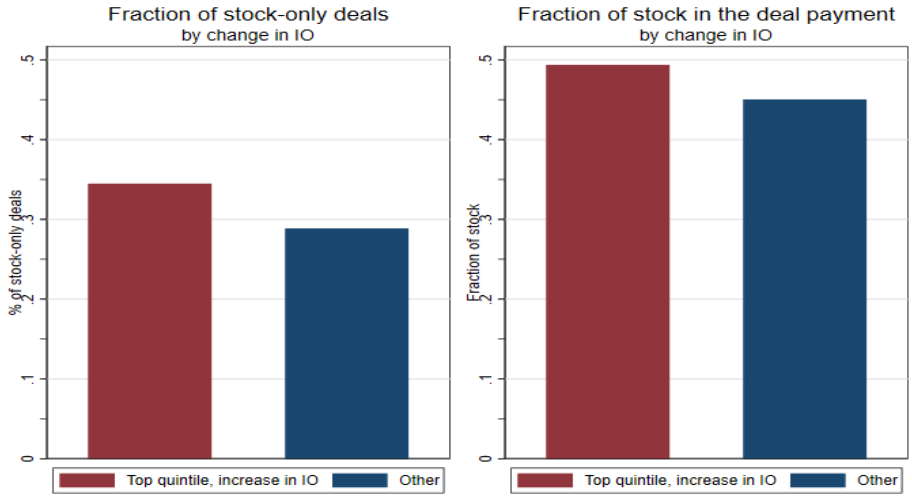
Figure 3.3 – Institutional ownership and stock payments in M&A offers

This figure plots time trends in institutional ownership (IO) by different types of institutional investors from 1984 and 2018. The sample consists of M&A target firms that are involved in 3,236 completed or withdrawn offers with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Both targets and bidders are U.S. non-financial and non-utility firms publicly traded on U.S. stock exchanges. Appendix 3.A1 describes the sample construction procedure in detail. The solid line represents total IO, whereas long-dashed, dashed, and short-dashed lines, respectively, represent QIX-DED IO, Monitoring IO, and Indep-Block IO. Appendix 3.A2 provides variable definitions in detail.

Panel A: Bidders are public or private firms or subsidiaries



Panel B: Bidders are public firms only



Prima facie evidence for stock-based merger offers leads to our formal investigation in the regression framework. To examine the likelihood of stock-based offers, we estimate the multinomial logit model, where the dependent variable is an indicator that takes the values of zero, one, and two, respectively, if the payment design of the deal in question is cash-only (base outcome), mixed, and stock-only. We also estimate the tobit model to examine the proportion of stock as the dependent variable. Table 3.3 reports the results using our entire M&A sample (Columns 1–3) and the public bidder sample (Columns 4–6), with the tobit results in Columns 3 and 6. The multinomial logit results suggest that targets' institutional ownership indeed increases the probability of stock-only offers. Furthermore, our tobit results confirm that targets' institutional owners facilitate the bidders' use of shares as a means of merger payment. The results are qualitatively the same when our public bidder sample of 3,236 deals is used, and are also robust to a battery of additional control variables.[13]

Given the asymmetric information problem, and potential mispricing associated with bidders' shares, a target would consider a stock-based offer only if such a problem could properly be assessed. The bidder likewise would only put a stock offer on the table when it expects the target to be able to evaluate its offer fairly. Our results thus suggest that bidders perceive that the greater presence of targets' institutional shareholders, who are considered as the more informed group of shareholders, can mitigate the valuation problem associated with stock offers under uncertainty. We return to this economic mechanism in subsection 3.3.4.

[13]In untabulated results, we find our results robust to additional controls for deal characteristics (toehold, lockup provision, prior bidding, and merger of equals), industry and market characteristics (competitive industry, high-tech industry, one-year macroeconomic change, and target Herfindahl-Hirschman index), and firm characteristics (market-adjusted returns of the target and bidder and inverse Mill's ratio (Heckman, 1979) estimated from our baseline targetiveness model).

Table 3.3 – Targets' institutional ownership and the consideration structure

This table reports the regression results of testing the impact of targets' institutional ownership on the extent to which stock payment is used in a takeover offer. The sample consists of M&A target firms that are involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. In columns 1–3 (columns 4–6), bidders are U.S. public or private firms or subsidiaries (public firms). Appendix 3.A1 describes the sample construction procedure in detail. In columns 1, 2, 4 and 5, the multinomial logit model is estimated, where the dependent variable is set to 1 and 2, respectively, if a firm receives a cash-stock mixed bid and a stock-only bid, each evaluated against the base case (cash-only bid). In columns 3 and 6, the tobit model is estimated, where the dependent variable is the fraction of stock in the consideration structure. Appendix 3.A2 provides variable definitions. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

	Bidder ∈ [Pub,Pri,Sub]			Bidder ∈ [Public]		
	Multinomial logit		Tobit	Multinomial logit		Tobit
	Mixed	Stock-only	%stock	Mixed	Stock-only	%stock
ΔIO	0.114	0.896**	0.109**	−0.009	1.092**	0.146***
	(0.766)	(0.023)	(0.016)	(0.986)	(0.041)	(0.010)
Deal characteristics						
Hostile deal [0/1]	−0.345***	−1.164***	−0.104***	−0.773***	−1.680***	−0.179***
	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Termination fee [0/1]	0.411***	0.359***	0.053***	0.380***	0.312**	0.038**
	(0.000)	(0.000)	(0.000)	(0.008)	(0.032)	(0.016)
Competed Bid [0/1]	−0.108	−0.940***	−0.084***	−0.261	−0.786***	−0.073***
	(0.353)	(0.000)	(0.000)	(0.138)	(0.000)	(0.000)
Tender offer [0/1]	−1.576***	−3.723***	−0.327***	−2.146***	−3.945***	−0.437***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Same industry [0/1]	0.814***	0.839***	0.109***	0.228*	0.115	0.010
	(0.000)	(0.000)	(0.000)	(0.053)	(0.344)	(0.438)
Relative size				0.159	0.003	−0.026**
				(0.186)	(0.983)	(0.042)
Size	0.414***	0.192***	0.025***	0.601***	0.517***	0.058***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Target characteristics						
Size	0.414***	0.192***	0.025***	0.601***	0.517***	0.058***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.031***	0.058***	0.008***	0.039***	0.064***	0.006***
	(0.002)	(0.000)	(0.000)	(0.006)	(0.000)	(0.000)
Leverage	0.256	−1.022***	−0.116***	0.116	−1.293***	−0.168***
	(0.228)	(0.000)	(0.000)	(0.707)	(0.000)	(0.000)
Cash flow	−0.831***	−0.838***	−0.122***	−0.420	−0.292	−0.025
	(0.001)	(0.000)	(0.000)	(0.252)	(0.415)	(0.501)
R&D	0.964	1.186**	0.187***	0.192	0.550	0.087
	(0.135)	(0.032)	(0.005)	(0.839)	(0.535)	(0.349)
Bidder characteristics						
Size				−0.366***	−0.440***	−0.053***
				(0.000)	(0.000)	(0.000)
Market-to-book				0.008	0.036***	0.004***
				(0.559)	(0.010)	(0.007)
Leverage				0.008	−0.468	−0.060
				(0.980)	(0.184)	(0.115)
Cash flow				−2.591***	−3.164***	−0.265***
				(0.000)	(0.000)	(0.000)
R&D				1.591	2.207	0.197
				(0.274)	(0.110)	(0.134)
Industry & Year FE	Yes		Yes	Yes		Yes
N	5,706		5,706	3,236		3,236
Pseudo R^2	0.251		0.348	0.310		0.455

3.3.3 IV estimation using the Russell index reconstitution

In this subsection, we use the instrumental variable (IV) approach to support the causal interpretation of the impact of institutional ownership we find. Although we focus our analysis on the change of institutional ownership in an attempt to mitigate a mechanistic correlation between the level of institutional ownership and takeover outcome, endogeneity concerns arguably remain because some unobservable factors might affect both variables. For example, cost-effective or innovative firms may attract institutional money and potential bidders at the same time. To address these concerns, we use the reconstitution of the Russell indices as a source of exogenous variation in institutional ownership (Chang, Hong, and Liskovich, 2015; Appel et al., 2016; Crane et al., 2016; Schmidt and Fahlenbrach, 2017). Our identification strategy exploits shocks to institutional ownership associated with index membership switches between the Russell 1000 and Russell 2000 indices.[14] Since the membership assignment relies only on the end-of-May market capitalization of each stock, an event of Russell 1000/2000 membership switch is plausibly exogenous to firm characteristics and other confounding factors. That is, certain attributes linked with a firm's targetiveness are unlikely to induce a change in the firm's index membership status. Moreover, as index weights are determined within each index, the top-tier members of Russell 2000 get larger weights than the bottom tiers of Russell 1000. Therefore, a switch from Russell 1000 to Russell 2000 leads to an increase in stock holdings by institutions tracking the Russell indices, whereas a switch from

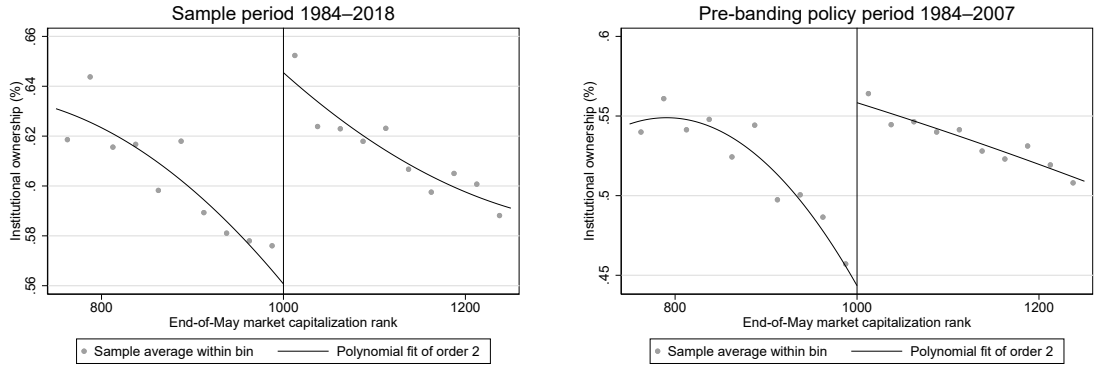
[14]On the "rank day", which is at the end of May each year, Russell assigns index membership based on the market capitalization of stocks. The largest 1,000 stocks (ranked 1 to 1,000) and next 2,000 stocks comprise Russell 1000 and Russell 2000, respectively. The annual reconstitution occurs at the end of June using index weights based on the float-adjusted market capitalization of member stocks. The purpose of the float adjustment is to "include only those shares available to the public" (FTSE Russell (2019), pp.23-24).

Russell 2000 to Russell 1000 results in a decrease in such holdings.

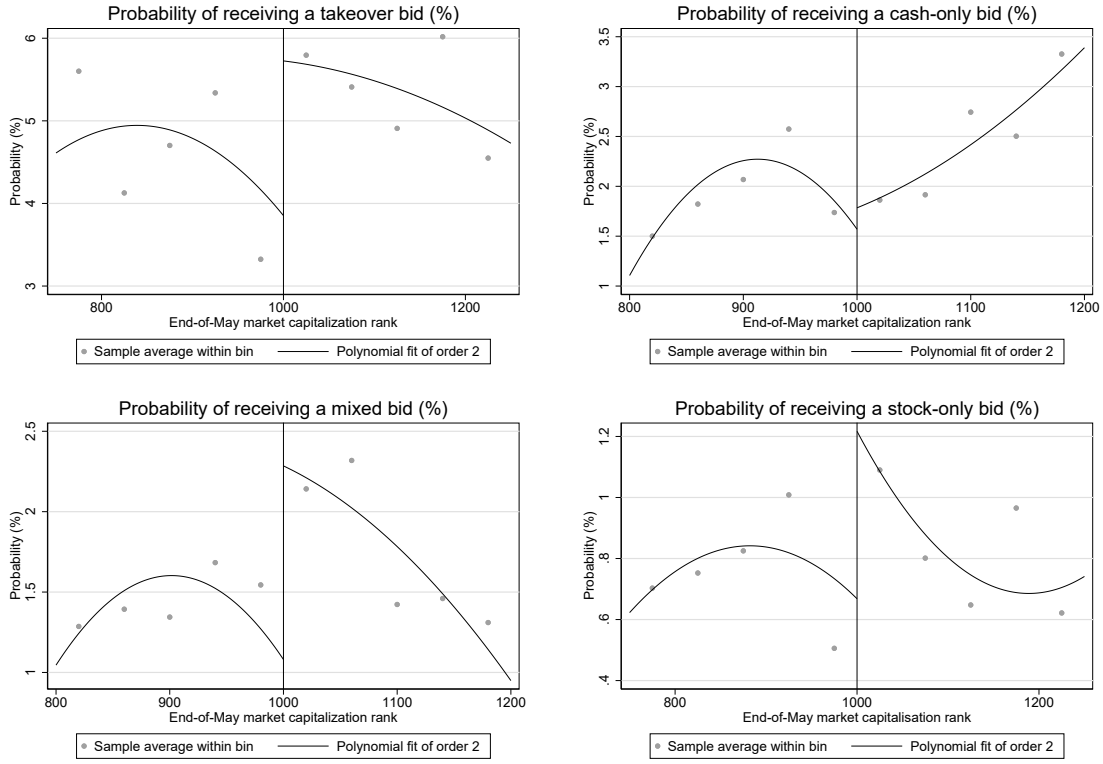
Figure 3.4 – Discontinuities in institutional ownership and the targetiveness around the Russell 1000/2000 threshold

This figure plots time trends in institutional ownership (IO) by different types of institutional investors from 1984 and 2018. The sample consists of M&A target firms that are involved in 3,236 completed or withdrawn offers with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Both targets and bidders are U.S. non-financial and non-utility firms publicly traded on U.S. stock exchanges. Appendix 3.A1 describes the sample construction procedure in detail. The solid line represents total IO, whereas long-dashed, dashed, and short-dashed lines, respectively, represent QIX-DED IO, Monitoring IO, and Indep-Block IO. Appendix 3.A2 provides variable definitions in detail.

Panel A: Institutional Ownership



Panel B: Probability of receiving a takeover bid by payment methods



Panel A of Figure 3.4 illustrates the discontinuity in institutional ownership in the end-of-May market-cap rank around the Russell 1000/2000 Index threshold for our sample period (left panel) and the Russell pre-banding policy period.[15] In Panel B, the upper-left panel plots the takeover likelihood against the end-of-May market-cap rank around the threshold, while the other three, respectively, the likelihood of different payment types. These plots suggest that firms switching to Russell 2000 are more likely to receive a takeover bid. Importantly, the effect is concentrated in stock-only and mixed-payment bids, whereas no meaningful discontinuity around the threshold is observed for cash-only bids.

Following Fich et al. (2015) and Schmidt and Fahlenbrach (2017), we use the 2SLS framework to examine the impact of institutional ownership on targetiveness and the stock-based offers. Table 3.4 reports the estimation results using our panel sample and our M&A sample, respectively, in Panels A and B. The number of observations decreases by about 30% due to the additional data requirement that target firms be Russell index constituents. The first-stage results show that the switch from Russell 1000 to Russel 2000 results in an increase in institutional ownership, whereas the switch from Russel 2000 to Russell 1000 results in a decrease, consistent with the intuition discussed. We also include change in the May market-cap rank and its squared term to account for the variation of institutional ownership associated with firm size. This is because a positive relationship between the market-cap rank (inverse of the rank value) and institutional ownership is generally expected. The diagnostic statistics support the validity of these instruments in our setting: p-value for Hansen J statistic is 0.643 (over-identifying restrictions), while Kleibergen-Paap

[15]Since 2007, Russell initiated the banding policy for reconstitution where firms close to the cut-off threshold do not automatically switch to the new index if its market capitalization does not deviate beyond the 2.5% banding thresholds on either side of the thresholds.

F-stat is 275.197 (relevance).

Table 3.4 – IV estimation using Russell index reconstitution

This table reports the IV estimation results of testing the impact of targets' institutional ownership on the targetiveness and the extent to which stock payment is used in a takeover offer. Column 1 reports the first stage result, and columns 2 and 3, respectively, the second-stage results for the likelihood of receiving a takeover offer and that of a stock-for-stock offer. In Panel A, the sample consists of firm-year observations from 1984 to 2018 from the Compustat, and the M&A targets in the sample are the firms that are involved in completed or withdrawn offers with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public or private firms or subsidiaries. In Panel B, the sample consists of M&A target firms. Appendix 3.A1 describes the sample construction procedure in detail although the sample size is smaller, compared with Tables 2 and 3, due to further exclusion of non-Russell index members. Appendix 3.A2 provides variable definitions, and Appendix E describes the IV method and the instruments. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

Panel A: The panel sample

		Pr[Takeover bid]	Pr[Stock-only bid]
	1^{st} stage	2^{nd} stage	2^{nd} stage
ΔIO		0.085*	0.045*
		(0.069)	(0.093)
$R1000_{t-1} \rightarrow R2000_t$	0.020***		
	(0.000)		
$R2000_{t-1} \rightarrow R1000_t$	−0.033***		
	(0.000)		
$\Delta Rank_t$	0.004***		
	(0.000)		
$(\Delta Rank_t)^2$	0.000***		
	(0.000)		
$\ln(mktcap_{May})$	−0.007***	−0.009***	0.001
	(0.000)	(0.000)	(0.235)
Size	0.004***	0.005***	−0.002**
	(0.000)	(0.002)	(0.030)
Tobin's Q	0.010***	−0.005***	−0.001*
	(0.000)	(0.000)	(0.053)
Leverage	−0.004	0.005	−0.003
	(0.105)	(0.298)	(0.218)
Cash flow	0.085***	−0.026**	−0.005
	(0.000)	(0.015)	(0.337)
R&D	−0.006	0.058***	0.020**
	(0.340)	(0.000)	(0.010)
Sale growth	0.010***	−0.004**	0.002*
	(0.000)	(0.036)	(0.078)
Return on assets	−0.026***	0.036***	0.004
	(0.000)	(0.001)	(0.490)
Compounded excess return	0.015***	0.009	0.004
	(0.000)	(0.400)	(0.300)
Industry acquisition [0/1]	0.003	0.003	−0.001
	(0.166)	(0.566)	(0.714)
Growth-resource mismatch [0/1]	−0.001*	0.003*	−0.002***
	(0.066)	(0.066)	(0.002)
Industry & Year FE	Yes	Yes	Yes
N	76,031	76,031	76,031
Adjusted R^2		0.01	0.01
Weak-instrument test: H0 = weak instrument			
Kleibergen-Paap F-stat	275.197		

Panel B: M&A sample

		Pr[Stock-only bid]	%stock
	1^{st} stage	2^{nd} stage	2^{nd} stage
ΔIO		0.867***	0.522*
		(0.009)	(0.082)
$R1000_{t-1} \rightarrow R2000_t$	−0.003		
	(0.839)		
$R2000_{t-1} \rightarrow R1000_t$	−0.025**		
	(0.016)		
$\Delta Rank_t$	0.005***		
	(0.000)		
$(\Delta Rank_t)^2$	0.000		
	(0.252)		
$\ln(mktcap_{May})$	0.007**	0.032***	0.052***
	(0.013)	(0.001)	(0.000)
Hostile deal [0/1]	0.002	−0.094***	−0.120***
	(0.676)	(0.000)	(0.000)
Termination fee [0/1]	0.011***	0.007	0.025*
	(0.009)	(0.651)	(0.081)
Competed Bid [0/1]	−0.000	−0.055***	−0.069***
	(0.943)	(0.000)	(0.000)
Tender offer [0/1]	−0.007*	−0.213***	−0.316***
	(0.062)	(0.000)	(0.000)
Same industry [0/1]	0.008**	0.060***	0.110***
	(0.034)	(0.000)	(0.000)
Relative size	−0.012***	−0.029***	−0.020*
	(0.000)	(0.009)	(0.078)
Size	0.002***	0.002	0.003**
	(0.000)	(0.325)	(0.048)
Market-to-book	0.010	−0.068**	−0.017
	(0.336)	(0.034)	(0.614)
Leverage	0.055***	−0.056	−0.096**
	(0.000)	(0.215)	(0.031)
Cash flow	−0.048	0.292***	0.256***
	(0.120)	(0.004)	(0.007)
R&D	−0.048	0.292***	0.256***
	(0.120)	(0.004)	(0.007)
Industry & Year FE	Yes	Yes	Yes
N	4,036	4,036	4,036
Adjusted R^2		0.16	0.32
Weak-instrument test: H0 = weak instrument			
Kleibergen-Paap F-stat	19.593		

Turning to the second-stage results reported in Panel A of Table 3.4, we find that our IV results are consistent with our baseline results presented in Table 3.2. An exogenous increase in institutional ownership of a target firm leads to a higher likelihood of receiving a takeover offer, particularly in the form of stock-based offer. Similarly, the IV second-stage results in Panel B of Table 3.4, where we use our M&A sample, buttress our findings reported in Table 3.3.[16] That is, exogenous

[16]In untabulated results, we find similar results when we use our public bidder sample. We also

variation in institutional ownership of a target firm generates a positive effect on the bidders' use of their shares as the merger payment. Overall, our IV results provide strong support to the causal interpretation of our findings, suggesting that institutional owners play a significant role in facilitating the rational design of the M&A payment.

3.3.4 The role of targets' institutional ownership in mitigating information asymmetry

Having uncovered a strong effect of the presence of target firms' institutional ownership on stock-based merger offers, we now turn to the economic mechanism underlying our finding. To the extent that institutional investors have an information advantage concerning M&A deals, the theory of rational payment design (Eckbo et al., 2018) suggests that the effect of a target's institutional ownership should be stronger when information asymmetries associated with bidders and M&As are more severe. We test this hypothesis in our subsequent analyses.

3.3.4.1 Stock-based offers with high information asymmetry

To motivate our analysis, we consider a takeover offer in the presence of asymmetric information. With information frictions, the shareholders of a target firm may find it difficult to assess a bidder's offer, particularly when the offer comes with the bidder's shares as the payment. The information problem would then discourage the target to consider a stock-based deal and accordingly, would also discourage rational bidders to offer their shares as the payment. A rational bidder would make a stock-

find our IV results robust to using the sample prior to FTSE Russell's "banding policy" started in 2007, which may degrade the validity of the index switch as an instrument.

based offer only if the target's shareholders are correctly informed about the value of the bidder shares (Eckbo et al., 2018).[17] It then implies that insofar as target firms' institutional ownership helps mitigate information asymmetries associated with M&As, such a mitigation effect would primarily come into play for the deals with a high level of asymmetries. We therefore expect the effect of institutional ownership on stock-based offers to be stronger when information asymmetries facing targets are more severe.

We employ various empirical proxies, as introduced in Section 3.2, to capture information asymmetries associated with bidders and merger deals. Table 3.5 reports our results based on Karpoff et al.'s (2013) composite index (Panel A), recent acquisition and recent SEO dummies (Panel B), and local deal dummy and industry complementarity (Panel C). Consistent with our prediction, the results show that the effect of targets' institutional ownership on stock payment is more pronounced when bidders and deals with higher information asymmetry. Panel A, for example, shows that a 1% increase in institutional ownership leads to a 28.3% increase in the fraction of stocks in the payment when the bidder is more opaque. For the bidders with low information asymmetries, the effect of targets' institutional ownership is close to zero and statistically insignificant. We find similar contrasts in Panels B and C, based on other proxies. The effect of institutional ownership is more pronounced when bidders have not undergone another acquisition or SEO in two years prior to the deal announcement, when the bidder is located close to the target, and when the two firms' industries are complementary to each other.

Overall, our findings lend support to the notion of rational payment design.

[17] As discussed, an opposite prediction can be developed from the bidder opportunism hypothesis, i.e., bidders take advantage of information asymmetries to use their overvalued shares as the merger payment. We check this alternative possibility in the subsequent sub-subsection.

Table 3.5 – Information asymmetry and the stock-based payment

This table reports the regression results of testing the role of information asymmetry in the relationship between targets' institutional ownership and the use of stock as the merger payment. As indicated in the panel headers, different measures of information asymmetries associated with M&A bidders and deals are used to classify firms into high and low information asymmetry subgroups. The medians of each measure are used. In all cases, the tobit model is estimated, where the dependent variable is the fraction of stock in the consideration structure. The sample consists of M&A target firms that are involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public firms. Appendix 3.A1 describes the sample construction procedure in detail. Appendix 3.A2 provides variable definitions, and Appendix 3.A3 describes the composite index in detail. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

Panel A: Composite proxy for bidder information asymmetry

	Low information asymmetry	High information asymmetry
ΔIO	0.025	0.292***
	(0.751)	(0.000)
Deal/Target/Bidder controls	Yes	Yes
Industry & Year FE	Yes	Yes
N	1,630	1,599
Pseudo R^2	0.475	0.481

Panel B: Other proxies for bidder information asymmetry

	Recent acquisitions [0/1]		Recent SEO [0/1]	
	Recent	Non-recent	Recent	Non-recent
ΔIO	0.044	0.174***	0.076	0.154**
	(0.691)	(0.007)	(0.498)	(0.017)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	740	2,496	720	2,516
Pseudo R^2	0.635	0.460	0.592	0.461

Panel C: Proxies for deal-level information asymmetry

	Local deal [0/1]		Industry complementarity	
	Local	Non-local	High	Low
ΔIO	0.055	0.170***	0.089	0.187**
	(0.653)	(0.007)	(0.222)	(0.035)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	615	2,621	1,725	1,511
Pseudo R^2	0.632	0.459	0.514	0.454

They suggest that institutional shareholders of a target firm help mitigate the information gap that would otherwise discourage bidders' use of stock payment. This mitigation effect is stronger when the asymmetric information problem is more se-

vere.

3.3.4.2 Does misvaluation encourage stock-based offers?

Contrary to our interpretation drawn on the rational payment design, the bidder opportunism hypothesis assumes that bidders can take advantage of the asymmetric information to sell their overvalued shares to targets and to reap the benefit at the expense of the targets' shareholders (Shleifer and Vishny, 2003; Rhodes-Kropf et al., 2005). If the bidder opportunism indeed prevailed in our analyses, the effect of targets' institutional ownership we find could be interpreted as institutional investors merely inviting stock-based offers, even the ones with overpriced shares.

We therefore conduct a set of analyses to ensure that the bidder opportunism is not a force driving our results. To this end, we employ well-established empirical proxies of share mispricing to evaluate whether the effect of targets' institutional ownership is omnipresent or only shows up when the bidders' shares are fairly priced. Table 3.6 reports our results based on Rhodes-Kropf et al.'s (2005) market to book decomposition methods (Panel A) and Ben-David et al.'s (2015) short interest rate (Panel B). To the extent that institutional investors have an information advantage to weed out overpriced shares, we expect the positive effect of targets' institutional ownership on stock-based offers (fraction of stocks in payment) to be concentrated in the low mispricing subgroup. Consistent with this expectation, we find that the coefficient on institutional ownership is indifferent from zero for the high mispricing group, whereas it is positive and significant both economically and statistically when the bidders' shares are relatively fairly priced. In Column 3 of Panel A, for instance, we see that a 1% increase in a target's institutional ownership leads to a 28% increase

in the fraction of stock in the bidder's payment, which translates to an increase from the sample mean by 13%. The results are consistent across different sample stratification methods (three market to book decomposition models and the short interest rate).[18]

Table 3.6 – Stock mispricing

This table reports the regression results of testing whether the relationship between targets' institutional ownership and the use of stock as the merger payment is driven by bidders with overpriced shares. As indicated in the panel headers, different measures of stock mispricing associated with M&A bidders are used to classify firms into high and low mispricing subgroups. The annual median of sum of firm-specific error and time-series sector error and that of adjusted short interest ratio, respectively, are used in Panels A and B. In all cases, the tobit model is estimated, where the dependent variable is the fraction of stock in the consideration structure. The sample consists of M&A target firms that are involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public firms. Appendix 3.A1 describes the sample construction procedure in detail. Appendix 3.A2 provides variable definitions, and Appendix 3.A4 describes the market to book decomposition procedure in detail. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

Panel A: Rhodes-Kropf et al. (2005) market to book decomposition

RRV-Misvaluation	Model I		Model II		Model III	
	High	Low	High	Low	High	Low
ΔIO	0.104	0.218**	0.064	0.272***	0.080	0.283***
	(0.176)	(0.017)	(0.406)	(0.002)	(0.298)	(0.002)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1,491	1,474	1,494	1,472	1,493	1,471
Pseudo R^2	0.585	0.418	0.569	0.431	0.573	0.424

Panel B: Bidder short-selling intensity

	High	Low
ΔIO	-0.010	0.329***
	(0.896)	(0.000)
Deal/Target/Bidder controls	Yes	Yes
Industry & Year FE	Yes	Yes
N	1,635	1,601
Pseudo R^2	0.463	0.509

These results therefore address the potential concern that the bidder oppor-

[18] We perform further robustness checks, such as excluding 2008 to account for the effect of staggered introduction of short-selling ban, as well as the financial crisis and excluding the hot market period 1995–2000 to differentiate the short-position proxy from the market-wide overvaluation (Boehmer, Jones, and Zhang, 2013). Our results (unreported) are robust to these changes.

tunism might explain the positive relationship between targets' institutional ownership and stock-based merger offers. Our findings instead suggest that the bidders with overpriced shares tend to—presumably rationally—avoid using their shares as the merger payment, particularly when the target has a strong presence of institutional ownership.

3.3.4.3 A regulatory shock to information environment

To provide evidence corroborating the information channel underlying the merger payment design, we exploit an exogenous shock to the information environment. An ideal natural experiment would be an event that affects the amount of information available to the managers and shareholders of target firms. To our knowledge, Regulation Fair Disclosure (Reg FD, henceforth) is the only regulatory shock that directly affect the information disclosure and have material effect in the M&A context. Since becoming effective on October 23, 2000, Reg FD prohibited public companies from making selective disclosure of material nonpublic information to securities professionals and institutional investors.[19] It is then expected that the effect of targets' institutional ownership on stock-based offers gets weaker following Reg FD.

While the above prediction is akin to our finding that the effect of institutional ownership on stock-based offers is muted when the information asymmetry is low (Table 3.5), we note that an experiment relying on Reg FD has its own problem. Prior literature documents that the intended effect is unwarranted due to the "chilling effect", an adverse effect of Reg FD on firms' information disclosure (Koch

[19] See the SEC website for details: "Selective Disclosure and Insider Trading" https://www.sec.gov/rules/final/33-7881.htm. Many studies document evidence for the effect of Reg FD on curtailing information asymmetries, through an increase in public disclosure (Heflin, Subramanyam, and Zhang, 2003), improvement in analyst forecast (Irani and Karamanou, 2003), a decrease in information disseminated by analysts (Gintschel and Markov, 2004), and levelling the playing field for all market participants (Koch, Lefanowicz, and Robinson, 2013; Leuz and Wysocki, 2016)

et al., 2013), particularly for small and high-technology firms (Sidhu, Smith, Whaley, and Willis, 2008; Duarte, Han, Harford, and Young, 2008). The literature shows that given the chilling effect, the effect of Reg FD on curtailing information asymmetries is relatively weak for high information-asymmetry firms and small firms. Therefore, conditioning on the firm-level information asymmetry helps identify the treatment and control groups for one's analysis of Reg FD. In our context, the effect of targets' institutional ownership is likely to remain post Reg FD for the high information-asymmetry firms, whereas the effect is expected to vanish for the low information-asymmetry firms (i.e., those free from the chilling effect).

In Table 3.7, we use Karpoff et al.'s (2013) composite index to classify our sample into the low and high information-asymmetry groups, and examine the relationship between targets' institutional ownership and the fraction of stock in the merger payment before and after the adoption of Reg FD, using a ten-year window from 1996 to 2005. The reported results confirm our predictions: While the effect of institutional ownership is overall attenuated post Reg FD, the low asymmetry group (Columns 1 and 2) experiences a greater rate of the attenuation than does the high asymmetry group.[20] Reg FD, as the literature shows, has been more effective in closing the information gap for the low information-asymmetry firms, thereby rendering targets' institutional ownership less influential post Reg FD (the coefficient is small and insignificant in Column 2). However, the role of institutional investors remains important post Reg FD for the high asymmetry firms.

[20]The U.S. SEC introduced Regulation M-A Communication Rules (Reg M-A) on January 27, 2000, which is a rule similar to Reg FD (see Weil, Gotshal & Manges LLP, "M&A Transactions in a Post-Sarbanes-Oxley Environment" https://www.weil.com/~/media/files/pdfs/WeilAlert_10-1-04_MA-PostSOXA.pdf). To address a concern that this might bias our results, we perform a robustness check using the Reg M-A date as the cutoff, and find our results (unreported) qualitatively the same as the Reg FD results.

Table 3.7 – Reg-FD as a shock to information environment

This table reports the regression results of testing the impact of Reg-FD on October 23, 2000, as a shock to information environment, on the relationship between targets' institutional ownership and the use of stock as the merger payment. The composite index of bidder information asymmetry is used to classify firms into low (columns 1 and 2) and high information asymmetry subgroups. In all cases, the tobit model is estimated, where the dependent variable is the fraction of stock in the consideration structure. The sample consists of M&A target firms that are involved in completed or withdrawn offers from 1996 to 2006 (a 10-year window around Reg-FD) with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public firms. Appendix 3.A1 describes the sample construction procedure in detail. Appendix 3.A2 provides variable definitions, and Appendix 3.A3 describes the composite index in detail. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

	Low information asymmetry		High information asymmetry	
	pre-Reg FD	post-Reg FD	pre-Reg FD	post-Reg FD
ΔIO	0.233*	0.035	0.419***	0.292*
	(0.089)	(0.846)	(0.000)	(0.093)
Deal characteristics				
Hostile deal [0/1]	-0.208***	-0.141	-0.112*	-0.052
	(0.002)	(0.167)	(0.060)	(0.503)
Termination fee [0/1]	-0.010	0.079	0.089***	0.153***
	(0.792)	(0.259)	(0.003)	(0.002)
Competed Bid [0/1]	-0.041	0.041	-0.144***	0.046
	(0.471)	(0.538)	(0.007)	(0.488)
Tender offer [0/1]	-0.606***	-0.169***	-0.645***	-0.439***
	(0.000)	(0.002)	(0.000)	(0.000)
Same industry [0/1]	0.038	-0.070	-0.010	-0.014
	(0.298)	(0.101)	(0.716)	(0.725)
Relative size	0.036	-0.003	0.011	0.076
	(0.421)	(0.973)	(0.632)	(0.128)
	(0.632)	(0.651)	(0.128)	(0.087)
Target characteristics				
Size	0.025*	0.137***	0.023	0.089***
	(0.097)	(0.000)	(0.134)	(0.000)
Market-to-book	0.003	0.012**	0.004	0.009*
	(0.344)	(0.019)	(0.219)	(0.088)
Leverage	-0.237***	-0.187	-0.216***	-0.376***
	(0.005)	(0.102)	(0.007)	(0.005)
Cash flow	0.059	-0.238*	0.015	0.077
	(0.606)	(0.087)	(0.832)	(0.299)
R&D	-0.057	0.005	0.248	0.315
	(0.828)	(0.987)	(0.167)	(0.140)
Bidder characteristics				
Size	-0.018	-0.097***	0.000	-0.108***
	(0.278)	(0.000)	(0.983)	(0.000)
Market-to-book	0.005	-0.002	0.004	0.003
	(0.189)	(0.726)	(0.122)	(0.616)
Leverage	-0.125	-0.073	-0.039	-0.015
	(0.353)	(0.615)	(0.601)	(0.906)
Cash flow	-0.183	-0.811***	-0.168*	-0.270***
	(0.460)	(0.001)	(0.078)	(0.007)
R&D	0.130	-0.265	0.158	-0.097
	(0.796)	(0.634)	(0.469)	(0.761)
Industry & Year FE	Yes	Yes	Yes	Yes
N	402	295	561	304
Pseudo R^2	0.725	0.620	0.663	0.673

3.3.5 Institutions' share retention around mergers

In this subsection, we use the investor-level data to provide additional evidence for the institutional shareholders' information advantage in assessing the bidders' offers. One of the crucial elements for the targets' shareholders to consider stock-based offers is the potential merger synergy because they might hold on to the shares of the post-merger combined firm. This scenario thus gives an incentive for the targets' institutional shareholders to carefully assess the merger synergies and any information acquired during the negotiation. Insofar as the institutions have an information advantage, they are expected to retain the shares only if the merger is value-creating for the combined firm. An analysis of the institutions' share retention decision around the merger thus allows for a more direct way to assess whether they ex ante process the information concerning merger synergies and act accordingly.

To this end, we follow Burch et al. (2012) to examine both the post-completion retention rate and pre-completion retention rate.[21] The post-completion retention rate is the number of bidder shares owned by an institution two quarters after the deal completion, divided by the number of bidder shares owned by the institution as the result of the stock-based merger.[22] Similarly, the pre-completion retention rate (between the announcement and the completion of a merger) is defined as the number of target shares owned at the latest quarter before the deal completion

[21]Both measures are winsorized at the 1% level in both tails. The mean and median post-completion (pre-completion) retention rates are 54% and 0% (55% and 54%) in our stock-for-stock deal sample, similar to Burch et al. (2012).

[22]The number of bidder shares that a target's institutional shareholder would own, as the result of a stock merger, is estimated based on its share ownership of the target at the quarter before the announcement and the deal exchange ratio from SDC. The deal exchange ratio is the number of new shares per legacy target shares quoted from the deal consideration. When this is missing, we extract the information from M&A tear sheets as follows: for deals with collar agreements, it is based on the number of shares issued eventually (Dasgupta, Harford, and Ma, 2019). We keep the exchange ratio missing if a deal involves two-tier stock swap or multiple class shares. Our results are robust to dropping all deals with missing exchange ratio.

date, divided by the number of target shares owned at the latest quarter before the deal announcement. The pre-completion retention rate is used to account for possible trading strategies by institutional investors around an announcement that may affect the post-completion retention rate. To wit, investors' selling activities could already be under way before the merger is completed (Burch et al., 2012), and the investors with no intention to hold—as the result of the stock merger—shares of the bidder would choose to sell their shares of the target firm before the stock swap takes place. Some investors might prefer this strategy because the target firms' share price gains are usually large at the deal announcement and the combined firms' stocks may perform poorly after the deal completion. Such a strategy could then bias the post-completion retention rate. In contrast, the pre-completion retention rate suffers little from this issue.

Table 3.8 reports our results for the whole sample (Panel A) and the subsamples based on deal synergies (Panels B and C). We restrict our attention to the institutions that own at least 1% of a target firm—and no bidder shares—prior to the announcement of a stock-for-stock deal (Burch et al., 2012). Such a sample allows us to investigate the actions taken by those institutions that have incentives to carefully evaluate the deal terms and offer price. The change in the institution-level ownership of a target firm $\Delta IO[inst]$ is measured as a four-quarter change before the date of deal announcement. From our whole sample results in Panel A of Table 3.8, we see that the institutions that have increased their holdings in a target firm before the announcement, retain more shares of the merged firm (post-completion retention) and the target firm (pre-completion retention) in stock-for-stock deal.[23]

[23]We find the qualitatively the same results (unreported) when we examine the likelihood of retention, using the retention dummy as the dependent variable in the probit model following Burch et al. (2012).

Table 3.8 – Institution-level ex-post share retention rates

This table reports the regression results of testing the institutions' decision to retain shares of post-merger combined firms. The dependent variable is either the post-completion retention rate (column 1) or the pre-completion retention rate (column 2). Panel A reports the results for the whole sample, and Panels B and C, respectively, report the results for the subsamples formed based on combined CARs and post-merger long-term performance, as indicated in the panel headers. The sample consists of institutional investors holding M&A target firms involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million. Bidders are U.S. public firms. Appendix 3.A1 describes the sample construction procedure in detail. Appendix 3.A2 provides variable definitions. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

Panel A: Institutional-level baseline results

	Post-completion retention	Pre-completion retention
ΔIO[inst]	0.016*	0.012***
	(0.099)	(0.000)
Deal characteristics		
Hostile deal [0/1]	0.039	-0.064
	(0.843)	(0.271)
Termination fee [0/1]	-0.032	-0.012
	(0.576)	(0.544)
Competed Bid [0/1]	-0.120	0.062*
	(0.278)	(0.086)
Tender offer [0/1]	-0.194*	-0.126***
	(0.069)	(0.000)
Same industry [0/1]	0.019	-0.014
	(0.666)	(0.379)
Relative size	-0.079	-0.033*
	(0.112)	(0.055)
Bidder CAR[-1;+1]	0.405*	-0.095
	(0.098)	(0.256)
Target CAR[-1;+1]	-0.017	-0.189***
	(0.874)	(0.000)
Completion days	0.000	-0.001***
	(0.727)	(0.000)
Percent of portfolio	0.783*	0.791***
	(0.055)	(0.000)
Institution size	0.128***	0.034***
	(0.000)	(0.000)
Target characteristics		
Size	0.027	0.005
	(0.306)	(0.589)
Market-to-book	0.000	-0.003
	(0.998)	(0.160)
Leverage	-0.050	-0.028
	(0.712)	(0.525)
R&D	0.081	-0.297**
	(0.819)	(0.014)
Cash flow	0.225	-0.148***
	(0.148)	(0.003)
Bidder characteristics		
Size	-0.037*	-0.046***
	(0.098)	(0.000)
Leverage	-0.114	0.144***
	(0.380)	(0.001)
R&D	0.081	0.130
	(0.852)	(0.399)
Market-to-book	-0.001	-0.000
	(0.717)	(0.798)
Cash flow	0.379*	0.105
	(0.052)	(0.144)
Industry & Year FE	Yes	Yes
N	4,972	5,597
Adjusted R^2	0.044	0.078

Panel B: Partitioning by combined CARs

	Post-completion retention		Pre-completion retention	
CAR[−1, +1]	High	Low	High	Low
ΔIO[inst]	0.023*	0.007	0.014***	0.010*
	(0.073)	(0.668)	(0.001)	(0.081)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	2,914	2,058	3,421	2,176
Adjusted R^2	0.040	0.069	0.075	0.116

Panel C: Partitioning by post-merger long-term performance

	Post-completion retention		Pre-completion retention	
3-year avg ΔROA	High	Low	High	Low
ΔIO[inst]	0.034**	0.005	0.019***	0.011**
	(0.046)	(0.759)	(0.000)	(0.037)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	2,028	2,121	2,332	2,312
Adjusted R^2	0.054	0.047	0.085	0.091
3-year avg ΔSLG	High	Low	High	Low
ΔIO[inst]	0.024*	0.011	0.017***	0.010**
	(0.089)	(0.406)	(0.001)	(0.020)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	2,140	2,182	2,447	3,150
Adjusted R^2	0.057	0.046	0.099	0.078
3-year avg ΔCOGS	High	Low	High	Low
ΔIO[inst]	0.011	0.028*	0.013***	0.019***
	(0.444)	(0.079)	(0.010)	(0.000)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	2,184	2,118	2,403	2,455
Adjusted R^2	0.048	0.050	0.087	0.083

The institutions whose ownership of a target firm has increased before the announcement and also retained more shares ex post, seem to have formed a more favorable view on the potential merger synergies.

More importantly, we then employ several proxies for short-term and long-term synergies to examine whether the merger synergies to be realized motivates the institutions' share retention decision. In Panels B and C of Table 3.8, our sample stratification is based on the following measures: three-day combined cumulative abnormal returns around the announcement $CAR[-1, +1]$ and post-merger

three-year changes in, respectively, return on assets ΔROA, sales growth ΔSLG, and costs of goods sold to sales $\Delta CoGS$ (Ghosh, 2001; Harford et al., 2011; Brooks et al., 2018).[24] Our results reveal that the positive relationship between the ex-ante target ownership and ex-post share retention is stronger when bigger merger synergies are expected. The results are consistent across both retention measures and across all short-term and long-term measures of deal synergies. Higher share retention rates by targets' institutional shareholders are observed when the announcement returns are high. Similarly, we find higher share retention rates when the merged firms have experienced a relatively large increase in their ROA and sales and a relatively large decrease in their costs. These results thus suggest that the institutions' share-retention decisions are informed and value-driven, motivated by potential deal synergies.

Our findings provide further support to the notion that targets' institutional investors are incentivized to capitalize upon their information advantage in the M&A process. It allows the institutions to form a more accurate assessment of bidders and merger synergies, leading to informed share-retention decisions—whether to retain or dispose of—linked to the prospect of the combined firms.

3.4 Further tests

3.4.1 Pre-merger cross-holding

Prior literature documents the role played by institutional cross-holding in M&As. In the M&A context, cross-holding is established when an institutional investor owns

[24] CAR is estimated from the market model, where the parameters are estimated in $[-291, -41]$ prior to the announcement, with the minimum of 100 valid return observations in the estimation period (Eckbo et al., 2018).

the shares of both the target and the bidder prior to the merger announcement. Cross-holding institutions are likely to be well informed about an M&A deal in question (Matvos and Ostrovsky, 2008; Harford et al., 2011; Brooks et al., 2018). Therefore, we ensure that the effect of target firms' institutional ownership on stock-based offers we find is not an artifact of the effect of institutional cross-holding.

Table 3.9 reports our tobit estimation results that account for institutional cross-holding. Following prior studies to employ several measures of cross-holding (Matvos and Ostrovsky, 2008; Brooks et al., 2018). Columns 1 through 3 use the numbers of top 5, 10, and 20 cross-holding institutions *Cross top* 5/10/20 *count*, and Columns 5 and 6 targets' institutional ownership represented by cross-holding institutions *Target Cross IO* and such ownership with at least 1% in both the target and the bidder *Target Cross IO*[1 pct]. The results confirm that the cross-holding effect does not explain away the incremental effect of targets' institutional ownership we find. Across all measures, the coefficient on targets' institutional ownership remains statistically significant and its economic magnitude is similar to the one reported in Table 3.3.[25]

3.4.2 Types of institutional shareholders

Prior literature documents that the influence of institutional investors on their portfolio firms is heterogenous across characteristics of the institutions. Extant studies in this line of research show that the monitoring incentive is stronger when the institutions hold the large block ownership (Indep-Block IO, Chen et al. (2007)), hold shares in long term (QIX-DED IO, Bushee (1998)), or hold shares of firms that con-

[25]Our results also hold (unreported) when we include *Bidder Cross IO* or *Bidder Cross IO*[1 pct], i.e., bidders' institutional ownership represented by cross-holding institutions.

Table 3.9 – Institutions' cross-holdings of bidders and targets

This table reports the regression results of testing whether the relationship between targets' institutional ownership and the use of stock as the merger payment is assumed away by institutions' cross-holding of both bidder and target. Institutional cross-holding is measured by either the fraction of ownership held by a target's institutional shareholders that own—i.e., cross-hold—shares of the bidder or the number of top 5/10/20 institutional shareholders that cross-hold both target and bidder. In all cases, the tobit model is estimated, where the dependent variable is the fraction of stock in the consideration structure. The sample consists of M&A target firms that are involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public firms. Appendix 3.A1 describes the sample construction procedure in detail. Appendix 3.A2 provides variable definitions. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

	Dependent variable = Percentage of stock				
ΔIO	0.147**	0.152***	0.142**	0.130**	0.135**
	(0.010)	(0.008)	(0.013)	(0.024)	(0.019)
Cross top 5 count	0.013*				
	(0.056)				
Cross top 10 count		0.011**			
		(0.012)			
Cross top 20 count			0.011***		
			(0.000)		
Target Cross IO				0.104**	
				(0.017)	
Target Cross IO [1 pct]					0.199***
					(0.007)
Deal characteristics					
Hostile deal [0/1]	−0.177***	−0.176***	−0.176***	−0.180***	−0.179***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Termination fee [0/1]	0.040**	0.041**	0.039**	0.038**	0.038**
	(0.013)	(0.012)	(0.014)	(0.019)	(0.017)
Competed Bid [0/1]	−0.073***	−0.074***	−0.075***	−0.074***	−0.073***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tender offer [0/1]	−0.431***	−0.431***	−0.430***	−0.432***	−0.431***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Same industry [0/1]	0.006	0.004	0.002	0.005	0.004
	(0.678)	(0.740)	(0.864)	(0.731)	(0.761)
Relative size	−0.021	−0.020	−0.019	−0.019	−0.019
	(0.125)	(0.141)	(0.155)	(0.147)	(0.157)
Target characteristics					
Size	0.057***	0.055***	0.049***	0.053***	0.054***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.007***	0.007***	0.006***	0.007***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	−0.156***	−0.154***	−0.142***	−0.153***	−0.155***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow	0.002	0.003	0.005	−0.005	−0.005
	(0.958)	(0.930)	(0.890)	(0.904)	(0.902)
R&D	0.107	0.101	0.091	0.106	0.103
	(0.266)	(0.293)	(0.340)	(0.267)	(0.283)
Bidder characteristics					
Size	−0.055***	−0.055***	−0.055***	−0.058***	−0.055***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.003**	0.003**	0.003**	0.003*	0.003**
	(0.049)	(0.045)	(0.047)	(0.060)	(0.046)
Leverage	−0.071*	−0.069*	−0.062	−0.065	−0.070*
	(0.071)	(0.080)	(0.113)	(0.100)	(0.076)
Cash flow	−0.332***	−0.331***	−0.323***	−0.340***	−0.337***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&D	0.167	0.156	0.147	0.144	0.159
	(0.225)	(0.256)	(0.283)	(0.296)	(0.248)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
N	3,088	3,088	3,088	3,088	3,088
Pseudo R^2	0.462	0.463	0.466	0.463	0.463

stitute a significant portion of their portfolios (Monitoring IO, Fich et al. (2015)). We likewise expect the effect on stock-based merger offers to be more pronounced for the institutions with these attributes.

Table 3.10 – Institutions with long-term focuses and monitoring incentives

This table reports the regression results of testing the impact of different types of institutional ownership on the use of stock as the merger payment. In all cases, the tobit model is estimated, where the dependent variable is the fraction of stock in the consideration structure. The sample consists of M&A target firms that are involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and have institutional ownership data on Thomson Reuters 13F. Bidders are U.S. public firms. Appendix 3.A1 describes the sample construction procedure in detail. Appendix 3.A2 provides variable definitions. *, **, and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, based on standard errors robust to clustering at the firm level (p-values in the parentheses).

Panel A: Whole M&A sample

	Dependent variable = Percentage of stock			
ΔIO	0.146***			
	(0.010)			
ΔMonitoring IO		0.169*		
		(0.082)		
ΔNon-Monitoring IO		0.123**		
		(0.035)		
ΔQIX-DED IO			0.132*	
			(0.068)	
ΔTRA IO			0.107	
			(0.215)	
ΔIndep-block IO				0.405**
				(0.037)
ΔNon-indep-block IO				0.144**
				(0.011)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes
N	3,236	3,236	3,236	3,236
Pseudo R^2	0.455	0.455	0.455	0.456

Table 3.10 reports the results for Monitoring IO, QIX-DED IO, and Indep-Block IO, respectively, using the entire M&A sample (Panel A) and information-symmetry subsamples (Panel B). Consistent with prior evidence, we find that the effect of targets' institutional ownership on facilitating stock-for-stock offers is more pronounced for these institutions. Additionally, the positive influence is again more pronounced when the bidder information asymmetry is higher. Overall, the results confirm the intuition that institutional shareholders with a larger incentive to mon-

Panel B: Information asymmetry subsamples

	Low information asymmetry				High information asymmetry			
ΔIO	0.025				0.292***			
	(0.751)				(0.000)			
ΔMonitoring IO		-0.043				0.500***		
		(0.731)				(0.001)		
ΔNon-monitoring IO		0.017				0.237***		
		(0.835)				(0.004)		
ΔQIX-DED IO			-0.003				0.334***	
			(0.977)				(0.002)	
ΔTRA IO			0.004				0.218*	
			(0.969)				(0.094)	
ΔIndep-block IO				0.340				0.628**
				(0.172)				(0.038)
ΔNon-indep-block IO				0.017				0.301***
				(0.828)				(0.000)
Deal/Target/Bidder controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,630	1,630	1,630	1,630	1,599	1,599	1,599	1,599
Pseudo R^2	0.475	0.475	0.475	0.476	0.481	0.482	0.481	0.482

itor their portfolio firms exert a stronger impact on the design of merger payment.

3.5 Conclusion

In this chapter, we have investigated the role of target firms' institutional ownership in M&A deals. A large volume of research examines a longstanding question whether institutional investors have motivation and resources to play a governance role for their portfolio firms. However, ours departs from these studies by focusing on target firms and their institutional shareholders, to ask when—rather than whether—institutional investors' information advantage comes into play. We first show a positive effect of targets' institutional ownership on both the likelihood of receiving stock-based offers and the fraction of stocks in the merger payment. More importantly, we provide evidence for the institutional investors' information advantage, consistent with the prediction rooted in the theory of rational payment design (e.g., Eckbo et al. (2018)). The effect we find is more pronounced when the problem of information asymmetries between targets and bidders is more severe. We ensure that our findings are not driven by the bidders' attempt to take advantage of their

overpriced shares. Moreover, an analysis of Reg FD as a regulatory shock to the information environment provides further support to the information channel. We also exploit a different angle to show that the institution-level share-retention decisions surrounding the mergers are an informed and value-driven one, motivated by potential deal synergies they estimate ex ante.

Our findings, collectively, lend support to the notion that institutional investors can perform a governance function in capital markets by capitalizing upon their information advantage. As our evidence suggests, the information role played by institutional investors in stock-based offers can help the target management to avoid decisions detrimental to their shareholders. We believe that this evidence therefore goes a long way towards our understanding of the motivation and engagement of institutional investors, as well as the determinants of M&A targetiveness and the consideration structure.

Appendices: Chapter 3

Table 3.A1 – Formation of M&A samples

This section describes the formation of our M&A sample. After applying the sample selection criteria outlined below, the resulting sample consists of 5,706 completed or withdrawn M&A offers between 1984 and 2018 in which the takeover target is U.S. public firms that have data available from CRSP, Compustat, and Thomson Reuters 13F. The respective number of offers in which both targets and bidders are U.S. public firms are shown in the parentheses.

Sample Criteria	**N.**
Initial M&A sample	
Deals are announced between 01/01/1984 and 31/12/2018 and both bidders and targets are U.S firms	288,707
Targets are public firms	56,458
Bidders are public, subsidiary or private firms	55,679
Deal value is at least $1 million and account for at least 1% of the bidder's market capitalisation reported at the fiscal year-end date prior to the bid announcement date	45,079
Deal is either completed or withdrawn	24,891
Deal is classified as 'merger' or 'acquisition of majority interest'	12,639
More than 50% of outstanding shares of the target are acquired in a completed deal (or sought in a withdrawn deal)	12,514
Time to completion or withdrawn is less than 1000 days	12,491
CRSP/Compustat/13F	
Deals where targets (both targets and bidders) have stock market and accounting data available from CRSP and Compustat	8,369 (5,689)
Deals where targets have ownership information available from Thomson Reuters Institutional Holdings 13F database	8,099 (5,269)
Exclude observations with missing control variables for takeover probability tests and those in financial (SIC 6000–6999) and utility (4900–4999) industries	6,015 (3,505)
Information on deal payment is available and the fraction of stock payment is not missing, to enable classification into either stock-only, cash-only, or mixed	5,706 (3,236)

Table 3.A2 – Variable definitions

This section describes the formation of our M&A sample. After applying the sample selection criteria outlined below, the resulting sample consists of 5,706 completed or withdrawn M&A offers between 1984 and 2018 in which the takeover target is U.S. public firms that have data available from CRSP, Compustat, and Thomson Reuters 13F. The respective number of offers in which both targets and bidders are U.S. public firms are shown in the parentheses.

Variables	Definitions (data sources)
Deal characteristics	
Stock-only deals	1 if consideration is share-only (SDC M&A)
Cash-only deals	1 if consideration is cash-only (SDC M&A)
Mixed deals	1 if consideration is a mix of shares and cash payment (SDC M&A)
Hostile deals	1 if deal attitude is hostile or unsolicited (SDC M&A)
Toehold	1 if bidder owns a fraction of target shares (SDC M&A)
Termination fee	1 if target has termination fee provision in the merger agreement (SDC M&A)
Local deals	1 if bidder and target are located within 30 miles. The spherical law of cosines formula: 3963 miles $\times$ acos[sin(lat_b) $\times$ sin(lat_t) + cos(lat_b) $\times$ cos(lat_t) $\times$ cos($long_b$-$long_t$)], where (lat_b,$long_b$) and (lat_t,$long_t$) are (latitude,longitude), measured in radians, of the bidder and target location, respectively. (US Census Gazetteer 2000 & city coordinates).
Recent acquirer	1 if bidder announced another merger bid within 2 years prior to the sample bid (SDC M&A)
Recent SEO	1 if bidder issued common stocks within 2 years prior to the sample bid (SDC Equity)
Industry complementarity	The degree to which the target and bidder input and output industries overlap (US BEA, Joseph Fan's website)
Same industry	1 if target and bidder are in the same 4-digit SIC industry (Compustat)
Tender offer	1 if tender merger flag is labelled "YES" (SDC M&A)
Competed bids	1 if there are more than 1 bidder for the deal (SDC M&A)
Relative size	Deal value divided by market capitalisation of bidder (SDC M&A)
Institutional ownership	
ΔIO	Change in the fraction of total institutional ownership at the fiscal year-end (Thomson Reuters 13F)
ΔIO[inst]	Change in the fraction of total ownership in target firms at the institution-level at the fiscal year-end.
Target Cross IO	Ownership represented by a target's institutional shareholders that own—i.e., cross-hold—shares of the bidder (Target Cross IO[1 pct] is such ownership greater than 1% in both firms)
Cross top 5 count	Number of top 5 institutional shareholders that cross-hold both target and bidder firms (Cross top 10 count and Cross top 20 count are defined in the same way).
ΔMonitoring IO	Change in monitoring institutional ownership at the fiscal year-end, where Monitoring IO (Fich et al., 2015) is defined as the ownership represented by institutions whose holdings in the target firm account for top 10% of their portfolios.
ΔQIX-DED IO	Change in ownership represented by quasi-indexer and dedicated institutions (Bushee, 1998) at the fiscal year-end.
ΔIndep-Block IO	Change in independent blockholder ownership (Chen et al., 2007) at the fiscal year-end.
Firm characteristics	
Firm size	Natural log of book assets (Compustat)
Leverage	Long-term debt divided by book assets (Compustat)
Cash flow	Income before extraordinary items and depreciation divided by book assets (Compustat)
Return on asset	Earnings before interests divided by book assets (Compustat)
Market-to-book	Market value of equity divided by book value of equity (Compustat)
R&D	Research and development expense divided by book assets (Compustat)
Compounded excess returns	Compounded monthly excess returns at the fiscal year-end (CRSP)
Sales growth	$sale_t/sale_{t-1} - 1$ (Compustat)
Growth-resource mismatch	1 if there is a combination of low sale growth, high liquidity and low leverage or high sale growth, low liquidity and high leverage, and 0 otherwise (Compustat)
Industry acquisition	1 if there is at least one acquisition in the firm's 4-digit SIC industry in the year prior to the year of bid announcement, and 0 otherwise (SDC, Compustat)

Appendix 3.A2 [con'd]

Variables	Definitions (data sources)
Information asymmetry	
Tangible assets	Tangible assets divided by book assets (Compustat)
Firm age	Age of a firm at the announcement date since its appearance in the CRSP database.
Analysts following	Number of analysts forecasting a firm's EPS in the fiscal year before the announcement (I/B/E/S)
Return volatility	Standard deviation of daily stock returns for a period of $[-90, -11]$ trading days prior to the announcement date (CRSP)
Bid-ask spread	Mean bid-ask spreads of a firm's daily stock price divided by its price for a period of $[-90, -11]$ trading days prior to the announcement date (CRSP)
No. of IPO & SEOs	Number of IPO and SEOs prior to the announcement date (SDC Equity)
Abnormal accruals	Absolute value of firm-specific abnormal accruals minus the median abnormal accruals for its respective industry-performance-matched portfolio (2 digit-SIC, year and ROA_{it-1}). The firm-specific abnormal accruals is the residuals obtained from the modified Jones model: $\frac{Accr_{it}}{at_{it-1}} = \alpha_0 + \alpha_1 \times \frac{1}{at_{it-1}} + \alpha_2 \times \frac{\Delta sale_{it}}{at_{it-1}} + \alpha_3 \times \frac{ppe_{it}}{at_{it-1}}$, where $Accr_{it}$ is the total accruals for firm i in year t, defined as the difference between earnings before extraordinary items and discontinued operations ibc_{it}, and operating cash flow from continuing operations $oancf_{it} - xidoc_{it}$, following Karpoff et al. (2013) (Compustat)
Misvaluation	
Misvaluation	Sum of firm-specific error and time-series sector error. Firm-specific error: $m_{it} - v(\theta_{it}; \alpha_{jt})$, where α_{kjt} is the annual, sector-average multiples. Time-series sector error, $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \bar{\alpha}_j)$, where α_{kj} is the long-run sector average multiples. The detailed procedure is provided in Appendix C (Compustat)
Adjusted short interest	The difference between a stock's short interest ratio and the mean ratio of all common stocks (shrcd 10, 11) traded on NYSE, AMEX and NASDAQ in the same month, where short interest ratio is the short position on the 15^{th} of each month (settlement date), divided by shares outstanding of the same month (Compustat, CRSP)
Misvaluation	
Post-completion retention rate	The number of a bidder's shares owned by an institution two quarters after the deal completion, divided by the expected number of shares the institution would own, based on its ownership of the target's shares at the latest quarter before the announcement and deal exchange ratio (Thomson Reuters 13F, SDC M&A)
Pre-completion retention rate	The number of a target's shares owned at the latest quarter before the deal completion, divided by the number of the target's shares owned at the latest quarter before the deal announcement (Thomson Reuters 13F, SDC M&A)
CAR[-1,+1]	3-day CARs, bidder and target combined (CRSP)
3-year avg ΔROA	Difference between the 3-year-average post-announcement ROA and the pre-announcement ROA of bidder firm (Compustat)
3-year avg ΔSLG	Difference between the 3-year-average post-announcement sales growth and the pre-announcement sales growth (Compustat)
3-year avg $\Delta CoGS$	Difference between the 3-year-average post-announcement cost of goods sold (CoGS) and the pre-announcement CoGS of bidder firm (Compustat)

Appendix 3.A3 – Composite index of bidders' information asymmetry

This section describes our composite index of bidders' information asymmetry based on the factor analysis using eight firm characteristics (Karpoff et al., 2013). The five indicators for the price informativeness are firm size, tangible assets, firm age, number of analysts followings, and number of prior IPO and SEOs (Barth, Kasznik, and McNichols, 2001; Hong, Lim, and Stein, 2000). The three components positively correlated with information asymmetry include bid-ask spreads, return volatility (the risk-bearing of uninformed investors, e.g., Corwin, 2003), and abnormal accruals (the quality of accounting information, see, e.g., Kothari, Leone, and Wasley (2005) and Lee and Masulis (2009)).

Table A1: Factor analysis results for the composite index of bidder information asymmetry

This table reports the factor analysis results with the eight firm characteristics associated with information asymmetry (Karpoff et al., 2013). Kaiser-Meyer-Olkin (KMO) statistics measure the sampling adequacy for the composite factor. The sample consists of M&A bidder firms involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and targets with institutional ownership data on Thomson Reuters 13F. Both bidders and targets are U.S. public firms. Appendix A describes the sample construction procedure in detail. Appendix B provides variable definitions, and Appendix C describes the composite index in detail.

Proxies	Variables	Predicted correlation with info asymmetry	Factor1	Factor2	KMO measure of sampling adequacy
1	Firm size	—	0.8657	−0.0936	0.6683
2	Tangible assets	—	0.2543	0.6807	0.6836
3	Firm age	—	0.6862	0.1816	0.7662
4	Analyst followings	—	0.6645	−0.2501	0.7064
5	No. of IPO & SEOs	—	0.3139	−0.2004	0.7311
6	Bid-ask spreads	+	−0.3896	0.5200	0.7761
7	Return volatility	+	−0.6920	−0.0759	0.7813
8	Abnormal accruals	+	−0.3138	−0.5180	0.7035
	KMO overall				0.7195
	Eigenvalue		2.5541	1.1523	

Table A1 reports the results for two factors (Factor 1 and Factor 2) with eigenvalue greater than 1, implying that the two factors capture sufficient variation in the eight measures. Factor 1 is considered a more appropriate proxy for the following reasons: (1) its eigenvalue of 2.55 suggests that it summarizes a significant amount

of variation in the eight factor loadings; (2) each factor loading of Factor 1—as an individual proxy for information symmetry—has an opposite sign to the predicted sign of information asymmetry; and (3) Kaiser-Meyer-Olkin (KMO) statistics measuring the sampling adequacy are sufficiently high for each factor loading and for the composite factor with the overall value of 0.72. We therefore choose Factor 1 as the adequate measure of information symmetry of the bidders in our sample. Our final measure of the bidder information asymmetry is then obtained by multiplying Factor 1 by –1.

Appendix 3.A4 – Bidder misvaluation: market-to-book decomposition

This section describes the procedure for the market-to-book decomposition used in our analysis. Following Rhodes-Kropf et al. (2005), we use three models to estimate the MTB decomposition:

Model I: $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \epsilon_{it}$

Model II: $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ln(NI)^{+}_{it} + \alpha_{3jt} I_{(<0)} ln(NI)^{+}_{it} + \epsilon_{it}$

Model III: $m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ln(NI)^{+}_{it} + \alpha_{3jt} I_{(<0)} ln(NI)^{+}_{it} + \alpha_{4jt} LEV_{it} + \epsilon_{it}$

where m_{it} is the natural logarithm of firm's market value of equity, b_{it} is the natural logarithm of the firm's book value of equity, and α_{0jt} and α_{1jt} are estimated from the annual, cross-sectional regressions for each sector. The log of market to book $m_{it} - b_{it}$ is then decomposed into 3 components: firm-specific error $(m_{it} - v(\theta_{it}, \alpha_{jt}))$, time-series sector error $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \bar{\alpha}_j)$ and long-run value-to-book $v(\theta_{it}; \bar{\alpha}_j) - b_{it}$. The fundamental value $v(\theta_{it}, \alpha_{jt})$ is obtained by applying the annual, sector-average regression multiples to firm-level accounting variables: $v(\theta_{it}, \alpha_{jt}) = \hat{\alpha}_{0jt} + \hat{\alpha}_{1jt} b_{it}$. Similarly, $v(\theta_{it}; \bar{\alpha}_j)$ is obtained by applying the long-run sector-average regression multiples to firm-level accounting variables: $v(\theta_{it}, \alpha_j) = \bar{\alpha}_{0j} + \bar{\alpha}_{1j} b_{it}$ where $\bar{\alpha}_j = 1/T \sum \hat{\alpha}_{jt}$. In Model II, $ln(NI)^{+}_{it}$ is the log of absolute value of net income and $I_{(<0)}$ is a binary indicator for negative net income. Model III adds leverage ratio, defined as the long-term debt plus debt in short-term liabilities divided by book assets.

Table A2: Market to book decomposition summary statistics by payment methods

This table reports summary statistics for the three components (firm-specific error, time-series sector error, and long-run value to book) of the market to book decomposition, based on three decomposition models (Rhodes-Kropf et al., 2005). Columns 1–3 report results for different payment methods. The sample consists of M&A bidder firms involved in completed or withdrawn offers from 1984 to 2018 with a transaction value of no less than $1 million and targets with institutional ownership data on Thomson Reuters 13F. Both bidders and targets are U.S. public firms. Appendix A describes the sample construction procedure in detail. Appendix B provides variable definitions, and Appendix D describes the market to book decomposition procedure in detail.

	Cash-only	**Mixed**	**Stock-only**
	Mean	Mean	Mean
$m_{it} - b_{it}$ (log of market to book)	0.735	0.647	0.918
Model I			
Firm-specific error	0.136	0.119	0.309
Time-series sector error	0.062	0.070	0.097
Long-run value to book	0.537	0.456	0.512
Model II			
Firm-specific error	0.056	0.093	0.252
Time-series sector error	0.078	0.099	0.098
Long-run value to book	0.474	0.564	0.568
Model III			
Firm-specific error	0.063	0.091	0.248
Time-series sector error	0.051	0.078	0.098
Long-run value to book	0.622	0.475	0.572

Table A2 reports the summary statistics for the three models by different payment methods (columns 1–3). We use the sample construction criteria similar to those used in Golubov and Konstantinidi (2019): market-to-book between 0 and 100, return on equity between –1 and 1, book leverage between 0 and 1, and non-missing values for all components used in Model III. These restrictions help eliminate the effect of outliers on the long-run value estimation. The Fama-French 12 industry classification is used to define sectors.

Appendix 3.A5 – Russell Index switches and Russell rank proxy

This section discusses the Russell index reconstitution as the instrument for change in institutional ownership used in our IV estimation. Stocks that are close to either side of the Russell 1000/2000 index threshold have similar market capitalization at the end of May ("rank date"). The assignment to Russell indices is exogenous to firms' actions, conditional on their market capitalization, because the index reconstitution relies solely on the end-of-May market capitalization. In addition, Russell uses its proprietary method in calculating market capitalization to account for float shares—those available to the public—and the index assignment depends on the float-adjusted market capitalization at the end of May, over which firms have no direct control (Crane et al., 2016). Given that the Russell 1000 and 2000 indices are value-weighted within each index, the annual index reconstitution has significant implications for institutions' holdings of stocks that switch their index membership status. To wit, the stock ranked 1,000th in Russell 1000 gets a significantly lower portfolio weight than does the one ranked first in Russell 2000 although the two stocks have almost the same market capitalization (Chang et al., 2015; Appel et al., 2016; Crane et al., 2016; Schmidt and Fahlenbrach, 2017). Therefore, stocks switching from Russell 2000 to Russell 1000 are likely to experience an increase in institutional ownership, whereas the opposite holds for those switching from Russell 1000 to Russell 2000.

The Russell Index data are from the FTSE Russell U.S. Monthly Index Holdings. Since Russell's proprietary ranking data used to determine the index membership is unavailable, we construct a proxy for the end-of-May market-cap ranking. Using the ranking based on Russell's June index weights is not appropriate, because

most of portfolio rebalancing is completed within a few days after the reconstitution at the beginning of June (Schmidt and Fahlenbrach, 2017; Appel, Gormley, and Keim, 2019; Wei and Young, 2019). To mitigate biases, we employ a method to approximate the Russel's end-of-May market-cap ranks based on both the Compustat quarterly data and CRSP (Ben-David et al., 2019).[26] Specifically, when the CRSP-based market capitalization aggregated at the firm level is equal to or larger than the Compustat-based one, the CRSP record is taken as the approximate; otherwise the Compustat record is used.

Using the approximate end-of-May market capitalization and the market-cap ranks facilitates the implementation of the Russell 1000/2000 setting in wider bandwidths. While there is a tradeoff between noise and bias in employing the fuzzy regression discontinuity design (RDD) and IV estimation, in our case, the latter is the only viable option given the nature of our M&A sample (i.e., the RDD approach leaves us only a handful of observations for analysis). We estimate the following equations in 2SLS:

$$\begin{aligned} \Delta IO_{it} = \alpha_j + \sigma_t + \beta_1(R1000_{t-1} \to R2000_t) + \beta_2(R2000_{t-1} \to R1000_t) \\ + \gamma_1 \Delta Rank_t + \gamma_2(\Delta Rank_t)^2 + \delta ln(mktcap)_t + \theta X_{it} + \epsilon_{it} \end{aligned} \tag{3.1}$$

$$y_{i,t+1} = \alpha_j + \sigma_t + \lambda \widehat{\Delta IO_{it}} + \kappa ln(mktcap)_t + \phi X_{it} + \mu_{it} \tag{3.2}$$

where α_j is industry-fixed effects, σ_t is time-fixed effects, $ln(mktcap)_{it}$ is natural log of the end-of-May market capitalization, and X_{it} is a set of time-varying covariates. The instruments for institutional ownership ΔIO_{it} used in the first stage (Equation

[26] We thank the authors for providing the codes for generating the approximation of Russell ranks (Ben-David et al. (2019), Appendix B)

1) are a dummy indicator for the switch from Russell 1000 to Russell 2000, a dummy indicator for the switch from Russell 2000 to Russell 1000, change in the May market-cap rank and its squared term. In the second stage, $\widehat{\Delta IO_{it}}$ is the fitted value from Equation (1), and $y_{i,t+1}$ indicates whether a firm receives a takeover offer (or a stock-for-stock offer) in the year following the change in institutional ownership.

Chapter 4

The Investment Skill of ESG-Aware Mutual Funds

Abstract

This chapter investigates financial returns to ESG integration by mutual fund families measured via a novel survey on responsible investing. Funds with the highest level of ESG integration have monthly risk-adjusted returns that are 4 basis points higher than comparable funds with lower levels of integration. Pedersen, Fitzgibbons, and Pomorski (2021) predict that ESG aware fund managers that trade based on superior information should outperform ESG motivated managers that trade based on taste. Consistent with this, not the socially conscious funds but the conventional ones outperform, when they are part of ESG aware fund families. The findings are robust to controlling for portfolio exposure to an ESG factor and to time-unvarying fund and portfolio manager characteristics. We find that the higher returns are concentrated in mutual funds with the highest level of ESG integration that are also exposed to firms where having superior information is most valuable, i.e., those with high disagreement in ESG ratings and those that experience incidents. Specifically, only funds with the highest level of ESG integration that overweight high ESG uncertainty stocks (against their respective investment benchmark) outperform. Taken together, the results showcase the superior investment skill of ESG-aware fund managers.

Keywords: Mutual funds; ESG integration; ESG investing; Investment skill.

JEL classification: G11, G23, Q56

4.1 Introduction

The attention towards ESG investing, an approach that considers integrating environmental, social and governance factors into the investment process, has grown exponentially over the last decade. The United Nations-supported Principles for Responsible Investment (PRI) is a prime example of the commitment towards a more sustainable financial system. As of 2020, it counted more than 4,000 signatories representing over $100 trillion in assets under management. The aim of the PRI is "to understand the investment implications of environmental, social and governance (ESG) factors; and to support signatories in incorporating these factors into their investment and ownership decisions."[1]

It is unclear *if*, *why*, and *how* ESG integration impacts financial investment returns. On the one hand, ESG incorporation could come at the expense of financial returns. For example, green stocks will under-perform brown stocks due to a supply and demand imbalance (Pástor et al., 2021a; Zerbib, 2021). Similarly, sin stocks will out-perform due to value-aligned investors shunning away from such investments (Hong and Kacperczyk, 2009). On the other hand, sustainable firms will out-perform when there is an increase in attention towards sustainability (Pástor et al., 2021b), when ESG rating uncertainty is high for highly rated ESG stocks (Avramov et al., 2021), or during periods of positive macroeconomic outlook (Bansal et al., 2021).[2]

Pedersen et al. (2021) and Avramov et al. (2021) take the first step to reconcile these opposing results for U.S. stocks. Pedersen et al. (2021) argue that firms' sus-

[1]For more information refer to the overview of the PRI principles.

[2]Some reasons for this divergence are differences in ESG ratings across data providers (Berg et al., 2019; Christensen, Serafeim, and Sikochi, 2022), differences in investment strategies (Gibson, Krueger, and Schmidt, 2021), and differences in sample periods (Lins et al., 2017; Bansal et al., 2021).

tainability performance is a positive predictor of returns, only when ESG measures are associated with higher profits in a way that markets *have not fully incorporated*. The effect on returns is reversed when the ESG performance is transparent and investors start to accept lower returns since they hold sustainable stocks also for non-pecuniary reasons. In a similar vein, Avramov et al. (2021) suggest that ESG uncertainty affects the risk-return trade-off. Specifically, they show that the correlation between ESG rating and alpha is negative when ESG rating dispersion is low, but becomes neutral or even positive when the dispersion increases.

This chapter tests whether these firm-level concepts hold when applied to mutual fund managers. Are "ESG aware" fund managers, i.e., those that have a higher degree of ESG integration at the fund family level, better at identifying profitable investment opportunities?[3] If so, are these opportunities to be found in firms whose ESG performance is yet to be incorporated in asset prices?

The main challenge is to measure ESG integration in a way that does not rely on the observable ESG scores of portfolio firms.[4] We overcome this challenge by using the "Reporting & Assessment (R&A)" framework, a yearly survey on practices related to sustainability that all PRI signatories are obliged to fill out and that is assessed and scored by the PRI. Effectively, we have access to a measure of ESG integration that is comparable across funds and has a comprehensive coverage of fund families across the world (Ceccarelli, Glossner, and Homanen, 2022).

We start by categorizing institutions into scoring bands based on the assess-

[3]For ease of exposition we will use the terms being ESG aware and having a high degree of ESG integration interchangeably in the remainder of the chapter.

[4]Relying on ESG portfolio scores would be detrimental for at least two reasons: First, ESG scores are public information and widely used for taste-based sustainable investing strategies (Kölbel, Heeb, Paetzold, and Busch, 2020). Following such a strategy should – if anything – have lower expected returns (Pedersen et al., 2021). Second, ESG ratings are often backward looking (Liang and Renneboog, 2020).

ment scores of their R&A framework, where highest scoring bands identify signatories with the best ESG integration. We match these to a list of global mutual funds from Morningstar for which we have obtained the holdings from FactSet (formerly known as LionShare). This allows us to compare risk-adjusted returns of funds across different levels of ESG integration.

Our first hypothesis is that fund managers from families with a high degree of integration will out-perform, as they are more likely to be ESG aware and thus able to identify profitable investment opportunities. This hypothesis is confirmed in our sample: Funds with higher R&A ratings out-perform other funds by 4 basis points per month on average over the period from 2014 to 2019. We employ several measures of performance including gross returns, Morningstar category-adjusted returns (Christoffersen et al., 2013), and funds' alpha over the CAPM, the Fama-French 3-factor, and the Fama-French-Carhart 4-factor model (Carhart, 1997; Fama and French, 1993). This result is robust to adding fund-family and fund manager fixed effects to control for time-invariant unobservables and to using a subset of the R&A survey to identify ESG integration.

It could be that the way we construct risk-adjusted returns is flawed, because we are disregarding exposure to an ESG factor which might be already priced in. To account for this, we replicate the methodology of Pástor et al. (2021a) and compute E, S, G, and ESG factors. We re-estimate our measure of abnormal returns (alphas) while controlling for these factors. Our main insights remain unaffected.

We argue that the reason behind the positive relationship between financial returns and ESG integration is mutual fund managers being ESG-aware as opposed to ESG-motivated. The latter prefer firms with high ESG scores solely out of a

taste-based motive and should, if anything, experience worse financial performance compared to the ESG aware investors (Pedersen et al., 2021). We test this conjecture by looking at funds that label themselves as socially conscious, which we use as a proxy for being ESG motivated. Our main effect is concentrated in the sample of conventional funds, i.e., those that are ESG aware but *not* ESG motivated. Our conjecture remains unchanged when using the highest Morningstar Sustainability rating (5 ESG "Globes") as a proxy for being ESG motivated.[5]

While we find evidence of out-performance, identifying skill remains challenging due to noise, random shocks to stock returns, and short sample periods. Jiang and Zheng (2018) introduce the "Active Fundamental Performance" (AFP) measure that looks at funds' performance around earnings announcements, since this is the moment when new fundamental information is released to the markets. Fund managers are considered skilled if their active investment choices prior to the earning announcement are positively correlated to abnormal returns. While we want to establish if fund managers are skilled, we are interested in *ESG-specific* investment skill. Following Avramov et al. (2021), we conjecture that ESG-specific investment skill can be best measured around earnings announcements of firms whose ESG performance is uncertain. We proxy for this using the degree of disagreement between four ESG rating agencies.

To test for ESG-specific investment skill, we need to measure the Active Fundamental Performance (AFP) of mutual funds.[6] First, we sort the portfolio holdings

[5]Funds that receive 5 Globes are among the top 10% of their peer group (investment categories) in terms of weighted portfolio ESG scores. See the Morningstar Sustainability Ratings for Funds here.

[6]The AFP measures how profitable a fund's active portfolio choices are during the days surrounding the release of new fundamental information via earning announcements. Active positions are bench-marked against the average holdings of funds in the same category. The AFP measure is high when the fund manager holds stocks before earnings announcements that performed well in the three day window surrounding the announcement.

of fund managers along the disagreement of ESG scores across four rating providers: Sustainalytics, MSCI IVA, Thomson Asset4, and S&P Global ESG Scores. In this way we can estimate investment skill separately for firms with high ESG uncertainty (AFP^{Disag}) and low ESg uncertainty (AFP^{Others}). The out-performance of ESG-aware fund managers should be concentrated in the part of the portfolio with high ESG uncertainty and *not* in firms where the market can easily incorporate ESG information into prices.

Our findings suggest that ESG-aware mutual funds with a high degree of ESG integration exhibit investment skill. When we interact AFP^{Disag} with the measure of ESG integration, we find a strong and positive effect on alpha. In other words, in portfolios that are exposed to firms where ESG performance is uncertain, only fund managers of families with a high level of ESG integration are able to identify lucrative investment opportunities. Compared to their less aware peers, ESG-aware fund managers are not able to generate higher performance from firms with a relatively certain ESG performance, i.e. insignificant effect when interacting AFP^{Others} with the measure of ESG integration.

A drawback of using rating disagreement is that our measure could be noisy because we have access to a limited number of rating agencies. To mitigate this, we repeat the test above using RepRisk incidents (Glossner, 2021; Yang, 2021) instead of ESG score disagreement. RepRisk measures negative ESG events, which are called "incidents", from public news sources. We argue that – similar to earnings announcements – active investment decisions taken before severe incidents happen are informative of investment skill. In this setting we also find suggestive evidence that fund managers from families with a high degree of ESG integration are skilled.

The positive relationship between ESG integration and abnormal performance is concentrated in funds that also have high active fundamental performance (AFP) measured around severe incidents.

We have shown that ESG aware mutual funds over-perform funds with a smaller degree of ESG integration and that this over-performance seems driven by investment skill. Next we ask *how* fund managers over-perform, i.e., how does the ESG investment skill translate into higher returns. An intuitive explanation is that skilled fund managers will over-weight firms for which they have superior information. This intuition is consistent with Kacperczyk, Sialm, and Zheng (2005), that show how mutual funds overperform when their holdings are concentrated in a small set of industries. Cici, Gehde-Trapp, Göricke, and Kempf (2018) argue that such over-weighting is particularly profitable when fund managers had prior experience in the specific industries. In a similar vein, Jiang, Verbeek, and Wang (2014) show how firms that are over-weighted by active mutual funds outperform. Following this line of reasoning, we conjecture that ESG-aware fund managers should *over-weight* firms with high ESG-uncertainty.

To test this conjecture, we first develop a measure for the degree to which a fund is over-exposed to firms with a high ESG disagreement. To this end, we compare the individual fund's exposure (percent of AuM invested in a given company) to that of the average fund in its category. We then sum up the holdings in all over-weighted firms for which the fund has a higher exposure than the average and call this fund-level measure "*Over-weight*". If our hypothesis is correct, the interaction between ESG aware funds and their over-exposure to high ESG disagreement should be positive. Moreover, the positive effect should be more pronounced for funds with

longer holding duration in stocks with high ESG uncertainty since investments into ESG typically take time to be incorporated into stock returns (Edmans, 2011; Starks, Venkat, and Zhu, 2020). Our findings confirm this: The observed out-performance is concentrated in those funds with the highest level of ESG integration that have both an over-exposure to and a longer holding duration in firms with high ESG uncertainty.

This chapter makes three contributions of the literature. First, it adds to the studies on the financial implication of ESG incorporation by fund managers. Pedersen et al. (2021) have shown the benefits for risk-adjusted performance of incorporating ESG information at the stock level. Moreover, a rapidly growing literature examines the effects of ESG information, ESG tastes, or both on stock prices (Bolton and Kacperczyk, 2021a,b; Pástor et al., 2021a; Zerbib, 2021). We are the first to study how the benefits of ESG integration at the *institutional level* benefit financial performance. This is important since it builds on real investment choices of fund managers as opposed to constructed portfolios. Moreover, it helps ESG aware investors choose mutual funds that match their preferences.

Second, this chapter is also related to the literature studying investment practices of PRI signatories. Existing works have documented greenwashing among some signatories (Gibson et al., 2021; Liang, Sun, and Teo, 2020; Kim and Yoon, 2020) while Humphrey and Li (2021) show that fund managers reduce emissions after joining the PRI. Ceccarelli et al. (2022) look not only at PRI membership status, but also at the level of ESG integration within PRI signatories. They shows that mutual fund investors reward funds with higher inflows *only* when their fund families have a high level of integration. We add to this literature by studying the financial

performance of mutual funds whose families are PRI signatories, while taking the level of ESG integration into account.

The final contribution of this chapter is to propose a new measure of ESG-specific investment skill. We show that such skill is concentrated around the release of information about firms' fundamentals, but only for those firms with a high level of disagreement in ESG performance. In doing so we add to the insights related to ESG disagreement (Avramov et al., 2021) and measuring general fund manager skill (Jiang and Zheng, 2018). To our knowledge, this is the first study to provide evidence that the ESG-specific investment skill of mutual fund managers, as reflected in their holdings and trading strategies of firms with high ESG uncertainty, results in superior fund returns.

The remainder of this chapter proceeds as follows. Section 4.2 describes our sample. Section 4.3 presents the baseline results. Section 4.4 examines the mechanism through which ESG incorporation affects fund returns. Section 4.5 concludes. In this chapter, figures and tables are presented at the end of the chapter.

4.2 Data

4.2.1 PRI R&A rating

Since 2014, PRI signatories have the duty to report on their responsible investing practices, in accordance with the Reporting and Assessment (R&A) framework. The signatories are required to fill out an annual survey in the reporting window between the 6th of January and the 31st of March. The survey is then assessed by PRI staff and signatories receive their assessment reports in early July each year, based on the submitted responses during the recent reporting period. This report consists

of several modules, documenting the responsible investing practices of institutions across their organization. The main modules are 1) Strategy & Governance 2) Listed Equity 3) Active Ownership and 4) Asset Manager Selection, Appointment and Monitoring.[7] Within each modules there are several types of questions: Mandatory to report and disclose, mandatory to report and voluntary to disclose, and voluntary to report and disclose. The first type of questions are published as part of the investors' transparency reports on the PRI website.[8] The second type are published only with the signatory's consent while for the last type the signatory can opt not to answer. Ceccarelli et al. (2022) provide detailed discussion of the benefits and responsibility of being a PRI signatory in the space of responsible investment.

For our study, we make use of the assessment scores that PRI staff provide. Importantly, these scores are based on the entirety of the disclosure, both public and private. Moreover, the performance bands are standardized and comparable across institutions. The scores for each module range from "A+" to "E", where "A+" indicates highest level of ESG incorporation. Figure 4.1 shows one such example.[9]

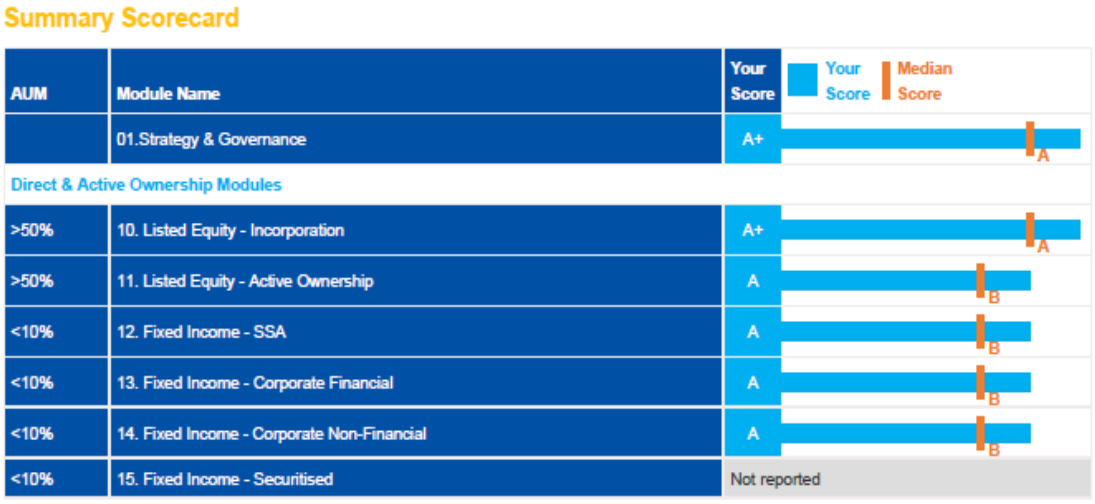
The aggregate R&A rating score, denoted as $\varnothing R\&A$, is defined as the average score across all available modules: (1) Strategy and Governance, (2) Selection, appointment of managers - SAM: Listed Equity, (3) SAM: Fixed Income, (4) Listed Equity: Screening, (5) Listed Equity: Integration, (6) Listed Equity: Active Ownership, (7) Private Equity, (8) Direct Property, (9) Direct Infrastructure , and (10) Fixed Income. We then categorize institutions into 4 groups based on the aggregate

[7]This applies for surveys filled out within the period from 2014 to 2020. From 2021, the PRI introduced the revised Reporting and Assessment framework with the purpose of improving reporting process and quality.

[8]See PRI public signatory's transparency report here.

[9]See an example of a private transparency report, which signatory voluntarily published their report.

Figure 4.1 – Example of Reporting and Assessment Scorecard
This figure shows an example of a Reporting and Assessment Scorecard that is



R&A rating score. $\varnothing R\&A \geq A$ is an indicator variable taking value of 1 for funds that have an average score of A or greater across all modules. This will be a proxy for the highest level of ESG integration by a mutual fund family. $\varnothing R\&A \in [B, A)$ is an indicator variable for funds that have an average score of B or greater, but smaller than A across all modules, while $\varnothing R\&A < B$ is an indicator variable for funds that have an average score smaller than B across all modules. *No Rating* identifies funds with no R&A rating including funds of signatories in one-year grace period and/or funds of non-PRI signatories.

4.2.2 Mutual fund data

Our survivorship-bias-free fund sample consists of all open-end equity mutual funds from Morningstar for the period spanning from January 2014 to December 2019. We collect fund-specific information including total assets under management at the fund level (the sum of the assets across all share classes) and at the fund-family level (the sum of the assets across all funds of a given fund-family). The fund age

is retrieved from the largest share class (Hartzmark and Sussman, 2019). We also collect information for expense ratio, load fee, and the turnover ratio.[10] A more detailed description of all variables is provided in Appendix Table 4.A1.

To measure funds' financial returns, we use gross returns, Morningstar-category adjusted benchmark returns (proxy for benchmark adjusted returns), and alphas over CAPM, 3-risk factor and 4-risk factor models. We obtain the monthly regional risk-factor from AQR benchmark factor datasets.[11] To measure alphas, we require a minimum of 3 years of return data to estimate the model (with minimum of 24 monthly observations). Our first estimate of a fund's alpha is for January 2012. A positive (negative) alpha indicates that the fund out-performs (under-performs) the regional benchmark.

We get information on the holdings of mutual funds from FactSet Ownership (formerly known as Lionshares). In this way we can compute several additional measures of interest: The ESG disagreement of the firms in a mutual fund's portfolio, the over-exposure to specific firms, as well as the degree of under-trading for a given stock.

We then manually match the Morningstar fund-level sample to the PRI signatories data using the fund family name (Ceccarelli et al., 2022). In this way we obtain the Reporting & Assessment scores for mutual funds.

4.2.3 Summary statistics

Our final mutual fund sample for which risk-adjusted returns are available, includes 2,608 fund families consisting of 27,983 unique funds. Figure 4.2 plots the sample

[10] We do not drop observations where these variables are missing because of the limited availability of such data for the non-US sample.

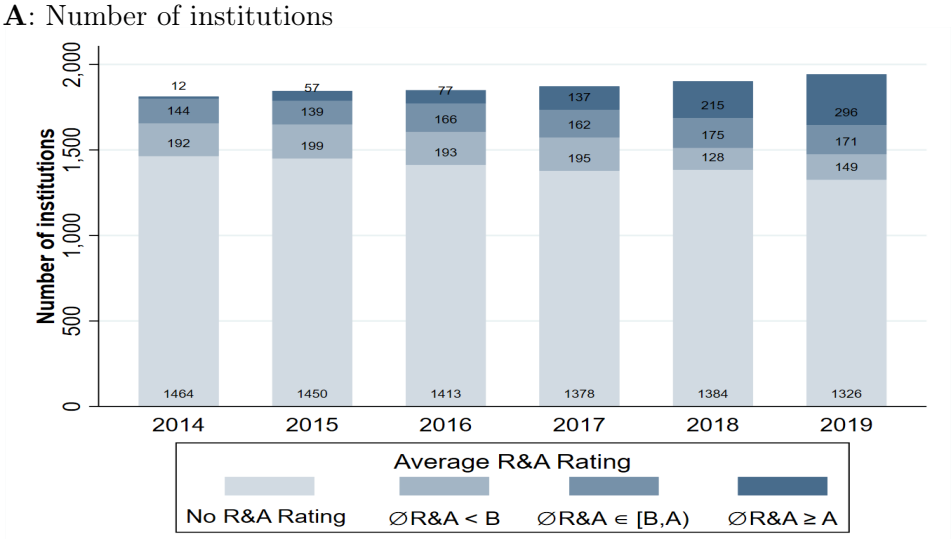
[11] AQR Betting Against Beta: Equity Factors Data, Monthly

distribution of the R&A rating by year. The number of PRI signatories increases from 348 in 2014 to 616 at the end of 2019, with the number of signatories with the highest R&A rating account for the most significant rise from 12 in 2014 to 296 in 2019, translating into stark growth in the number of funds with highest rating as shown in Panel B of Figure 4.2.

Figure 4.2 – Distribution of R&A ratings by year

This figure plots the Reporting & Assessment (R&A) rating for the mutual fund sample from January 2014 to December 2019. Panel A plots the number of institutions by rating category, while Panel B plots the number of funds by rating category.

Panel A: Number of institutions



Panel B: Number of funds

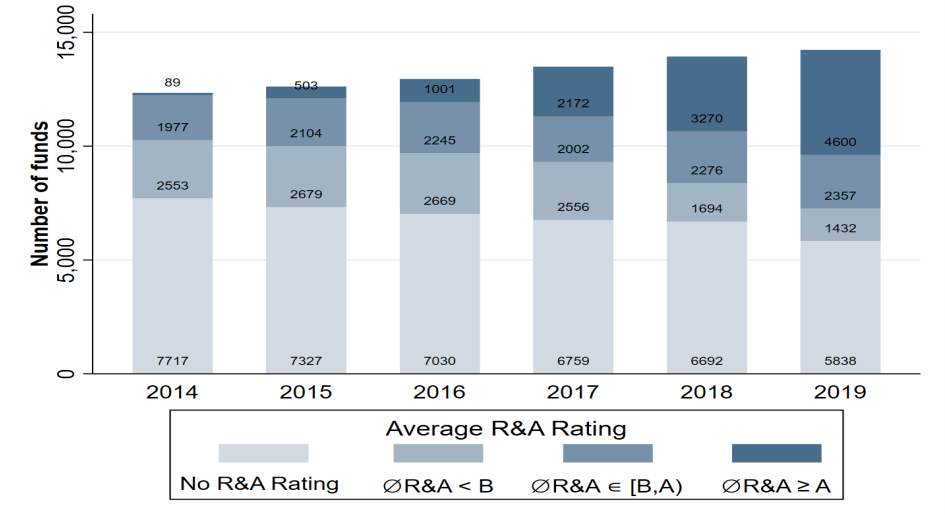
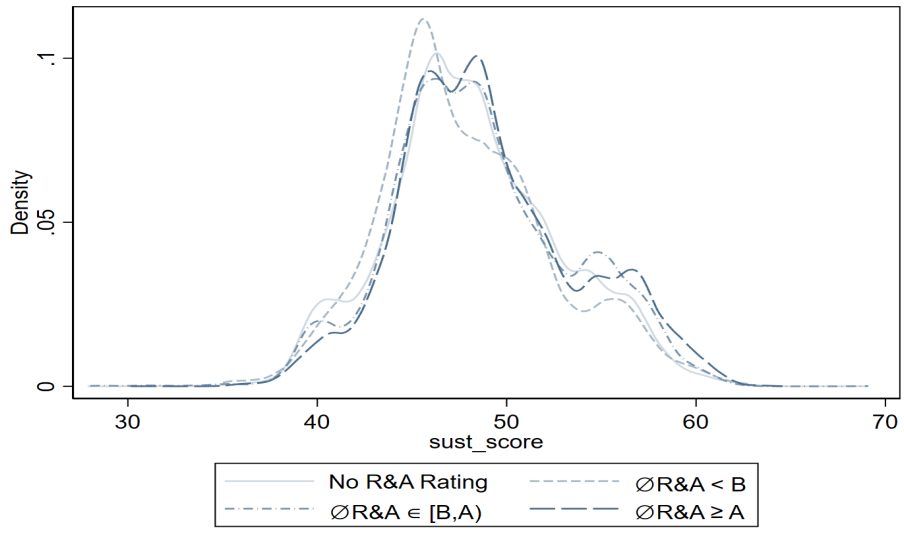


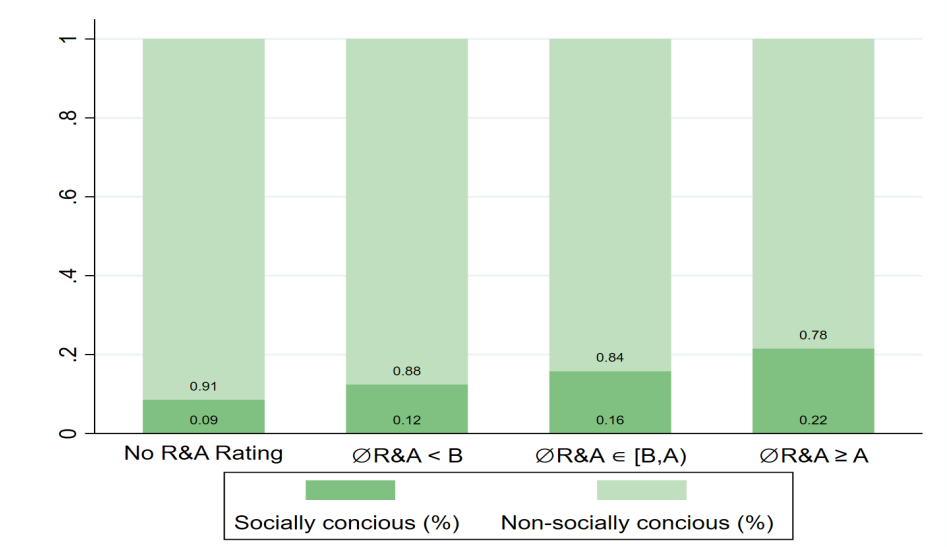
Figure 4.3 – Distribution of funds' portfolio ESG footprint by average R&A rating

Panel A of this figure plots the distribution of the portfolio ESG footprint of signatories by average R&A rating. The footprint is computed as the weighted average ESG score of funds' portfolio holdings. Panel B shows the fraction of funds that self-classify as "socially conscious" by R&A rating.

Panel A: ESG score distribution by R&A ratings



Panel B: Fraction of socially conscious funds by R&A ratings



To verify that R&A rating is a reasonable proxy for ESG integration by mutual fund families, we examine the ESG score distribution of funds by rating groups. Figure 4.3 show that A/A+ signatories have higher portfolio footprint on average and

higher fraction of social conscious funds.[12] However, there is substantial variation in the distribution of the portfolio ESG score within R&A rating.

Panel A of Table 4.1 reports the summary statistics of the fund sample. Panel A shows variables for the mutual funds sample used in our analysis. All sample average risk-adjusted returns are negative, and, apart from the category-adjusted returns, the same holds for the sample median as well. The average assessment score of a fund family is 4.3, corresponding to a score slightly above "B". About half of the fund families in our sample are not PRI signatories. For the remaining half, the split between rating groups (e.g., funds with an average rating of A or higher) is approximately uniform.

Table 4.1 – Descriptive statistics

This table shows summary statistics for the sample of Morningstar mutual funds used in our analysis. The sample is at the fund-month level and covers the period from 2014 to 2019. Panel A reports the sample descriptive statistics. Panel B reports the sample average Spearman correlation coefficients. Appendix Table 4.A1 provides variable definitions.

Panel A: Summary statistics

	Obs	Mean	S.D.	p25	p50	p75
Fund characteristics						
Gross Return	838,042	0.56	3.66	-1.68	0.72	2.90
Mstar categ-adj Return	838,042	-0.01	1.31	-0.63	0.00	0.61
Alpha 1F	838,042	-0.09	1.90	-1.09	-0.09	0.90
Alpha 3F	838,042	-0.09	1.85	-1.04	-0.10	0.84
Alpha 4F	838,042	-0.11	1.88	-1.06	-0.11	0.83
Log Fund Assets$_{t-1}$	838,042	18.49	1.94	17.18	18.51	19.85
Log Fund Age$_{t-1}$	838,042	2.47	0.58	2.05	2.55	2.92
Fund-family characteristics						
Log Family Assets$_{t-1}$	838,042	23.09	2.18	21.75	23.44	24.72
$\varnothing R\&A_{t-1}$	431,416	4.34	0.96	3.60	4.40	5.08
$\varnothing R\&A_{t-1} \geq A$	838,042	0.15	0.35	0.00	0.00	0.00
$\varnothing R\&A_{t-1} \in [B, A)$	838,042	0.16	0.37	0.00	0.00	0.00
$\varnothing R\&A_{t-1} < B$	838,042	0.17	0.38	0.00	0.00	0.00
No R&A Rating	838,042	0.52	0.50	0.00	1.00	1.00

[12] In untabulated tests, we also find that on average, fund-families with the highest rating have higher fraction of socially conscious funds after controlling for the family size.

Panel B: Sample average Spearman correlation coefficients

	(1)	(2)	(3)	(4)	(5)
(1) Alpha 4F	1				
(2) Log Fund Assets$_{t-1}$	0.0152	1			
(3) Log Fund Age$_{t-1}$	0.0028	0.1375	1		
(4) Log Family Assets$_{t-1}$	0.0198	0.4094	0.0618	1	
(5) $\varnothing R\&A_{t-1}$	0.0205	0.1345	0.0237	0.3902	1

Panel B shows the sample average Spearman correlation coefficients of the main variables used in our analyses. We observe a positive correlation between risk-adjusted returns and R&A rating, suggesting that the higher level of ESG integration by the mutual fund families is associated with higher risk-adjusted returns since 2014.

4.3 R&A rating and fund performance

This section asks whether ESG aware funds outperform similar funds that have lower ESG integration, as proxied by the R&A ratings. To build intuition, we start with a univariate comparison of mean returns by level of integration. Table 4.2 below shows that there is a considerable difference between average returns in the sample of funds from families that receive the highest rating in the Reporting & Assessment framework and those from families that are not even PRI signatories. The difference is statistically significant and large, corresponding to 10% of a standard deviation in monthly gross returns. We have similar discrepancies when looking at risk-adjusted performance, e.g., category-adjusted or using Fama-French factor models.

Next we formally test whether these difference persists in a regression setup while controlling for fund characteristics. We run the following specification:

$$Return^{\tau}_{f,t} = \beta_1 \ \varnothing R\&A_{f,t} + \beta_2' \ \Gamma_{f,t-1} + \beta_3 \ \delta_t \times \gamma_f + \epsilon_{f,t} \tag{4.1}$$

Table 4.2 – ESG integration and fund performance: Univariate descriptive statistics

This table reports average fund returns, separately by mutual funds' Reporting & Assessment (R&A) ratings. Funds' gross returns are calculated before deducting fees and expenses. Category-adjusted returns are the the difference between the gross returns and the returns of the fund's benchmark, as provided by Morningstar. Risk-adjusted returns are computed using the CAPM model (Alpha 1F), the Fama-French model (Alpha 3F), the Carhart model (Alpha 4F). Appendix Table 4.A1 provides variable definitions.

	No Rating	$\varnothing R\&A < B$	$\varnothing R\&A \in [B, A)$	$\varnothing R\&A \geq A$	Diff. (t-stat)	Diff. (t-stat)
	(1)	(2)	(3)	(4)	(4) - (1)	(4) - (2)
Number of obs.	434,874	142,469	137,377	123,322		
Gross Return	0.481	0.538	0.566	0.850	0.369***	0.312***
					(31.27)	(21.91)
Categ-adj	-0.039	-0.004	0.025	0.015	0.054***	0.019***
Return					(12.60)	(3.91)
Alpha 1F	-0.136	-0.062	-0.038	-0.028	0.108***	0.034***
					(17.86)	(4.63)
Alpha 3F	-0.124	-0.064	-0.054	-0.039	0.084***	0.025***
					(14.33)	(3.48)
Alpha 4F	-0.137	-0.090	-0.076	-0.047	0.090***	0.043***
					(15.08)	(5.83)

$Return^{\tau}_{f,t}$ is our measure of fund's f return during month t and τ captures the various return measures that we use: gross, category-adjusted, CAPM, and Fama-French three and four factor models. $\varnothing R\&A_{f,t-1}$ is our proxy for a fund's level of ESG integration and measures the average Reporting & Assessment score that the fund family receives. $\Gamma_{f,t-1}$ is a vector of time-varying fund-level characteristics, the logarithm of fund and fund-family size, and fund age. $\delta_t \times \gamma_f$ are our category-by-months fixed effects which absorb time-varying trends specific to a fund investment strategy. $\epsilon_{f,t}$ are the standard errors, which are clustered at the fund and month level. Table 4.3 shows the results from this regression.

In column (1) we find that funds with the highest level of ESG integration, i.e., those with an average R&A rating of A or higher, outperform non-rated funds by 4.1 basis point in gross returns per month, with the t-statistics of 2.27. Columns (2) to (5) show that controlling for standard risk-factors does not change our interpretation.

Table 4.3 – R&A rating and fund performance

This table reports results from regressions of funds' monthly performance on Reporting & Assessment (R&A) ratings. In model (1), fund returns are calculated before deducting fees and expenses. Model (2) accounts for the difference between the fund gross return and the return of the fund benchmark, as provided by Morningstar. Models (3) to (5) adjust respectively for exposure to the market factor (CAPM), the Fama-French three-factor model, and the Carhart model. All the control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at both time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

	Gross Return	Mstar categ-adj Return	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1} \geq A$	0.041**	0.033**	0.041**	0.041**	0.056***
	(2.27)	(2.38)	(2.29)	(2.35)	(3.39)
$\varnothing R\&A_{t-1} \in [B, A)$	0.041***	0.036***	0.040***	0.030*	0.035**
	(2.96)	(4.07)	(2.69)	(1.97)	(2.19)
$\varnothing R\&A_{t-1} < B$	0.017	0.009	0.019	0.015	0.018
	(0.90)	(0.99)	(0.98)	(0.77)	(0.89)
Log Fund Assets_{t-1}	0.015***	0.015***	0.018***	0.015**	0.013**
	(2.71)	(5.91)	(3.05)	(2.48)	(2.17)
Log Fund Age_{t-1}	-0.005	-0.016**	-0.015*	-0.013	-0.007
	(-0.46)	(-2.32)	(-1.89)	(-1.53)	(-0.81)
Log Family Assets_{t-1}	0.011***	0.010***	0.008**	0.007**	0.004
	(3.14)	(3.94)	(2.60)	(2.18)	(1.36)
Categ x Time FE	Yes	Yes	Yes	Yes	Yes
N	828,647	828,647	828,647	828,647	828,647
Adj R2	0.824	0.013	0.368	0.343	0.346

If anything, the effect becomes even stronger.

4.3.1 Ruling out alternative explanations

There are several alternative explanations that could drive our findings. First, it could be that funds with higher expense ratios are also those that are more willing to invest in ESG integration. This could be because such funds have larger budgets at their disposal (Ibert, Kaniel, van Nieuwerburgh, and Vestman, 2018; Ma, Tand, and Gómez, 2019) or because their clients are generally more willing to pay a premium for ESG integration (Laudi, Smeets, and Weitzel, 2021). To make sure that this is not the case, we repeat our analysis while including the fund's fee structure as

controls. Panel A of Appendix Table 4.A2 shows that our results remain robust.[13] Panel B reports the results using alternative measure of alpha using country-level benchmark risk factors. Chaieb, Langlois, and Scaillet (2021) document that regional benchmark factor do not capture all country-level risk factors, which are priced in. Our main results are also robust to using a different measure of alpha, defined as returns over country-level market, size, value and momentum risk factors benchmark. In addition, Panel C reports the baseline results for the restricted Morningstar sample consisting of all funds with non-missing FactSet holdings data. Our findings suggest that the outperformance related to the level of ESG integration is also observed in a more restricted testing sample. Specifically, funds with higher level of ESG integration level have 4 basis points higher in returns (measured by *Gross Return*) and risk-adjusted returns (measured by Alpha 4F).

We further examine the sensitivity of the documented results to the construction of R&A rating. Appendix Table 4.A3 shows that our results are robust to using the restricted version of R&A rating, which is constructed based on the restricted sample of reporting modules filled out for approximately 90% of signatories: S&G–Strategy & Governance, LEI–Listed Equity Screening, Integration, and LEA–Active Ownership (Ceccarelli et al., 2022). Panel B of this Table shows that the List Equity modules have the highest power in explaining the outperformance of funds with high over R&A rating.

In addition, we document that the geographical variations of the relationship between ESG incorporation and returns. Appendix Table 4.A4 show observed effect

[13]Since data on fund net expense ratio is not available for a large fraction of non-US domiciled funds, controlling for fund expense and fee charges significant reduces the testing sample. Our interpretation is robust to this alternative specification controlling for *Expense Ratio* and *Load Fee*.

mainly comes from European funds and R&A rating combination, not from the U.S. domiciled funds or funds from other regions. Note that, there are only 4 Asia-Pacific countries that are included in our sample because of the availability of risk-factor benchmark. Figure A1 shows that the highest intensity of institutions with R&A rating of A/A+, defined as the country-level fraction of A/A+ institutions over total number of institutions in the respective countries of headquarter, is observed in the EU and Pacific region.

[Insert Figure 4.A1 here]

4.3.2 Controlling for unobserved heterogeneity

Although our baseline results provide evidence that the out-performance of high R&A rated funds is not driven by several fund-specific effects documented in prior studies including fund size, age and investment styles, there may be plausible alternative explanations related to unobserved (1) fund family, (2) fund, and (3) manager-level heterogeneity.

First, given the economics of the asset management industry, family-level unobserved factors other than the level of ESG incorporation, as proxied by R&A rating, are also a relevant concern. To address this concern, we include fund-family fixed effects in our regressions in columns (1) and (2) of Table 4.4. In this regressions, we compare the performance of mutual funds from the same family, after the Reporting & Assessment score changes. There seems to be no significant difference in gross returns. However, our main coefficient of interest correlates positively and significantly with risk-adjusted returns. Funds with the highest level of ESG inte-

Table 4.4 – R&A rating and fund performance - Fixed Effects

This table reports results from regressions of funds' monthly performance on Reporting & Assessment (R&A) ratings. In model (1) and (2), we further control for fund-family fixed-effects. Model (3) and (4) include fund fixed-effects. Model (5) and (6) include fund manager fixed-effects. All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

	Gross Return	Alpha 4F	Gross Return	Alpha 4F	Gross Return	Alpha 4F
	(1)	(2)	(3)	(4)	(5)	(6)
$\varnothing R\&A_{t-1} \geq A$	0.058	0.081**	0.062*	0.086**	0.048*	0.063**
	(1.64)	(2.27)	(1.72)	(2.38)	(1.94)	(2.61)
$\varnothing R\&A_{t-1} \in [B, A)$	0.036	0.039	0.040	0.044	0.030	0.031
	(1.40)	(1.37)	(1.56)	(1.55)	(1.48)	(1.49)
$\varnothing R\&A_{t-1} < B$	0.010	0.006	0.013	0.011	0.003	-0.002
	(0.38)	(0.25)	(0.51)	(0.47)	(0.14)	(-0.10)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	Yes	Yes				
Fund FE			Yes	Yes		
Manager FE					Yes	Yes
N	828,631	828,631	828,464	828,464	535,439	535,439
Adj R2	0.825	0.350	0.825	0.352	0.847	0.325

gration generate 8.1bp higher monthly alphas compared to funds that are not PRI signatories. In other words, time-invariant fund family characteristics do not explain the positive relationship between ESG integration and performance.

Second, since PRI R&A ratings are quite persistent during our sample period, one concern is that the cross-sectional differences in R&A ratings might be capturing time-invariant heterogeneity across funds. We address this concern by including fund fixed effects in our specification. Columns (3) and (4) show that these concerns are misguided.

Third, time-invariant fund-manager characteristics such as their preferences or their investment ability might drive our results. For example, higher ability fund managers might self-select into funds from institutions with high R&A rating. Thus, the superior performance would be the result of manager attributes rather than the

superior ESG awareness of the fund-family. Column (5) and (6) of Table 4.4 adds manager fixed effects to the regression.[14]. Again, we confirm the robustness of our results.[15]

4.3.3 Exposure to the regional ESG-factor

One possible reason for the observed out-performance is that high R&A funds have higher exposure to the ESG-factor or to one of its component factors E,S, and G. Such exposure should be priced in by markets Pástor et al. (2021b).

We want to test if the over-performance we document is driven by loading on an ESG factor, that contains public information, as opposed to investment skill driven by private information. To this end we estimate fund alphas over a 2 risk-factor model including size together with, respectively, each of the E-, S-, G-, and ESG-factors. Specifically, we follow the method of constructing the green factor (E-factor) proposed in Pástor et al. (2021b) and start by constructing E-, S-, G-, and ESG-benchmark factors for each investment regions using MSCI IVA ESG data.[16] We then estimate fund monthly exposure (β) to E-factor using up to 3 years of returns data (with minimum of 24 monthly observations), then derive monthly alpha over the regional market risk and the E-factor risk, denoted as $Alpha(mkt, E-fac)$. In similar fashion, we estimate $Alpha(mkt, S-fac)$, $Alpha(mkt, G-fac)$ and

[14]The number of observations for this test decreases because in several cases fund manager information is either missing or not disclosed.

[15]In untabulated tests we show that the findings remain unchanged when using alternative returns measures, including $Alpha1F$ and $Alpha3F$.

[16]The green factor $\hat{f}_{gt}$ for each region, denoted as E-factor in our study, is estimated following equation (3) in Pástor et al. (2021b), where

$$\hat{f}_{gt} = \frac{g'_{t-1}\tilde{r}^e_t}{g'_{t-1}g_{t-1}}$$

where g_{t-1} is the vector of stocks' E-score, and $\tilde{r}^e_t$ is the vector of stocks' market-adjusted excess returns. We also construct S-, G- and the aggregate ESG-factor following this construction method.

$Alpha(mkt, ESG - fac)$.

Table 4.5 – R&A rating and ESG-factor alpha

This table reports results from regressions of fund performance variables on PRI R&A rating. Fund returns are calculated before (gross) deducting fees and expense, adjusted using the market risk factor and E-, S-, G- and ESG-factor. All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

		ESG Factor (MSCI IVA data)			
	Alpha 1F (mkt)	Alpha (mkt, E-fac)	Alpha (mkt, S-fac)	Alpha (mkt, G-fac)	Alpha (mkt, ESG-fac)
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1} \geq A$	0.041**	0.046**	0.037**	0.035**	0.037**
	(2.29)	(2.57)	(2.04)	(2.01)	(2.23)
$\varnothing R\&A_{t-1} \in [B, A)$	0.040***	0.045***	0.035**	0.035**	0.049***
	(2.69)	(2.95)	(2.26)	(2.33)	(3.14)
$\varnothing R\&A_{t-1} < B$	0.019	0.028	0.017	0.008	0.025
	(0.98)	(1.42)	(0.86)	(0.39)	(1.25)
Controls	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes
N	828,647	823,206	823,206	823,206	823,206
Adj R2	0.368	0.345	0.348	0.351	0.346

If a ESG-factor loading were to explain our results, using the newly computed alpha as dependent variable should yield insignificant results in our baseline specification. Table 4.5 tests whether this is the case. Our results suggest that fund regional ESG exposure do not explain the superior performance of high R&A rating funds, as shown in column (5).

To make sure that our findings are not specific to a single rating provider, we construct fund ESG-adjusted Alpha where the regional the regional E-, S-, G- and ESG-factor are estimated from Sustainalytics ESG data, then replicate the above tests. Appendix Table 4.A5 shows that the results are robust to using different rating providers.

An alternative way to capture mutual funds' exposure to public ESG informa-

tion is to control for its ESG portfolio rating. This measures the weighted average of the ESG scores of a fund's holdings. Results in Appendix Table 4.A6 show that the positive association between R&A rating and fund returns is robust to the inclusion of portfolio-level ESG scores. Columns (1) and (2) control for the normalized Sustainalytics ESG ranking within investment category and time while (3) and (4) control for Morningstar's sustainability ratings (Globes).

4.3.4 The role of ESG awareness and taste in fund performance

We next examine the relationship between financial returns and the ESG investment style of fund managers. Pedersen et al. (2021) argue that the reason behind the positive relationship between financial returns and ESG integration is mutual fund managers being ESG aware as opposed to ESG motivated. The latter prefer ESG firms solely out of a taste-based motive and should, if anything, experience worse financial performance compared to the ESG aware investors (Fama and French, 2007).

To measure the role of ESG taste, we propose two proxies. The first is the self-designation of funds as "socially conscious." Morningstar identifies these types of funds based on their name or investment prospectus. The second proxy is the ESG rating ("Globes") that Morningstar assigns funds based on their holdings (Hartzmark and Sussman, 2019). Morningstar ranks funds along the weighted ESG score of their holdings and assigns the highest 5 Globe rating to those that are among the top 10% of their category.

We argue that, to some extent, both socially conscious and 5 Globe funds are employing taste-based investment strategies. Therefore, the out-performance

Table 4.6 – R&A ratings and fund performance - The role of ESG taste

This table reports results from regressions of funds' monthly performance on Reporting & Assessment (R&A) ratings. Panel A partitions the sample by funds that self-designate as "socially conscious" while Panel B splits the funds by their ESG portfolio rating ("Globes"). Morningstar identifies funds as socially conscious when the fund states this in its name or prospectus. The highest ESG rating (5 Globes) is awarded to funds whose portfolio ESG score is among the top 10% in their investment category. All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

Panel A: Socially conscious funds

	Socially conscious funds		Conventional funds	
	Alpha 4F	Alpha 4F	Alpha 4F	Alpha 4F
	(1)	(2)	(3)	(4)
$\varnothing R\&A_{t-1} \geq A$	0.051*	0.004	0.072***	0.129***
	(1.90)	(0.06)	(3.13)	(2.76)
$\varnothing R\&A_{t-1} \in [B, A)$	0.010	-0.038	0.052**	0.070*
	(0.38)	(-0.65)	(2.19)	(1.82)
$\varnothing R\&A_{t-1} < B$	0.008	-0.055	0.034	0.012
	(0.35)	(-1.45)	(1.04)	(0.40)
Controls	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes
Family FE		Yes		Yes
N	103,316	103,312	734,726	734,710
Adj R2	0.027	0.031	0.019	0.024

Panel B: Morningstar Sustainability Globes

	5 Globe funds		Remaining funds	
	(1)	(2)	(3)	(4)
$\varnothing R\&A_{t-1} \geq A$	0.075**	0.027	0.068***	0.116**
	(2.58)	(0.39)	(3.26)	(2.57)
$\varnothing R\&A_{t-1} \in [B, A)$	0.039	-0.022	0.045**	0.058
	(1.64)	(-0.34)	(2.07)	(1.56)
$\varnothing R\&A_{t-1} < B$	-0.022	-0.116**	0.033	0.008
	(-0.70)	(-2.10)	(1.07)	(0.26)
Controls	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes
Family FE		Yes		Yes
N	52,327	52,229	785,715	785,698
Adj R2	0.026	0.032	0.019	0.024

we document should be concentrated in the funds that are ESG aware but have *no* ESG taste. Table 4.6 tests whether this is the case. Panel A shows that the positive relationship between ESG integration and fund returns is mostly concentrated in conventional funds that have the highest R&A rating (columns (3) and (4)). For

socially conscious funds we observe a marginally significant relationship that disappears once fund family fixed effects are introduced in column (2). In a similar vein, Panel B shows a similar pattern for funds with the highest ESG rating. Together these results suggest that, ESG awareness can give rise to superior financial performance, but only when the fund managers' investment decisions are not additionally motivated by an ESG taste.

4.4 Fund investment skill

The previous section documents a positive relation between the degree of ESG integration of a fund family and the financial performance of its mutual funds. However, credibly identifying investment skill is notoriously difficult, especially in a short time window as ours (Fama and French, 2010).

To overcome this challenge, we employ the active fundamental performance (AFP) measure proposed by Jiang and Zheng (2018). The AFP is a forward-looking measure to proxy for fund managers' skill as it captures the performance of the fund around earning announcements. Looking at these events is useful because this is when new information about firm fundamentals is released to the market which then allows for repricing to occur. We employ this measure to investigate the difference in fund specific-skill (in ESG investment) and fund-family ESG incorporation in impacting fund returns.

4.4.1 Measuring Active Fundamental Performance (AFP)

We first replicate the index-based AFP measure of Jiang and Zheng (2018) because it is comprehensive in capturing the information set of active fund managers. For

each fund in each quarter, the index-based AFP is defined as the sum of product of quarterly portfolio active weights (difference between portfolio weights and corresponding passive benchmark portfolio weights) and subsequent 3-day abnormal returns surrounding earning announcements.[17]

$$Index\text{-}based\ AFP_{j,t} = \sum_{i=1}^{N_j} (w_{i,t}^{j} - w_{i,t}^{bj}) CAR_{i,t}$$

where $CAR_{i,t}$ is the 3-day abnormal returns surrounding quarterly earnings announcements, ($w_{i,t}^{j}$ is the weight of stock i in fund j's portfolio at the start of quarter t, ($w_{i,t}^{bj}$ is the weight of stock i in fund j's benchmark portfolio at the start of quarter t. The 3-day CAR[-1, 1] refers to the sum of daily abnormal returns over the Carhart 4-factor regional risk benchmark from 1 day before to 1 day after earnings announcements.

The analysis of fund performance on fund's AFP is done at the quarterly level since portfolio stock earnings are announced quarterly. We track the performance of a particular fund for the subsequent quarter after the release of quarterly earnings of majority of portfolio firms.

4.4.2 Active fundamental performance and ESG Disagreement

Our hypothesis is that if high R&A funds have skill in assessing firm ESG value under uncertainty (Avramov et al., 2021), we should see them out-perform around earning announcements of firms with high ESG rating disagreement.

[17] We use quarterly instead of monthly data for this test because the earnings announcements of portfolio firms are observed at the quarter-level. For stocks that publish multiple earnings in any given quarter, we keep the first earnings announcement of the firm as the unique quarterly earnings announcement. We then observe CAR[-1,+1] around the unique earnings announcement event for the construction of funds' AFP measure.

We employ the index-based AFP measure but only consider firms with high ESG disagreement observed at the earnings announcement date. The idea is that during such events new information hits the markets and repricing occurs. We defined ESG disagreement score as the standard deviation of the four ESG raters (MSCI IVA, Thomson Reuters Asset4, Sustainalytics and S&P Global ESG data) when there are all four ESG ratings available, or minimum of two ESG Ratings when only two are available (Gibson et al., 2021; Serafeim and Yoon, 2021). We then classify firms into annual quintiles of ESG disagreement to construct AFP^{Disag} measure conditioned on the high ESG disagreement group and AFP^{Others} measure for the remaining portfolio firms with lower ESG disagreement score.

We find that there exists positive returns to fund-family and fund-specific skill in selecting stocks with high ESG disagreement, which on average generate positive returns around earnings announcement. In fact, Gibson et al. (2021) find that there is a risk premium for firms with higher ESG rating disagreement for the sample S&P 500 firms in the period from 2010 to 2017. Our results are robust to alternative sample partition of ESG disagreement, including firms with high ESG disagreement classified by top quartile or tercile of disagreement score. However, we do not observe additional value of family-level skill in the high ESG disagreement by sample median-split.

In untabulated test, we show that our AFP measure conditioned on ESG disagreement captures ESG-related information available to skilled fund managers. Specifically, we do not observe the positive effect of AFP measure conditioned on quarterly analyst earnings forecasts disagreement on fund returns, suggesting that ESG disagreement is not simply just a proxy for business risk unrelated to ESG.

Table 4.7 – Investment skill and ESG Disagreement

This table reports results from regressions of funds' monthly performance on Reporting & Assessment (R&A) ratings interacted with a proxy for investment skill, Active Fundamental Performance (Jiang and Zheng, 2018). AFP captures how profitable a fund's active portfolio choices are during the days surrounding the release of new fundamental information via earning announcements. For every portfolio, the holdings are sorted by the disagreement of their ESG scores and AFP is computed separately for the firms with the highest level of disagreement, AFP_t^{Disag} and for those with a lower level of disagreement AFP_t^{Others}. High level of ESG disagreement is measured differently across models, from the top quintile of firms in (1) and (2), to firms above the sample median in (7) and (8). Fund returns are measured from the second month of a given quarter to the first month of the following quarter. We keep only portfolios where at least 95% of firms report quarterly earnings. All fund control variables arelagged by one quarter and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-quarter) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

Stock-level ESG Disagreement:	Top Quintile		Top Quartile		Top Tercile		Above Median	
	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\varnothing R\&A_{t-1} \geq A \times AFP_t^{Disag}$	0.148**	0.128**	0.134**	0.120*	0.145**	0.137**	0.069	0.064
	(2.36)	(2.07)	(2.10)	(1.80)	(2.49)	(2.35)	(1.38)	(1.27)
$\varnothing R\&A_{t-1} \geq A \times AFP^{Others}$		-0.023		-0.030		-0.056		-0.056
		(-0.54)		(-0.63)		(-1.08)		(-0.81)
$\varnothing R\&A_{t-1} \geq A$	0.080**	0.078**	0.079**	0.077**	0.080**	0.078**	0.081**	0.079**
	(2.32)	(2.31)	(2.30)	(2.29)	(2.36)	(2.33)	(2.33)	(2.34)
AFP^{Disag}	0.455***	0.446***	0.473***	0.462***	0.497***	0.486***	0.484***	0.475***
	(9.14)	(9.06)	(10.50)	(10.46)	(12.77)	(12.70)	(15.70)	(14.92)
AFP^{Others}		0.465***		0.460***		0.446***		0.443***
		(16.18)		(16.33)		(13.70)		(11.90)
$\varnothing R\&A_{t-1} \in [B, A)$	0.049	0.046	0.049	0.046	0.049	0.046	0.049	0.046
	(1.39)	(1.30)	(1.40)	(1.30)	(1.40)	(1.30)	(1.39)	(1.30)
$\varnothing R\&A_{t-1} < B$	0.039	0.036	0.038	0.036	0.036	0.036	0.036	0.036
	(1.37)	(1.29)	(1.35)	(1.29)	(1.31)	(1.29)	(1.28)	(1.28)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	126,509	126,509	126,509	126,509	126,509	126,509	126,509	126,509
Adj R2	0.277	0.295	0.278	0.295	0.282	0.295	0.286	0.295

4.4.3 Active fundamental performance and RepRisk incidents

We further perform additional test on the relationship between active fundamental performance conditional on ESG information. Our conjecture is that similar rationale to earning announcement events can be applied to negative ESG incidents. We thus compute AFP^{RR} around the month of ESG incidents of portfolio firms, where stock prices are reevaluated, specifically negatively adjusted following the negative incident news.

We construct the modified version of AFP measure as the correlation of fraction of portfolio weight exposed to incidents events and monthly CARs. We use this approach because of the following 2 reasons. First, unlike firm quarterly earnings announcement where we can observe 3-day CARs around specific earnings announcement dates, we only observe the month-interval of high RepRisk incident score, thus we employ the monthly abnormal returns around incidents as a proxy for returns. And second, unlike earnings announcement events when more than 95% of portfolio firms report earnings in the second month of each quarter, RepRisk events are unexpected in the timing of occurrence. Thus, we use total portfolio weight exposed to incidents events as proxy for portfolio weight (Lo, 2008).

The analysis of fund performance on fund's AFP^{RR} is done at the monthly level. We track the performance of a particular fund for the subsequent month following. Our results suggest that funds with high R&A ratings have better investment skill in predicting and allocating to stock with future negative ESG events, and thus outperform other funds in month following the month that any ESG incidents of portfolio firms occur.

Table 4.8 – Investment skill and RepRisk incidents

This table reports results from regressions of fund performance variables on PRI R&A rating and AFP measure conditioned on RepRisk negative ESG incident, AFP_t^{RR}. AFP_t^{RR} is defined as fund-level monthly correlation of portfolio holdings in the previous quarter and monthly CARs in the month of RepRisk incident occurrence of each portfolio firm. We define RepRisk incident to portfolio firm as an event with the monthly increase in RepRisk score equals the 95th percentile of the sample monthly change in RepRisk score, i.e. $\Delta RepRisk\ score = 8$. Monthly returns are observed in the month following RepRisk incidents. All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

	AFP_t^{RR}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}
	(1)	(2)	(3)	(4)
AFP_t^{RR}		0.471	0.547	0.532
		(1.37)	(1.30)	(1.24)
$\varnothing R\&A_{t-1} \geq A \times AFP_t^{RR}$			1.776*	1.861**
			(1.87)	(2.02)
$\varnothing R\&A_{t-1} \in [B, A) \times AFP_t^{RR}$			-0.940	-0.869
			(-1.52)	(-1.43)
$\varnothing R\&A_{t-1} < B \times AFP_t^{RR}$			-0.608	-0.574
			(-0.77)	(-0.73)
$\varnothing R\&A_{t-1} \geq A$	0.000		0.056***	0.050
	(1.04)		(2.82)	(1.26)
$\varnothing R\&A_{t-1} \in [B, A)$	0.000		0.025	0.001
	(0.19)		(1.16)	(0.04)
$\varnothing R\&A_{t-1} < B$	-0.000		0.001	-0.044*
	(-0.73)		(0.03)	(-1.90)
Controls	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes
Family FE				Yes
N	362,158	329,062	329,062	329,062
Adj R2	0.021	0.299	0.299	0.303

Appendix Table A8 reports the results of tests using ESG-specific AFP by fund domicile. Panel A shows that the positive effect of fund R&A and AFP^{Disag} on α_{t+1}^{4F} is concentrated in EU-domiciled funds. The same interpretation is mirrored from the results reported in Panel B for tests using AFP^{RR}. Overall, our findings suggest that the effect of skill is more pronounced in the EU-domiciled fund sample.

4.5 Mutual funds' investment strategies

So far, we have established that ESG aware mutual fund managers have investment skill when measured around the release of fundamental information. This skill is not homogeneous across all firms in a fund's portfolio, but is concentrated among stocks with high ESG-related uncertainty. What is less clear is what investment strategies these fund managers follow.

In order to perform better than their peers, fund managers need to take an active investment stance compared to the average fund in their benchmark (Cremers and Pareek, 2016). They can either over- or under-weight certain positions, hold certain firms for longer/shorter period, or do a mixture of the two. Since we are interested in ESG investment skill, we need to obtain a measure that is specific to firms with high ESG uncertainty.

To this end we start by sorting firms by the level of ESG disagreement. First, for each firm that has a high level of disagreement, we compute the average holding size in percentage of AuM (Jiang et al., 2014). Second, we define a dummy each for firms that are over-held by mutual funds, meaning that the difference between the weight of the firm stock in the fund and the respective benchmark weight of the stock is in the top tercile. Finally, we define the variable *Over-weight* as the sum the weights of positions in stocks with high ESG disagreement and are over-weighted for the mutual funds in our sample.

$$Over\text{-}weight_{j,t} = \sum_{i=1}^{N_j} (w_{i,t}^{j} | i \in X)$$

where stocks i are both over-weighted by fund j against the fund respective bench-

mark and have high level of ESG disagreement in any given quarter.

To test whether the investment strategies of ESG aware funds are different from their peers we interact our proxy of ESG awareness with the measures of over-exposure. If fund managers generate alphas by having a higher exposure to firms whose ESG performance is uncertain, we expect the interaction between $\varnothing R\&A$ and *Over-weight* to be positive. Moreover, given that investments into ESG typically take time to be incorporated into stock returns (Edmans, 2011; Starks et al., 2020), we should expect the interaction between $\varnothing R\&A$ and *Over-weight* to be positive for funds with longer holding duration in stocks with high ESG uncertainty. Thus, we further test the effect of over-exposure and being ESG-aware on alpha for the subsample of funds with *Long holding duration* separately from the subsample of funds with *Short holding duration*. We construct the fund holding duration in a similar fashion as Cremers and Pareek (2015), with the additional requirement that fund holding duration in stocks with highest level of ESG disagreement (Top Quintile/Quartile/Tercicle). *Long (Short) holding duration* is defined as above (below) the median value of holding duration in each investment category-quarter.

Panel A of Table 4.9 presents the performance of portfolios (Alpha 4F) formed by sorting funds independently based on the R&A ratings and quintiles of *Over-weight*. Similar to Table 4.2, the "All" row represent portfolios based on a univariate sort of the R&A ratings for the sample of funds with available Factset holdings information. We confirm that funds with highest R&A rating outperform funds with no R&A rating by over 4 bps per month. More importantly, we observe that the significant outperformance is concentrated in funds of the highest R&A rating that over-expose to stocks with high ESG uncertainty.

Table 4.9 – Investment strategies and ESG disagreement

This table presents the association between funds' monthly performance (Alpha 4F) and ESG investment strategy. Panel A presents the performance of portfolios of funds (mean of funds' Alpha 4F) formed using the R&A ratings and quintiles of *Over-weight*—a proxy for ESG-related investment strategy. *Over-weight* measures the total fund holdings of stocks that (a) have high level of ESG disagreement (those in the top tercile of ESG rating disagreement in a given quarter) and (b) are over-weighted in a portfolio compared to its respective Morningstar benchmark (those in the top tercile in terms of the difference between its portfolio weight and its respective benchmark weight). Panel B presents the coefficient estimates from regressions estimating funds' monthly performance on R&A ratings and *Over-weight*. High level of ESG disagreement is measured differently across models, from the top quintile of firms to the top tercile of firms as in Panel A. Column (4) to (9) of Panel B present regression results for the subsample partitioning by fund holding duration in stocks with corresponding level of ESG disagreement (Quint/Quar/Ter). *Long (Short) holding duration* is defined as above (below) the median value of holding duration in each investment category-quarter. All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

Panel A: Mean of Alpha 4F of portfolio of funds formed by sorting on fund R&A rating and *Over-weight*

	No Rating	$\varnothing R\&A < B$	$\varnothing R\&A \in [B, A)$	$\varnothing R\&A \geq A$	Diff. (t-stat)
	(1)	(2)	(3)	(4)	(4) - (1)
All	-0.103	-0.088	-0.084	-0.054	0.049***
					(6.173)
Over-weight					
(1) Low	-0.055	-0.032	-0.045	-0.041	0.014
					(0.842)
(2)	-0.100	-0.108	-0.060	-0.084	0.015
					(0.866)
(3)	-0.121	-0.080	-0.111	-0.076	0.111***
					(2.577)
(4)	-0.118	-0.086	-0.098	-0.039	0.080***
					(4.499)
(5) High	-0.117	-0.135	-0.115	-0.022	0.095***
					(4.728)
Diff. (t-stat)	-0.061***	-0.105***	-0.074***	0.020	
(5) -(1)	(-4.953)	(-4.668)	(-3.731)	(0.924)	

Table 4.9: [con'd]

Panel B: Regression analysis

	Whole sample			Long holding duration			Short holding duration		
ESG Disagreement	Quint	Quar	Ter	Quint	Quar	Ter	Quint	Quar	Ter
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\varnothing R\&A_{t-1} \geq A \times$ Over-weight	0.221*	0.177	0.167**	0.243*	0.203*	0.256***	0.065	0.011	-0.037
	(1.98)	(1.66)	(2.05)	(1.88)	(1.71)	(2.67)	(0.40)	(0.07)	(-0.32)
Over-weight	-0.143	-0.096	-0.082	-0.128	-0.074	-0.079	-0.136	-0.073	-0.063
	(-1.33)	(-1.01)	(-1.20)	(-1.13)	(-0.75)	(-1.05)	(-1.50)	(-0.86)	(-0.98)
$\varnothing R\&A_{t-1} \geq A$	0.017	0.018	0.011	0.014	0.014	-0.011	0.033	0.040	0.055*
	(0.80)	(0.76)	(0.48)	(0.62)	(0.55)	(-0.43)	(1.21)	(1.41)	(1.94)
$\varnothing R\&A_{t-1} \in [B, A)$	0.017	0.016	0.017	0.014	0.012	0.008	0.018	0.020	0.025
	(0.81)	(0.81)	(0.81)	(0.64)	(0.53)	(0.40)	(0.80)	(0.94)	(1.09)
$\varnothing R\&A_{t-1} < B$	0.004	0.003	0.004	-0.008	-0.012	-0.014	0.019	0.024	0.023
	(0.21)	(0.20)	(0.21)	(-0.40)	(-0.62)	(-0.75)	(1.02)	(1.33)	(1.25)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	390,438	390,438	390,438	194,479	194,479	194,479	195,592	195,592	195,592
Adj R2	0.303	0.303	0.303	0.359	0.359	0.359	0.283	0.284	0.283

Panel B of Table 4.9 shows the results of regression analysis. The out-performance that we observe in ESG aware funds is concentrated in those that over-weight firms for which they are most likely to have superior information, i.e., those with a high degree of ESG uncertainty. While we find some evidence that ESG aware fund that are over-exposed to firms with a high ESG uncertainty outperform, the evidence is not overly robust across models using different thresholds for defining *High ESG disagreement*. The positive effect becomes stronger and robust when examining the subsample of funds with longer holding durations of stocks with high ESG uncertainty. For example, while a one standard deviation increase in *Over-weight* (0.102) correlate to an increase in monthly performance of 0.87 basis points ((0.167 - 0.082) $\times$ 0.102) in model (3), a one standard deviation increase in *Over-weight* correlate to an increase in monthly performance of 1.86 basis points ((0.256 - 0.079) $\times$ 0.102) in model (6) for the sub-sample of funds with longer holding duration.[18]

4.6 Conclusion

This chapter contributes to the large discussion on the relationship between ESG integration and financial performance. We document a positive association between being ESG aware, i.e., of having a high level of integration, and fund performance. This is robust to including a vast set of fund-family, individual fund, and even fund manager fixed effects. Also, controlling for the funds' exposure to regional ESG-factors does not explain this out-performance, nor does controlling funds' portfolio sustainability ratings. We argue that the out-performance we observe is driven by awareness as opposed to taste: Our results are concentrated among conventional

[18]In Appendix Table 4.A9 we confirm that our results hold when additionally controlling for fund family fixed effects.

funds with high ESG integration – those that are ESG-aware – instead of the sample of socially conscious funds – that are ESG-motivated.

Is the out-performance a coincidence or is driven by investment skill? To answer this question, we leverage the measure of active fundamental performance developed by Jiang and Zheng (2018) to identify active investment skill. Our findings suggest that only mutual funds with high degree of ESG integration exhibit ESG-specific investment skill, especially in the presence of ESG uncertainty or unexpected events.

In the last part of the chapter we also show *how* this out-performance is achieved. Mutual funds tend to be over-exposed to stocks whose ESG performance is uncertain and at the same time also under-trade these firms. Overall, our findings support the conjecture that ESG-aware investors can utilize their ESG informational advantage to identify lucrative investment opportunities.

Appendices: Chapter 4

Table 4.A1 – Variable definitions

Variable	Definition (Data source)
Fund characteristics	
Gross return	Gross return of fund i in month t, in percentage. (Morningstar Mutual Fund)
Mstar categ-adj return	Difference between the fund's gross return and the return of the Morningstar-category in month t, in percentage
Alpha 1F	Fund's monthly alpha over the CAPM, in percentage. (Morningstar Mutual Fund, AQR benchmark factor)
Alpha 3F	Fund's monthly alpha over the regional Fama-French 3-factor, in percentage. (Morningstar Mutual Fund, AQR benchmark factor)
Alpha 4F	Fund's monthly alpha over the regional Fama-French-Carhart 4-factor in month t, in percentage. (Morningstar Mutual Fund, AQR benchmark factor)
Alpha (mkt, E-fac)	Fund's monthly alpha over the market risk premium and the regional green factor's realization in month t, in percentage. We follow the methodology of Pástor et al. (2021b) to calculate the green factor's realization for each investment region. we construct Alpha (mkt, S-fac), Alpha (mkt, G-fac) and Alpha (mkt, ESG-fac) in a similar factor. (Morningstar Mutual Fund, MSCI IVA ESG)
Log Fund Assets	Natural logarithm of total assets under management (AUM), in US $m. Fund-level AUM is the sum of the assets across all share classes. (Morningstar Mutual Fund)
Log Fund Age	Natural logarithm of the number of years since the fund inception date. (Morningstar Mutual Fund)
Socially conscious	Indicator variable for funds that are classified by Morningstar as "socially conscious".
Fund ESG ranking	The standardised ESG portfolio score [0,1] in a given Category x Time. (Morningstar)
Fund 'Globes'	Morningstar sustainability 'Globes' rating on the scale 1-5, where 5 is the highest sustainability globes. (Morningstar)
Institution characteristics	
Log Family Assets	Natural logarithm of total AUM by the fund-family, in US $m. Fund family-level is the sum of the assets across all funds of the fund family. (Morningstar Mutual Fund)
R&A score	The average PRI R&A module scores. The included module scores are (1) Strategy and Governance, (2) Selection, appointment of managers - SAM: Listed Equity, (3) SAM: Fixed Income, (4) Listed Equity: Screening, (5) Listed Equity: Integration, (6) Listed Equity: Active Ownership, (7) Private Equity, (8) Direct Property, (9) Direct Infrastructure , and (10) Fixed Income. (PRI Reporting and Assessment)
$\varnothing R\&A_{t-1} \geq A$	Indicator variable for funds that have an average score of A or greater across all modules. (PRI Reporting and Assessment)
$\varnothing R\&A_{t-1} \in [B, A)$	Indicator variable for funds that have an average score of B or greater, but smaller than A across all modules. (PRI Reporting and Assessment)
$\varnothing R\&A_{t-1} < B$	Indicator variable for funds that have an average score smaller than B across all modules. (PRI Reporting and Assessment)
No R&A Rating	Indicator variable for funds that do not have PRI R&A rating, consisting of non-PRI funds or funds of first-year being PRI signatories. (PRI Reporting and Assessment)

Appendix 4.A1. [con'd]

Variable	Definition (Data source)
Other variables	
ESG disagreement	Standard deviation of ESG ratings cross four ratings providers or when at least two ratings are available. High ESG disagreement is an indicator variable takes values of 1 if the stock is in the Top Quintile (or Top Quartile/ Tercicle) of ESG disagreement in a given quarter. (MSCI IVA ESG, Sustainalytics ESG, Thomson Asset4 and S&P Global ESG scores)
AFP^{Disag}	Fund-level quarterly sum of the change in portfolio holdings in the previous quarter and CAR[-1;+1] around quarter earnings announcement date of each portfolio firm with high level of ESG disagreement. (Morningstar Mutual Fund, FactSet monthly holdings, Compustat Security Daily for North America and Global, I/B/E/S Detail History Actuals)
AFP^{Others}	Fund-level quarterly sum of the change in portfolio holdings in the previous quarter and CAR[-1;+1] around quarter earnings announcement date of each portfolio firm with low level of ESG disagreement.
AFP^{RR}	Fund-level monthly correlation of portfolio holdings in the previous quarter and monthly CARs in the month of RepRisk incident occurrence of each portfolio firm. We define a firm RepRisk incident as an event with the monthly increase in RepRisk score equals the 95th percentile of the sample change, i.e. $\Delta RepRisk\ score = 8$ (Morningstar Mutual Fund, FactSet monthly holdings, FactSet monthly returns, RepRisk ESG incidents)
Over/Under-weight	Fund-level total portfolio weights of stocks that a) have high level of ESG disagreement (Top quintile/quartile/tercile or Above Median) and b) are over-held/under-held in a fund portfolio against its benchmark. A stock is considered as being over-held (under-held) in a fund portfolio if the difference between its portfolio weight and its respective Morningstar benchmark weight, i.e. active weight, is in the top tercile (bottom tercile) of the sample difference. Alternative definitions of stock over-holdings in a fund portfolio using quintile or quartile of active weights are reported in the Internet Appendix. (FactSet holdings, ESG Disagreement) *** Insert equation here
Holding duration	The weighted average number of quarters a fund holds a stock with high level of ESG disagreement over the past five years. We construct the fund holding duration in a similar fashion as Cremers and Pareek (2015), with the additional requirement that fung holding duration in stocks with highest level of ESG disagreement (Top Quintile/Quartile/ Tercicle).*Long (Short) holding duration* is defined as above (below) the median value of holding duration in each investment category-quarter.

Table 4.A2 – Robustness checks

This table reports results from regressions of fund monthly performance variables on PRI R&A rating. Panel A shows results of regressions controlling for additional fund characteristics as in Ferreira, Keswani, Miguel, and Ramos (2013). Panel B presents results of fund alpha over alternative individual country-level risk-factor benchmark on R&A rating. Panel C presents results using the sample of funds that have non-missing holdings data from FactSet. Fund returns are calculated before (gross) deducting fees and expenses. These returns are also adjusted using the CAPM model (Alpha 1F), the Fama-French model (Alpha 3F), the Carhart model (Alpha 4F), or computed as the difference between the fund gross return and the return of the fund benchmark, as provided by Morningstar. All fund control variables are lagged one month and winsorized at 1st and 99th percentiles. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix A provides variable definitions.

Panel A: Controlling for additional fund characteristics

	Gross Return	Mstar categ-adj Return	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1} \geq A$	0.0347***	0.0249**	0.0289**	0.0218*	0.0227*
	(2.986)	(2.586)	(2.425)	(1.818)	(1.794)
$\varnothing R\&A_{t-1} \in [B, A)$	0.0326***	0.0300***	0.0277***	0.0133	0.0128
	(3.410)	(3.970)	(2.659)	(1.349)	(1.232)
$\varnothing R\&A_{t-1} < B$	0.0016	0.0158*	0.0038	-0.0025	-0.0066
	(0.148)	(1.923)	(0.356)	(-0.267)	(-0.631)
Log Fund Assets$_{t-1}$	0.0079**	0.0078***	0.0068**	0.0065**	0.0047
	(2.272)	(3.149)	(2.279)	(2.365)	(1.663)
Log Fund Age$_{t-1}$	-0.0014	-0.0035	0.0063	0.0034	0.0003
	(-0.181)	(-0.804)	(0.698)	(0.388)	(0.038)
Expense Ratio$_{t-1}$	-0.0483**	-0.0620***	-0.0619***	-0.0496***	-0.0471***
	(-2.592)	(-5.063)	(-3.275)	(-3.035)	(-2.913)
Load Fee$_{t-1}$	0.0012	0.0006	0.0007	-0.0006	-0.0010
	(0.989)	(0.595)	(0.580)	(-0.517)	(-0.861)
Flow$_{t-1}$	0.0029**	0.0021**	0.0031**	0.0019*	0.0016*
	(2.147)	(2.061)	(2.623)	(1.969)	(1.788)
Flow$_{t-2}$	-0.0015	-0.0005	-0.0008	-0.0004	-0.0009
	(-1.220)	(-0.548)	(-0.710)	(-0.439)	(-0.965)
Alpha$_{t-1}$	-0.0251	-0.0137	-0.0144	-0.0175	-0.0085
	(-1.280)	(-1.200)	(-0.732)	(-0.956)	(-0.444)
Alpha$_{t-2}$	0.0138	0.0044	0.0248	0.0271	0.0322*
	(0.779)	(0.407)	(1.491)	(1.593)	(1.920)
Categ x Time FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
N	485,667	485,667	485,667	485,667	485,667
Adj R2	0.820	0.018	0.464	0.422	0.411

Panel B: Fund alpha over country-level risk-factor benchmark

	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)
$\varnothing R\&A_{t-1} \geq A$	0.038**	0.037**	0.051***
	(2.24)	(2.27)	(3.27)
$\varnothing R\&A_{t-1} \in [B, A)$	0.039***	0.030**	0.034**
	(3.01)	(2.31)	(2.55)
$\varnothing R\&A_{t-1} < B$	0.016	0.011	0.015
	(0.87)	(0.62)	(0.81)
Controls	Yes	Yes	Yes
Categ x Time FE	Yes	Yes	Yes
N	828,305	828,305	828,305
Adj R2	0.290	0.246	0.246

Panel C: R&A rating and fund performance: Sample of PRI funds

	Gross Return	Mstar categ-adj Return	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1} \geq A$	0.030	0.020*	0.031*	0.032*	0.038**
	(1.52)	(1.70)	(1.68)	(1.92)	(2.25)
$\varnothing R\&A_{t-1} \in [B, A)$	0.024*	0.025***	0.025*	0.020	0.020
	(1.90)	(3.37)	(1.89)	(1.60)	(1.60)
Controls	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Categ x Time FE	Yes	Yes	Yes	Yes	Yes
N	663,697	663,697	437,827	437,827	437,827
Adj R2	0.811	0.021	0.389	0.372	0.378

Panel D: R&A rating and fund performance: Sample of non-missing stock holdings

	Gross Return	Mstar categ-adj Return	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1} \geq A$	0.041**	0.037**	0.030	0.025	0.045**
	(2.00)	(2.64)	(1.54)	(1.27)	(2.40)
$\varnothing R\&A_{t-1} \in [B, A)$	0.037*	0.038***	0.030	0.008	0.017
	(1.92)	(3.52)	(1.54)	(0.42)	(0.83)
$\varnothing R\&A_{t-1} < B$	0.020	0.018	0.018	0.003	0.003
	(1.22)	(1.65)	(1.08)	(0.14)	(0.19)
Controls	Yes	Yes	Yes	Yes	Yes
Categ x Time FE	Yes	Yes	Yes	Yes	Yes
N	390,438	390,438	390,438	390,438	390,438
Adj R2	0.843	0.010	0.358	0.302	0.303

Table 4.A3 – R&A module rating and fund performance

This table reports results from regressions of fund monthly performance variables on R&A module rating. Listed Fund returns are calculated before (gross) deducting fees and expenses. These returns are also adjusted using the CAPM model (Alpha 1F), the Fama-French model (Alpha 3F), the Carhart model (Alpha 4F), or computed as the difference between the fund gross return and the return of the fund benchmark, as provided by Morningstar. All fund control variables are lagged one month and winsorized at 1st and 99th percentiles. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix A provides variable definitions.

Panel A: Equity-funds: Avg score based on a subset of R&A modules: SG, LEI, LEA

	Gross Return	Mstar categ-adj Return	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1}^{restr.} \geq A$	0.0300**	0.0260***	0.0331**	0.0341**	0.0436***
	(2.049)	(2.825)	(2.148)	(2.143)	(2.748)
$\varnothing R\&A_{t-1}^{restr.} \in [B, A)$	0.0345**	0.0248***	0.0300*	0.0141	0.0157
	(2.222)	(2.694)	(1.831)	(0.831)	(0.905)
$\varnothing R\&A_{t-1}^{restr.} < B$	0.0334	0.0208	0.0342	0.0292	0.0336
	(1.285)	(1.653)	(1.401)	(1.212)	(1.387)
Constant	0.0283	-0.5053***	-0.5957***	-0.4940***	-0.4370***
	(0.209)	(-5.545)	(-4.320)	(-3.895)	(-3.478)
Controls	Yes	Yes	Yes	Yes	Yes
Categ x Time FE	Yes	Yes	Yes	Yes	Yes
N	828,647	828,647	828,647	828,647	828,647
Adj R2	0.824	0.013	0.368	0.343	0.346

Panel B: Equity-funds: Avg score based on a subset of R&A Listed Equity modules (LE): LEI, LEA

	Gross Return	Mstar categ-adj Return	Alpha 1F	Alpha 3F	Alpha 4F
	(1)	(2)	(3)	(4)	(5)
$\varnothing R\&A_{t-1}^{LE} \geq A$	0.0212	0.0161*	0.0275*	0.0348**	0.0426***
	(1.426)	(1.887)	(1.807)	(2.236)	(2.720)
$\varnothing R\&A_{t-1}^{LE} \in [B, A)$	0.0235*	0.0116	0.0142	0.0160	0.0257*
	(1.787)	(1.211)	(1.052)	(1.095)	(1.845)
$\varnothing R\&A_{t-1}^{LE} < B$	0.0357	0.0142	0.0344	0.0247	0.0344*
	(1.546)	(1.351)	(1.624)	(1.237)	(1.729)
Constant	0.0011	-0.5296***	-0.6204***	-0.5069***	-0.4536***
	(0.008)	(-5.569)	(-4.553)	(-4.059)	(-3.637)
Controls	Yes	Yes	Yes	Yes	Yes
Categ x Time FE	Yes	Yes	Yes	Yes	Yes
N	828,647	828,647	828,647	828,647	828,647
Adj R2	0.824	0.013	0.368	0.343	0.346

Figure 4.A1 – Country of headquarter of institutions with A/A$^+$ R&A rating

This figure plots the sample fraction of PRI signatory institutions with A/A$^+$ R&A rating

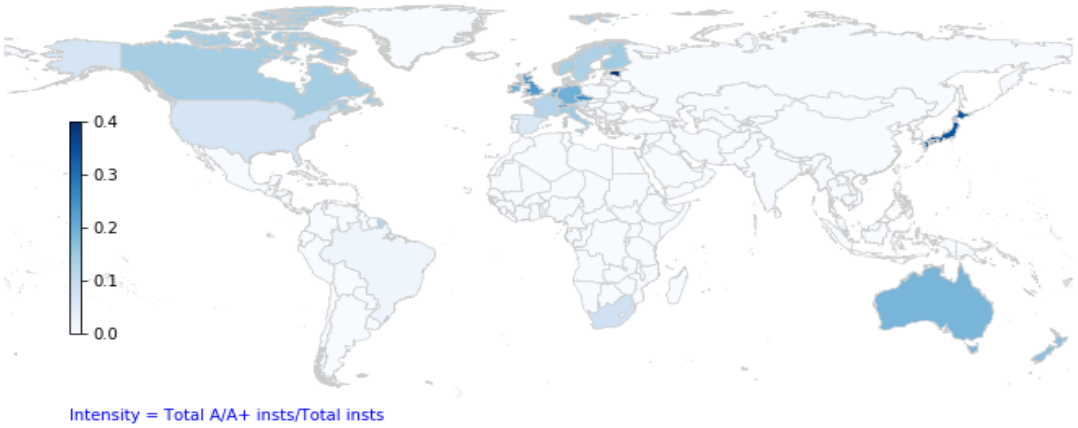


Table 4.A4 – R&A Rating and fund performance by fund domicile

This table reports results from regressions of fund monthly performance variables on PRI R&A rating by fund domicile. Fund returns are calculated before (gross) deducting fees and expenses. These returns are also adjusted using the Carhart model (Alpha 4F). All fund control variables are lagged one month and winsorized at 1st and 99th percentiles. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix A provides variable definitions.

	US-domiciled		EU-domiciled		Other	
	Gross Return	Alpha 4F	Gross Return	Alpha 4F	Gross Return	Alpha 4F
	(1)	(2)	(3)	(4)	(5)	(6)
$\varnothing R\&A_{t-1} \geq A$	0.001	0.010	0.073***	0.085***	0.014	0.036
	(0.06)	(0.49)	(3.42)	(4.23)	(0.45)	(1.10)
$\varnothing R\&A_{t-1} \in [B, A)$	0.016	0.022	0.066***	0.048**	0.030	0.034
	(1.18)	(1.56)	(3.67)	(2.45)	(1.01)	(1.07)
$\varnothing R\&A_{t-1} < B$	0.007	0.001	0.024	0.017	0.008	0.030
	(0.42)	(0.06)	(1.38)	(0.89)	(0.25)	(0.89)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	182,257	182,257	432,509	432,509	213,731	213,731
Adj R2	0.868	0.307	0.841	0.298	0.789	0.495

Table 4.A5 – R&A rating and ESG-factor alpha

This table reports results from regressions of fund performance variables on PRI R&A rating. Fund returns are calculated before (gross) deducting fees and expense, adjusted using the market risk factor and E/S/G factor. All fund control variables are lagged one month and winsorized at 1st and 99th percentiles. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix A provides variable definitions.

		ESG Factor (Sustainalytics ESG data)			
	Alpha 1F (mkt)	Alpha (mkt, E-fac)	Alpha (mkt, S-fac)	Alpha (mkt, G-fac)	Alpha (mkt, ESG-fac)
$\varnothing R\&A_{t-1} \geq A$	0.041**	0.037*	0.033*	0.039*	0.036*
	(2.29)	(1.89)	(1.69)	(1.96)	(1.83)
$\varnothing R\&A_{t-1} \in [B, A)$	0.040***	0.040**	0.037**	0.042**	0.040**
	(2.69)	(2.48)	(2.27)	(2.59)	(2.47)
$\varnothing R\&A_{t-1} < B$	0.019	0.014	0.016	0.021	0.015
	(0.98)	(0.69)	(0.76)	(1.01)	(0.74)
Controls	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes
N	828,647	771,565	771,565	771,565	771,565
Adj R2	0.368	0.347	0.359	0.346	0.352

Table 4.A6 – Control for portfolio ESG ranking

This table reports results from regressions of fund monthly performance variables on PRI R&A rating. In model (1) and (2), we further control for fund portfolio ESG score. *ESG score ranking* is the standardised ranking [0,1] within the same Category x Time, and *ESG score ranking (missing)* takes value of 1 when *ESG score ranking* is missing. Model (3) and (4) include fund Morningstar 'Globes' sustainability rating on the scale 1-5 (highest sustainability rating). All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

	Fund ESG ranking		Fund 'Globes' ranking	
	Gross Return	Alpha 4F	Gross Return	Alpha 4F
	(1)	(2)	(3)	(4)
$\varnothing R\&A_{t-1} \geq A$	0.040**	0.056***	0.040**	0.056***
	(2.28)	(3.47)	(2.31)	(3.37)
$\varnothing R\&A_{t-1} \in [B, A)$	0.040***	0.035**	0.040***	0.035**
	(2.86)	(2.18)	(2.87)	(2.13)
$\varnothing R\&A_{t-1} < B$	0.017	0.018	0.017	0.018
	(0.91)	(0.89)	(0.89)	(0.88)
Log Fund Assets$_{t-1}$	0.014***	0.013**	0.015***	0.013**
	(2.86)	(2.43)	(3.09)	(2.60)
Log Fund Age$_{t-1}$	-0.005	-0.007	-0.005	-0.007
	(-0.48)	(-0.81)	(-0.46)	(-0.83)
Log Family Assets$_{t-1}$	0.010***	0.004	0.010***	0.004
	(3.12)	(1.35)	(3.12)	(1.37)
ESG score ranking	-0.005	-0.005		
	(-0.30)	(-0.44)		
ESG score ranking (missing)	-0.044	-0.018		
	(-0.74)	(-0.39)		
Globes ranking			-0.033	0.004
			(-0.50)	(0.09)
Globes ranking (missing)			-0.033	0.007
			(-0.78)	(0.23)
Categ x Time	Yes	Yes	Yes	Yes
N	828,647	828,647	828,647	828,647
Adj R2	0.824	0.346	0.824	0.346

Table 4.A7 – Fund active fundamental performance (AFP)

This table reports results from regressions of fund performance variables on PRI R&A rating and index-based AFP measure. The mutual fund index-based AFP is defined as the sum of the product of active portfolio weights (difference between portfolio weights and corresponding passive benchmark weights) and portfolio stocks' subsequent 3-day abnormal returns surrounding earning announcements. Fund returns are observed in the second month in each quarter to the first quarter in the following quarter after construct quarterly AFP, when more than 95% of holding firms report firm quarterly earnings. We employ α^{4F}_{t+1} as the main return measure in the similar fashion as Jiang and Zheng (2018). All fund control variables are observed in the quarter prior to the AFP measure and winsorized at 1st and 99th percentiles. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

	AFP_t	α^{4F}_{t+1}	α^{4F}_{t+1}	α^{4F}_{t+1}
	(1)	(2)	(3)	(4)
AFP_t		0.475***	0.476***	0.475***
		(20.38)	(21.02)	(21.15)
$\varnothing R\&A_{t-1} \geq A \times AFP$			-0.006	-0.003
			(-0.16)	(-0.09)
$\varnothing R\&A_{t-1} \geq A$	-0.001		0.081**	0.011
	(-0.08)		(2.35)	(0.16)
$\varnothing R\&A_{t-1} \in [B, A)$	0.009		0.046	-0.031
	(1.24)		(1.29)	(-0.59)
$\varnothing R\&A_{t-1} < B$	0.005		0.036	-0.035
	(1.05)		(1.28)	(-0.80)
Log Fund Assets$_{t-1}$	-0.002	0.019*	0.018*	-0.001
	(-1.20)	(1.85)	(1.81)	(-0.31)
Log Fund Age$_{t-1}$	0.007**	-0.015	-0.013	0.007
	(2.49)	(-1.11)	(-1.03)	(0.61)
Log Family Assets$_{t-1}$	0.002	0.007	0.002	-0.069
	(1.34)	(1.32)	(0.41)	(-1.60)
Categ x Time	Yes	Yes	Yes	Yes
Family FE				Yes
N	173,337	126,509	126,509	126,480
Adj R2	0.113	0.301	0.301	0.309

Table 4.A8 – R&A Rating and ESG-specific AFP measure by investment region

This table reports results from regressions of fund performance variables on PRI R&A rating and specific AFP measure by investment region. Panel A reports the results from regression of fund returns on PRI rating and AFP_t^{Disag} in a similar fashion as Table 4.7 by sub-sample of investment regions. Panel B reports the results from regression of fund returns on PRI rating and AFP_t^{RR} in a similar fashion as Table 4.8 by sub-sample of investment regions. We employ α_{4F} as the main return measure in the similar fashion as Jiang and Zheng (2018). All fund control variables are observed in the quarter prior to the AFP measure and winsorized at 1st and 99th percentiles. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

Panel A: R&A rating and Highest ESG Disagreement (AFP_t^{Disag} is defined by $Top\,Quintile$)

	US-domiciled			EU-domiciled		
	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}	α_{t+1}^{4F}
	(1)	(2)	(3)	(4)	(5)	(6)
AFP_t^{Disag}	0.480***	0.478***	0.482***	0.444***	0.421***	0.416***
	(8.06)	(7.87)	(8.26)	(5.68)	(5.48)	(5.47)
AFP_t^{Others}	0.513***	0.514***	0.516***	0.436***	0.431***	0.429***
	(13.43)	(14.18)	(14.27)	(10.53)	(10.18)	(11.03)
$\varnothing R\&A_{t-1} \geq A \times AFP_t^{Disag}$		0.055	0.058		0.161*	0.160*
		(0.41)	(0.42)		(1.88)	(1.87)
$\varnothing R\&A_{t-1} \geq A \times AFP_t^{Others}$		-0.029	-0.019		0.018	0.019
		(-0.40)	(-0.24)		(0.31)	(0.31)
$\varnothing R\&A_{t-1} \geq A$	0.002	0.002	-0.009	0.028**	0.025**	0.002
	(0.33)	(0.30)	(-1.63)	(2.22)	(2.17)	(0.40)
$\varnothing R\&A_{t-1} \in [B, A)$	0.012	0.013	0.030	-0.028	-0.029	-0.008
	(0.64)	(0.65)	(1.33)	(-1.55)	(-1.59)	(-0.60)
$\varnothing R\&A_{t-1} < B$	0.003	0.000	-0.029	0.016	0.006	-0.135***
	(0.74)	(0.10)	(-0.63)	(1.36)	(0.67)	(-2.92)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes	Yes
Family FE			Yes			Yes
N	47,051	47,051	47,049	75,503	75,503	75,479
Adj R2	0.337	0.337	0.346	0.290	0.290	0.298

Table 4.A8: [con'd]
Panel B: R&A rating and RepRisk negative ESG incidents

	US-domiciled			EU-domiciled		
	α^{4F}_{t+1}	α^{4F}_{t+1}	α^{4F}_{t+1}	α^{4F}_{t+1}	α^{4F}_{t+1}	α^{4F}_{t+1}
	(1)	(2)	(3)	(4)	(5)	(6)
AFP^{RR}_t	1.480***	1.504***	1.524**	0.240	0.160	0.153
	(2.73)	(2.82)	(2.64)	(0.96)	(0.66)	(0.62)
$\varnothing R\&A_{t-1} \geq A \times AFP^{RR}_t$		-2.197	-2.362		2.207**	2.235**
		(-1.19)	(-1.26)		(2.16)	(2.26)
$\varnothing R\&A_{t-1} \geq A$		-0.003	-0.034		0.090***	0.086
		(-0.13)	(-0.98)		(3.94)	(1.65)
$\varnothing R\&A_{t-1} \in [B, A)$		0.023	0.005		0.042	0.004
		(1.32)	(0.16)		(1.63)	(0.12)
$\varnothing R\&A_{t-1} < B$		-0.002	-0.021		0.011	-0.064**
		(-0.14)	(-0.82)		(0.40)	(-2.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes	Yes
Family FE			Yes			Yes
N	116,448	116,448	116,447	203,463	203,463	203,460
Adj R2	0.328	0.328	0.333	0.298	0.299	0.302

Table 4.A9 – Investment strategies and ESG disagreement

This table presents the coefficient estimates from regressions estimating funds' monthly performance on R&A ratings and *Over-weight*. *Over-weight* measures the total fund holdings of stocks that (a) have high level of ESG disagreement and (b) are over-weighted in a portfolio compared to its respective Morningstar benchmark (those in the top tercile in terms of the difference between its portfolio weight and its respective benchmark weight). High level of ESG disagreement is measured differently across models, from the top quintile of firms to the top tercile of firms as in Panel A. Column (4) to (9) of Panel B present regression results for the subsample partitioning by fund holding duration in stocks with corresponding level of ESG disagreement (Quint/Quar/Ter). *Long (Short) holding duration* is defined as above (below) the median value of holding duration in each investment category-quarter. All fund control variables are lagged by one month and winsorized at the 1st and 99th percentile. t-statistics based on standard errors clustered at the time (year-month) and fund level, are shown in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Appendix Table 4.A1 provides variable definitions.

	Whole sample			Long holding duration			Short holding duration		
ESG Disagreement	Quint	Quar	Ter	Quint	Quar	Ter	Quint	Quar	Ter
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\varnothing R\&A_{t-1} \geq A \times$ Over-weight	0.2328**	0.1821*	0.1836**	0.2722**	0.2089*	0.2723***	0.0625	0.0012	-0.0177
	(2.155)	(1.751)	(2.285)	(2.083)	(1.729)	(2.752)	(0.360)	(0.007)	(-0.141)
Over-weight	-0.1870*	-0.1299	-0.1221*	-0.1711*	-0.0994	-0.1211*	-0.1372	-0.0732	-0.0837
	(-1.887)	(-1.446)	(-1.919)	(-1.729)	(-1.088)	(-1.753)	(-1.518)	(-0.875)	(-1.274)
$\varnothing R\&A_{t-1} \geq A$	0.0040	0.0049	-0.0043	-0.0293	-0.0304	-0.0423	0.0507	0.0610	0.0513
	(0.101)	(0.118)	(-0.104)	(-0.778)	(-0.740)	(-1.005)	(1.096)	(1.247)	(1.049)
$\varnothing R\&A_{t-1} \in [B, A)$	-0.0064	-0.0068	-0.0066	-0.0309	-0.0359	-0.0270	0.0242	0.0268	0.0168
	(-0.231)	(-0.243)	(-0.239)	(-0.937)	(-1.098)	(-0.853)	(0.804)	(0.888)	(0.554)
$\varnothing R\&A_{t-1} < B$	-0.0331	-0.0333	-0.0329	-0.0511*	-0.0548**	-0.0455*	-0.0035	0.0019	-0.0140
	(-1.393)	(-1.402)	(-1.389)	(-1.889)	(-2.008)	(-1.675)	(-0.129)	(0.071)	(-0.535)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Categ x Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	390,430	390,430	390,430	194,469	194,469	194,465	195,585	195,586	195,584
Adj R2	0.307	0.307	0.307	0.362	0.361	0.362	0.288	0.289	0.288

Chapter 5

Conclusions and Future Research

5.1 Summary and Conclusion

This thesis explores the role of internal and external corporate governance mechanisms in shaping firms' outcomes. Chapter 2 and 3 focus on the topic of the role played by board of directors and institutional investors in influencing firms' decisions. Chapter 4 of this thesis centers around the topic of the financial implication of ESG incorporation by global mutual fund managers.

This thesis contributes to the literature on the effectiveness of corporate governance in several aspects. First, the findings presented in chapter 2 highlight that adequate director workload is a requisite for effective oversight of a firm's environmental performance—one component of ESG which has attracted growing attention from investors, corporate stakeholders and the media (Di Giuli and Kostovetsky, 2014; Dai et al., 2021; Krueger et al., 2020). In addition, our findings speak to the importance of corporate governance policy on regulating multiple directorships. Multiple directorships may allow firms for greater access to soft information and external resources through board network (Amin et al., 2020; Brown et al., 2019). Nevertheless, as shown in this chapter, multiple directorships can cost firms in terms of limited time availability for monitoring non-financial aspects, specifically corporate environmental performance.

Second, chapter 3 contributes to the established literature on the role played by

institutional investors in assisting portfolio firms from a distinctive angle. That is, we investigate the motivation for institutional investors from the target side to exert influence in takeover deals via the payment channel. This chapter finds that the presence of institutional investors in the target firms is an important determinant of payment structure in the U.S. takeover market as they help attenuate information asymmetry about the value of payment between the target and the bidder firms (Hansen, 1987; Fishman, 1989; Eckbo et al., 1990, 2018).

Lastly, chapter 4 empirically investigates how ESG incorporation by mutual fund mangers impacts fund returns. The debate on whether higher level of ESG incorporation helps or hurts financial returns has proven to be one of the most controversial one (Edmans, 2011; Pedersen et al., 2021; Avramov et al., 2021). Our findings favour the view that higher level of ESG incorporation is associated with higher returns, especially when ESG-related skill matters the most. Specifically, the realised returns to ESG integration by mutual funds are most pronounced when it is unclear to the market how to evaluate the stock-level ESG information. In sum, this chapter has practical implications for investment selection of mutual funds and fund families to match investors' ESG preference.

5.2 Limitations and Recommendation for Future Research

Based on the analyses conducted in the three empirical chapters, there are shortcomings of the thesis that should be considered when designing future research.

First, while chapter 2 of this thesis focuses on the effect of board busyness for U.S. firms, future study can broaden the scope of research by examining the effect of director workload on firms' environmental performance in the international setting.

This goes beyond documenting the results in a larger sample since it can enhance our understanding of whether and how geographical differences in attitude towards ESG affect the influence of board of directors on this matter.

Second, chapter 3 documents that institutional investors act as an influential external corporate governance mechanism in important corporate events. To further develop the study, estimating the value effect of such involvement by target institutional investors can help evaluate the bargaining power of target firms. In addition, alternative hypotheses that might have power in explaining the current results should be considered. One of which concerns with the role of investment advisors in M&A in evaluating bidders' shares as a substitute for the presence of target institutional owners.

Third, although chapter 4 extends the prior literature on ESG finance, some further issues remain to be explored. Specifically, further tests to distinguish the true-ESG versus green-washing mutual funds that belong to fund-family with dissimilar level of ESG integration may reveal the underlying relationship between fund-level ESG integration and financial returns.

Finally, a number of unanswered research questions can be explored by future research. With regards to the probable influence of corporate external stakeholders on firms' ESG performance, research to address the question of *whether* and *how* local religiosity affect corporate engagement in promoting workforce diversity, is of relevance to the development of corporate policies. With regards to the ESG finance topic, it would be interesting to investigate whether managers' traits reveal their attitude towards ESG matters. The answers to these questions through well-designed research have implications for ESG-related policies.

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