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Essays on Corporate Transparency

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To my father,

whose memory accompanies me every day,

and to my mother,

the embodiment of unconditional love.

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Abstract

Corporate transparency is frequently proposed as a solution to societal problems. The underlying rationale behind this view is that by forcing corporations to disclose their impact on society, stakeholders will learn about corporate activities, change their decision-making, and impose a cost on corporations whose behavior is considered objectionable. To this end, in recent years, policymakers around the world have increasingly mandated corporations to be more transparent on specific dimensions with the assumption that stakeholders will better learn about corporate activities. This thesis investigates the relationship between corporate transparency and stakeholders' decision-making. More specifically, the first study aims to explore whether an increase in Corporate Social Responsibility (CSR) transparency will change decision-making by a stakeholder group that theoretically has a first-order interest in learning and monitoring CSR information. To investigate this relationship, the first study exploits granular data from the workplace safety regulator. Empirical evidence shows that when workplace safety information is available through ratings, regulators adjust their enforcement activity on firms where the disciplining effect is higher. The second chapter shows how an increase in transparency and easier processing of financial information allows market participants to devote more time to non-financial information. The study leverages a regulation that made the processing of financial information easier for market participants. It shows that after the regulation, market participants have more resources to monitor other firm activities, which in turn, encourages firms to improve their behavior towards these activities. While the first two studies investigate the relationship between corporate transparency and *external* stakeholders, the last study shows how corporate transparency affects *internal* agent behavior. More specifically, by adopting a dynamic structural model and combining it with empirical data, the study shows how managers use investments as a signal

to influence stock market valuation, particularly when the firm's level of transparency is low. Overall, the thesis demonstrates how corporate transparency influences stakeholder actions.

Abstract (Spanish)

La transparencia corporativa es frecuentemente propuesta como una solución a los problemas sociales. La razón subyacente detrás de esta visión es que al forzar a las corporaciones a divulgar su impacto en la sociedad, stakeholders aprenderán sobre las actividades corporativas, cambiarán su toma de decisiones e impondrán un costo a las corporaciones cuyo comportamiento se considera objetable. Con este fin, en los últimos años, los responsables de políticas en todo el mundo han mandado cada vez más a las corporaciones a ser más transparentes en dimensiones específicas con la suposición de que stakeholders aprenderán mejor sobre las actividades corporativas. Esta tesis investiga la relación entre la transparencia corporativa y la toma de decisiones de stakeholders. Más específicamente, el primer estudio tiene como objetivo explorar si un aumento en la transparencia de la Responsabilidad Social Corporativa (RSC) cambiará la toma de decisiones por un grupo de interesados que teóricamente tiene un interés primordial en aprender y monitorear la información de la RSC. Para investigar esta relación, el primer estudio explota datos granulares del regulador de seguridad en el trabajo. La evidencia empírica muestra que cuando la información sobre seguridad en el trabajo está disponible a través de ratings, los reguladores ajustan su actividad de aplicación sobre las empresas donde el efecto disuasorio es mayor. El segundo capítulo muestra cómo un aumento en la transparencia y el procesamiento más fácil de la información financiera permite a los participantes del mercado dedicar más tiempo a la información no financiera. El estudio aprovecha una regulación que facilitó el procesamiento de la información financiera para los participantes del mercado. Muestra que después de la regulación, los participantes del mercado tienen más recursos para monitorear otras actividades de la empresa, lo que a su vez, alienta a las empresas a mejorar su comportamiento hacia estas actividades. Mientras que los primeros dos estudios investigan la relación entre

la transparencia corporativa y stakeholders *externos*, el último estudio muestra cómo la transparencia corporativa afecta el comportamiento de los agentes *internos*. Más específicamente, adoptando un modelo estructural dinámico y combinándolo con datos empíricos, el estudio muestra cómo los gerentes usan las inversiones como una señal para influir en la valoración del mercado de valores, particularmente cuando el nivel de transparencia de la empresa es bajo. En general, la tesis demuestra cómo la transparencia corporativa influye en las acciones de stakeholders.

Abstract (Catalan)

La transparència corporativa és freqüentment proposada com una solució als problemes socials. La raó subjacent darrere d'aquesta visió és que en forçar a les corporacions a divulgar el seu impacte en la societat, els stakeholders aprendran sobre les activitats corporatives, canviaran la seva presa de decisions i imposaran un cost a les corporacions el comportament de les quals es considera objetable. Amb aquest fi, en els últims anys, els responsables de polítiques arreu del món han manat cada vegada més a les corporacions a ser més transparents en dimensions específiques amb la suposició que els stakeholders aprendran millor sobre les activitats corporatives. Aquesta tesi investiga la relació entre la transparència corporativa i la presa de decisions dels stakeholders. Més específicament, el primer estudi té com a objectiu explorar si un augment en la transparència de la Responsabilitat Social Corporativa (RSC) canviarà la presa de decisions per un grup d'interessats que teòricament té un interès primordial en aprendre i monitorar la informació de la RSC. Per investigar aquesta relació, el primer estudi explota dades granulars del regulador de seguretat en el treball. L'evidència empírica mostra que quan la informació sobre seguretat en el treball està disponible a través de valoracions, els reguladors ajusten la seva activitat d'aplicació sobre les empreses on l'efecte dissuasiu és major. El segon capítol mostra com un augment en la transparència i el processament més fàcil de la informació financera permet als participants del mercat dedicar més temps a la informació no financera. L'estudi aprofita una regulació que va facilitar el processament de la informació financera per als participants del mercat. Mostra que després de la regulació, els participants del mercat tenen més recursos per monitorar altres activitats de l'empresa, la qual cosa al seu torn, anima a les empreses a millorar el seu comportament cap a aquestes activitats. Mentre que els primers dos estudis investiguen la relació entre la transparència corporativa i els stakeholders *externs*, l'últim estudi mostra com

la transparència corporativa afecta el comportament dels agents *interns.* Més específicament, adoptant un model estructural dinàmic i combinant-lo amb dades empíriques, l'estudi mostra com els gerents utilitzen les inversions com un senyal per influir en la valoració del mercat de valors, particularment quan el nivell de transparència de l'empresa és baix. En general, la tesi demostra com la transparència corporativa influeix en les accions dels stakeholders.

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CHAPTER 1
Introduction

1.1 An Overview

In recent years, regulations targeting corporate transparency have become increasingly widespread. Corporate transparency is seen as a way to encourage corporations to behave in a manner that is not solely in their economic interest. Traditionally, policymakers have relied on other tools such as taxes and penalties to induce behavior that addresses societal issues. Nevertheless, these tools are often considered politically expensive, and governments have implemented alternative solutions such as transparency regulation (Karpoff et al., 2022). Proponents of transparency mandates justify their introduction as they can bring positive externalities to various stakeholders, such as better understanding of corporate activities. Yet, much remains to understand on how an increase in transparency will affect stakeholder decision-making. The main focus of this dissertation is to shed light on whether transparency produces meaningful externalities that may affect how stakeholder reacts to corporate disclosure.

To begin with, this thesis examines whether mandating Corporate Social Responsibility (CSR) transparency information affects stakeholder decision-making. Policymakers and regulators such as the Securities Exchange Commission (SEC) and the EU are considering CSR reporting mandates (Christensen, Hail, and Leuz, 2021) with the stated objective of facilitating monitoring by stakeholders. While there is evidence that investors value CSR (Hartzmark and Sussman, 2019), it remains an open question to what extent non-traditional stakeholders incorporate CSR information (Darendeli et al., 2022). Recent evidence shows that customers may alter their decision-making in response to negative CSR information from firms. In this thesis, I focus on regulators, a stakeholder group that often faces severe resource constraints and is accused of ineffective monitoring mechanisms. In particular, I study whether transparency on CSR activities affects regulators' enforcement activity and, if so, how this information shapes enforcement outcomes.

Next, this thesis investigate whether an increase of transparency and easier financial information processing, produce monitoring externalities for market participants on other sources of information. Information processing costs impede market participants from acquiring and integrating the information available in public disclosures (Grossman and Stiglitz, 1980; Verrecchia, 1982; Merton et al., 1987). Several studies have shown positive capital market effects for market participants when regulation reduces financial information processing costs (Blankespoor, Miller, and White, 2014; Liu, Wang, and Yao, 2014;

Kim, Kim, and Lim, 2019; Blankespoor, 2019). However, little is known about whether these benefits spill over to firms' non-financial information. To extent that an easier processing of financial information will benefit market participants, is plausible to assume that they may devote more time to process other non-financial information. This in turn can affects firms' incentives to improve their behavior toward non-financial activities if they anticipate an increase of level of monitoring. Lastly, this thesis investigates how the level of corporate transparency may incentivize managers' use of investments to affect corporate valuation. Corporate managers design their investment policy to suit the needs of their investors and to showcase the profitability of a firm. However, uninformed investors can be misled regarding the true state of a firm's performance. The more asymmetric information between the two occurs, the greater the chance of misvaluation. More specifically, this thesis shows how low level of transparency may lead managers tend to take advantage of investment as information signal to boost market valuation.

1.2 Economics Consequences of Transparency

Over the past decade, numerous countries have implemented different transparency mandates with the stated objective of generating positive externalities and encouraging good corporate behavior toward the society. These mandates have gained traction notably in the aftermath of scandals. In response, regulators have elevate corporate transparency levels, under the premise that more reporting not only facilitates stakeholder scrutiny but also promotes desirable firm behaviors while deterring undesirable ones (Christensen, Hail, and Leuz, 2021). As societies expand the scope of regulations pertaining to disclosure and transparency beyond just financial reporting, understanding the actual impacts of more transparency is first order-important (Leuz and Wysocki, 2016). For instance, in recent years there has been mounting pressure and advocacy for mandatory CSR reporting by policymakers such as the Securities and Exchange Commission (SEC) and the European Parliament (Directive2014/95/EU; SEC 2021). The stated objective of these mandates is that will lead to better stakeholder monitoring of firms' CSR activities (Fiechter, Hitz, and Lehmann, 2022). Nevertheless, a priori, it is not unclear whether more transparency is associated with more stakeholder learning.

Traditionally, increased transparency has been associated with tangible capital-market benefits, including enhanced liquidity, reduced cost of capital, higher asset prices (or firm value), and potentially improved corporate decision-making.[1] At the same time, transparency brings its (direct and direct) cotst. Often, these costs can occur in the form of proprietary costs, to the extent that multiple stakeholders (e.g., competitors, suppliers, etc.) can use the information provided to investors at the expense of the "more transparent" firm (Breuer and Breuer, 2022). For instance more detailed reporting can also affects firms' innovation incentives (Breuer, Leuz, and Vanhaverbeke, 2019), which with the current discussion around potential CSR mandates, could be even more relevant. All these disclosure costs are not specific to financial reporting but also apply to the current reporting of CSR information. Therefore, when analyzing transparency (and its regulation), is first-order important to capture all potential externalities arising and whether it actually changes corporate behavior.

1.3 Dissertation Structure

As proponents of transparency typically point to the existence of positive externalities (or spillovers) as justification for mandates, the goal of the thesis is to detect the presence of these externalities in the context of increased transparency. Specifically, throughout my thesis, I will investigate whether trans-

[1] See Leuz and Wysocki (2016) for a review.

parency: improves stakeholder monitoring (Chapter II), encourages desirable firm behavior (Chapter III), and affects corporate investment decisions (Chapter IV). Therefore, the dissertation is structured as a monograph based on three related manuscripts. While the central objective of the dissertation is to highlight the effects of transparency, each of the three manuscripts is developed as a standalone research paper addressing one of the above three challenges that arise when policymakers design transparency mandates. Overall, these three manuscripts complement and contribute to the general understanding of the economic consequences of corporate transparency.

The first manuscript examines whether the availability and dissemination of CSR information affect regulatory activity. Regulators are a specific group of stakeholders with severe budget constraints and are often accused of ineffective monitoring. The availability of CSR information may assist regulators in identifying firms whose CSR performance is worse than previously assumed. On the other hand, CSR information disseminated by a third-party rating agency exposes firms to reputational risks, as enforcement activity is embedded in CSR ratings and disseminated to stakeholders. This, in turn, increases the marginal benefit of enforcement activity for regulators due to an increase in deterrence.

The second manuscript investigates whether there are financial information costs that hinder market participants from processing and scrutinizing other sources of information, such as ESG (Environmental, Social, and Governance) information. We examine whether, after relaxing constraints associated with processing financial information, market participants increase their level of monitoring of ESG information.

Lastly, in the third manuscript, we analyze how a low level of corporate transparency may induce firm managers to influence the investor valuation process.

1.4 Objectives and Contributions of Each Manuscript

The main objectives and academic contributions for each of the three research projects presented in this dissertation are summarized as follows:

1.4.1 Study I: "CSR Information and Regulatory Activity"

Contributions: Given that different jurisdictions around the world are considering CSR transparency mandates, my contribution is significant to both the academic community and practitioners. I contribute to the literature by demonstrating that regulators incorporate CSR information. However, CSR information does not necessarily improve regulatory learning. This could be due to CSR ratings lacking additional salient information for the regulator I study, or because the regulator is indifferent to that information. Nonetheless, CSR disclosure by a third-party increases a firm's reputational exposure, as OSHA activity is included in CSR ratings and disseminated to stakeholders. This, in turn, affects the marginal benefit of OSHA enforcement activity on newly covered firms. Evidence from institutional holdings supports my findings, as I observe an increase in stakeholder awareness of workplace safety issues in newly covered firms during the post-period.

1.4.2 Study II: "The Non-Financial Spillovers of Financial Information Processing Costs: Evidence from the U.S. XBRL Mandate"

Contributions: The impact of regulations targeting information processing costs on financial markets and corporate financial decisions has been widely debated and discussed. Over the past decade, numerous studies have examined the effects of such regulations on various market and firm-level financial characteristics, including information asymmetry, market efficiency, earnings quality, institutional ownership, and corporate tax behavior. However, there remains much to be understood regarding the possible frictions that impede market participants from monitoring other types of disclosure due to financial information processing costs. We provide evidence that relaxing the constraints associated with financial information processing capacity can incentivize: 1) market participants to process ESG information and 2) firms to improve their non-financial ESG policies, given the increase in the level of monitoring toward ESG information. When financial disclosures are available for quick processing in a standardized format, market participants are able to pay more attention to non-financial disclosures. Our study is particularly relevant in the ongoing debate on the effectiveness of corporate social responsibility (CSR) and environmental, social, and governance (ESG) mandates. Proponents of non-financial disclosure mandates argue that these would lead to better market outcomes than a voluntary disclosure regime. Therefore, by revealing the underlying frictions that impede firms' incentives to disclose non-financial information, our study provides informative insights.

1.4.3 Study III: "Corporate Investments and Stock Market Valuation"

Contributions: We construct a dynamic structural model to provide insights into how firms' managers' investment decisions can influence stock market valuation. We demonstrate that self-interest-maximizing managers may exploit the information asymmetry between investors and the firm, thus investing beyond the optimal levels to influence investors' valuation process and increase managerial utility. In doing so, we contribute to both the transparency literature and the literature examining the association between corporate investment and stock market valuation (Baker, Stein, and Wurgler, 2003; Polk and Sapienza, 2008; Strobl, 2014). The prevailing view on this relationship suggests that firms issue overvalued stocks and utilize the proceeds for investment, thereby making the stock market an important predictor of real investment decisions (Baker, Stein, and Wurgler, 2003). However, Polk and Sapienza (2008) cast doubt on the equity issuance channel and propose that managers of firms with short-horizon shareholders may prioritize current investment if market participants misprice firms based on observed investment choices. Our framework extends beyond the work of Polk and Sapienza (2008) by demonstrating that a low level of transparency may influence firms' managers to misallocate investments to influence stock market valuation.

1.5 Scholarly Contributions

The first two articles presented in this dissertation are currently being revised for journal submissions. The third article has been published in the *Journal of Business Finance Accounting*. These articles have been presented at various international conferences and seminars in leading universities. Details about each of their authorship and conference presentations are summarized in Table 1.1. The first manuscript is solo-authored. The second is co-authored with Dr. Mohammed Zakriya, and the last one is co-authored with Dr. Shushu Liao.

Table 1.1 Scholarly contributions from the dissertation

Title	Authorship	Current Status	Conference/Seminar Presentations
CSR Information and Regulatory Activity	solo-authored	Working Paper, Journal submission planned for fall 2024	- 2024: University of Washington, Tilburg University, Erasmus University. - 2023: lab class University of Chicago, ESADE, Emerging Scholar in Accounting Conference, EAA Talent Workshop, CUNEF, Universitat Pompeu Fabra, University of Amsterdam, ESSEC, IE, SKEMA
The Non-Financial Spillovers of Financial Information Processing Costs: Evidence from the U.S. XBRL Mandate	Marco Errico and Mohammed Zakriya	Working Paper, Journal submission planned for Winter 2025.	- 2023: EAA Annual Meeting, lab class University of Chicago - 2022 IESEG, ESADE
Corporate Investments and Stock Market Valuation	Marco Errico Shushu Liao	Published Paper, *Journal of Business Finance & Accounting* 2023.	

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CHAPTER 2

CSR Information and Regulatory Activity

2.1 Abstract

I investigate how regulators adjust their enforcement activity in response to firm's corporate social responsibility (CSR) information. Using exogenous variation in CSR ratings coverage and enforcement data from the U.S. Occupational Safety and Health Administration (OSHA), I find that regulators increase enforcement activity on newly CSR covered firms. I explore two non-mutually exclusive mechanisms that can explain my findings: regulatory learning and firms' reputational exposure after the CSR coverage. My results are consistent with firms' CSR-related reputation and deterrence being a more

plausible channel. CSR disclosure by a third-party increases firm's reputational exposure as OSHA activity will be impounded in CSR ratings and disseminated to stakeholder. In turn, this affects OSHA marginal benefit of its enforcement activity on newly covered firms. Evidence from institutional investor holdings corroborates the reputational mechanism. Finally, I document evidence of a spill-over effect on peer firms as they exhibit increased compliance efforts following a violation by a focal firm. Collectively, my findings provide novel insights on the role of CSR information in regulatory activity.

2.2 Introduction

Does the availability and dissemination of corporate social responsibility (CSR) information affect regulators' enforcement activity? If so, how does this information shape enforcement outcomes? CSR information can capture public perceptions of firms, which, if negative, can affect stakeholders' decision making (Dai, Liang, and Ng, 2021; Darendeli et al., 2022; Christensen et al., 2023). While regulators are important stakeholders that monitor firms' compliance on different dimensions, their enforcement actions are often inefficient. For example, in 2022, the Occupational Safety and Health Administration (OSHA), a prominent U.S. regulator responsible for workplace safety, inspected less than 0.5% of establishments under its jurisdiction because of budget constraints. Despite regulators maximizing the efficiency of their enforcement activities by scrutinizing firms' public information acquired from alternative sources (Bozanic et al., 2017; Li et al., 2022; Lerman, Steffen, and Zhang, 2022; Li and Wang, 2022), little is known on whether and how the availability and dissemination of CSR information affects regulators' monitoring. Shedding light on the existence of this relationship is of first-order importance in the current context as, both in the U.S. and European Union, policymakers are considering mandated CSR reporting due to increased stakeholders' demand for monitoring firms' CSR activities (Fiechter, Hitz, and Lehmann, 2022; Christensen, Hail, and Leuz, 2021).

In this paper, I investigate whether the availability and dissemination of CSR information affects the workplace safety regulator's enforcement activity, while also identifying some of its underlying mechanisms. Identifying the impact of CSR information on regulatory action is empirically challenging because, a firm's CSR information is endogenous. I overcome this challenge by examining the impact of regulatory activity on a firm when its CSR information dissemination is initiated by a third-party rating agency. In 2017, Refinitiv (formerly known as Thomson Reuters) Asset4, a prominent CSR ratings provider, significantly expanded its index-based coverage of U.S. companies. This expansion resulted in the inclusion of CSR ratings for firms listed in the Russell 2000 index, in addition to the previously covered Russell 1000 firms. Meanwhile, for the same Russell 2000 firms, there were neither any changes in ratings coverage by other CSR data providers, nor any changes in CSR disclosure mandates. Darendeli et al. (2022) show that this CSR rating coverage affected customer-supplier contracting decisions. In contrast, I focus on regulatory decision making and enforcement activity on a focal firm instead of the effects on its supply chain participants.

A priori, availability and dissemination of new information may benefit regulators by reducing information asymmetry. I hypothesize that this could potentially be explained by two non-mutually exclusive mechanisms: 1) regulatory learning and 2) deterrence effect. As for the first channel, the CSR information coverage may represent an integral, incremental, and salient source of information. Indeed, Asset4 employs more than 700 content research analysts that are trained to collect CSR information from a wide variety of public sources. This information is then condensed into ratings and disseminated. Therefore, CSR rating providers such as Asset4 act as intermediaries that can reduce processing costs for stakeholders (Blankespoor, deHaan, and Marinovic, 2020), particularly for regulators such as OSHA that may not have the resources to incorporate all available information into enforcement activities. Moreover, an increased level of harmonization from CSR ratings can also improve OSHA's ability to compare CSR information across firms under its jurisdiction (Christensen, Hail, and Leuz, 2021), targeting worksites whose safety performance are worse than previously assumed. As for the second channel, regulatory activity such as inspections are costly and the deterrence effects only through inspections are negligible. For this reason, OSHA takes into account factors such as information dissemination to deter firms from future violations. Deterrence is an integral part of enforcement activity as it affects the regulator's marginal benefit from conducting an inspection (Johnson, 2020; Leonelli, 2021). CSR rating coverage imposes a reputational cost on the firm as regulatory activity will now be impounded in CSR ratings and disseminated to stakeholders. Indeed, analysts and investors react negatively to negative CSR news and subsequent ratings downgrades (Krüger, 2015; Benlemlih and Bitar, 2018; Lee, Palmon, and Yezegel, 2018; Nofsinger, Sulaeman, and Varma, 2019; Hartzmark and Sussman, 2019). Therefore, the CSR rating coverage expansion may incentivize OSHA to adjust enforcement activity toward newly covered firms in order to maximize deterrence. However, it is ex-ante unclear which of these two channels dominates.

By employing a difference-in-differences specification (DiD), I study the effect of CSR coverage expansion on regulatory activity over the period from 2014 to 2020, with the expansion of Asset4 coverage in 2017 as the treatment year. Accordingly, the treatment group comprises of Russell 2000 index constituents. The Russell 1000 index constituents form the control group as these firms were always covered by Asset4 during my sample years. Following Chapman, Miller, and White (2019), Darendeli et al. (2022), and McMullin and Schonberger (2022), I employ entropy balancing weights to minimize pre-treatment differences between treated and control firms while, at the same time, preserving the entire sample. I proxy for regulatory activity using data from OSHA. Specifically, I measure regulatory activity by analyzing the annual count of OSHA inspections, and the total volume of workplace safety violations associated with these activities at the firm level.[2]

On average, Russell 1000 firms have more OSHA inspections and are reprimanded more for OSHA guideline violations than Russell 2000 firms. However, following the CSR coverage expansion, I find that OSHA enforcement activity targeting Russell 2000 firms increases significantly with almost 7.25% more inspections and 11.6% more violations. These baseline results remain robust despite controlling for additional unobservable factors including industry-trends, accounting for time- and firm- specific heterogeneities, or using alternative regression specifications controlling for potential confounding factors as the coefficient for the DiD term remains statistically and economically significant.[3]

Next, I also confirm the internal validity of my main inferences by inspecting pre-treatment trends and implementing an additional test using an alternatively stricter identification through the application of quasi-experimental regression discontinuity. Specifically, I repeat my analyses by restricting the sample to the top 5%, 10%, and 12.5% Russell 2000 firms in terms of their size. This corresponds to around 100, 200, or 250 treatment group firms, respectively. Accordingly, the smallest 100, 200, or 250 firms belonging to Russell 1000 are correspondingly assigned to the control group. My approach is akin to

[2] While the granularity of my data allows me to observe inspections and violations at the facility level, I employ firm-level aggregation for these measures in my main analysis to account for the fact that CSR information is at the firm level.

[3] While in the main analysis I employ entropy balancing to account for the differences between the composition of the treatment and control groups, the results are unaffected with alternative weighting scheme (i.e., using analytical weights from entropy balancing instead of probabilistic weights), with propensity-score matching (PSM), or with unmatched samples.

a DiD regression discontinuity design, allowing me to minimize any differences between the treated and control groups' covariates (i.e., importantly in this case, their size differences). The main results are confirmed even when these alternative comparable samples are used. In fact, the economic significance of the DiD coefficients across all the samples in these estimations is even larger than those found in the more conservative baseline models.

I next explore two non-mutually exclusive mechanisms that can drive my estimates. On the one hand, if the CSR information represents an additional salient source of information for regulatory activity, I should expect enforcement activity to be more concentrated in at least some firms whose CSR performance is lower than what OSHA had previously assumed. I proxy for OSHA learning incentives by partitioning the sample into low vs. high *revealed* CSR scores during the treatment year. I do not find enforcement intensity to be concentrated in low CSR performance firms after the treatment year. These results are unaffected even with more salient CSR subcategories such as the Social or Workforce Safety score. Moreover, I implement a complementary test in which I separately examine a subset of treated firms where OSHA has plausibly higher information asymmetry *and* higher learning incentives from CSR information. If the CSR information represents additional and salient source of information, enforcement intensity should be directed toward this group of firms. By analyzing firms that were not inspected in the pre-period (thus, firms with plausibly higher information asymmetry) and with low revealed CSR performance in the treatment year, I do not find any strong evidence supporting the learning channel even when OSHA learning incentives are high.

On the other hand, if deterrence considerations are driving regulatory activity, I should expect that OSHA prioritizes firms with high reputational exposures after the CSR coverage expansion because there is a larger deterrence effect on these firms.[4] This channel relies on the assumption of OSHA's awareness of the importance of workplace safety for CSR rating consideration, which has been shown by a recent white paper (OSHA, 2016). I proxy for firms' reputational exposures (and related deterrence propensities) by partitioning the sample into low vs. high CSR media coverage, analysts coverage, and firm size during the treatment year. I find strong and robust evidence of regulatory activity concentrated on firms which have high CSR media exposure, high number of analysts covering them, and a plausibly higher media visibility due to their larger size.

Next, I corroborate my findings on OSHA's proclivity for deterrence effects by providing evidence of an increase in stakeholder attention toward safety issues after the CSR coverage. Evidence shows how institutional investors care about CSR information and may invest according to their CSR preferences (Petersen and Vredenburg, 2009; Nofsinger, Sulaeman, and Varma, 2019; Chen, Dong, and Lin, 2020). I compare changes in institutional ownership for firms before and after the CSR information coverage following OSHA violations. Particularly, I am able to isolate the incremental effect of OSHA violations on institutional investor behavior when they are disseminated through CSR ratings. In the post period, I find a significant decrease in institutional investor holdings for the treated firms following OSHA violations, but not for those in the control group. This indicates that stakeholders are more aware and sensitive to safety issues when they are impounded and disseminated through CSR ratings, which is consistent with the reputational exposure mechanism.

Finally, as my results suggest that deterrence considerations are driving OSHA enforcement activities following the CSR ratings coverage, I examine whether

[4] I conduct preliminary tests on the information content of CSR ratings and find a negative association between firm's OSHA violations and subsequent CSR ratings downgrades (see Section 2.6.2). This further emphasizes OSHA's potential use of deterrence through CSR ratings.

this deterrence is transmitted to peer firms. In order to amplify deterrence, regulators choose a wide variety of policies. For instance, OSHA publicizes violations and enforcement outcomes, which can lead to more compliance in peer firms (Johnson, 2020). As workplace misconduct are impounded in CSR ratings and the associated scores are disseminated to the public, peer firms that observe a violation from a focal firm may improve their compliance to avoid reputational damage after the CSR coverage. I find evidence supporting this notion as the CSR information coverage leads to less future violations in peer firms following a violation by a focal firm, with this effect mainly concentrated in newly covered firms.

This study's findings make several contributions. I contribute to the literature showing the effect of CSR information on stakeholder decision making (Christensen, Hail, and Leuz, 2021; Darendeli et al., 2022; Christensen et al., 2023). My paper differs from Dai, Liang, and Ng (2021) and Darendeli et al. (2022) that focus on how corporate customers adjust their supplier contracting following CSR rating coverage. In this paper, I provide novel evidence on whether and how CSR information influences workplace safety regulator monitoring, a stakeholder group that has a first oder interest in monitoring CSR compliance. Second, I contribute to the literature that studies deterrence mechanisms employed by regulators (Johnson, 2020; Leonelli, 2021; Huang et al., 2022). Given budget constraints, regulators are facing difficulties in monitoring firms' compliance (Berkowitz, 2019). Therefore, deterrence mechanisms are an important means to increase the effectiveness of regulatory activity. Third, I contribute to the literature on information processing cost (Blankespoor, deHaan, and Marinovic, 2020). Specifically, by showing institutional investor sensitivity to safety violations only when are disseminated trough CSR ratings, I document awareness costs associated with safety issues. An alternative source of processing cost may be related to acquisition and integration costs. Nevertheless, OSHA violations are publicly available on regulator's website making them easy to access and to integrate in valuation decisions. Therefore, the results suggest awareness costs as plausible explanation of institutional investor reaction following a violation in the post period. Fourth, I contribute to the literature that examines real effects of CSR disclosures (Christensen, Hail, and Leuz, 2021; Christensen et al., 2017; Fiechter, Hitz, and Lehmann, 2022). Finally, my study contributes to the literature studying the role of public information for regulatory activity (Bozanic et al., 2017; Li et al., 2022; Lerman, Steffen, and Zhang, 2022).

2.3 Theoretical Motivation & Institutional Background

2.3.1 The Importance of CSR Information

Regulators can benefit by incorporating available public information into their enforcement actions, specifically when it comes to tax-related disclosures (Bozanic et al., 2017), firms' voluntary disclosures (Li et al., 2022; Lerman, Steffen, and Zhang, 2022), and mandatory financial reporting (Li and Wang, 2022). However, the importance of CSR information for regulatory enforcement has yet to be established. CSR has become increasingly significant for businesses, especially in the era of increasing climate risks (Krueger, Sautner, and Starks, 2020). It refers to a company's commitment to conducting its operations in an ethical and sustainable manner, taking into account the interests of various stakeholders beyond its shareholders (Christensen, Hail, and Leuz, 2021). To establish the importance of CSR information dissemination for regulators, I first present the arguments from literature on the importance of CSR for firms, investors, and other stakeholders including regulators, and then focus specifically on why CSR information may be pertinent to regulatory activity.

CSR could offer several key advantages for firms. It can enhance a company's reputation and brand image, leading to increased customer loyalty and trust

(Lins, Servaes, and Tamayo, 2017) and enhanced value chains (Dai, Liang, and Ng, 2021; Darendeli et al., 2022). Alternatively, CSR initiatives can help businesses create value by attracting and retaining talented employees (Edmans, 2011), by fostering innovation that drives sustainable product development (Cook et al., 2019), by inhibiting earnings management (Kim, Park, and Wier, 2012; Wang, Cao, and Ye, 2018) and improving firms' tax compliance (Lanis and Richardson, 2012; Hoi, Wu, and Zhang, 2013), and by promoting efficiency-driven cost savings that can benefit firms in the long run (Ferrell, Liang, and Renneboog, 2016; Benlemlih and Bitar, 2018). Moreover, CSR also enhances shareholder value by mitigating risks (Kim, Li, and Li, 2014; Dumitrescu, El Hefnawy, and Zakriya, 2020; Dumitrescu and Zakriya, 2021), improving brand reputation (Hur, Kim, and Woo, 2014; Bardos, Ertugrul, and Gao, 2020), and fostering stakeholder trust (Du, Bhattacharya, and Sen, 2011; Lins, Servaes, and Tamayo, 2017). Given these potential long-run benefits of CSR for firms, CSR has gained significant importance for investors in recent years (Amel-Zadeh and Serafeim, 2018). While some investors see CSR as a potential risk management tool (Eccles, Kastrapeli, and Potter, 2017) that allows them to generate superior returns (Starks, Venkat, and Zhu, 2017; Kim et al., 2019) meeting their pecuniary motives, others target good CSR firms due to their specific ESG preferences (Pástor, Stambaugh, and Taylor, 2021; Pedersen, Fitzgibbons, and Pomorski, 2021).

2.3.2 CSR Information and Regulatory Activity

Availability of CSR information can complement existing regulations and fill gaps in areas where legislation may be lacking or insufficient (Liang and Renneboog, 2017). By asking companies to mandatorily disclose their CSR practices or by encouraging companies to voluntarily engage in socially responsible practices, regulators can promote higher standards and address emerging issues that may not yet be adequately covered by other financial or accounting regulations (Fiechter, Hitz, and Lehmann, 2022; Rajgopal and Tantri, 2023). When firms adopt CSR disclosures for the purpose of legitimacy (Cho and Patten, 2007), CSR information from such disclosures can also, in parallel, help regulators monitor and enforce compliance with existing regulations. Companies that prioritize CSR are more likely to maintain robust internal systems and procedures for tracking and reporting their social and environmental impacts (Rodgers, Söderbom, and Guiral, 2015), making it easier for regulators to assess their compliance with relevant laws.

In light of above arguments, I hypothesize that CSR information can play a crucial role in regulatory enforcement actions by providing valuable insights into a company's compliance with CSR standards. When regulatory authorities investigate potential violations, CSR information can help determine the extent to which a company adheres to relevant regulations and industry best practices. For example, CSR reports may reveal information about a company's environmental impact, labor practices, supply chain transparency, or community engagement efforts (Christensen et al., 2017; Pinnuck et al., 2021). By examining this information, regulatory bodies can assess the level of compliance, identify areas of concern, and take appropriate enforcement actions.

CSR information is particularly important for regulatory enforcement because it offers a comprehensive view of a company's commitment to responsible business practices. It allows regulators to evaluate whether a company is meeting its obligations beyond mere legal compliance. By analyzing CSR reports and related data, regulators can assess whether a company is proactively addressing social and environmental issues, mitigating risks, and implementing effective governance structures. This information can assist in determining the severity of any non-compliance and shaping the appropriate enforcement response, such as fines, penalties, or corrective actions.

Furthermore, CSR information provides transparency and accountability, both of which are essential for effective regulatory enforcement (Weil, 1996). It allows stakeholders, including regulatory bodies, to evaluate a company's performance against its stated commitments and track progress over time. This information can uncover discrepancies between a company's public image and its actual practices, enabling regulators to hold the company accountable for any misleading claims or deceptive practices. By considering CSR information in regulatory enforcement, authorities can foster a culture of transparency, promote responsible business behavior, and incentivize companies to prioritize ESG considerations in their operations.

2.3.3 Learning versus Deterrence

On one hand, regulators can leverage CSR data and their reporting to gain insights into industry trends, identify areas of concern, and accordingly shape future policies or regulations (i.e., the *learning* effect). On the other hand, regulators can encourage CSR engagement by directly mandating CSR disclosures (Chen, Hung, and Wang, 2018) or indirectly providing incentives for regulatory compliance by either rewarding companies that demonstrate exemplary social and environmental performance or punishing those that do not comply to the regulatory standards (i.e., the *deterrence* effect). Thus, in general, availability and dissemination of new CSR information may benefit regulators by reducing information asymmetry or by increasing compliance through deterrence of potential future violators.

Accordingly, I hypothesize that these two non-mutually exclusive channels, i.e., learning and deterrence, are vital for the utility of CSR information for regulatory enforcement.

As for the learning channel, CSR information may be useful for regulators to obtain a comprehensive understanding of a company's adherence to CSR standards and responsible business practices. Regulatory authorities examine alternatively available public information to assess firm's compliance and optimize enforcement actions (Bozanic et al., 2017; Li et al., 2022; Li and Wang, 2022). CSR information can complement the set of information that regulator scrutinizes, especially when it is standardized and is disseminated or audited by a third party. The CSR information from Asset4 that I consider in my experimental setting may represent a salient source of information that benefits the regulator. Especially for regulators such as OSHA that may not have the resources to collect and process firms' CSR disclosures on its own, Asset4's CSR ratings coverage can help it forego some of the information processing costs as they make CSR information available in a standardized form. Furthermore, the dissemination of harmonized CSR ratings by third parties could also be beneficial for OSHA in terms of its ability to compare and contrast CSR information across firms (Christensen, Hail, and Leuz, 2021). This can help improve the efficiency of enforcement activities as OSHA can potentially identify and target workplaces where the safety performance is worse than previously reported.

Since regulatory activity such as OSHA inspections are costly, deterrence effects only through inspections are minimal, especially considering the regulator's budget constraints. Therefore, OSHA might exploit the increase in CSR information dissemination after 2017 to bolster the deterrence effect among firms under its jurisdiction given that deterrence is key to maximize the regulator's marginal benefit per inspection (Leonelli, 2021). Moreover, if regulatory activity itself gets disseminated through CSR ratings, this will further increase effectiveness of regulatory actions as firm will face increase of reputational exposure that affects not only the focal firm but also its peers (Johnson, 2020). In other words, CSR ratings coverage can amplify the reputational exposure of newly covered firms if regulatory activity gets communicated to stakeholders through these ratings (Krüger, 2015; Benlemlih and Bitar, 2018; Lee, Palmon, and Yezegel, 2018).[5] In response, this may have incentivized OSHA to recalibrate its attention to some of the newly covered firms in order to maximize deterrence effects. Note that deterrence mechanism can be self-reinforcing in some ways as it can further have a snowballing effect when it promotes sustainability actions among peer firms leading to a virtuous cycle that supports the well-being of society and the environment.

2.3.4 OSHA Activity

The Occupational Safety and Health Administration (OSHA) is a regulatory agency within the United States Department of Labor. It was established in 1970 with the primary goal of ensuring safe and healthy working conditions for employees across various industries and sectors. Despite a debate surrounding the effectiveness of OSHA in the past (Gray, 1987; Viscusi, 1979, 1986), its crucial role in reducing workplace injuries, illnesses, and fatalities by enforcing occupational safety and health standards has been widely established in recent years (Weil, 1996).

OSHA is a good setting to explore the impact of CSR information on regulatory activity for several reasons. Firstly, the granularity of OSHA data allows me to observe enforcement proactive behavior measured by inspections. Second, violations of workplace safety are impounded in CSR ratings, specifically in the social and workforce dimensions and this may potentially increase the marginal benefit of conducting an inspections given the importance of deterrence for OSHA. Third, I can observe OSHA budget that is constant over the period of my analysis, therefore potentially rule out any increase of OSHA activity driven by increments in OSHA budget.[6] Despite its critical role in safeguarding

[5] OSHA compliance guidelines are mainly directed toward workplace safety. Alongside the importance of safety considerations for firms given their potential reputational relevance (i.e., external impact), these can also be a vital factor for firms' operational decisions through litigation exposure, talent retention, etc. (i.e. internal impact).

[6] Information of OSHA budget is available at https://www.dol.gov/general/budget/archive.

worker safety, OSHA often faces significant budget constraints that impact its ability to fulfill its mission effectively. The agency's budget is determined through the federal appropriations process, which can be influenced by various factors, including changing political priorities and economic conditions. For example, during the fiscal year 2022, OSHA conducted 31,820 inspections out of over 8 million worksites under OSHA's jurisdictions.[7]

OSHA officers have some degree of discretion related to inspections. Indeed, inspections can be either a result of a triggering events (e.g. injuries, accidents or whistleblowing) or they are determined based on guidelines provide at the state level (Raghunandan and Ruchti, 2023). During an inspection, an OSHA inspector undertakes a comprehensive walk-around of the business premises, documenting any safety-related issues that might be relevant. Subsequently, the inspector assesses whether any violations have occurred. More specifically, violations are determined to exist when four specific conditions converge (Raghunandan and Ruchti, 2022): (i) the identification of a potential hazard within the workplace, (ii) the hazard's contravention of a relevant OSHA standard, (iii) the employer's prior knowledge of the applicable standard, and (iv) a substantiated case of employee exposure to the identified hazard.

Violations may lead to reputational damage for the firm as severe violations are publicized by OSHA through press releases and sent to local media and industry press for further dissemination (Johnson, 2020). The inclusion of violations in CSR ratings estimation enhances the employer's exposure to reputational damage and potentially amplifies the incremental benefits of conducting inspections. Moreover, as discussed in Section 2.1, investors may also have their own CSR preferences (Starks, Venkat, and Zhu, 2017; Kim et al., 2019; Bermejo, Rizzo, and Zakriya, 2022) and, hence, impound CSR ratings

[7] OSHA historical inspections statistics are available at https://www.osha.gov/enforcement/2022-enforcement-summary.

into their investment decisions (Pástor, Stambaugh, and Taylor, 2021; Pedersen, Fitzgibbons, and Pomorski, 2021). This implies that any change in CSR ratings that accompany the reprimands issued to OSHA violators should be consequential to firms' equity value when investors react to these changes in their investment decisions. This also indicates that OSHA's regulatory actions can become marginally more important when a firm is covered by CSR ratings.

2.3.5 Thomson Reuters Asset4 Expansion

Thomson Reuters Asset4 provides CSR information for more than 9,000 publicly listed firms globally since 2002. With over 700 content research analysts and experts to scrutinize and collect CSR information, Asset4 has one of the largest CSR content collection operations in the world. Asset4's analysts process numerous publicly available information sources with the aim of providing updated, objective, and comprehensive coverage. There are over 630 CSR indicators that Asset4 analysts process manually and apply in their analysis. Based on publicly-reported information, each measure is reviewed and standardized in order to make it comparable across the entire range of Asset4 universe. CSR measures are grouped into 10 categories that are combined into the three pillar scores (i.e., environmental, social, and governance pillar scores) and the overall CSR score, which is a reflection of the company's CSR performance, commitment and effectiveness. All CSR scores are updated on a weekly basis. Figure 2.1 provides a snapshot of historical changes in Asset4 data coverage as provided by Thomson Reuters.[8]

Asset4 is one of the prominent CSR rating providers (Berg, Koelbel, and Rigobon, 2022) and ranked among top CSR data providers in terms of quality and usefulness of ratings (Rate the Raters, 2023). Asset4 ratings are employed

[8]For a detailed explanations on how Asset4 CSR analysts collect information and how the different ratings are constructed, see Refinitiv Eikon (2021)

by institutional investors to assess their CSR related-riskiness of their investment portfolios and a growing number of academic studies have analyzed them (Dyck et al., 2019; Dai, Liang, and Ng, 2021; Darendeli et al., 2022). In 2017, Asset4 expanded its CSR ratings coverage, providing in addition to the previously covered Russell 1000 firms, CSR information of all firms belonging to the Russell 2000 index. This has been the largest coverage increase, within one year, in the history of Asset4. This coverage expansion represents a plausible exogenous variation to CSR information dissemination. In particular, commercial rating providers such as Asset4 collect information from a variety of sources and condense it into ratings that are disseminated to stakeholders. In essence, they (i) reduce information processing costs for stakeholders (Blankespoor, deHaan, and Marinovic, 2020) and (ii) increase firms' visibility and reputational exposure. As for the latter corporate scandals may emerge after regulatory actions are impounded in the ratings (Kjaer and Kirchmaier, 2023).

2.4 Data & Research Design

2.4.1 Data

My sample period covers a seven-year window around the Asset4 coverage expansion in 2017 (i.e., 2014–2020). I obtain OSHA inspection and violation data from the US Department of Labor's Enforcement Data webpage.[9] The data contains information regarding the establishment being inspected, its date, and whether there have been any violations detected following an inspection. Given that the inspections and violations are at the establishment level but CSR information is at the firm level, I aggregate my data at the firm level

[9]Data are public available at https://enforcedata.dol.gov/views/data$_c$*atalogs.php*

following Raghunandan and Ruchti (2022).[10] I obtain the data on firms' fundamentals from Compustat, stock price data from CRSP, analysts data from IBES, CSR ratings from Asset4, Russell indexes constituents from Bloomberg, media exposure scores from RepRisk, and institutional investor holdings from Thomson Reuters 13f data. I exclude financial institutions. Appendix A provides definitions of all variables included in my analyses.

2.4.2 Descriptive Statistics

Table 2.1 provides the descriptive statistics (Panel A) for all the main variables included in our analyses as well as information on the sample composition across industries (Panel B), indicating that treated and control firms have similar industry distributions. For the ease of interpretation, I report non-transformed variables for *Inspections* and *Violations*. The mean (standard deviation) of the number of inspections is 2.96 (8.53) for Russell 1000 firms and 0.60 (1.98) for Russell 2000 firms. The average number of violations is 3.71 (10.84) for Russell 1000 firms and 1.00 (3.94) for Russell 2000 firms. Note that in my main analyses I consider missing inspection or violation records in OSHA database as "true zeros," implying that these firms were either not inspected or did not receive any violation reprimand in that year.[11] In my sample of Russell 1000 and 2000 firms during the experimental period, approximately 70% (76%) of the observations represent firms that weren't inspected (caught for any violations). These proportions are marginally smaller for Russell 1000 firms than for Russell 2000 firms. Overall, both these sets of trends indicate

[10] To address the concern that systematic differences between inspected and non-inspected firms affect my estimates, I implement additional tests repeating my primary analyses by restricting the sample to firms with at least one inspection in my sample period. The results are reported in table 2.A.8 and remain qualitatively similar.

[11] While the non-inspected or non-violating firm-year observations are important for my identification strategy, as a robustness check I alternatively re-estimate my main results by omitting these observations as explained in section 2.6.1. The results remain qualitatively similar despite the loss of a significant sample size.

that Russell 1000 firms (control group) receives, on average, more inspections as well as violation reprimands. Furthermore, in Figures 2.2 and 2.3, I show the average number of inspections and violations respectively, over the sample period, for the two groups. To account for the differences in average inspections and violations across the two groups, I plot the demeaned values each year so that their relatively trends can be closely examined.[12] For both inspections and violations, these figures provide early evidence supporting the assumption of parallel trends before the treatment period as the declining trend observed for the average number of inspections and violations are relatively similar up to 2017 (the treatment year), following which the two lines diverge and move in opposite directions.

As for control variables, I find a sizable difference in the values for the Russell 1000 and Russell 2000 firms, in term of Size, ROA, Capex, and Leverage with Russell 1000 firms expectedly having significantly higher values for these variables. Moreover, larger firms covered in Russell 1000 also tend to have a higher ESG Score as well as its two CSR related sub-scores, i.e., Environmental (ENV) and Social (SOC) Scores consistent with findings in prior literature (for e.g., Drempetic, Klein, and Zwergel, 2020).

2.4.3 Research Design

In my empirical tests, I implement a difference-in-differences (DiD) model to study the effect of CSR information on regulatory activity. The following equation estimates my baseline model:

$$RegActivity_{i,t} = \beta_0 + \beta_1 TreatxPost + \sum \beta_K Controls_K + \sum \beta_J FixedEffects_J + \epsilon_{i,t} \tag{2.1}$$

[12]This is done by first calculating the average number of inspections (violations) for each group over the years and then demeaning them using their time-series averages before plotting them for each year.

Where i indicates firm and t indicates time. The coefficient $TreatxPost$ captures the effect of CSR coverage expansion on regulatory activity for Russell 2000 firms at the time of Asset4 expansion when compared to the Russell 1000 firms.

To proxy for *RegActivity*, I consider the natural logarithm of one plus all OSHA inspections (*Inspections*) and the the natural logarithm of one plus all violations detected by OSHA (*Violations*) in a given firm-year. I include firm fixed effects to control for unobservable and time-invariant firm characteristics. Moreover, year fixed effects are included to account for time-specific heterogeneities. OSHA inspections can be palnned or not planned. Planned inspections are randomized each year, but are conducted based on some specific factors such as industry decided at state level. Therefore, each year OSHA might prioritize some industry relative to others to inspect.[13] Therefore, in an alternative estimation, I include industry-by-year fixed effects to absorb any potential confounding variation that may arise due to this policy.[14]

Controls include financial variables that affect workplace safety as suggested by the literature (Raghunandan and Ruchti, 2022; Cohn and Wardlaw, 2016; Caskey and Ozel, 2017). These include firm's assets (*Size)*, return on assets (*ROA*), property, plant, and equipment (*PPE*), capital expenditure (*Capex*), firm's leverage (*Leverage*), the level of cash (*Cash*), market to book ratio (*MB*), changes in sales (*Sales Growth*) and research and development expenses (*R&D*). To mitigate concerns that outliers drive my estimates of the economic magnitudes, I winsorize the dependent variables at the 99^{th} percentile.[15] Finally, to minimize systematic differences between treated and control group,

[13]For a comprehensive overview on inspections type, methods as well as target selection by OSHA, refer to Field Operations Manual available at https://www.osha.gov/enforcement/directives/cpl-02-00-164.

[14]I define industry segments as 2-digit SIC industry classification.

[15]The results remain unchanged by winsorizing at 97^{th} or 95^{th} percentiles. These tests confirm that the results are not driven by outliers in the distribution of dependant variables.

I implement entropy balancing and estimate equation (2.1) based on entropy balancing weights (Heckman et al., 1998; McMullin and Schonberger, 2022). All control variables are winsorized at the 1^{st} and 99^{th} percentiles. Standard errors are clustered at firm level.

2.5 Main Results

2.5.1 Baseline Results

In the first set of my empirical tests, I examined whether the CSR information affects regulatory activity. Table 2.2 reports the findings from estimating equation (2.1) for my two outcome variables: inspections (Panel A) and violations (Panel B). In both Panels A and B, I estimate three DiD specifications: without fixed effects (column 1), with firm and year fixed effects (column 2), and with firm and industry-year fixed effects (column 3). To mitigate concerns that observable differences in the pre-period are driving my estimation (Hainmueller, 2012; McMullin and Schonberger, 2022), I employ entropy balanced sample based on pre-treatment levels of firm's characteristics including *Return on Assets*, *Cash*, and *Sales Growth* as well as its industry membership using 2-digit SIC code.[16]

These results provide several insights. First, the average treatment effects (i.e., *TreatxPost* coefficients) reported in all of the columns, are positive and statistically significant at 1% level for both my main outcomes of interest. These results indicate that, on average, regulatory activity increases after the CSR coverage. Second, my average treatment effects remain stable across all specifications. In terms of economic significance, in the most restrictive

[16] As summarized in Appendix Table 2.A.2, the treatment and control groups are different on several covariates. Given that my treatment indicator is based on size, I cannot include *Size* as an additional control to absorb differential pre-post size trends that may confound my results in my DiD specification. Nevertheless, in section 2.3, I address this potential concern related to size by looking at the discontinuity in Russell composition cut-off.

specification (column 3); after the CSR coverage, treated firms receive almost 7.25% (11.6%) more inspections (violations) relative to control firms.[17] Note that the economic magnitudes reported for both inspections and violations in Table 2.2 represent a relatively lower bound of estimates as treated firms are, on average, smaller and subject to fewer inspections. All my baseline results remain robust even when I employ industry-clustered standard errors instead of firm-level clustering (see Appendix Table 2.A.3).

While I follow Chapman, Miller, and White (2019) and Darendeli et al. (2022) in employing entropy balancing to account for pre-treatment differences between the treatment and control group firms without compromising on the sample size, there might be concerns about the application of entropy balanced weights driving my results. Therefore, I re-estimate my main results (a) using unbalanced sample (i.e., unweighted), (b) using analytic weights instead of probability weights, and (c) using an alternative covariate balancing technique, i.e., propensity score matching. The results for each of these robustness checks are presenting in Appendix Tables 2.A.4, 2.A.5, and 2.A.6, respectively. Similar to Table 2.2, I report the results for inspections (Panel A) and violations (Panel B). The coefficients for my main variable of interest *TreatxPost* remain relatively stable across all these alternative specifications (see Figures 2.6a and 2.6b), especially with main model that includes both firm and industry-year fixed effects (column 3).

2.5.2 Parallel Trends and Placebo Test

The main assumption of my identification strategy is that inspection and violation rates across Russell 1000 and Russell 2000 firms would have been similar

[17] Since the two main dependent variables are log-transformed, the interpretation of my estimated coefficients requires exponential transformation. For instance, the coefficient for inspections in Column (3) of Table 2.2 Panel A is 0.07, which translates to $e^{0.07} - 1 = 7.25\%$ more inspections for treated firms after the CSR coverage expansion in 2017.

in the absence of the CSR coverage expansion. In Figure 2.4 and 2.5, I visualize the estimated coefficients of inspections and violations respectively over the event time (2016 serves as the benchmark). Figure 2.4 and 2.5 suggest that treated and control firms have similar enforcement activity patterns during the pre CSR coverage period, suggesting that the parallel trend assumption is valid. Treatment effects effectively materialize following the CSR coverage expansion as suggested by the increase of both number inspections and violations for Russell 2000 firms relative to control group. Overall, the estimated coefficients over event time suggest the validity of the parallel-trends assumption.

I additionally run a placebo test to confirm the validity of my main results and to see if parallel trends are observed when a placebo treatment is assumed instead of the actual CSR coverage expansion. I start by shifting my sample period from 2014–2020 to 2011–2017. The year 2011 is chosen as the starting year for this placebo test because it is the year when Asset4 initiated their coverage of Russell 1000 firms (see, Figure 2.1). Accordingly, a *placebo CSR rating coverage expansion* is assumed for the Russell 2000 firms in 2014 instead of the actual treatment year 2017. I then replicate my analysis in section 2.5.1 using equation 2.1 for this placebo treatment. The estimated DiD term for this *placebo* coverage expansion is reported in Appendix Table 2.A.7 for inspections (Panel A) and violations (Panel B). The results show that the trends of OSHA inspections and violations for Russell 1000 and Russell 2000 firms around this placebo treatment year are similar as the DiD term is statistically insignificant especially when the firm and year (or, firm and industry-year) heterogeneities are accounted for in column 2 (column 3).

2.5.3 Restricted Sample: Firms With At Least One Inspection

Almost 70% of my sample comprises of firms that do not appear in OSHA records (either for inspections or violations) despite being Russell 1000/2000 index constituents and being covered by Asset4. It can be safely presumed that the absence of firms in OSHA records mean that in those specific years, they had neither been inspected by OSHA nor reprimanded for any violations of OSHA regulations. Thus, in my main analyses discussed so far, firms with missing OSHA records are treated as "true zeros". In my main identification strategy, the non-inspected or non-violating firms are important to capture the true impact of CSR information dissemination on regulatory activity. In other words, ignoring the firms that do not appear in OSHA data would imply that my analyses focuses only on firms that are targeted by regulatory activity while ignoring those that do not draw regulators attention. For this reason, in section 2.5.1 I have employed the entire sample of Russell 1000/2000 firms by assigning zero inspections/violations if they are not covered in OSHA data.

The central assumption in my main analyses with regards to inclusion of "true zeros" is that there are no regulator-specific biases driving the regulatory action for one set of firms while the others are let off. Despite this being a safe assumption given that inspections are largely random events, I run a set of parallel analyses by omitting those firms that are missing in OSHA records. In this restricted sample, I capture the impact of CSR information on regulatory activity for only those firms that OSHA has targeted during my sample years. The results using this restricted sample are presented in Appendix Table 2.A.8 with Panel A showing the DiD coefficients for inspections and Panel B reporting the same for violations. Even with this constrained (and, potentially biased) sample, I find that my main results from Table 2.2 are confirmed, especially with my full model specification in column (3) when the firm and industry-year fixed effects are employed.[18]

2.5.4 Alternative Identification: Russell Composition Cut-off

In my main specification, even if I implement entropy balancing weights to minimize differences in covariates, there could still be potential concerns related to firm size as my treatment is based on a size-based threshold. In this section, I therefore implement a tighter identification by look at the discontinuity around the Russell composition cut-off (Appel, Gormley, and Keim, 2016; Crane, Michenaud, and Weston, 2016; Lin, Mao, and Wang, 2018).

Table 2.3 reports the results by focusing on the sample of [-100,100] (column 1), [-200,200] (column 2), [-250,250] (column 3), respectively. Essentially, my approach is akin to a regression discontinuity DiD design to further mitigate concerns of observable and unobservable differences in my treated and control group that could bias my estimates. Overall, I find robust evidence that treated firms are subject to more inspections (Panel A) and OSHA imposes more penalties (Panel B). Even when I focus on a small number of firm (column 1), I find some evidence (although weak due to a low statistical power) that my estimates hold with the magnitudes of estimated coefficients similar to or higher than the baseline estimates in Table 2.2.

2.6 What Drives Regulatory Activity?

2.6.1 Possible Channel: Regulatory Learning

While my baseline results show a positive effect of CSR information on regulatory activity, it is not ex-ante clear how the availability and dissemination of CSR information affects OSHA enforcement actions. On the one hand,

[18]Note that the lack of statistical significance for the ordinary least square (OLS) model (column 1) in the Appendix Table 2.A.8 should be interpreted with caution because my main model DiD specification in equation 2.1 relies on within-firm variation across the treatment, which is not cleanly captured by an OLS model.

the expansion of Asset4 coverage may represent a reduction to the regulator's information processing costs. While OSHA should possess information regarding workplace condition of establishments under its jurisdiction, it may face constraints in identifying and assimilating *all* information into its enforcement decisions. To this extent, for firm's that receive low CSR ratings, especially in the social dimension that includes ratings for workplace safety, CSR information may present incremental and salient information that can help OSHA re-orient its enforcement actions toward firms with poorer workplace safety conditions than what was previously assumed by OSHA officials. This argument is consistent with literature that shows regulators incorporate alternative publicly available information in their enforcement decisions (Bozanic et al., 2017; Li et al., 2022; Li and Wang, 2022). On the other hand, OSHA may have already incorporated *all* the relevant information on workplace safety conditions for establishments under its jurisdiction. In this case, the newly available CSR ratings should not elicit learning.

To test whether regulatory learning is driving the observed increase in regulatory activity for the treatment firms when compared to the control group firms, I constructed a measure of regulatory learning incentives by splitting treated firms in two non-overlapping groups: Russell 2000 firms with low CSR ratings and Russell 2000 firms with high CSR ratings. The intuition behind this measure is that if CSR information disseminated through ratings results in an additional salient source of information for OSHA, at least for some treated firms when low CSR scores are revealed, OSHA should learn that their workplace safety is lower than previously assumed. I identify firms with high (low) regulator learning incentives, by partitioning the sample based on the industry-median value of CSR performance in the treatment year 2017. I proxy for relevant CSR ratings for regulatory learning by looking at: (a) Overall CSR Score, (b) Social Score, (c) Workplace Safety Score and (d) Environmental Score.

In Table 2.4, I report the results for the tests on regulatory learning channel by estimating equation 2.1 for sub-samples identified based on high (low) CSR performance.[19] The main coefficient (*TreatxPost*) reported in Panel A, indicate a stronger (weaker) effects for firms when high (low) CSR ratings are revealed. These results are consistent for CSR Score (columns 1-2), Social Score (columns 3-4), Workplace Safety Score (columns 5-6), and the Environmental Score (columns 7-8) with the estimated coefficient for the sub-sample with high CSR ratings always being greater than those observed for low CSR ratings. Contrary to learning channel, this implies that after the CSR coverage, the increase in OSHA inspections seem to be driven by firms with better CSR ratings rather than those with low ratings. In Panel B, qualitatively similar results are seen when I use violations as proxy of enforcement activity. Firms with high (low) CSR ratings are subject to more penalties and these results are robust across different proxies of CSR performance. I additionally run tests to check if the difference in the DiD coefficients for high/low CSR ratings firms are statistically significant and find that they are statistically different for many of the proxies, especially in case of OSHA violations.

Next, I perform a supplementary test by identifying a sub-sample of treated firms on which OSHA has plausibly has high information asymmetry and high learning incentives. Accordingly, I define high information asymmetry firms as those treated firms that were not receiving any inspections during pre-treatment period and then the ratings coverage *revealed* their low CSR ratings (i.e., with ratings below the median value in the treatment year 2017). In Table 2.5, I report the results using the same four measures of CSR ratings as employed in Table 2.4. The estimated coefficients for the variable of in-

[19]The results reported in Table 2.4 are estimating with the strictest identification similar to column (3) of main results in Table 2.2 i.e., including firm and industry-year fixed effects. For robustness, I perform the analysis with the inclusion of firm and year fixed effects and my estimates for the DiD term remain unchanged.

terest (*TreatxPost*) across most proxies of CSR performance in Panels A and Panel B are statistically insignificant suggesting the absence of increased enforcement intensity for these high information asymmetry firms. The negative coefficient across the different proxies might *partially* suggest that OSHA officers re-allocate enforcement activity toward firms that can experience a larger deterrence effect after the CSR coverage expansion.

Overall, the results in Table 2.4 and Table 2.5 are indicative of the absence of a direct learning channel by OSHA. Newly CSR covered firms with low CSR ratings are subject to less regulatory activity than those with high CSR ratings. The results are confirmed even when I focus on a subset of firms with high information asymmetry, where regulator learning incentives should be plausibly higher.

2.6.2 Possible Channel: Deterrence Due to Reputational Exposure

The results in section 2.6.1 shows that OSHA does not prioritize firms with low CSR ratings, suggesting therefore that the CSR coverage does not provide additional salient source of information for regulatory activity. In parallel, one possible explanation for the observed stronger effects for high firms with high CSR ratings in Table 2.4 could be that OSHA takes advantage of increased reputational exposure of high CSR ratings firms to deter them from prospective workplace safety violations. Indeed, literature suggests that deterrence is an effective component of regulatory enforcement mechanisms (Johnson, 2020; Leonelli, 2021). Therefore, new firms covered by Asset4's CSR analysts after 2017 could be more exposed to reputational damage in front of investors and, in general, all stakeholders (Darendeli et al., 2022), and OSHA might exploit this exposure to maximise deterrence.

To investigate whether reputational exposure and related deterrence explains the observed effects of CSR information on regulatory activity, I look at firms that are more visible among stakeholders, so that there is a higher propensity for ex-post reputational damage when their CSR ratings are revealed.[20] I proxy for firms' reputational exposure by identifying firms with high CSR media attention, the number of the analysts following the firm, and firm size. For CSR media attention, I use data from RepRisk (Burke, 2021) that captures the number of news articles that are relevant to firm's CSR issues, which can amplify firm's reputational damage. I also collect data on number of analysts covering a firm from I/B/E/S. Analysts are an important source of information intermediaries between firms and stakeholders (Bhushan, 1989; Healy and Palepu, 2001). Firms followed by analysts are more visible and their misconducts can be quickly disseminated among market participants (Chen et al., 2016). Lastly, I proxy for overall visibility of firms using their size (Bushee and Miller, 2012; Schreck and Raithel, 2018). Based on these three proxies, I partition the sample using its industry-median value in the treatment year 2017. In Table 2.6, I report the results of estimating equation 2.1 by dividing the sample based on high (low) reputational exposure. Consistent with OSHA targeting deterrence by exploiting firms' reputational exposures, the effect of enforcement activity is stronger for firms with higher exposure to reputational damage. Treated Firms with high CSR Media Coverage are subject to approximately 10.5% (22%) more inspections (violations) relative to the control group. Conversely, firms with low CSR Media Coverage do not experience any statistically significant increase in inspections or violations following the CSR coverage expansion. I further test the difference in the DiD coefficients for high versus low CSR Media Coverage firms and find that it is statistically significant for both inspections and violations. The effect is qualitatively similar when I adopt other two proxies of visibility, i.e., the

[20] In Table 2.A.9, I also provide evidence of the negative association between OSHA violations and CSR rating downgrades.

number of analysts following a firm and firm size.

Overall, the results in Table 2.6, suggest that the enforcement activity is concentrated in more visible firms that are exposed to higher reputational damage after CSR information dissemination. This is consistent with deterrence considerations driving OSHA enforcement activity (Leonelli, 2021).

2.6.3 Institutional Investors sensitivity to CSR Information dissemination

In this section, I provide further evidence on the deterrence effect of OSHA violations when they are impounded in CSR ratings. Given that an increase in public attention to CSR information of Russell 2000 firms is one of the assumptions in explaining my findings on deterrence effect, I look at whether the information on OSHA violations is better transmitted to stakeholders after the CSR ratings get disseminated for these firms. I focus on the behavior of a specific group of stakeholder—institutional investors—and examine whether they become more aware and sensitive to OSHA violations after the CSR coverage of treated firms. I gathered the data from Thomson Reuters 13f Institutional Holdings and identified institutional investors that hold Russell 1000 and Russell 2000 constituents in their investment portfolios. My approach is similar to Christensen et al. (2017), which shows that mutual funds becomes more sensitive to mine safety records when they are included in firms financial statements. In particular, I am able to isolate the incremental effect of OSHA violations on institutional investor behavior when they are disseminated through CSR ratings.

I look at the change in institutional ownership from quarter before an OSHA violation to the end of the subsequent quarter by estimating the following model:

$$\%\Delta Holding_{i,j.t} = \beta_0 + \beta_1 ViolxPost + \sum \beta_J FixedEffects_J + \epsilon_{i,j,t} \quad (2.2)$$

The main dependant variable $\%\Delta Holding$ represents the percentage change in institutional investor i's holdings in firm j from quarter $t-1$ to quarter t. *Viol* is an indicator variable that equals 1 for OSHA violating firms. In this specification, institutional ownership fixed effects and year-quarter fixed effects are also included. $\%\Delta Holding$ is winsorized at its 1% and 99% levels to control for the presence of outliers and the standard errors are clustered for each institutional investor.

I conducted the analysis *within* control and treatment groups separately to compare the differential effects of OSHA violating firms. The results are presented in Table 2.7. The sharp contrast in the coefficients for *Viol* and *ViolxPost* for the two sets of firms (i.e., R1000 and R2000 firms) highlight the importance of CSR ratings coverage for institutional investors. For the treated group (column 2), there is a marked reduction in the institutional investors' holdings for OSHA violating firms only after the CSR coverage expansion. The statistically significant coefficient of -0.15 for the interaction term *ViolxPost* implies that, on average, institutional ownership in violating firms reduces by 13.9% ($e^{-0.15}-1$) during quarters when CSR ratings are available for the Russell 2000 firms. Given that the average quarterly change in investor holdings for R2000 firms is 47.84% (see Table 2.1), this implies a 6.6% ($13.9\% \times 47.84\%$) reduction of investments in the violating firms. After accounting for the unconditional trends in institutional ownership of violating firms, this translates to a significant decline in institutional investments by approximately 3.25%.[21]

[21] To examine the economic magnitude, the incremental effect of -0.07 observed in Table 2.7 column (2) is transformed into $(e^{-0.07}-1) \times 47.84\% = 3.25\%$.

Consistent with sophisticated investors reacting to OSHA violations only when it is impounded in CSR ratings, we find a similar effect visible for R1000 firms (column 1) regardless of the CSR information expansion for the treated firms: the unconditional effect represented by the coefficient on *Viol* once again indicates around 3.2% (i.e., $(e^{-0.10} - 1) \times 33.69\%$) decline in institutional investor holdings for violating R1000 firms.

Overall, these results are indicative of institutional investor holdings becoming more sensitive to OSHA violations after CSR ratings are made available by Asset4 for the violating firms. These findings suggest that stakeholders, including sophisticated investors, pay more attention to OSHA violations when they are impounded in CSR ratings. Overall, the increase of stakeholder attention corroborate the deterrence mechanism.

2.7 Peer Effects

The results in Section 2.6.2 suggest deterrence due to the threat of firm's reputational damage as a plausible mechanism driving the observed effects of CSR information on regulatory activity. This is consistent with prior literature showing how OSHA leverages on the deterrence effects to increase compliance across the establishments under its jurisdiction (Johnson, 2020; Leonelli, 2021). Given that inspections are costly and OSHA faces significant budget constraints, visibility of workplace safety through CSR ratings may be an effective complement to inspections in order to incentivize firms to improve their workplace safety.

I therefore test whether CSR ratings lead to increased safety and health compliance for "peer" firms that, after CSR information dissemination, observe a violation by a focal firm when this information is disseminated through CSR ratings. I identify a set of peer firms within the treatment and control groups as those firms that operate in the same industry sector of the OSHA violating focal firms. I then re-estimate Equation 2.1 by replacing *Treat* indicator with a new indicator *Peer* that identifies peer firms.

Results are reported in Table 2.8. Similar to section 2.6.3, I conduct the analysis *within* control and treatment groups separately to compare the differential effects of CSR violating information on these two sets of firms. In columns (1) and (2), I identify peer firms that operate in the same SIC 2-digit industry as a violating firm. In column (1), I focus on Russell 2000 firms (i.e., treated group) and in column (2), I report results for Russell 1000 firms (i.e., control group). The coefficient of *PeerxPost* is statistically significant (at 0.01 level) only for the treated cohort. This implies that improvement in workplace safety compliance among peer firms could be driven by the new CSR coverage expansion. These findings are economically meaningful. After the CSR information coverage, peer firms improve their workplace safety and health compliance by 34% after they observe violations by a focal firm. To put this magnitude in perspective, Johnson (2020) found that press releases revealing OSHA violations, lead to 73% more compliance at peer facilities. I also corroborate my analyses by implementing a more granular classification of peer firms, specifically looking at industry classification adopted by OSHA officials. Using this alternative classification, Columns (3) and (4) report the results for Russell 1000 and Russell 2000 firms, respectively. The coefficient of *PeerxPost* remains statistically significant only for the treated group. The economic effect is smaller, but this is plausibly explained by the granularity of industry groups implemented by OSHA which uses NAICS detailed classifications.

2.8 Conclusion

Research has shown that availability of public information plays an important role in a variety of regulatory enforcement settings (Bozanic et al., 2017; Li et al., 2022; Lerman, Steffen, and Zhang, 2022; Li and Wang, 2022). In this paper, I investigate whether CSR information, disseminated through ratings by a third-party agency, affects regulators' enforcement activity and if so, how this information is impounded in enforcement outcomes. By leveraging a plausibly exogenous CSR ratings coverage expansion by Thomson Reuters Asset4, I document evidence that workplace safety regulator increases its enforcement activity toward newly covered firms. I investigate two non-mutually exclusive channels that can explain my findings: regulatory learning and deterrence effects. My findings are consistent with deterrence effects being the plausible mechanism that explain my main results. CSR disclosure by a third-party increases firm's reputational exposure as OSHA activity will be impounded in CSR ratings and disseminated to stakeholder. In turn, this affects OSHA marginal benefit of its enforcement activity on newly covered firms. Evidence from institutional holdings corroborate my findings as I document an increase of stakeholder awareness toward workplace safety issues in newly covered firms in the post period. Finally, I find some evidence of transmission of deterrence effects among newly covered peers as they appear to increase their OSHA compliance following violations by a focal firm. Overall, my findings suggest that, from a monitoring perspective, there is no information content in CSR rating. Nevertheless, the disclosure by a third-party itself could serve as a signal that increases deterrence.

My study informs regulators as well as policymakers. CSR mandates have been considered by different jurisdictions (Christensen, Hail, and Leuz, 2021; Fiechter, Hitz, and Lehmann, 2022; Rajgopal and Tantri, 2023). The stated objective of these reporting mandates is to facilitate monitoring by stakeholders. My study specifically focuses on regulators, a stakeholder group that often faces severe resource constraints and is accused of ineffective monitoring mechanisms. Standardized CSR reporting via ratings by third-party agencies may benefit regulators as it could help them in improving their ability to detect establishments when their revealed CSR performance are worse than previously assumed. In this study, I find absence of such *pure* learning channels for regulators. This might be either because CSR ratings do not carry any additional salient source of information for the regulator that I study or because the regulator is indifferent to that information. Nevertheless, it shows the effectiveness of a deterrence mechanism (Johnson, 2020; Leonelli, 2021) when CSR information is released for firms with high reputational exposures. Lastly, my findings are also informative to the discussion on the role of CSR intermediary agencies (Berg, Koelbel, and Rigobon, 2022; Christensen, Serafeim, and Sikochi, 2022).

Figure 2.1 Asset4 Coverage Expansion

Frequency of updates

All Refinitiv ESG scores, including controversies scores, are updated on a weekly basis.

Definitive scores

Scores will be marked as 'definitive' for all historical years excluding the five most recent. For instance, if the most recent fiscal year is FY2020, then all historical scores prior to FY2016 will be considered definitive – but not those between FY2016 and FY2020. Definitive scores remain unchanged, even if there are changes to the underlying data due to company restatements or data corrections.

Global coverage

The universe of companies for which ESG data is maintained and ESG scores are calculated consists of 12,500 public and private companies globally. Regional breakdown is provided in the illustration below.

Our coverage has evolved over time and is continuously expanding as we include more indices. We review the constituents of these indices on a quarterly basis, when additional companies are also included in our coverage. We have added Russell 3000 Index companies to the coverage. The illustration below shows a timeline of various indices' inclusion in the ESG universe.

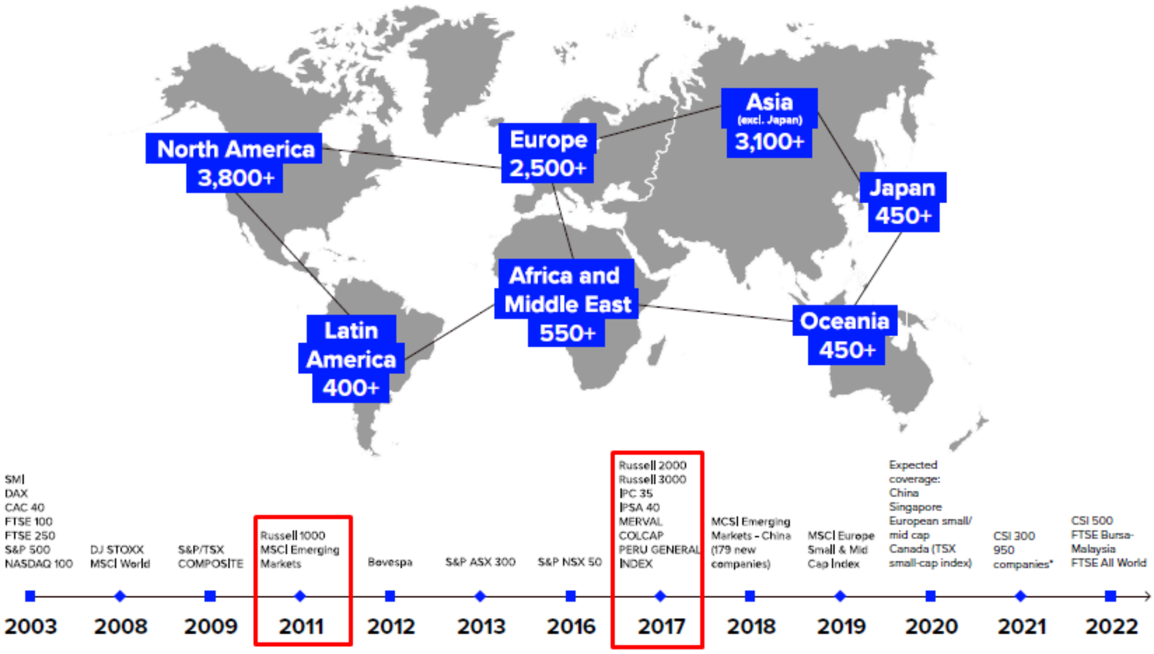


Figure 2.2 Inspections Pre-Trend

This figure plots the average number of OSHA inspections observed in the treated (red) and control (blue) group firms observed in each year. Russell 1000 firms have a relatively higher inspection rate compared to Russell 2000 firms. Therefore, I employ demeaned values of OSHA inspections computed for each firm based on whether it belongs to treated or control group. This allows for a closer comparison of trends seen for each group after accounting for the average differences between Russell 1000 and Russell 2000 firms.

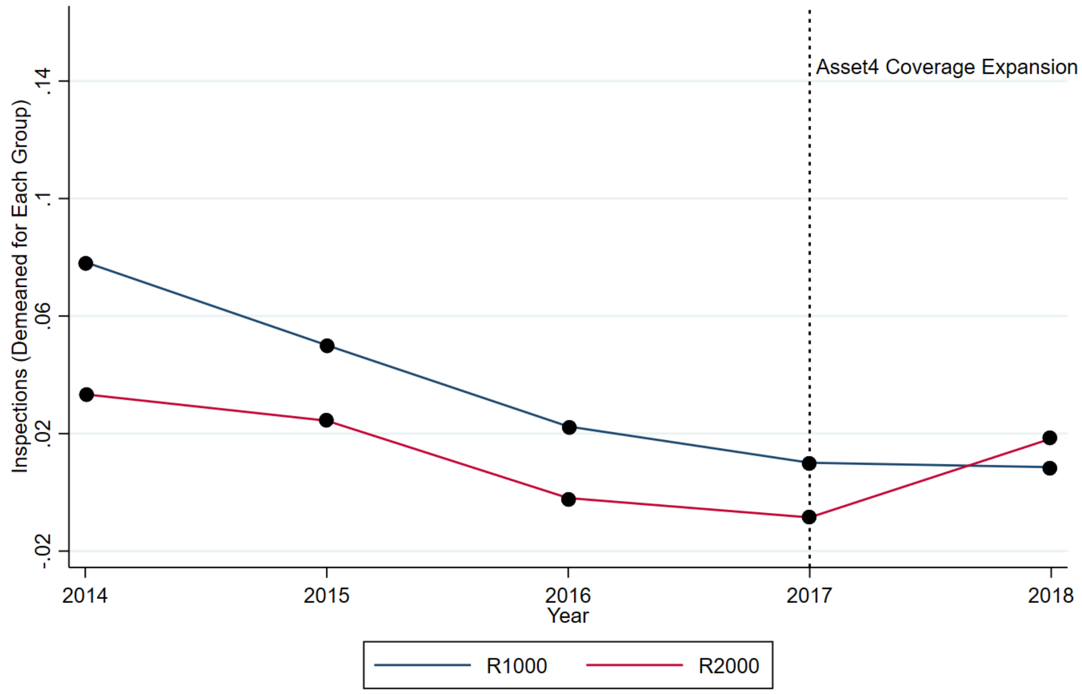


Figure 2.3 Violations Pre-Trend

This figure shows the average number of OSHA violations reported by treated (red) and control (blue) group firms in each year. Similar to Figure 2.2, I construct these plots annually using the demeaned values of OSHA violations conditional on whether the firm belogs to treated of control group.

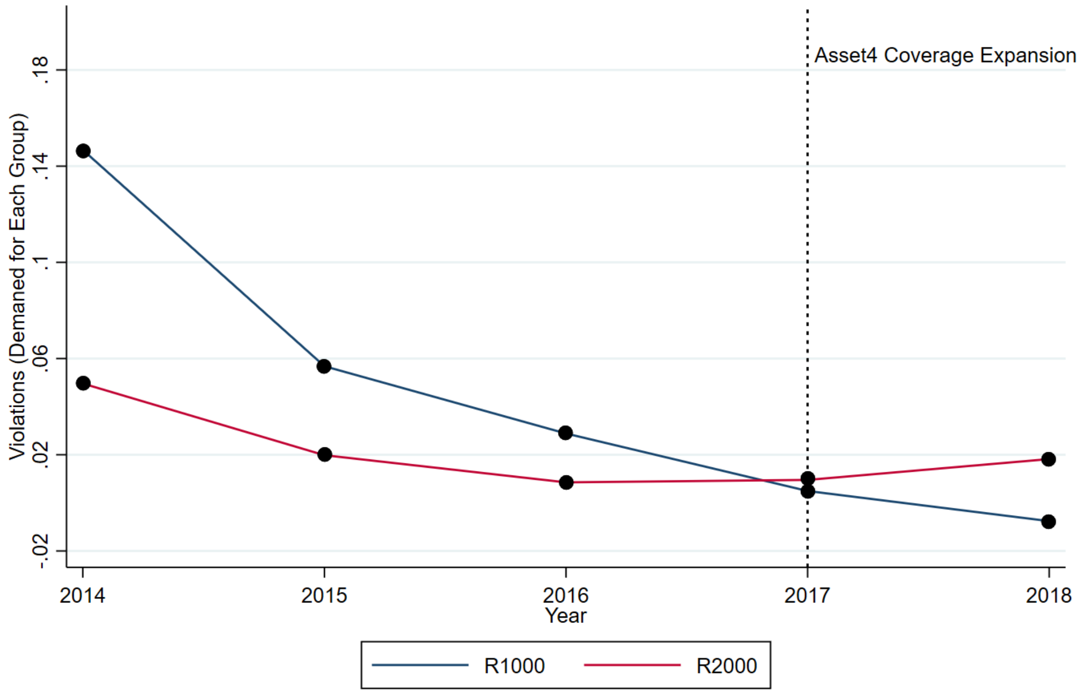


Figure 2.4 Inspections over Event Time

This figure shows show the estimated coefficients of regressing the natural logarithm of one plus total number of OSHA inspections on the interaction *TreatxPost* following Asset4 Coverage expansion (i.e., the event) with year and firm fixed effects. Standard errors are estimated by clustering at the firm level. I omit the indicator for year t-1, which serves as benchmark. Vertical bands represent 95% confidence interval for the point estimate each year relative to the treatment period.

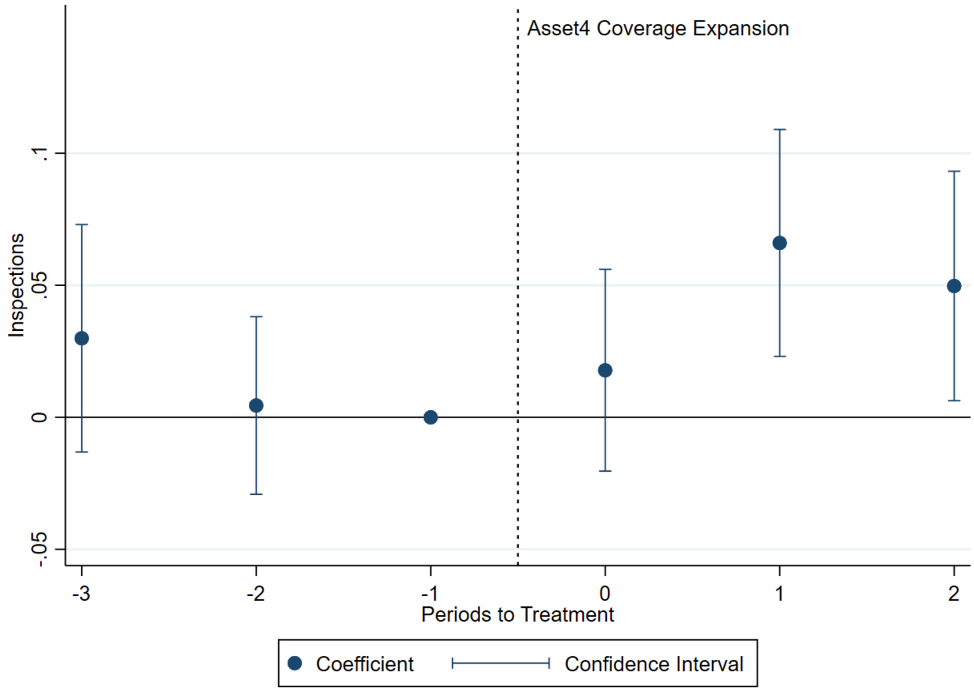


Figure 2.5   Violations over Event Time

This figure shows the estimated coefficients of regressing the natural logarithm of one plus total number of OSHA violations on the interaction *TreatxPost* following Asset4 Coverage expansion (i.e., the event) with year and firm fixed effects. Standard errors are estimated by clustering at the firm level. I omit the indicator for year t-1, which serves as benchmark. Vertical bands represent 95% confidence interval for the point estimate each year relative to the treatment period.

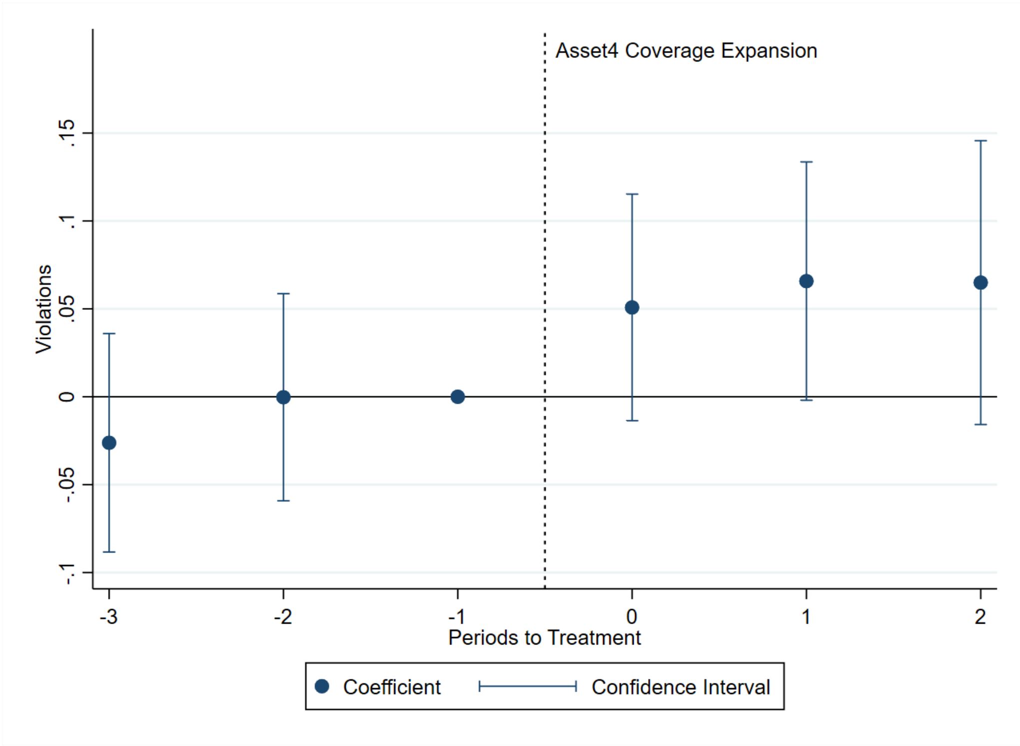
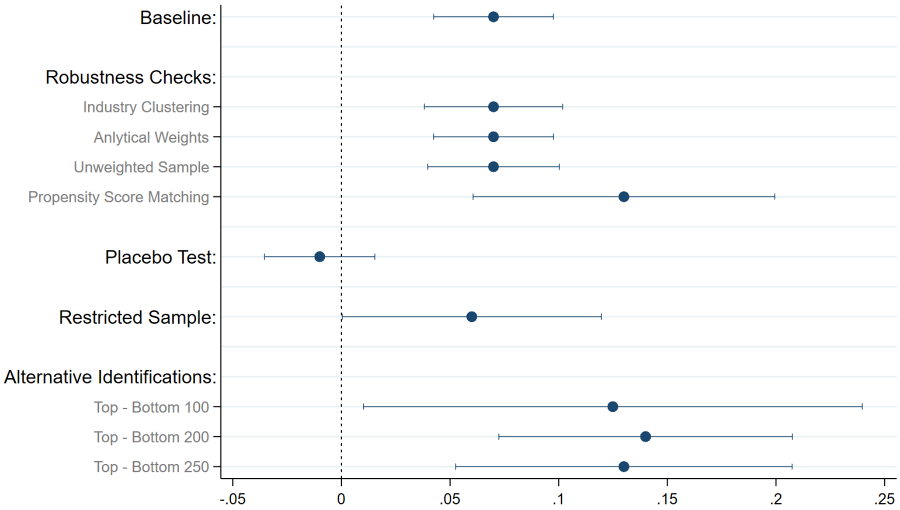
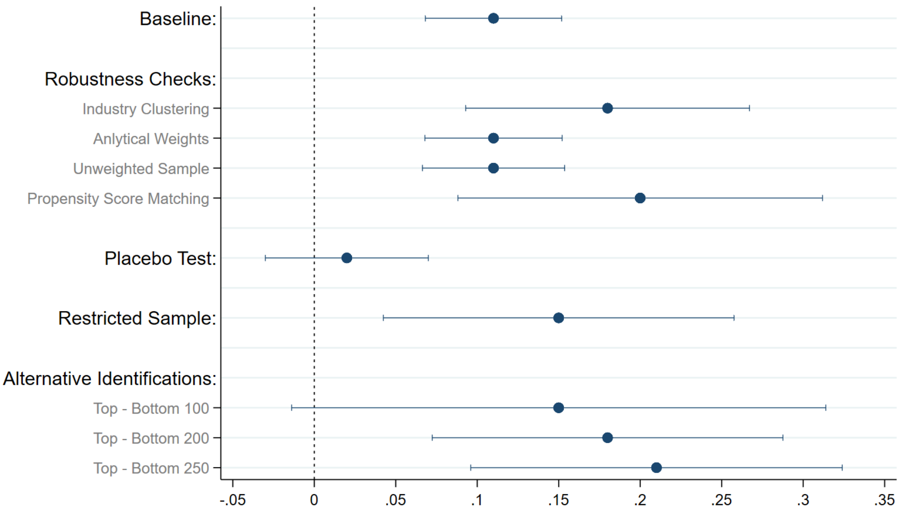


Figure 2.6 Baseline versus Alternative Estimations

This figure plots the coefficients estimated using alternative model specifications of equation 2.1 and alternative identification strategies (see Section 2.5). These tests are meant to collectively assess the robustness of the baseline estimate and to confirm its internal validity. The coefficients are plotted for (a) inspections and (b) violations as the dependent variables. Along with the point estimates of the coefficients in each estimation, 90% confidence intervals are also marked. Baseline estimates are from Table 2.2; robustness checks are from Appendix Table 2.A.3 (industry clustering), Table 2.A.4 (analytical weights), Table 2.A.5 (unweighted sample), and Table 2.A.6 (propensity score matched sample); placebo tests from Table 2.A.7; and alternative specifications from Table 2.3. All estimations use standard errors clustered at firm level, unless mentioned otherwise.



(a) Inspections



(b) Violations

Table 2.1 Sample Description.

This table presents summary statistics of main variables used in the empirical analyses by treated and control group. The sample consists of Russell 1000 and Russell 2000 constituents for the period 2013-2020. Panel A reports the number of observations (N), Mean, Standard Deviation (SD), Minimum (Min) and Maximum (Max) values. Panel B provides information on the sample composition across industries. The variables are as defined in Appendix 2.A.1. Dependant variables are winsorized at 99%, control variables are winsorized at 1% and 99%.

Panel A: Descriptive statistics

	R1000 (N=4,364)				R2000 (N=8,058)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Inspections	2.96	8.53	0.00	154.00	0.60	1.98	0.00	36.00
Violations	3.71	10.84	0.00	201.00	1.00	3.94	0.00	82.00
Size	9.03	1.18	4.38	11.34	6.53	1.19	0.85	10.50
ROA	0.05	0.10	-1.23	0.46	-0.05	0.28	-6.64	0.46
PPE	0.26	0.24	0.00	0.93	0.23	0.23	0.00	0.93
Capex	5.52	1.51	-3.19	8.54	2.75	1.85	-5.81	7.62
Leverage	0.33	0.23	0.00	2.75	0.26	0.26	0.00	2.75
Cash	0.14	0.15	0.00	0.99	0.23	0.24	0.00	0.99
MB	2.61	1.97	0.59	23.29	2.35	2.13	0.50	81.23
Sales Growth	0.08	0.35	-1.00	7.77	0.19	0.85	-1.00	7.77
R&D	0.03	0.06	0.00	0.65	0.07	0.15	0.00	1.58
ESG Score	50.66	19.64	1.58	94.48	32.18	13.62	0.45	87.15
SOC Score	53.11	21.89	3.68	97.99	34.31	16.51	0.60	93.02
ENV Score	41.04	28.73	0.00	98.55	12.80	17.86	0.00	88.64
CSR Media Coverage	16.91	12.81	0.00	65.67	6.21	7.86	0.00	36.08
Workforce Score	54.62	26.19	0.00	99.85	31.34	20.83	0.00	98.82
Analysts	16.66	8.02	1.00	49.33	6.16	4.28	1.00	33.83
% Δ Holding	33.69	65.87	0.00	261.09	47.84	76.58	0.00	261.09

Panel B: Sample distribution per Industry

	R1000		R2000	
	Firm-years	Percent	Firm-years	Percent
Consumer Non-Durables	311	7.14	415	5.17
Consumer Durables	140	3.21	250	3.11
Manufacturing	566	12.99	1,028	12.8
Oil, Gas, & Coal (Energy)	287	6.59	236	2.94
Chemicals & Allied Products	210	4.82	239	2.98
Business Equipment	955	21.92	1,567	19.51
Phone & TV Transmission	154	3.53	239	2.98
Utilities	21	0.48	47	0.59
Wholesale, Retail, & Services	574	13.17	1,011	12.59
Healthcare, Medical Eq., Drugs	413	9.48	1,499	18.66
Finance	127	2.91	178	2.22
Other	606	13.75	1,349	16.48
Total	*4,364*	*100.0*	*8,058*	*100.0*

Table 2.2 Baseline Results

This table presents results of the impact of Asset4 coverage expansion on regulatory activity from difference-in-differences (DiD) models. Treated group is Russell 2000 constituent firms and the control group is Russell 1000 constituent firms. Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects and column (3) includes firm and year-by-industry fixed effects. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). The rest of the variables are as defined as in Appendix 2.A.1. Dependant variables are winsorized at 99% and control variables are winsorized at 1% and 99%. All models are estimated based on entropy balancing using pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership. All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: CSR Information and Inspections

	Inspections		
	(1)	(2)	(3)
Treat	-0.09*		
	(-1.91)		
Post	-0.19***		
	(-6.68)		
TreatxPost	0.07***	0.07***	0.07***
	(2.98)	(3.71)	(4.19)
Size	0.12***	0.08***	0.06***
	(5.86)	(5.47)	(4.66)
ROA	-0.12**	0.01	0.02
	(-2.51)	(0.41)	(0.11)
PPE	0.25**	0.06	0.04
	(2.43)	(0.67)	(0.46)
Capex	0.02	0.01	0.01**
	(1.31)	(0.76)	(2.01)
Leverage	0.03	0.03	-0.00
	(0.37)	(0.73)	(-0.00)
Cash	-0.40***	-0.10**	-0.05
	(-7.36)	(-2.16)	(-1.21)
MB	-0.01	0.00	0.00
	(-0.34)	(1.46)	(1.37)
Sales Growth	0.00	-0.00	-0.01*
	(0.35)	(-1.61)	(-1.86)
R&D	-0.11	0.07	0.06
	(-1.23)	(1.44)	(1.35)
Observations	12,465	12,449	12,422
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.21	0.75	0.76

Panel B: CSR Information and Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.11**		
	(-2.06)		
Post	-0.17***		
	(-5.96)		
TreatxPost	0.11***	0.11***	0.11***
	(3.11)	(3.90)	(4.34)
Size	0.09***	0.10***	0.08***
	(4.12)	(4.16)	(3.82)
ROA	-0.08	0.02	-0.01
	(-1.38)	(0.43)	(-0.19)
PPE	0.22**	0.07	0.11
	(1.98)	(0.55)	(0.87)
Capex	0.03**	0.00	0.00
	(2.00)	(0.07)	(0.51)
Leverage	-0.01	0.02	-0.00
	(-0.02)	(0.43)	(-0.06)
Cash	-0.46***	-0.18**	-0.08
	(-7.80)	(-2.52)	(-1.21)
MB	0.00	0.01*	0.00
	(0.01)	(1.65)	(1.40)
Sales Growth	0.01	-0.01*	-0.01*
	(1.23)	(-1.75)	(-1.81)
R&D	-0.13	0.06	0.04
	(-1.31)	(0.88)	(0.58)
Observations	12,465	12,449	12,422
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.13	0.58	0.60

Table 2.3 Alternative Identifications

This table reports the results using alternative cross-sectional identifications to capture the effect of Asset4 coverage expansion on regulatory activity. Similar to the main DiD (Table 2.2, I employ Russell 2000 constituents firms as the treated group and Russell 1000 constituents as the control group. However, instead of taking all the constituents of these two Russell indexes, I apply size-based criteria to run an empirical identification using a quasi-regression discontinuity framework. Accordingly, I select the largest 100/200/250 Russell 2000 firms and compare their inspections (Panel A) and violations (Panel B) to the smallest 100/200/250 Russell 1000 firms. Each of these three criteria for identification are denoted by Top – Bottom 100 (Column 1), Top – Bottom 200 (Column 2), and Top – Bottom 250 (Column 3), respectively. For variable definitions, see Appendix 2.A.1. Dependant variables are winsorized at 99%, control variables are winsorized at 1% and 99%. Like in Table 2.2, All models are estimated based entropy balancing estimation. All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	[Top - Bottom 100] (1)	[Top - Bottom 200] (2)	[Top - Bottom 250] (3)
TreatxPost	0.12*	0.14***	0.13***
	(1.80)	(3.42)	(2.77)
Observations	668	1,595	1,744
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.88	0.89	0.84

Panel B: Violations

	Violations		
	[Top - Bottom 100] (1)	[Top - Bottom 200] (2)	[Top - Bottom 250] (3)
TreatxPost	0.15	0.18***	0.21***
	(1.51)	(2.76)	(3.04)
Observations	668	1,595	1,744
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.80	0.73	0.74

Table 2.4 Cross-sectional analysis based on regulator learning incentives.

This table presents the effect of Asset4 coverage expansion on regulatory activity conditional on Regulator learning incentives. Control group has Russell 1000 constituent firms and the treated group consists of Russell 2000 constituents. I proxy for regulator learning incentives by dividing the sample into High/Low ESG Score (columns 1-2), Social Score (columns 3-4), Workforce Score (columns 5-6), and Environmental Score (columns 7-8) based on whether the relative score is greater/lower than their 2017-median valuea. I employ the DiD specification from Table 2.2 with the dependant variables being either the logarithm of one plus total number of OSHA inspections (Panel A) or the natural logarithm of one plus total number of OSHA violations (Panel B). See Appendix 2.A.1, for the definitions of all the main and control variables. Similar to the main DiD specifications estimated in Table 2.2, all models are estimated based on entropy balancing using pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership. These estimations use firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections							
	ESG		Social		Workforce		Environmental	
	High	Low	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TreatxPost	0.12***	0.02	0.09***	0.05**	0.09***	0.06**	0.11***	0.04
	(4.69)	(1.08)	(4.00)	(2.07)	(3.65)	(2.17)	(4.56)	(1.05)
P-value	0.00***		0.20		0.24		0.10*	
(Difference in Coefficients)								
Observations	5,533	5,060	5,478	5,115	5,504	5,522	6,942	3,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:								
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R^2	0.79	0.72	0.79	0.72	0.78	0.76	0.79	0.78

Panel B: Violations

	Violations							
	ESG		Social		Workforce		Environmental	
	High	Low	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TreatxPost	0.20***	0.03	0.16***	0.07*	0.15***	0.09***	0.17***	0.06
	(5.20)	(0.76)	(4.57)	(1.85)	(3.71)	(2.59)	(4.80)	(1.13)
P-value	0.00***		0.06*		0.10*		0.09*	
(Difference in Coefficients)								
Observations	5,533	5,060	5,478	5,115	5,504	5,522	6,942	3,659
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:								
Firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R^2	0.63	0.56	0.64	0.55	0.63	0.60	0.64	0.55

Table 2.5 Additional test on regulator learning: Conditional on high information asymmetry

This table presents the effect of Asset4 coverage expansion on regulatory activity conditional on Regulator learning incentives. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). The dependent variable in Panel B is the natural logarithm of one plus total number of OSHA violations. The variables are as defined as in Appendix 2.A.1. Dependant variables are winsorized at 99%, control variables are winsorized at 1% and 99%. All models are estimated based entropy balancing estimation. The entropy balancing estimation is based on pre-treatment levels of our main covariates variables (Return on Assets, Cash and Sales growth) as well as industry membership to minimize observable differences between treatment and control groups. All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections			
	ESG	Social	Workforce	Environmental
	(1)	(2)	(3)	(4)
TreatxPost	-0.03**	-0.03	-0.04*	-0.05
	(-2.00)	(-1.61)	(-1.80)	(-1.41)
Observations	2,228	2,194	2,335	1,395
Controls	Yes	Yes	Yes	Yes
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Adj. R^2	0.18	0.25	0.47	0.19

Panel B: Violations

	Violations			
	ESG	Social	Workforce	Environmental
	(1)	(2)	(3)	(4)
TreatxPost	-0.02	-0.03	-0.03	-0.02
	(-1.06)	(-1.13)	(-1.16)	(-0.53)
Observations	2,228	2,194	2,335	1,395
Controls	Yes	Yes	Yes	Yes
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Adj. R^2	0.10	0.15	0.35	0.06

Table 2.6 Cross-sectional analysis based on firms' reputational exposure

This table presents the effect of Asset4 coverage expansion on regulatory activity conditional on firms' reputational exposure. Treated and control groups are comprised of Russell 2000 and Russell 1000 constituent firms, respectively. I proxy for firm's reputational exposure incentives by dividing the sample between High (Low) number of news article related to CSR (column 1-2), number of analysts following a firm (column 3-4), and firm's size (column 5-6) based whether the relative value is greater (lower) than 2017-median value. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). The variables are as defined as in Appendix 2.A.1. Dependant variables are winsorized at 99%, control variables are winsorized at 1% and 99%. All models are estimated based entropy balancing estimation. The entropy balancing estimation is based on pre-treatment levels of our main covariates variables (Return on Assets, Cash and Sales growth) as well as industry membership to minimize observable differences between treatment and control groups. All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections					
	CSR Media Coverage		Analysts		Size	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
TreatxPost	0.10***	0.04*	0.09***	0.04	0.11***	0.03
	(3.26)	(0.99)	(3.55)	(1.71)	(4.37)	(1.26)
P-value (Difference in Coefficients)	0.10*		0.17		0.01***	
Observations	4,840	2,752	5,703	4,859	6,253	5,744
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R^2	0.78	0.73	0.77	0.77	0.78	0.72

Panel B: Violations

	Violations					
	CSR Media Coverage		Analysts		Size	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
TreatxPost	0.20***	0.02	0.12***	0.07*	0.16***	0.07**
	(4.40)	(0.33)	(3.55)	(1.81)	(4.00)	(2.22)
P-value (Difference in Coefficients)	0.00***		0.95		0.05**	
Observations	4,840	2,752	5,703	4,859	6,253	5,744
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
Adj. R^2	0.64	0.54	0.62	0.60	0.62	0.54

Table 2.7 Institutional Investors' sensitivity to OSHA violations after ratings coverage

This table reports the percentage change in institutional investors' holdings in Russell 1000 and Russell 2000 firms in the quarters following OSHA violations. In column (1), the model is estimated using Russell 1000 constituents; in column (2), the model is estimated with Russell 2000 constituents. The dependant variable is the natural logarithm of change in institutional investor i's holdings in firm j from quarter $t-1$ to quarter t. The variables are as defined as in Appendix 2.A.1. The dependant variable is winsorized at 3% and 97%. All models have institutional investor-clustered standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	ln(% Δ Holding)	
	R1000	R2000
	(1)	(2)
Viol	-0.10***	0.08**
	(-5.62)	(2.27)
ViolxPost	0.09***	-0.15***
	(4.34)	(-3.68)
F-test on Incremental Effect		
Viol + ViolxPost = 0	-0.01	-0.07***
[F-Stat]	[0.19]	[10.81]
Observations	978,603	127,242
Fixed Effects		
Inst. Investor	Yes	Yes
Year-Quarter	Yes	Yes
Cluster	Inst. Investor	Inst. Investor
Adj. R^2	0.26	0.28

Table 2.8 Peer compliance effects

This table presents peer firms' compliance after a focal-firm violation. Peer firms are identified based on 2-digit SIC code (column 1) and OSHA industry classification (column 2). In column (1), the model is estimated on Russell 2000 constituents; in column (2), the model is estimated on Russell 1000 constituents. The dependant variable is the natural logarithm of one plus total number of OSHA violations. The variables are as defined as in Appendix 2.A.1. The dependant variable is winsorized at 99%, control variables are winsorized at 1% and 99%. All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Violations			
	SIC		OSHA Classification	
	R2000	R1000	R2000	R1000
	(1)	(2)	(3)	(4)
Peer	-0.75***	-0.96***	0.05*	-0.03
	(-9.79)	(-8.43)	(1.89)	(-0.69)
PeerxPost	-0.42***	-0.09	-0.08**	-0.04
	(-2.60)	(-0.51)	(-2.53)	(-0.75)
Observations	8,048	4,329	8,023	4,322
Controls	Yes	Yes	Yes	Yes
Fixed Effects:				
Firm	Yes	Yes	Yes	Yes
Year x Industry	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Adj. R^2	0.49	0.66	0.48	0.65

Table 2.A.1 Variable Definitions

Variable	Definition	Source
Inspections	Natural logarithm of one plus all complete and partial OSHA inspections at the firm-year level	US Department of Labor's Enforcement Data webpage
Violations	Natural logarithm of one plus all OSHA violations at the firm-year level	US Department of Labor's Enforcement Data webpage
Size	Natural logarithm of total assets	Compustat
ROA	Return on assets, measured as ratio of net income to lagged total assets	Compustat
PPE	Property, plant and equipment divided by lagged total assets	Compustat
Capex	Natural logarithm of capital expenditure	Compustat
Leverage	Total debt divided by total assets	Compustat
Cash	Cash and short term investments divided by total assets	Compustat
MB	Market to book ratio	Compustat
Sales Growth	Annual changes in sales	Compustat
R&D	Research and development expenses divided by lagged total assets	Compustat
High ESG Score	Indicator variable equals to one if the value of ESG Score firm i in the Asset4 coverage expansion year (2017) is above the industry-median, zero otherwise.	Asset4
High SOC Score	Indicator variable equals to one if the value of Social Score firm i in the Asset4 coverage expansion year (2017) is above the industry-median, zero otherwise.	Asset4
High ENV Score	Indicator variable equals to one if the value of Environmental Score firm i in the Asset4 coverage expansion year (2017) is above the industry-median, zero otherwise.	Asset4
High Workforce Score	Indicator variable equals to one if the value of Workforce Score firm i in the Asset4 coverage expansion year (2017) is above the industry-median, zero otherwise.	Asset4
High CSR Media Coverage	Indicator variable equals to one if the sum of news article that covers CSR issues by firm i in the Asset4 coverage expansion year (2017) is above the industry-median, zero otherwise.	Rep Risk
High Analysts	Indicator variable equals to one if the number of Analysts covering the firm i in the Asset4 coverage expansion year (2017) is above the industry-median, zero otherwise.	I/B/E/S
Treat	Indicator variable equal to 1 for firms in Russell 2000 index	Bloomberg
Post	Indicator variable for years after 2016	Compustat
Peer	Indicator variable equals to 1 for peer firms that observe violation of a focal firm	Compustat
Viol	Indicator variable that equals to 1 for violating firms	Compustat
%ΔHolding	Natural logarithm of percentage change in quarterly institutional investor holdings in firms.	Thomson Reuters 13f Holdings

Table 2.A.2 Entropy balanced matching

	Before Weighting						After Weighting					
	Treat			Control			Treat			Control		
	Mean	Variance	Skewness	Mean	Variance	Skewness	Mean	Variance	Skewness	Mean	Variance	Skewness
ROA	-0.03	0.12	-18.01	0.05	0.01	-12.45	-0.03	0.12	-18.01	-0.03	0.12	-8.84
Cash	0.21	0.05	1.44	0.13	0.02	2.19	0.21	0.05	1.44	0.21	0.05	1.56
Sales Growth	0.20	0.66	6.93	0.13	0.21	10.05	0.20	0.66	6.93	0.20	0.66	6.87
7.SIC-2	0.00	0.00	.	0.00	0.00	29.82	0.00	0.00	.	0.00	0.00	274.00
10.SIC-2	0.00	0.00	18.06	0.00	0.00	14.61	0.00	0.00	18.06	0.00	0.00	18.06
13.SIC-2	0.02	0.02	6.94	0.04	0.04	4.40	0.02	0.02	6.94	0.02	0.02	6.94
14.SIC-2	0.00	0.00	17.44	0.00	0.00	15.08	0.00	0.00	17.44	0.00	0.00	17.44
15.SIC-2	0.01	0.01	9.36	0.01	0.01	10.72	0.01	0.01	9.36	0.01	0.01	9.36
16.SIC-2	0.01	0.01	10.60	0.00	0.00	19.31	0.01	0.01	10.60	0.01	0.01	10.60
17.SIC-2	0.00	0.00	16.87	0.00	0.00	18.36	0.00	0.00	16.87	0.00	0.00	16.87
20.SIC-2	0.02	0.02	6.57	0.04	0.04	4.84	0.02	0.02	6.57	0.02	0.02	6.57
21.SIC-2	0.00	0.00	56.94	0.00	0.00	16.48	0.00	0.00	56.94	0.00	0.00	56.75
22.SIC-2	0.00	0.00	16.35	0.00	0.00	26.02	0.00	0.00	16.35	0.00	0.00	16.36
23.SIC-2	0.01	0.01	11.40	0.01	0.01	9.67	0.01	0.01	11.40	0.01	0.01	11.40
24.SIC-2	0.01	0.01	11.10	0.00	0.00	26.02	0.01	0.01	11.10	0.01	0.01	11.10
25.SIC-2	0.01	0.01	9.85	0.01	0.01	11.82	0.01	0.01	9.85	0.01	0.01	9.85
26.SIC-2	0.01	0.01	13.26	0.01	0.01	8.23	0.01	0.01	13.26	0.01	0.01	13.26
27.SIC-2	0.01	0.01	9.43	0.00	0.00	15.73	0.01	0.01	9.43	0.01	0.01	9.43
28.SIC-2	0.12	0.11	2.35	0.08	0.07	3.07	0.12	0.11	2.35	0.12	0.11	2.35
29.SIC-2	0.01	0.01	13.48	0.01	0.01	10.14	0.01	0.01	13.48	0.01	0.01	13.48
30.SIC-2	0.01	0.01	13.06	0.01	0.01	10.06	0.01	0.01	13.06	0.01	0.01	13.06
31.SIC-2	0.00	0.00	17.44	0.00	0.00	18.36	0.00	0.00	17.44	0.00	0.00	17.44
32.SIC-2	0.01	0.01	13.59	0.01	0.01	11.95	0.01	0.01	13.59	0.01	0.01	13.59
33.SIC-2	0.02	0.02	7.56	0.00	0.00	14.18	0.02	0.02	7.56	0.02	0.02	7.56
34.SIC-2	0.02	0.02	6.43	0.01	0.01	8.19	0.02	0.02	6.43	0.02	0.02	6.43
35.SIC-2	0.05	0.05	4.16	0.05	0.05	4.03	0.05	0.05	4.16	0.05	0.05	4.16
36.SIC-2	0.07	0.07	3.24	0.05	0.05	4.24	0.07	0.07	3.24	0.07	0.07	3.24
37.SIC-2	0.03	0.03	5.24	0.04	0.03	5.00	0.03	0.03	5.24	0.03	0.03	5.24
38.SIC-2	0.06	0.06	3.58	0.06	0.05	3.84	0.06	0.06	3.58	0.06	0.06	3.58
39.SIC-2	0.01	0.01	12.18	0.00	0.00	14.95	0.01	0.01	12.18	0.01	0.01	12.19
40.SIC-2	0.00	0.00	.	0.01	0.01	11.70	0.00	0.00	.	0.00	0.00	108.50
42.SIC-2	0.01	0.01	8.76	0.01	0.01	11.53	0.01	0.01	8.76	0.01	0.01	8.76
44.SIC-2	0.00	0.00	16.66	0.00	0.00	18.36	0.00	0.00	16.66	0.00	0.00	16.66
45.SIC-2	0.01	0.01	12.91	0.01	0.01	9.32	0.01	0.01	12.91	0.01	0.01	12.91
47.SIC-2	0.00	0.00	16.35	0.00	0.00	17.53	0.00	0.00	16.35	0.00	0.00	16.36
48.SIC-2	0.03	0.03	5.77	0.03	0.03	5.61	0.03	0.03	5.77	0.03	0.03	5.77
49.SIC-2	0.03	0.03	5.49	0.07	0.07	3.35	0.03	0.03	5.49	0.03	0.03	5.49
50.SIC-2	0.02	0.02	6.73	0.02	0.02	6.42	0.02	0.02	6.73	0.02	0.02	6.73
51.SIC-2	0.02	0.02	7.77	0.01	0.01	9.95	0.02	0.02	7.77	0.02	0.02	7.77
52.SIC-2	0.00	0.00	27.46	0.00	0.00	14.95	0.00	0.00	27.46	0.00	0.00	27.47
53.SIC-2	0.00	0.00	14.40	0.01	0.01	8.57	0.00	0.00	14.40	0.00	0.00	14.40
54.SIC-2	0.00	0.00	14.90	0.00	0.00	14.39	0.00	0.00	14.90	0.00	0.00	14.90
55.SIC-2	0.01	0.01	10.52	0.01	0.01	9.67	0.01	0.01	10.52	0.01	0.01	10.52
56.SIC-2	0.02	0.02	7.33	0.01	0.01	10.14	0.02	0.02	7.33	0.02	0.02	7.33
57.SIC-2	0.00	0.00	14.27	0.00	0.00	14.95	0.00	0.00	14.27	0.00	0.00	14.27
58.SIC-2	0.02	0.02	6.81	0.01	0.01	8.19	0.02	0.02	6.81	0.02	0.02	6.81
59.SIC-2	0.01	0.01	8.59	0.02	0.02	7.40	0.01	0.01	8.59	0.01	0.01	8.59
65.SIC-2	0.01	0.01	11.46	0.01	0.01	11.48	0.01	0.01	11.46	0.01	0.01	11.47
67.SIC-2	0.08	0.07	3.21	0.11	0.10	2.53	0.08	0.07	3.21	0.08	0.07	3.21
70.SIC-2	0.00	0.00	20.83	0.00	0.00	15.46	0.00	0.00	20.83	0.00	0.00	20.83
72.SIC-2	0.00	0.00	16.98	0.00	0.00	14.95	0.00	0.00	16.98	0.00	0.00	16.98
73.SIC-2	0.11	0.10	2.43	0.11	0.10	2.48	0.11	0.10	2.43	0.11	0.10	2.43
75.SIC-2	0.00	0.00	23.48	0.00	0.00	14.95	0.00	0.00	23.48	0.00	0.00	23.48
78.SIC-2	0.00	0.00	17.68	0.00	0.00	14.07	0.00	0.00	17.68	0.00	0.00	17.68
79.SIC-2	0.01	0.01	9.01	0.01	0.01	10.42	0.01	0.01	9.01	0.01	0.01	9.01
80.SIC-2	0.02	0.02	7.40	0.02	0.02	7.37	0.02	0.02	7.40	0.02	0.02	7.40
82.SIC-2	0.01	0.01	10.49	0.00	0.00	26.02	0.01	0.01	10.49	0.01	0.01	10.49
87.SIC-2	0.03	0.03	5.92	0.01	0.01	12.55	0.03	0.03	5.92	0.03	0.03	5.92
99.SIC-2	0.00	0.00	23.19	0.00	0.00	14.95	0.00	0.00	23.19	0.00	0.00	23.19

Table 2.A.3 Baseline analysis with industry-clustered standard errors

This table replicates the results presented in Table 2.2 for the impact of Asset4 coverage expansion on regulatory activity from difference-in-differences (DiD) models using industry-clustered standard errors instead of firm-clustered standard errors. Similar to the baseline analysis, I employ entropy balanced sample based on pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership. Treated group comprises of Russell 2000 constituents and the control group has Russell 1000 constituents. Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects, and column (3) includes firm and year-by-industry fixed effects. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations).
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	(1)	(2)	(3)
Treat	-0.09**		
	(-2.07)		
Post	-0.14***		
	(-5.82)		
TreatxPost	0.07***	0.07***	0.07***
	(3.28)	(3.49)	(3.63)
Observations	12,433	12,417	12,390
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Industry	Industry	Industry
Adj. R^2	0.21	0.75	0.76

Panel B: Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.11*		
	(-1.87)		
Post	-0.17***		
	(-4.75)		
TreatxPost	0.10***	0.11***	0.18***
	(3.05)	(3.29)	(3.41)
Observations	12,433	12,417	12,390
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Industry	Industry	Industry
Adj. R^2	0.13	0.58	0.60

Table 2.A.4 Baseline analysis with analytical weights

This table replicates the results presented in Table 2.2 for the impact of Asset4 coverage expansion on regulatory activity from difference-in-differences (DiD) models that employ analytic weights instead of propensity weights after entropy balancing (based on pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership). Treated group comprises of Russell 2000 constituents and the control group has Russell 1000 constituents. Similar to Table 2.2, Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects, and column (3) includes firm and year-by-industry fixed effects. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	(1)	(2)	(3)
Treat	-0.09*		
	(-1.86)		
Post	-0.14***		
	(-6.75)		
TreatxPost	0.07***	0.07***	0.07***
	(3.01)	(3.70)	(4.18)
Observations	12,433	12,417	12,390
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R2̂	0.21	0.75	0.76

Panel B: Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.11**		
	(-2.02)		
Post	-0.17***		
	(-5.97)		
TreatxPost	0.10***	0.11***	0.11***
	(3.12)	(3.89)	(4.31)
Observations	12,433	12,417	12,390
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.13	0.58	0.60

Table 2.A.5 Baseline analysis on unweighted sample

This table reports the results for the impact of Asset4 coverage expansion on regulatory activity from difference-in-differences (DiD) models when entropy balancing is not employed, i.e., when an unmatched sample is used. As in Table 2.2, the treated group comprises of Russell 2000 constituents and the control group has Russell 1000 constituents. Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects, and column (3) includes firm and year-by-industry fixed effects. Each of the two main dependant variables, i.e., inspections and violations are shown in Panels A and B, respectively. All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	(1)	(2)	(3)
Treat	-0.10**		
	(-2.49)		
Post	-0.12***		
	(-7.27)		
TreatxPost	0.06***	0.06***	0.07***
	(3.02)	(3.44)	(3.81)
Observations	12,433	12,417	12,390
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R2̂	0.20	0.75	0.75

Panel B: Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.13**		
	(-2.55)		
Post	-0.16***		
	(-6.99)		
TreatxPost	0.10***	0.10***	0.11***
	(3.52)	(3.88)	(4.16)
Observations	12,433	12,417	12,390
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.13	0.59	0.59

Table 2.A.6 Baseline analysis using propensity score matched sample

This table shows the results for the impact of Asset4 coverage expansion on regulatory activity using the DiD specification in equation 2.1 on a propensity score (PS) matched sample instead of using entropy balancing. I apply one-to-one nearest neighbor PS matching based on pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership using a 0.2 calliper, thus selecting a comparable treated firm observation randomly for each control firm. Treated group comprises of Russell 2000 constituents and the control group has Russell 1000 constituents. Similar to Table 2.2, Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects, and column (3) includes firm and year-by-industry fixed effects. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	(1)	(2)	(3)
Treat	-0.17		
	(-1.47)		
Post	-0.22***		
	(-4.53)		
TreatxPost	0.14**	0.15***	0.13***
	(2.54)	(3.51)	(3.09)
Observations	2,207	2,206	2,132
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.20	0.75	0.75

Panel B: Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.20		
	(-1.52)		
Post	-0.27		
	(-3.73)		
TreatxPost	0.20**	0.20***	0.20***
	(2.29)	(2.98)	(2.95)
Observations	2,207	2,206	2,132
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.12	0.60	0.60

Table 2.A.7 Placebo Treatment

This table presents placebo test results for the impact of Asset4 coverage expansion on regulatory activity using DiD models that employ entropy balancing weights based on pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership. Unlike Table 2.2 that has the actual year of Asset 4 coverage expansion (2017) as treatment year, here I assume a *placebo* treatment in 2014. Accordingly, the results are estimated with a placebo experimental period 2011–2017 instead of the actual experimental period 2014–2020. Treated group comprises of Russell 1000 constituents and the control group has Russell 2000 constituents identified in the beginning of 2014. Similar to Table 2.2, Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects, and column (3) includes firm and year-by-industry fixed effects. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). All models have firm-clustered, robust standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	(1)	(2)	(3)
Treat	-0.07		
	(-1.44)		
Post	-0.12***		
	(-6.19)		
TreatxPost	0.04*	-0.01	-0.01
	(1.92)	(-0.55)	(-0.65)
Observations	12,229	12,212	12,183
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.23	0.76	0.77

Panel B: Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.09		
	(-1.59)		
Post	-0.15***		
	(-5.27)		
TreatxPost	0.07**	0.02	0.02
	(2.15)	(0.57)	(0.66)
Observations	12,229	12,212	12,183
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.15	0.61	0.62

Table 2.A.8 Baseline analysis on firms with at least one inspection

This table reports the results for the impact of Asset4 coverage expansion on regulatory activity using DiD models on a restricted sample of firms that had at least one OSHA inspection in each year. In this identification, the "true zeros" representing observations for firms that were not inspected or reprimanded for any violation by OSHA are omitted. All estimations employ entropy balancing weights based on pre-treatment levels of Return on Assets, Cash, and Sales growth as well as firms' industry membership. The experimental period is from 2014 to 2020 with 2017 assigned as the treatment year when Asset4 expanded its coverage from Russell 1000 constituents (control group) to also include Russell 2000 constituents (treatment group). Similar to Table 2.2, Column (1) reports results from OLS regression, column (2) includes firm and year fixed effects, and column (3) includes firm and year-by-industry fixed effects. The dependant variable in Panel A (Panel B) is the natural logarithm of one plus total number of OSHA inspections (violations). All models have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Inspections

	Inspections		
	(1)	(2)	(3)
Treat	0.39		
	(0.55)		
Post	-0.11***		
	(-3.14)		
TreatxPost	0.01	0.05	0.06*
	(0.06)	(1.28)	(1.66)
Observations	3,768	3,545	3,499
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.17	0.68	0.70

Panel B: Violations

	Violations		
	(1)	(2)	(3)
Treat	-0.02		
	(-0.20)		
Post	-0.21***		
	(-3.34)		
TreatxPost	0.065	0.15**	0.15**
	(0.90)	(2.25)	(2.30)
Observations	3,768	3,545	3,499
Controls	Yes	Yes	Yes
Fixed Effects:			
Firm	No	Yes	Yes
Year	No	Yes	No
Year x Industry	No	No	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.05	0.40	0.43

Table 2.A.9 CSR rating change following OSHA violations

This table presents results of the association between OSHA violations and ESG Scores. The dependant variable in Column (1) is the ESG combined Score, in column (2) the Social Score, and in column (3) the Workforce Score. The rest of the variables are as defined as in Appendix 2.A.1. Control variables are winsorized at 1% and 99%. All models include firm fixed effects and have firm-clustered, robust standard errors.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	ESG (1)	Social (2)	Workforce (3)
Viol	-1.02**	-1.71***	-1.46***
	(-2.33)	(-4.76)	(-3.51)
Observations	8,952	8,952	9,583
Control	Yes	Yes	Yes
Fixed Effects:			
Firm	Yes	Yes	Yes
Cluster	Firm	Firm	Firm
Adj. R^2	0.85	0.83	0.80

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CHAPTER 3

The Non-Financial Spillovers of Financial Information Processing Costs: Evidence from the U.S. XBRL Mandate

3.1 Abstract

We study the impact of market participants' financial information processing costs on firms' environmental, social, and governance (ESG) engagement. By leveraging the eXtensible Business Reporting Language (XBRL) mandate in the U.S. as an exogenous shock to financial information processing costs, we report a significant increase in firms' ESG performance after XBRL adoption.

Further analyses reveal that the mandate affected the Governance Score the most, which is consistent with XBRL being beneficial to institutional investors who value governance mechanisms more, as is also revealed by their voting behavior. Additionally, the magnitude of the mandate's effect wanes over time. Our results are robust to multiple falsification tests and alternative identification strategies. We argue that when market participants' constraints in processing financial information are relaxed, they allocate more time to processing non-financial (ESG) disclosures, especially in financially opaque firms. Facing this increased attention, firm managers respond by improving their ESG engagements. Consistent with this view, we find that the positive effects of the XBRL mandate are concentrated in firms that are either well-monitored, financially opaque, or have risk-taking managers.

3.2 Introduction

Information processing costs impede market participants from acquiring and integrating the information available in public disclosures (Grossman and Stiglitz, 1980; Verrecchia, 1982; Merton et al., 1987). Hence, market participants and investors "rationally weigh the benefits of obtaining firm information against the cost of processing that information" (Blankespoor, 2019). Consequently, market participants' response to disclosure is influenced by the costs associated with its processing. This in turn affects firms' disclosure incentives when they benefit from disclosing information. Several studies have shown positive capital market effects for market participants when there is a reduction in financial information processing costs (Blankespoor, Miller, and White, 2014; Liu, Wang, and Yao, 2014; Kim, Li, and Liu, 2019; Blankespoor, 2019).However, little is known about whether these benefits spill over to firms' non-financial information. This is particularly relevant in the context of the SEC's recent proposal to enhance and standardize climate risk disclosures and in the ongoing debate on the effectiveness of corporate social responsibility (CSR) and environmental, social, and governance (ESG) mandates (Christensen, Hail, and Leuz, 2021; Christensen, Serafeim, and Sikochi, 2022; Fiechter, Hitz, and Lehmann, 2022; Matsumura, Prakash, and Vera-Muñoz, 2022). Proponents of non-financial disclosure mandates argue that these would lead to better market outcomes than a voluntary disclosure regime. To this end, understanding the underlying frictions that impede firms' incentives to disclose non-financial information is also of first-order importance.

This study investigates how a reduction in market participants' financial information processing costs affects their level of engagement toward firms' non-financial information and incentivizes them to improve their ESG performance. Adoption of the mandatory eXtensible Business Reporting Language (XBRL) provides a setting that exogenously affects information processing costs. We hypothesize that because a mandatory switch to the XBRL format benefits market participants in processing financial information faster, they can dedicate more time to scrutinizing other non-financial information. Given that ESG information can provide investors with ample profitable investment opportunities (Van Duuren, Plantinga, and Scholtens, 2016; Pedersen, Fitzgibbons, and Pomorski, 2021; Pástor, Stambaugh, and Taylor, 2021, 2022), some of this increased scrutiny should have been directed toward the latter. Consequently, firms respond to this increase in attention toward non-financial information by improving their ESG policies.

The XBRL mandate used in our experimental setup has several advantages. First, firms that adopt the XBRL filing format, whether voluntarily or in response to the mandate, continue to do so without switching back to the non-XBRL format. This ensures that XBRL and non-XBRL filing firms are mutually exclusive and can be clearly and consistently identified without any possible empirical miscategorization. Second, the relatively short period of three years for the market-wide implementation of the XBRL mandate and the presence of voluntary adopters allowed us to perform multiple falsification tests to assess the validity of our results. Third, because the XBRL mandate has been introduced in three different phases, it permits the gathering of more detailed insights into the evolution of its impact on ESG over time, as well as exploiting the staggered adoption empirically to design alternative identification strategies. Fourth, in our empirical setting, firms are highly unlikely to self-select into the treatment group (i.e., mandated XBRL filers) or actively avoid XBRL adoption because they have no choice but to follow the SEC mandate. Self-selectors were weeded out and isolated from our sample in the form of voluntary adopters. Thus, we are also able to largely avoid any firm-specific sources of endogeneity. In particular, the presence of voluntary adopters allows us to analyze whether the effect is due to a firm's behavior (i.e., voluntary adopters), the regulation itself (i.e., mandatory adopters), or both. Lastly, for a financial disclosure regulation to effectively impact the non-financial behavior of firms, market participants should be well informed about the regulation change, while firms are not given enough time to understand and anticipate its potential impact and react to it. This is clearly the case with the XBRL mandate, which was officially announced only in the first phase of its implementation.

With an initial sample of over 28,500 ESG Scores, provided by Thomson Reuters Refinitiv/ASSET4 for U.S. firms from 2002 to 2020 (with a coverage of more than 3,200 firms), we study the change in firms' ESG performance when their 10-K reports are mandated to be filed using the newer, standardized, and machine-readable XBRL format. Refinitiv/ASSET4 ESG data has been frequently used in recent literature studying antecedents and outcomes of CSR or ESG Liang and Renneboog, 2017; Dyck et al., 2019; Christensen, Serafeim, and Sikochi, 2022. We employ a staggered difference-in-differences

(DiD) approach to show that firms mandated by the SEC to adopt XBRL filing experience a significant increase in their ESG scores relative to their pre-XBRL years. Emphasizing the economic significance of our findings, the average increase in ESG performance is approximately 5% relative to the pre-XBRL period. Our results are robust after controlling for time-variant and invariant firm characteristics to partially account for the staggered year-wise adoption of the XBRL mandate by implementing fixed effects and accounting for heterogeneity in the treatment effects of staggered phase-wise XBRL adoption (Sun and Abraham, 2021; Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Baker, Larcker, and Wang, 2022).). Next, we examine the effect of the XBRL mandate on the Environmental, Social, and Governance Pillar Scores separately, and find that the increment in their respective magnitudes is highest for the Governance Score and lowest for the Environmental Score. There are two possible explanations for these heterogeneities in ESG scores. First, this could be explained by the difficulties associated with assessing environmental parameters for firms, managers, and investors (Ittner and Larcker, 2001; Dumitrescu and Zakriya, 2021). Second, XBRL has been shown to benefit mostly sophisticated institutional investors with the requisite resources and capabilities (Blankespoor, Miller, and White, 2014). These investors have a first-order interest in influencing firm policies related to corporate governance mechanisms (Bushee, Carter, and Gerakos, 2014).

One underlying assumption in our main DiD identification is that firms react to the increased scrutiny of market participants regarding ESG disclosures after the XBRL mandate by improving their ESG engagement. To rule out the possibility that our results do not merely reflect changes in market participants' expectations toward ESG issues, we examine the ESG Controversies Score, which quantifies the gravity of "news stories about, among other issues, environmental incidents or scandals about product-harm responsibility" that firms do not have direct control over (Caglio, Melloni, and Perego, 2020). We find that there is no statistically significant effect of the XBRL mandate on the ESG Controversies Score, providing some indicative evidence that the impact of information processing costs is directed only toward ESG actions and not necessarily on ESG perceptions. Another central assumption in our DiD specification is that the impact of the XBRL mandate on ESG Scores is consistent across all three implementation phases. However, given that size is an important determinant of CSR engagement (Drempetic, Klein, and Zwergel, 2020) and that the three XBRL implementation phases were demarcated around a factor closely related to size—that is, firms' public float—we expect considerable heterogeneity in how the shock to information processing costs affects firms' ESG Scores in each of the three XBRL mandates. Indeed, we document a monotonically decreasing effect of XBRL reporting on ESG Scores and two of its three Pillars, the Social and Environmental Scores, over time. Zhou (2020) demonstrated a similar decline in the magnitude of the effect of XBRL adoption on the timeliness of firms' 10-K filings.

We conduct several tests to examine the internal validity of our main results and rule out potential sources of endogeneity. We start with the placebo XBRL implementation beginning in 2014, instead of the actual XBRL mandate of 2009, and assign placebo treatments using the same three market float-based criteria to identify phase-wise placebo adoptions. We also repeated the placebo test, focusing on the pre-XBRL implementation period. We did not find any effect of these placebo treatments on the ESG or its three Pillar Scores. These tests allay any concerns about the structured implementation of the mandate or similar confounding factors driving our results, while also affirming that there are parallel trends in the absence of treatment. Next, we investigate whether our findings are indeed driven by regulatory changes and do not merely reflect changes due to firms' XBRL adoption. Using a sample of "voluntary" firms that start filing their financial disclosures in XBRL format before the mandate, we do not find any evidence of changes in ESG Scores. This is consistent with the XBRL literature, which shows that market participants benefited from XBRL adoption only after its mass acceptance and implementation following mandatory adoption (Dong et al., 2016).[22]

Finally, we address concerns about the non-random assignment of the XBRL treatment and the related endogeneity arising from phase-wise implementation cutoffs. Given that phase-wise XBRL adoption relies on a firm's market float, which is closely related to firm size, one potential concern is that larger firms have more resources to allocate to ESG engagement and are more prone to ESG risks (Krüger, 2015; Drempetic, Klein, and Zwergel, 2020; Ting, 2021). This implies that the impact of the XBRL mandate was concentrated mainly in the first treatment phase. This is true in our setting, as seen from the magnitudes of the coefficients for the different XBRL adoption phases. Thus, studying firms of different sizes whose XBRL treatment assignment is endogenous to size could result in biased DiD estimates. We address this concern by exploiting fiscal year-end variations for similar-sized firms that affect their XBRL adoption, and by cross-sectionally studying the differential impact on their ESG performance. This approach allows for the identification of a similar control group that differs only because of differences in fiscal year-end variation between the treated and control groups. The results from this cleaner identification corroborated our main findings. Because this alternative identification captures within-year cross-sectional variations, it also alleviates concerns about other concurrent events that drive our results.[23]

[22]However, this result has to be interpreted with caution as there are only a few voluntary XBRL adopters in our sample, which severely constrains the statistical power of our findings.

[23]For instance, we use Thomson Reuters Asset4 data to measure ESG performance and the year when Thomson Reuters acquired Asset4 (2009) coincides with the XBRL implementation. The identification using fiscal year-end variations ensures that such confounding events are controlled for.

The principal means by which the SEC's XBRL mandate reduces information processing costs is by enabling market participants and investors to employ advanced data analytics tools by quickly processing machine-readable XBRL filings. Thus, we hypothesize that with easier and quicker access to financial information after XBRL adoption, firms' investors can potentially devote more time to seeking and understanding non-financial ESG information. In response to this increased attention, firms would have improved their ESG engagements. To understand the underlying channels accompanying increased investor scrutiny, we examine the variations in the treatment effect from the XBRL mandate cross-sectionally by median-based partitioning of our sample firms using proxies for external monitoring, firm opacity, and managerial risk aversion, and then examine how it moderates the XBRL treatment. Increased investor attention would have effectively translated into better ESG performance, more so in firms that are well-monitored because their financial statements are already under higher scrutiny. Moreover, the effect of XBRL adoption is expected to be higher for opaque firms because they are more susceptible to increased scrutiny when more accessible and standardized information disclosures in XBRL format are employed. Finally, increased investor attention requires firms to react quickly and improve ESG policies, which would have been easier for firms with a higher propensity for managerial risk-taking. We run empirical tests on these propositions and find evidence that all three aspects positively moderate the impact of mandated XBRL adoption on ESG performance.

Being a key "voice" mechanism for investors, investor voting behavior during shareholder meetings can partly reflect their involvement in monitoring and/or activism campaigns (Brochet, Ferri, and Miller, 2021; Bermejo, Rizzo, and Zakriya, 2022; Lesmeister, Limbach, and Goergen, 2022). Despite the differences in voting support for ESG proposals between ESG-motivated and conventional investors (Dikolli et al., 2022), we expect that when ESG scrutiny increases in the markets (following XBRL implementation), there is higher support for ESG-related proposals among shareholders (Chen, Dong, and Lin, 2020). Our empirical tests demonstrated that this was indeed the case. Essentially, following XBRL adoption, we find a marginal increase in investor support for ESG proposals, but not for non-ESG routine proposals. This trend is restricted primarily to management-sponsored proposals. These proposals target the governance aspects of a firm, toward which institutional investors tend to have greater sensitivity (Bushee, Carter, and Gerakos, 2014). Thus, these results are consistent with the XBRL mandate affecting the Governance Score more than Environmental and Social Scores given that it has benefited institutional investors the most.

Our main contribution to the existing literature is that financial disclosure regulations have important implications for firms' non-financial policies. This effect is relatively understudied, as research has largely focused on such regulations' effects on financial markets and their intermediaries (Griffin, 2003; Bhattacharya, Cho, and Kim, 2018; Drake et al., 2020), or firm-specific characteristics such as their financial information environment (Dong et al., 2016; Gao and Huang, 2020). Specifically, we contribute to and extend the literature on information processing costs (see Blankespoor, deHaan, and Marinovic, 2020 for a detailed review) by showing its economically significant impact on non-financial ESG performance. Moreover, by focusing on the XBRL mandate, we contribute to the literature on the effects of new technologies on disclosure dissemination (Miller and Skinner, 2015). To this end, we tangentially contribute to the literature on the ESG and sustainability effects of mandatory CSR reporting regulations (Christensen, Hail, and Leuz, 2021; Fiechter, Hitz, and Lehmann, 2022) by showing that financial disclosure mandates can also have ESG consequences when the constraints associated with processing financial information are relaxed. Given the current debate around a non-financial disclosure mandate, our study is informative. Our results on the differential impacts of XBRL adoption on the three ESG Pillar Scores address the literature that highlights measurement issues with ESG data owing to their multidimensionality (Khan, Serafeim, and Yoon, 2016; Kotsantonis and Serafeim, 2019; Serafeim and Yoon, 2022). Moreover, our study is relevant to the broader literature on CSR and ESG. Many studies have examined the financial accounting antecedents and outcomes of CSR (Moser and Martin, 2012; Watson et al., 2015; Gillan, Koch, and Starks, 2021). While much of this literature debates CSR's effect on firm valuation (Lys, Naughton, and Wang, 2015; Ferrell, Liang, and Renneboog, 2016; Lins, Servaes, and Tamayo, 2017; Bartov, Marra, and Momenté, 2021), some studies have focused on its implications for cost of capital (Dhaliwal et al., 2011; El Ghoul et al., 2011), firm risk (Dumitrescu and Zakriya, 2021), bankruptcy (Maso et al., 2020; Dumitrescu, El Hefnawy, and Zakriya, 2020), and taxes (Lanis and Richardson, 2012; Hoi, Wu, and Zhang, 2013). By examining financial information processing costs, we focus on an unexplored determinant of CSR and find that financial disclosure regulations can potentially have beneficial spillover effects on CSR performance.

The rest of this paper is organized as follows: Section 2 provides the institutional background on the XBRL mandate in the U.S. and develops our hypotheses. Section 3 describes the data, samples, and research methodology. In Section 4, we present our main causal estimation results, including robustness checks, falsification tests, and alternative identification. Section 5 provides insights into the underlying mechanisms that potentially explain our main results, and Section 6 concludes.

3.3 Institutional Background and Literature

3.3.1 Overview of the XBRL Mandate and its Impact

In April 2009, the SEC mandated that all public companies subject to filing requirements in the U.S. provide XBRL versions of their quarterly and annual financial reports, in addition to standard text or HTML filings. The mandate was introduced over three phase-in periods (2009 for firms with a public common equity float of over $5 billion; 2010 for firms with a public float over $700 million, and 2011 for all the remaining companies). The SEC argues that XBRL helps market participants capture and process information more quickly and at a lower cost (SEC, 2009). With XBRL, market participants would spend less time, money, and effort in acquiring financial information to make decisions, because XBRL facilitates the comparison of data across time and firms.

Several studies have examined the capital market consequences of the XBRL mandate in the U.S. Blankespoor, Miller, and White (2014) demonstrated that XBRL increases information asymmetry between less sophisticated investors and more-sophisticated investors around 10-k filings for the first phase of adopters. Dong et al. (2016) focused on all three phases of mandatory adoption in the U.S. and found that XBRL reporting facilitates the incorporation of firm-specific information into stock prices and lowers firms' stock return synchronicity. Similarly, Kim, Kim, and Lim (2019) and Blankespoor (2019) demonstrated the impact of XBRL adoption on accounting quality and disclosure choices, respectively. While earnings management and absolute discretionary accruals decrease following XBRL adoption, firms tend to increase their quantitative footnotes disclosure upon implementation.

Blankespoor, deHaan, and Marinovic (2020) provided a detailed review of how the shock to market participants' information processing costs from XBRL implementation not only influences firms' choices but also affects equity markets indirectly through institutional investors. For instance, Bhattacharya, Cho, and Kim (2018) demonstrated that information access has improved for smaller institutional investors following the XBRL mandate, thereby "leveling the playing field between large and small institutions." Consequently, Kim, Li, and Liu (2019) found that the breadth of ownership increases in firms after the adoption of XBRL and that the effect is stronger for firms with higher information processing costs. In addition to institutional investors, XBRL-related shocks to information processing costs benefit tax authorities. Chen et al. (2021) found that XBRL adoption decreases tax avoidance by small-cap firms, and that the XBRL mandate reduces the cost of Internal Revenue Service (IRS) monitoring.

3.3.2 CSR and ESG: Current Literature

Several managerial and firm characteristics, including governance structures, have been shown to be important in shaping firms' CSR and ESG outlooks (Moser and Martin, 2012; Gillan, Koch, and Starks, 2021; Christensen, Hail, and Leuz, 2021). One such firm-specific determinant of CSR strategies is firm size (Drempetic, Klein, and Zwergel, 2020). Larger firms have more resources to direct toward CSR investments, can communicate them more efficiently, and may be more incentivized to engage in CSR practices (Wickert, Scherer, and Spence, 2016; Ting, 2021). Banker et al. (2022), demonstrated that CSR activities reflect corporate strategies. Moreover, previous studies have shown the importance of unobservable and observable managerial traits in CSR (Davidson, Dey, and Smith, 2019), including personal and demographic attributes (Di Giuli and Kostovetsky, 2014; Borghesi, Houston, and Naranjo, 2014; Cronqvist and Yu, 2017; Hegde and Mishra, 2019).

In addition to these intra-firm aspects, external pressure from investors, industry peers, and other stakeholders is also critical to firms' CSR behavior (Khan, Serafeim, and Yoon, 2016; Dyck et al., 2019). While much of this pressure can be attributed to institutional investors and their ESG preferences (Chen, Dong, and Lin, 2020; Kim et al., 2019), the roles of other stakeholders—regulators (Dai et al., 2018), competitors (Dupire and M'Zali, 2018), media (El Ghoul et al., 2019), and customers (Dai, Liang, and Ng, 2021)—influence firms' CSR attitude.

Notwithstanding these antecedents of CSR, several outcomes have been studied, mainly focusing on its impact on firm value and performance (Watson et al., 2015; Gillan, Koch, and Starks, 2021). For instance, Lys, Naughton, and Wang (2015) and Bartov, Marra, and Momenté (2021) demonstrated the positive and negative impacts of socially responsible and irresponsible behaviors, respectively, on firm valuation. Moreover, CSR influences a firm's cost of capital and risk (Dhaliwal et al., 2011; Dumitrescu and Zakriya, 2021), information asymmetry and transparency (Kim, Park, and Wier, 2012; Cho, Lee, and Pfeiffer Jr, 2013), tax policies (Lanis and Richardson, 2012; Hoi, Wu, and Zhang, 2013), and innovation (Cook et al., 2019).

3.3.3 XBRL Mandate and ESG Performance: Predictions

The brief literature review presented above on the XBRL mandate and CSR/ESG performance motivated us to examine the impact of information processing costs on firms' ESG profiles. In particular, XBRL filings are meant to reduce information acquisition and processing costs because they benefit market participants when the available financial data in company filings is reported in a standardized form. Grossman and Stiglitz (1980) demonstrated that a reduction in the cost of information increases the number of informed investors and improves market efficiency. However, while benefiting financial markets through easier information access that is more disciplined and of better quality

(Dong et al., 2016; Kim, Kim, and Lim, 2019), it also affects market participants' ability to quickly assimilate and process financial information (Bhattacharya, Cho, and Kim, 2018; Blankespoor, deHaan, and Marinovic, 2020). Given that market participants do not have unlimited information processing capacity (Hirshleifer and Teoh, 2003), easy access to information helps optimize the time allocated to extracting useful information and learning from it (Peng, 2005). As a result, market participants, especially sophisticated ones, actively seek alternative sources of information to maintain their informational advantage (Kalay, 2015). Given the potential for high ESG firms' stocks to perform well (Van Duuren, Plantinga, and Scholtens, 2016; Pástor, Stambaugh, and Taylor, 2021, 2022), some investors would have reacted to the reduction in financial information processing costs by digressing their attention to non-financial ESG information (Pedersen, Fitzgibbons, and Pomorski, 2021). Furthermore, following the 2008 global financial crisis, market participants' attention to non-financial (i.e., ESG) information has considerably increased (Dumitrescu and Zakriya, 2022). Taken together, these arguments imply that following the XBRL mandate, the standardization of financial reports in the XBRL format facilitated firms' investors to devote more time to scrutinizing non-financial ESG information. Hence, we expect firms to react to increased scrutiny by improving their ESG policies. Accordingly, we propose the following hypothesis:

Hypothesis 1:

The XBRL mandate leads to improvements in firms' ESG performance.

In recent years, one frequently presented critique of ESG performance measures has been that they are overexpansive in terms of scope (Khan, Serafeim, and Yoon, 2016; Christensen, Hail, and Leuz, 2021), especially because they capture firms' engagement with multiple stakeholder groups that have their own competing interests (Dumitrescu and Zakriya, 2021). Hence, balancing the needs of stakeholders may not always be easy for firms and their managers. In particular, if we focus on the three broad categories covered under ESG performance, that is, environmental, social, and governance characteristics taken separately, we can expect considerable heterogeneity with respect to how firms address them. Moreover, market participants need not be equally receptive to each of the three ESG dimensions. For instance, while environmental superstars (exemplary green firms) and environmental laggards (notoriously toxic firms) are easily identifiable (Fernando, Sharfman, and Uysal, 2017), it is difficult for investors to assess the environmental performance of an average firm. In sharp contrast, "market participants [and investors have already] learned to appreciate the differences between well-governed firms and poorly governed firms" after early 2000s (Bebchuk, Cohen, and Wang, 2013). Moreover, most institutional investors capture the benefits of XBRL (Blankespoor, Miller, and White, 2014), and have specific preferences for certain governance mechanisms (Bushee, Carter, and Gerakos, 2014). In light of these arguments, if indeed mandated XBRL adoption impacts investor attention to ESG information, we expect a greater effect on governance performance than on environmental performance. Therefore, we propose the following hypothesis:

Hypothesis 2:

The effects of mandated XBRL adoption on firms' ESG performance are not homogeneous across its environmental, social, and governance pillars.

Finally, we investigate whether the firms targeted by each of the three phases of the XBRL mandate react in the same manner to an increase in investor scrutiny following XBRL adoption. On the one hand, Dong et al. (2016) demonstrated the increasing relevance of XBRL adoption to the amount of information impounded in stock prices. On the other hand, Zhou (2020) demonstrated the declining relevance of the XBRL mandate for firms' 10-K filing timeliness from Phase 1 to Phase 3 of the SEC's mandate. These opposing forces of delayed informational efficiency and improved market learning should ideally dictate how XBRL mandate affects ESG performance over the three phases. However, when focusing on ESG information, Drempetic, Klein, and Zwergel (2020) stated that "larger companies are under more pressure to disclose more information to gain legitimacy." Furthermore, the benefits arising from XBRL adoption itself could be size-dependent——that is, "benefits may be greater for large companies than for small companies" (Yoon, Zo, and Ciganek, 2011). Given that size, as reflected by the public float in the SEC's mandate, forms the basis for the three phases of the XBRL mandate, we predict a large variation in the way the XBRL mandate impacts ESG performance from phases 1 to 3. Based on these arguments, we hypothesize the following:

Hypothesis 3:

The effects of the XBRL mandate on firms' ESG performance declines progressively over the three phases of XBRL implementation.

3.4 Data and Methodology

3.4.1 Data Sources and Sample Selection

To construct our sample, we obtained ESG data for all U.S. firms available in the Thomson Reuters Refinitiv/ASSET4 database. Beginning in 2002, ASSET4 began compiling CSR data from publicly available sources for Russell 1000 firms. The number of companies covered by Refinitiv/ASSET4 has steadily increased over the years. Next, we collected the XBRL filings from Electronic Data Gathering, Analysis, and Retrieval System (EDGAR) databases of Interactive Data Filings and monthly Really Simple Syndication (RSS) feeds. These include voluntary XBRL filings starting in 2005 and mandatory XBRL adoption after 2009. For each XBRL filing, we obtained the form type, reporting period, and firm identity. As ESG data are available annually, we focus only on annual 10-K filings. Thus, for each of our Refinitiv/ASSET4 sample observations, we can track the 10-K filing dates for every instance in which these filings were made in the XBRL format. Although our full sample period spans 2002–2020, the three phases of mandated XBRL adoption were implemented between 2009 and 2012.

After merging the Refinitiv/ASSET4 and filing data, our sample comprised 28,551 firm-year observations for 3,261 firms. For these sample firms, we obtain annual financial fundamentals from Compustat, stock price data from the Center for Research in Security Prices (CRSP), CEO data from the Execucomp database, analyst coverage from the Institutional Brokers' Estimate System (IBES), and institutional ownership and blockholding data from Thomson Reuters 13-F filings. Finally, shareholder voting data are obtained from Institutional Shareholder Services (ISS) Voting Analytics, which reports voting activity and results for a large sample of U.S. firms. We included voting data for all proposals (both management- and shareholder-sponsored) submitted for consideration in the shareholder meetings of our sample firms between 2003 and 2020. In total, we obtained voting data for 474,109 proposals, with the majority (97.7%) sponsored by management. The ISS tracks shareholder voting data (voted for, against, or abstained) for each proposal raised during a shareholder meeting. Additional important proposal-related variables included meeting date, meeting type, proposal number, type or sponsor (management or shareholder), and management recommendations.

Table 1 summarizes the number of firms in the sample over time. While sample coverage increased considerably from 2002 to 2020, it remained relatively stable during the XBRL implementation years (2009–2012).

3.4.2 Summary Statistics

Our primary measures of firms' ESG performance are the ESG Score, Governance Pillar Score, Social Pillar Score, and Environmental Pillar Score provided each year on a scale of 0–100. The Environmental Pillar Score reflects the assessment of three broad categories: resource use, emissions, and innovation; the Social Pillar Score encompasses workforce, human rights, community, and product responsibility issues; and the Governance Pillar Score evaluates three verticals: management, shareholders, and CSR strategy. These 10 categories within the three pillars are aggregated into an ESG Score that measures firms' overall ESG performance. Along with these measures, the Refinitiv/ASSET4 also provides the ESG Controversies Score and ESG Combined Score. The ESG Controversies Score is assessed using a set of 23 ESG controversy topics and identifying whether the firms encountered any ESG scandals on these topics as reported in the media, whereas the ESG Combined Score simply combines the ESG Score and ESG Controversies Score. All our main variables, including ESG performance measures and XBRL adoption indicators, are defined in Appendix 3.A.1.

Table 3.2 provides the descriptive statistics for all the main variables included in our analyses. The mean (standard deviation) for ESG Score was 40.871 (20.026). Among the three ESG sub-scores, the Governance Score has the highest mean, whereas the Environmental Score has the lowest. In our sample, the mean (s.d.) of return on assets is 2.5% (5.5%), and of sales growth rate is 12.5% (50.5%). We also present the summary statistics for the partitioning variables. For instance, in our sample, firms are covered, on average, by 10.67 analysts, the mean ratio of the number of shares held by institutional investors to the total number of shares is 69,3%, and the mean number of blockholders in the sample firms is 2.58.

3.4.3 Research Design and Empirical Specification

To test Hypotheses 1 and 2, we assessed the average effect of mandated XBRL adoption on ESG performance measures by estimating the following regression:

$$Y_{i,t} = \beta_0 + \beta_1 XBRL_{mandate} + \sum_{j=1}^{K} Controls_{i,t-1}, + FirmFE + YearFE + \epsilon_{i,t} \tag{3.1}$$

Where $Y_{i,t,}$ denotes any of the ESG performance measures of firm i in year t. Our main variable of interest is $XBRL_{mandate}$ that equals to 1 for years when firms adopt XBRL following SEC mandate, and 0 otherwise. We also control for firm-specific characteristics ($Controls$), for idiosyncratic firm factors using firm fixed effects ($FirmFE$), and for time-specific variations by including year fixed effects ($YearFE$). We employ firm-clustered standard errors to account for any transitory shocks correlated over time for a given firm.

Following prior literature (Di Giuli and Kostovetsky, 2014; Davidson, Dey, and Smith, 2019; Dyck et al., 2019), we controlled for firm size (*Size*), leverage (*Leverage*), market-to-book ratio (*MTB*), return on assets (*ROA*), firm age (*Age*), average monthly returns (*Avg. Returns*), cash (*Cash*), dividends (*Dividend*), capital expenditures (*CAPEX*) and sales growth (*Sales Growth*).

Next, to test Hypothesis 3, we assessed the average effect of each of the three phases of the XBRL mandate on ESG performance measures using the following specifications:

$$\begin{aligned} Y_{i,t} =& \beta_0 + \beta_{1a} XBRL\_1_{mandate} + \beta_{1b} XBRL\_2_{mandate} + \beta_{1c} XBRL\_3_{mandate} \\ &+ \sum_{j=1}^{K} Controls_{i,t-1} + FirmFE + YearFE + \epsilon_{i,t} \end{aligned} \tag{3.2}$$

In this regression, we merely replace the variable $XBRL_{mandate}$ in Equation (3.1) with a set of indicators ($XBRL\_1_{mandate}$, $XBRL\_2_{mandate}$, and $XBRL\_3_{mandate}$) that are representative of years when firms report using XBRL format after either of the three phases of SEC mandate is implemented. All the other variables are as defined as in Equation (3.1).

3.5 Main Results: Information Processing Costs and ESG Performance

3.5.1 Average Treatment Effect

Figure 3.1 provides graphical evidence that ESG performance sharply increased after the XBRL mandate. This effect is distinctly visible across all four performance measures. Table 3.3 reports the main results of the effect of XBRL adoption on all ESG performance measures (i.e., ESG, Governance, Social, and Environmental Scores) using the empirical specifications in Equation (1). In each model, we controlled for year and firm fixed effects and used a DiD approach for the SEC's staggered XBRL adoption program. The coefficient of $XBRL_{mandate}$ captures the average effect of mandated XBRL adoption within each firm. The results show that the coefficients of $XBRL_{mandate}$ are positive and significant at 1% level across all ESG performance measures, supporting Hypothesis 1 that mandated XBRL adoption positively affects ESG performance. In terms of economic significance, the introduction of XBRL improves the ESG Score by almost 1.93 points (Column 1), which translates to an approximately 5% increase in average firms' ESG performance relative to the pre-regulation period. The effect of XBRL adoption was strongest for the Governance Score and weakest for the Environmental Score. This finding supports Hypothesis 2, given the heterogeneous effects of the XBRL mandate across ESG sub-scores.

For the control variables, our results were consistent with those of previous studies. Large firms tended to have higher ESG Scores. Indeed, the coefficient of *Size* is positive across all ESG dimensions. Similarly, there is a statistically significant positive coefficient for market-to-book ratio (*MTB*) and sales growth (*Sales Growth*) consistently.

Recent advances in econometrics have highlighted the potential issues encountered when using two-way fixed effect (TWFE) structures with heterogeneous treatment effects that vary over time and across groups (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021; Baker, Larcker, and Wang, 2022). We implemented alternative TWFE estimations that account for the staggered nature of XBRL over the three phases using Sun and Abraham's (2021) and Callaway and Sant'Anna's (2021) estimators. Table 3.A.2 Panels A and B report the average treatment effects of these two estimations. Our main estimates were economically and statistically significant. In each estimation, not-yet-treated firms are strictly assigned to the control group. Thus, unlike in Table 3.3, we restricted our sample to one year after the last cohort is treated (i.e., 2012) to ensure the implementation of a strict TWFE DiD design that requires at least one year before XBRL adoption (i.e., at least one untreated period). With this restricted sample, we also found that our baseline results remain robust (Panel C). In the previous discussion on the economic magnitudes of the effect of XBRL on ESG performance measures, we focused only on the results reported in Table 3.3 because they provide the most conservative estimates.

Next, we considered an alternative estimation that includes industry fixed effects instead of firm fixed effects. The results are reported in Table 3.A.3 and are qualitatively similar to the main results shown in Table 3. Finally, in Table 3.A.4, we analyzed the impact of mandated XBRL adoption on the ESG Controversies Score, which captures external issues outside the control of firms, such as controversial environmental scandals or governance-related lawsuits that disrupt firms' ESG reputations. The coefficient of $XBRL_{mandate}$ is not significant regardless of whether we use firm fixed effects (column 1) or industry fixed effects (column 3). Thus, the results in Table 3.A.4 corroborate our argument that firms react to the increased scrutiny of ESG disclosures, and we did not capture general changes in expectations from market participants over ESG trends.

3.5.2 The Effect of Different Phases of XBRL Mandate

In our main DiD analyses, we assumed that the XBRL mandate's impact on firms' ESG performance does not change during the three implementation phases. Hence, we employed a single indicator $XBRL_{mandate}$ representing the DiD term across all three phases. Nevertheless, given that size is an important determinant of CSR engagement (Drempetic, Klein, and Zwergel, 2020; Ting, 2021) and that the three XBRL implementation phases were designed around a size threshold (i.e., firms' public floats), we expected heterogeneity in the XBRL implementation groups. Thus, using Equation (3.2), we disaggregated the $XBRL_{mandate}$ of Equation (3.1) based on the three phases of XBRL mandate implementation and regress the ESG Score, Governance Score, Social Score, and Environmental Score on the three post-adoption indicators (i.e., $XBRL\_1_{mandate}$, $XBRL\_2_{mandate}$, and $XBRL\_3_{mandate}$).

Table 3.4 presents the results showing the impact of the XBRL mandate on ESG performance across the three phases of its implementation. Consistent with our main findings, a positive and statistically significant coefficient exists on $XBRL\_1_{mandate}$ for each of the ESG Score, Governance Score, and Social score. The coefficient is significant at the 1% level or better. In terms of economic significance, the effect of first phase XBRL adoption on ESG Score is approximately 7.5% relative to pre-regulation level. Governance and Social Score experienced the strongest improvement, by approximately 10.1% and

10.2% respectively. For $XBRL\_2_{mandate}$ and $XBRL\_3_{mandate}$, results are less consistent. For ESG Score, the magnitude of the effect for $XBRL\_2_{mandate}$ and $XBRL\_3_{mandate}$ monotonically decrease. This finding supports Hypothesis 3, which predicts the effect of the XBRL mandate to decline over the three phases of the SEC's implementation. This can potentially be explained by firms' declining proclivity to engage in ESG activities throughout the phases of the XBRL mandate. This could be due to the lack of investor attention toward smaller firms and, hence, less market scrutiny. Alternatively, this could also be due to management's reduced expectation of market scrutiny, or even the expectation of potential postponement or revocation of the mandate for smaller firms (Blankespoor, 2019). The magnitude of the effect is strongest for Governance Score. Each adoption group responded to the increase in monitoring by improving the Governance Score between almost 4.9 points ($XBRL\_1_{mandate}$) and 4.3 points ($XBRL\_2_{mandate}$). For both Social and Environmental Scores, there is a monotonic decrease in the magnitude of the coefficient. While the statistical significance for the coefficient of Social Score vanishes after the first year of adoption, the coefficients for Environmental Score are statistically insignificant. This potentially points to the difficulties faced when adjudicating the environmental engagement of firms by market participants and investors (Ittner and Larcker, 2001; Dumitrescu and Zakriya, 2021), and is consistent with the low magnitude of the overall effect of the XBRL mandate on the Environmental Score reported in Table 3.3. Overall, the results in Table 3.4 confirm our prediction of the monotonically decreasing effect of the XBRL mandate across the three implementation phases of XBRL mandate.

3.5.3 Internal Validity

To provide further evidence that the increase in CSR engagement is related to XBRL adoption, we implement three additional tests to strengthen our internal validity: placebo analyses, evidence from non-mandatory XBRL reporting, and variation in the fiscal year-end.

3.5.4 Evidence from Placebo Treatments

We conducted placebo treatments and falsification tests to alleviate any concerns of our main results being driven by any confounding extraneous factors or random differences between XBRL-mandated and non-mandated firms. Specifically, we assigned "placebo" treatments a) in the period when all firms were already treated to see if there is differential effect despite no exogenous XBRL mandate in this period, and b) in the pre-treatment period by restricting the sample up to 2009 to verify the parallel trend assumption and showed that in absence of the treatment, we do not find any differential effects on ESG performance. Ideally, the regression coefficients estimating the effects of these placebo XBRL treatments should not be statistically significant.

Table 3.5 presents the results of the first placebo test. In this placebo analysis, we assigned a fictitious XBRL mandate beginning in 2014 instead of the actual XBRL mandate of 2009 to the treatment firms designated using the same market float thresholds as the actual mandate. We then regress the ESG, Governance, Social, and Environmental Scores on $PlaceboXBRL_{mandate}$. In each model, the coefficients of interest are statistically insignificant.

Next, we assigned placebo treatment during the pre-treatment years to test the parallel trend assumption. We restricted our sample to 2009 and assigned a placebo XBRL mandate beginning in 2005 using the market float criteria of the actual XBRL mandate. We then replicated the results in Table 3.5 for the pre-treatment years. As shown in Appendix Table 3.A.5, the coefficients of $PlaceboXBRL_{mandate}$ reaffirmed the validity of our main results because they are statistically insignificant for the ESG Score and its three sub-scores.

3.5.5 Evidence from Non-Mandatory XBRL Reporting

To ensure that the observed effects on ESG performance are driven by a reduction in financial information processing costs, specifically due to the SEC's XBRL mandate, we examined the impact of XBRL filings under the voluntary adoption program. XBRL adoption in the U.S. started as a voluntary program in 2005 before being mandated by the SEC in 2009. Voluntarily adopting firms were not exposed to the same set of stringent requirements associated with XBRL filings under the mandatory program. Given the lack of clear guidelines for XBRL adoption during this non-mandated period and the untimely and possibly unreliable adoption by firms filing in XBRL format under the voluntary program (SEC, 2005; Dong et al., 2016), their impact on information processing costs would have been lower and would therefore have drawn little reaction from investors. Therefore, we predicted a weaker or no effect of XBRL adoption on ESG performance firms in the voluntary program. Moreover, by separating voluntary and mandatory adopters, we could assess whether the change in ESG performance is primarily due to firms' XBRL adoption decisions (voluntary adopters), changes in regulations (mandatory adopters), or both.

We identified all the voluntary adopters—including those firms adopting XBRL before June 15, 2009, as well as those that essentially fell under Phase 2 or Phase 3 of the mandate that still decided to adopt XBRL in advance—and examined whether XBRL adoption by these firms had an impact on their ESG, Governance, Social, and Environmental Scores. In Table 3.6, the main variable of interest is the indicator $XBRL_{no-mandate}$, which equals to 1 for those firms that voluntarily adopted XBRL during the period 2005-2010. We found that the effect of voluntary XBRL adoption is not statistically significant across all the ESG performance measures. This result corroborates our argument that the effect on ESG performance shown in our main results is caused by a change in the disclosure regulation rather than firms' action on XBRL adoption itself.

3.5.6 Evidence from Fiscal Year-End Variations

Our main analyses applied an identification strategy that relies on the DiD approach to test how XBRL mandates affect ESG performance measures. Nevertheless, because our treatment sample is not randomly assigned, endogeneity concerns may arise if the treated and control firms are not perfectly comparable. Indeed, the XBRL mandate, as a treatment, is based on size-specific thresholds (i.e., public float), which prior studies have shown to correlate with ESG engagement (Krüger, 2015; Drempetic, Klein, and Zwergel, 2020; Ting, 2021). Hence, to address this concern, we deploy our experimental setting by focusing on the regulation's implementation schedule, which allowed us to exploit variations in the fiscal year-ends (FYEs) of firms of the same size. Indeed, our main identification strategy also implicitly relies on fiscal year-ends because all three phases of XBRL implementation are specifically applicable to firms of a certain size (in terms of public float) whose FYE lies between June 15 of a given year and June 14 of the following year. Thus, for instance, in the second phase of the XBRL mandate, a mid-sized firm (i.e., with a public float between $700 million and $5 billion) would only be mandated to submit its 10-K filings in the XBRL format if it had its FYE after June 15, 2010. For similar-sized firms with FYE June 14, 2010, or earlier in that year, the XBRL mandate would be applicable alongside Phase 3 or in the following year.

Thus, we exploited this FYE variation in Phase 2 XBRL-mandated firms and studied the cross-sectional effect on their ESG performance in 2010 and 2011. Essentially, our identification strategy is aimed at isolating the difference in the ESG performance of mandated XBRL Phase 2 firms with those of similar size who had a delayed XBRL mandate only because their FYE was before

June 15, 2010, and not after.[24] Table 3.7 presents the results of the cross-sectional estimation. The indicator $XBRL\_2_{mandate}(FYE_{var})$ takes the value 1 to represent treated firms, that is, Phase 2 firms in 2010 that were mandated to report in XBRL format because their FYE was after June 15, whereas the control group comprised Phase 2 eligible firms (based on market float) that were not mandated in the applicable year because their FYE was before June 15. Our results from this alternative identification corroborated our main result, as we found a statistically significant impact on the ESG Score for XBRL-mandated firms. Of the three ESG sub-scores, only the Governance Score had a statistically significant coefficient for $XBRL\_2_{mandate}(FYE_{var})$. This is not surprising, given that we conducted this test using Phase 2 firms and, as documented in Table 3.4, the effect of the XBRL mandate for Phase 2 firms is mainly driven by the Governance Score.

3.6 Examining the Effectiveness of XBRL Mandate on ESG Performance

3.6.1 Cross-Sectional Analyses

Our main results document an average increase in ESG performance measures following the XBRL mandate. This finding is consistent with our prediction that a reduction in financial information processing costs provides market participants with more incentives to scrutinize non-financial information. However, we expect the effect of XBRL adoption on ESG performance to vary cross-sectionally, conditional on certain firm- and firm-related market characteristics. Specifically, we focus on external monitoring, firm opacity, and

[24] We replicate and re-estimate the same identification strategy for Phase 1 eligible firms (i.e., with market float $\geq$ \$5 billion) and find our results supported. However, with only a small number of firms comprising the control group in this case, the identification has very low statistical power.

managerial risk aversion.

We expect market participants—more specifically, investors—to be more attentive to non-financial ESG information in well-monitored firms. Given that XBRL adoption benefits sophisticated investors more as they can leverage their greater resources better than less sophisticated investors (Blankespoor, Miller, and White, 2014), using proxies for high monitoring by sophisticated investors, we expect the benefit of a reduction of information processing costs to be greater for firms with higher monitoring. XBRL adoption can affect the amount of disclosures made by firms (Blankespoor, 2019), hence, opaque firms are more likely to benefit from a reduction in information processing costs (Dong et al., 2016). By definition, opaque firms are generally less transparent about their financial information (Hutton, Marcus, and Tehranian, 2009). Accordingly, we predicted that the effect of the XBRL mandate on ESG performance will be stronger for opaque firms. Lastly, managers have an important role to play in shaping firms' ESG policies (Davidson, Dey, and Smith, 2019). Firms with risk-taking CEOs, who have more freedom to change and adapt corporate policies when faced with increased investor scrutiny, are more likely to react quickly to improve their ESG policies. Thus, we expect an XBRL mandate to have a greater influence on ESG performance in firms with low managerial risk aversion.

3.6.2 External Monitoring

To test our prediction regarding external monitoring, we used three proxies: the number of analysts covering a firm ($Analysts$), the percentage of shares held by institutional investors (IOP), and the number of institutional investors that hold more than 5% of firms' shares ($Blockholders$). We then partitioned firms into groups based on their medians each year. We then regressed the ESG, Governance, Social, and Environmental Scores on the interaction between $XBRL_{mandate}$ and an indicator representing high external monitoring (i.e., $High_{Analysts}$, $High_{IOP}$, or $High_{Blockholders}$). The results are shown in Table 3.8.

For all three external monitoring proxies, we found that firms with high levels of external monitoring exhibit stronger improvements in ESG, Governance, and Social Scores when the XBRL mandate is applied. These improvements are statistically significant at the 1% level. We found little or no evidence of the moderating effect of external monitoring on Environmental Scores. This is consistent with the results reported in Tables 3.3 and 3.4, which indicate little or no effect on the Environmental Score, and highlight the potential challenges that market participants face when assessing firms' environmental performance (Ittner and Larcker, 2001; Dumitrescu and Zakriya, 2021).

3.6.3 Firm Opacity

We measured firm opacity using two measures obtained from the discretionary accrual models: Dechow and Dichev (2002) model modified by McNichols (2002) ($AbsDDM$) and the modified Jones (1991) model ($AbsMJM$). Additionally, following Hutton, Marcus, and Tehranian (2009), we built a third proxy for opacity ($Opaque$) by using the three-year moving average of $AbsMJM$ to "capture the multi-year effects of earnings management." For each of these firm opacity proxies, we partitioned our sample firms into two groups based on their annual medians. We then regressed the ESG, Governance, Social, and Environmental Scores on the interaction term, combining $XBRL_{mandate}$ and an indicator representing high opacity (i.e., $High_{AbsDDM}$, $High_{AbsMJM}$, or $High_{Opaque}$). The results are reported in Table 3.9.

We found that high-opacity firms have a significantly higher positive effect of XBRL adoption on ESG Scores and two of its three pillars (i.e., Governance Score and Environmental Score) across all three opacity proxies. The effect is strongest when we use *Opaque* as a proxy of firm opacity in Panel C. Despite the unconditional effect of $XBRL_{mandate}$ on Social Score being significant, we observed no significant moderation effect of opacity for Social Score across all three proxies. This points to the increasing prominence of social issues for firms, irrespective of their financial transparency.

3.6.4 Managerial Risk Aversion

For managerial risk-taking and risk-aversion propensity, we implemented three proxies consistent with the literature: an indicator equal to 1 if the CEO has a dual role in the firm, that is, they also serve as chairman on the board of directors ($CEODuality$), the number of years since the CEO has been appointed ($CEOTenure$), and a gender indicator which is equal to 1 in case the CEO is male ($MaleCEO$) (Faccio, Marchica, and Mura, 2016; Ferris, Javakhadze, and Rajkovic, 2019). The continuous variable $CEOTenure$ is transformed into a high/low tenure indicator using the median values for each year. We then examined the moderating effect of managerial risk-taking by regressing ESG performance measures on the interaction between $XBRL_{mandate}$ and each of the managerial risk aversion proxies. The results are summarized in Table 3.10.

Owing to the limited availability of CEO-level data for our sample companies, we lost a significant number of observations when assessing the moderating effect of managerial risk-taking proxies. In Table 10, we found significant effects (at 10% or higher) for the ESG and Governance Scores across all three proxies. The concentration of power and risk-taking in firms is best represented using $CEODuality$ (Panel A), as documented by the coefficient of the interaction term, which is statistically significant across all ESG performance measures. The magnitude of the coefficients is the highest when we proxy for managerial risk aversion using the CEO's gender (Panel C).

3.7 XBRL Mandate and Investor Voting Behavior

Shareholder voting is arguably the most direct form of investor monitoring and engagement activity (Lesmeister, Limbach, and Goergen, 2022), while also representing investor activism to some degree (Brochet, Ferri, and Miller, 2021). If indeed investor pressure—due to increased attention to non-financial information—is the driver of improved ESG performance following SEC-mandated XBRL adoption by firms, it is plausible to assume an impact on their shareholder voting activity. We explored this channel by examining voting data covered by ISS Voting Analytics, which include both management- and shareholder-sponsored proposals. In our analysis, we focused on both, as they reflect two different facets of voting behavior: while the voting response on the first set of proposals captures shareholder engagement and support for managers' initiatives, the voting pattern for the second set of proposals is indicative of how well shareholders react to their fellow shareholders' activism.

Accordingly, we examined whether there are any underlying changes in shareholder voting behavior owing to the XBRL mandate. Essentially, the empirical tests performed in this section are aimed at assessing whether investor attention and pressure that drive ESG performance are visible when investors cast their votes on ESG-related proposals. To do so, we studied the shareholder *support* each proposal receives using an estimation similar to our baseline model in Equation (3.1). In these estimations, we also controlled for proposal and meeting characteristics, such as the proposals' management recommendation (voting "For" or "not"), proposal sponsor (management or shareholder), and meeting type (annual general meetings, extraordinary general meetings, special meetings, etc.). To examine voting behavior with respect to ESG-related proposals, we identified proposals that are specifically pertinent to governance (anti-takeover-, director-, board-, compensation-, or other governance-related proposals), social (human rights, gender equality, discrimination, charitable activities, etc.), and environmental (environmental policy changes, emissions, climate change, safety, recycling, etc.) issues. To ascertain that we capture variation in shareholder support only specific to ESG proposals and not to other proposals, we also identified a set of "routine" proposals that target non-ESG business or operational routines such as dividend approvals, company name changes, and auditor ratification.[25]

Table 3.11 reports the results of the proposal-level regressions for shareholder *support* (i.e., the proportion of "For" votes cast) on our main variable of interest $XBRL_{mandate}$. Our estimations are aimed at capturing the difference in shareholders' voting *support* for ESG proposals after XBRL mandate. In Panel A, the effect of XBRL mandate on voting support for different proposals raised during shareholder meetings is reported for all ESG proposals (column 1), and these proposals segregated by their sponsors (columns 2 and 3). We found that the coefficients on $XBRL_{mandate}$ is positive and statistically significant (at 1% level) for ESG proposals mainly when they are sponsored by the management. This is consistent with the importance of managers' role for the effectiveness of XBRL adoption seen in the previous section. More importantly, the coefficient of $XBRL_{mandate}$ is statistically insignificant for non-ESG routine proposals showing the influence of the XBRL adoption conveys the voting behavior mainly for ESG-related proposals. In Panel B, we separately analyze the E, S, and G specific proposals separately. The effect of XBRL adoption is found to be statistically significant for the governance-related proposals (at 1% level), with the support for these proposals improving by approximately 0.6% after a firm adopts XBRL reporting. These results are consistent with existing literature that shows XBRL being beneficial to institutional investors (Blankespoor, Miller, and White, 2014), some of which tend to show greater

[25] A full list of proposal identifiers from ISS (i.e., *ISSItemOnAgendaID*) classified into different categories according to their available descriptions can be made available on request.

"governance-sensitivity" (Bushee, Carter, and Gerakos, 2014).

Although these results largely support the role of investors and their attention to ESG proposals in improving ESG performance after adopting SEC-mandated XBRL, they must be interpreted with caution. First, when the focus is toward ESG proposals, only a minuscule proportion of social and environmental proposals are voted for in shareholder meetings. In other words, governance proposals were overrepresented. Second, multiple other factors, such as proxy voting advisors, meeting venues, and meeting contentiousness, can affect shareholder voting behavior (Li and Yermack, 2016; Malenko and Shen, 2016; Brochet, Ferri, and Miller, 2021). Because we did not observe and thus controlled for these factors, our results are merely indicative and do not necessarily reflect causality.

3.8 Conclusions

Financial information processing costs require market participants and investors to commit ample resources and time in assimilating and processing financial information, hence leaving them with very little resources that can be employed for understanding non-financial information. This study provides insights into this phenomenon by examining the impact of financial information processing costs on a firm's ESG performance.

The impact of regulations targeting information processing costs on financial markets and corporate financial decisions has been widely debated and discussed (Healy and Palepu, 2001; Leuz and Wysocki, 2016; Roychowdhury, Shroff, and Verdi, 2019). Over the past decade, numerous studies have shown the effects of such regulations on several market- and firm-level financial characteristics, including information asymmetry (Griffin, 2003; Blankespoor, Miller, and White, 2014; Bhattacharya, Cho, and Kim, 2018), market efficiency (Dong et al., 2016; Gao and Huang, 2020), earnings quality (Kim, Kim, and Lim, 2019), institutional ownership (Kim, Li, and Liu, 2019), and corporate tax behavior (Chen et al., 2021). However, much remains to be understood regarding the possible spillover effects of financial information processing cost-reducing regulations on firms' non-financial behavior such as their ESG performance and CSR disclosures. ESG information disclosures and communications are becoming increasingly important for both firms and investors. From a firm's perspective, the recent COVID-19 crisis has re-established the need for firms to engage in good ESG practices owing to its risk-mitigating properties (Albuquerque et al., 2020; Dumitrescu and Zakriya, 2021). Investors' attention to firms' ESG engagements along with their financial performance is becoming increasingly important to manage investment portfolios (Amel-Zadeh and Serafeim, 2018; Krueger, Sautner, and Starks, 2020). Therefore, it is important to understand how and why information processing costs affect firms' ESG policies.

We employ a quasi-natural experiment exploiting the U.S. SEC mandate that requires firms to submit their quarterly and annual financial reports in XBRL format. By making financial data standardized and machine-readable, XBRL filings aimed to reduce the information processing costs of market participants and investors. Our results show that following the XBRL mandate, XBRL-adopting firms have significantly higher ESG performance. Subsequent analyses reveal that the XBRL mandate affected Governance performance the most, followed by Social and Environmental performance. Moreover, the magnitude of the impact of XBRL adoption on ESG performance declines over the three phases of XBRL implementation by the SEC. Our results are robust to several internal validity checks, including falsification tests and alternative identification strategies.

Further supplementary analyses provide insights into how investor pressure could potentially drive improvements in firms' ESG performance when they benefit from a reduction in financial information processing costs. Firms with high external monitoring are prone to higher investor and analyst scrutiny of both financial and non-financial (or ESG) information. Moreover, opaque firms can be expected to suddenly face more investor scrutiny of their ESG policies when standardized reporting in the XBRL format reduces their information processing costs. Furthermore, to effectively respond to investor pressure, firms must be able to react quickly, which would ideally be easier for firms with risk-taking managers. Indeed, we find evidence supporting these underlying mechanisms, as the positive impact of the XBRL mandate on ESG performance is concentrated in well-monitored and financially opaque firms with low risk-aversion managers. Finally, we investigate investor engagement (through their voting behavior) as a potential channel that led to improvements in ESG performance. Our findings imply an increasing support for ESG-related proposals from investors in XBRL-mandated firms. However, this change in support was mainly seen in management-sponsored proposals specifically aimed at improving firms' governance characteristics.

By showing the spillover effects of a financial reporting mandate, our study also has implications for the current debate on the need for a non-financial reporting mandate and whether it could be effective (Christensen, Serafeim, and Sikochi, 2022; Fiechter, Hitz, and Lehmann, 2022) . To this end, we provide evidence that relaxing the constraints associated with financial information processing capacity can incentivize firms to improve their non-financial ESG policies. Increased monitoring and ESG engagement by market participants appear to be the underlying channel driving this effect: when financial disclosures are available for quick processing in a standardized format, market participants are able to pay more attention to non-financial disclosures.

Figure 3.1 ESG Performance Measures over Event Time

The figures below show the estimated coefficients of regressing ESG Score, Social Score, Governance Score, and Environmental Score on XBRL adoption following SEC mandate (i.e., the event) with year and firm fixed effects. Standard errors are estimated by clustering at the firm level. We omit the indicator for year t-1, which serves as benchmark. Vertical bands represent 95% confidence interval for the point estimate each year relative to the treatment period.

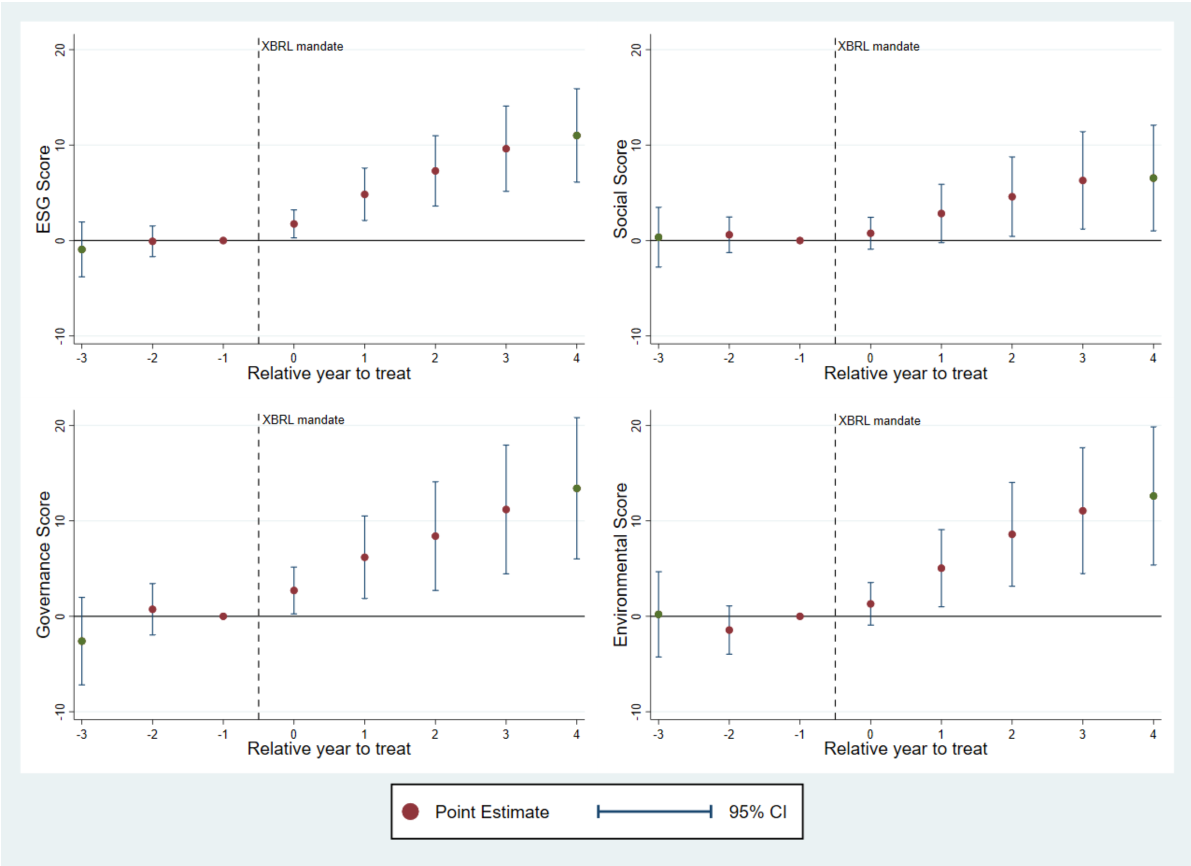

Table 3.1 XBRL Mandate and Refinitiv ESG Sample Distribution

This table shows the distribution of number of firms in the Refinitiv ESG sample over the years and how they are affected by the XBRL mandate across its three implementation phases. In this distribution, voluntary adopters are included within Non-XBRL$_{Mandated}$ group because they adopted XBRL even before they were mandated by SEC to do so.

Year	Non-XBRL$_{Mandated}$	XBRL$_{Mandated}$	Total	XBRL Implementation		
2002	527	0	527			
2003	522	0	522			
2004	734	0	734			
2005	851	0	851			
2006	853	0	853			
2007	850	0	850			
2008	1,041	0	1,041			
2009	877	291	1,168	Phase 1		
2010	477	756	1,233		Phase 2	
2011	384	853	1,237			Phase 3
2012	18	1,215	1,233			
2013	0	1,234	1,234			
2014	0	1,228	1,228			
2015	0	1,873	1,873			
2016	0	2,563	2,563			
2017	0	2,928	2,928			
2018	0	2,910	2,910			
2019	0	2,819	2,819			
2020	0	2,747	2,747			
Total	7,134	21,417	28,551			
	(25%)	(75%)	(100%)			

Table 3.2 Descriptive Statistics

Panel A presents summary statistics of main variables used in the empirical analyses. Panel B presents summary statistics of partitioning variables used in the empirical analyses. The sample consists of mandatory adopters for the period 2009–2012. The variables are as defined in Appendix 3.A.1 and variables are winsorized at 1% and 99%.

	N	Mean	SD	p25	Median	p75
Panel A. Main Variables						
Main Dependent Variables						
ESG Score	28,551	40.871	20.026	25.263	37.114	54.791
Governance Score	28,551	50.177	22.708	32.053	51.139	68.347
Environmental Score	28,551	27.384	28.444	0.000	18.727	49.335
Social Score	28,551	42.455	21.836	25.582	38.665	57.526
Other Dependent Variables						
ESG Controversy Score	28,540	88.380	25.413	100.000	100.000	100.000
ESG Combined Score	28,551	38.854	18.173	24.914	36.108	50.588
Voting Support	301,682	0.724	0.211	0.678	0.787	0.854
Control Variables						
Size	27,781	8.508	1.879	7.378	8.453	9.639
Leverage	27,763	0.605	0.267	0.440	0.600	0.771
MTB	27,315	2.694	4.688	0.972	1.625	3.007
ROA	25,191	0.025	0.055	0.012	0.028	0.043
Age	27,967	5.237	0.924	4.700	5.403	5.938
Avg. Returns	27,974	0.012	0.038	-0.005	0.012	0.028
Cash	28,551	0.090	0.133	0.004	0.044	0.121
Dividend	26,862	0.012	0.028	0.000	0.004	0.015
CAPEX	26,869	0.028	0.037	0.004	0.016	0.036
Sales Growth	27,120	0.001	0.005	-0.001	0.001	0.002
Panel B. Partitioning Variables						
External Monitoring						
Analysts	23,618	10.673	8.107	4.000	9.000	16.000
Institutional Ownership	24,999	0.696	0.388	0.557	0.776	0.902
Blockholders	25,005	2.583	1.793	1.000	3.000	4.000
Firm Opacity						
AbsDDM	26,919	0.080	0.109	0.028	0.054	0.096
AbsMJM	27,669	0.122	0.180	0.022	0.065	0.164
Opaque	25,900	0.391	0.544	0.107	0.256	0.506
Managerial Risk-Taking						
CEO Duality	18,350	0.498	0.500	0.000	0.000	1.000
CEO Tenure	18,222	7.184	7.147	2.000	5.000	10.000
Male CEO	18,350	0.961	0.807	1.000	1.000	1.000

Table 3.3 Mandatory XBRL Reporting and ESG Performance

This table provides results of regressing ESG Score, Governance Score, Social Score, and Environmental Score on $XBRL_{mandate}$ and firm-specific control variables using the specification shown in Equation (1). $XBRL_{mandate}$ is an indicator that takes value 1 for firms filing their financial statements in XBRL format when mandated by SEC and zero otherwise. It encompasses the implementation of all the three XBRL phases. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variable definitions are provided in Appendix 3.A.1
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL_{mandate}$	**1.9227***** **(3.79)**	**2.6566***** **(3.28)**	**1.9949***** **(2.82)**	**1.4615***** **(2.58)**
$Size_{t-1}$	2.5108*** (7.00)	2.1116*** (3.95)	3.6617*** (6.20)	2.3648*** (5.44)
$Leverage_{t-1}$	-0.9444 (-1.07)	-0.8576 (-0.68)	0.3457 (0.27)	-0.2796 (-0.28)
MTB_{t-1}	0.0001*** (3.13)	0.0004*** (7.59)	-0.0002*** (-14.51)	-0.0001*** (-5.11)
ROA_{t-1}	5.2666** (2.12)	8.2060* (1.90)	4.5831 (1.20)	3.7528 (1.10)
Age_{t-1}	1.4937*** (3.32)	3.3842*** (5.06)	0.8027 (1.15)	0.7658 (1.46)
Avg. $Returns_{t-1}$	2.0110 (1.13)	1.4264 (0.44)	-2.3837 (-0.95)	5.1402** (2.36)
$Cash_{t-1}$	-1.8883 (-1.30)	-2.7891 (-1.32)	-0.1441 (-0.07)	0.1324 (0.08)
$Dividend_{t-1}$	4.4708 (1.01)	-3.2533 (-0.52)	12.6436* (1.75)	5.8699 (1.35)
$CAPEX_{t-1}$	-5.5266 (-1.25)	-7.7672 (-1.13)	-14.2638** (-2.11)	-3.2449 (-0.64)
Sales $Growth_{t-1}$	0.0026*** (6.78)	0.0012** (2.00)	0.0020*** (4.25)	0.0042*** (10.36)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of observations	22,647	22,647	22,647	22,647
Adj. R^2	0.492	0.120	0.436	0.426
Number of Firms	3,261	3,261	3,261	3,261

Table 3.4 The Three Phases of Mandatory XBRL Reporting and ESG Performance

This table provides results of regressing ESG Score, Governance Score, Social Score, and Environmental Score number on the three different phases of XBRL mandate using the model specification shown in Equation (2). $XBRL\_1_{mandate}$, $XBRL\_2_{mandate}$, or $XBRL\_3_{mandate}$ are indicators that take value 1 for firms that are subject to the first, second, and third phase of the SEC mandate, respectively, and 0 otherwise. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variables are as defined in 3.A.1.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL\_1_{mandate}$	**2.7197*** **	**4.8910*** **	**4.0455*** **	**0.3277**
	(2.96)	**(3.67)**	**(2.60)**	**(0.29)**
$XBRL\_2_{mandate}$	**1.5402** **	**4.3312*** **	**0.4613**	**0.2528**
	(1.89)	**(3.32)**	**(0.34)**	**(0.26)**
$XBRL\_3_{mandate}$	**1.1851**	**4.5553** **	**-0.1279**	**-0.6802**
	(0.74)	(2.15)	(-0.06)	(-0.32)
$Size_{t-1}$	2.4904***	2.1236***	3.5926***	2.3500***
	(6.99)	(3.99)	(6.10)	(5.43)
$Leverage_{t-1}$	-0.9346	-0.8682	0.4046	-0.2807
	(-1.07)	(-0.69)	(0.32)	(-0.28)
MTB_{t-1}	0.0001***	0.0004***	-0.0002***	-0.0001***
	(2.98)	(7.47)	(-12.01)	(-4.42)
ROA_{t-1}	4.8420**	6.8848	4.3891	3.8448
	(1.97)	(1.61)	(1.17)	(1.13)
Age_{t-1}	1.6177***	3.5910***	0.9915	0.7911
	(3.56)	(5.31)	(1.42)	(1.50)
Avg. $Returns_{t-1}$	1.7076	0.9940	-2.5801	4.8292**
	(0.96)	(0.31)	(-1.03)	(2.21)
$Cash_{t-1}$	-1.7540	-2.6376	0.1314	0.1817
	(-1.22)	(-1.24)	(0.06)	(0.11)
$Dividend_{t-1}$	3.8246	-4.2819	11.7176*	5.6515
	(0.89)	(-0.69)	(1.66)	(1.31)
$CAPEX_{t-1}$	-6.2838	-9.2523	-15.1688**	-3.3476
	(-1.43)	(-1.36)	(-2.25)	(-0.66)
Sales $Growth_{t-1}$	0.0026***	0.0014**	0.0016***	0.0043***
	(6.14)	(2.18)	(2.97)	(9.41)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	22,647	22,647	22,647	22,647
Adj. R^2	0.492	0.122	0.438	0.426
Number of Firms	3,261	3,261	3,261	3,261

Table 3.5 Placebo Test for XBRL Reporting and ESG Performance

This table presents results for a placebo analysis that examines the effect of XBRL mandate on the ESG Score, Governance Score, Social Score, and Environmental Score when $PlaceboXBRL_{mandate}$ is employed in place of actual $XBRL_{mandate}$ in Equation (1). To do so, we assign placebo XBRL implementation from 2014 to 2017 instead of actual XBRL implementation from 2009 to 2012. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variables are as defined in 3.A.1
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$\text{PlaceboXBRL}_{mandate}$	**0.5508**	**0.5388**	**1.0983**	**0.2550**
	(1.14)	**(0.63)**	**(1.54)**	**(0.47)**
Size_{t-1}	2.4907***	2.0864***	3.6346***	2.3515***
	(6.95)	(3.91)	(6.15)	(5.41)
Leverage_{t-1}	-0.9860	-0.9139	0.2997	-0.3103
	(-1.12)	(-0.73)	(0.23)	(-0.31)
MTB_{t-1}	0.0001***	0.0004***	-0.0002***	-0.0001***
	(3.13)	(7.58)	(-14.56)	(-5.09)
ROA_{t-1}	5.3488**	8.3547*	4.5854	3.8411
	(2.16)	(1.94)	(1.20)	(1.12)
Age_{t-1}	1.5083***	3.4034***	0.8199	0.7762
	(3.34)	(5.06)	(1.18)	(1.48)
Avg. Returns_{t-1}	1.5794	0.8498	-2.8783	4.8266**
	(0.89)	(0.26)	(-1.15)	(2.21)
Cash_{t-1}	-1.9209	-2.8332	-0.1800	0.1083
	(-1.32)	(-1.35)	(-0.09)	(0.06)
Dividend_{t-1}	4.2992	-3.4844	12.4516*	5.7439
	(0.98)	(-0.55)	(1.72)	(1.33)
CAPEX_{t-1}	-5.8646	-8.2054	-14.6828**	-3.4806
	(-1.33)	(-1.20)	(-2.17)	(-0.69)
Sales Growth_{t-1}	0.0026***	0.0012**	0.0020***	0.0043***
	(6.80)	(2.01)	(4.28)	(10.37)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	22,647	22,647	22,647	22,647
Adj. R^2	0.492	0.120	0.437	0.427
Number of Firms	3,261	3,261	3,261	3,261

Table 3.6 Voluntary XBRL Reporting and ESG Performance

This table shows the effect of voluntary XBRL adoption on ESG Score, Governance Score, Social Score, and Environmental Score. The sample consists of voluntary adopters for the period 2005–2010. Unlike $XBRL_{mandate}$ that captures firms implementing XBRL following SEC mandate, $XBRL_{no-mandate}$ represents firms who voluntarily adopt XBRL even before they are mandated by SEC. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variables are as defined in Appendix 3.A.1
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL_{no-mandate}$	**-1.1680** **(-0.53)**	**0.9031** **(0.25)**	**1.7521** **(0.55)**	**-4.1910** **(-1.57)**
$Size_{t-1}$	-1.0074 (-1.21)	-1.0862 (-1.01)	1.1282 (0.84)	-1.5988* (-1.67)
$Leverage_{t-1}$	-1.1079 (-0.46)	-3.8868 (-1.25)	2.6515 (0.77)	-0.9017 (-0.33)
MTB_{t-1}	-0.0017** (-2.32)	-0.0071*** (-6.21)	0.0023** (2.06)	0.0003 (0.35)
ROA_{t-1}	12.6428 (1.23)	6.9223 (0.46)	20.0628 (1.33)	13.5982 (1.14)
Age_{t-1}	0.2865 (0.30)	0.6985 (0.59)	-0.6846 (-0.46)	1.4412 (1.23)
Avg. $Returns_{t-1}$	6.3365 (1.62)	9.5433 (1.35)	4.0686 (0.74)	5.6375 (1.29)
$Cash_{t-1}$	-11.0270*** (-3.07)	-14.8155*** (-3.39)	-2.3446 (-0.40)	-7.3164* (-1.82)
$Dividend_{t-1}$	-0.5588 (-0.07)	2.5146 (0.22)	-7.2190 (-0.46)	-0.8690 (-0.11)
$CAPEX_{t-1}$	-16.6619* (-1.66)	-14.9606 (-1.03)	-16.3973 (-1.08)	-20.0355* (-1.73)
Sales $Growth_{t-1}$	0.0051*** (17.96)	0.0024*** (6.05)	0.0055*** (13.64)	0.0069*** (20.50)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	5,629	5,629	5,629	5,629
Adj. R^2	0.411	0.0425	0.428	0.365
Number of Firms	1,126	1,126	1,126	1,126

Table 3.7 Mandatory XBRL Reporting and ESG Performance (Alternative Identification Using Variations in Fiscal Year-End)

This table presents the cross-sectional regression results for mandatory XBRL adoption on ESG Score, Governance Score, Social Score, and Environmental Score using an alternative identification strategy. Specifically, we exploit the variation of fiscal year-ends (FYEs) for XBRL phase 2 firms for the sample period 2010–2011. The main DiD variable $XBRL\_2_{mandate}(FYE_{var})$ represents treatment group denoted by 1 for firms who are mandated by SEC to adopt XBRL in phase 2—i.e., firms with public float between \$700 million and \$5 billion, and FYE between 15 June 2010 and 14 June 2011. Similar sized firms in terms of public float, but with FYE before 15 July 2010, thus, form the control group denoted by 0. Coefficients are provided with t-statistics in parentheses below. Unlike the main identification strategy in Table 3 that includes firm fixed effects, in these estimations we include industry fixed effects so that the cross-sectional variations are captured by the DiD term. All models have firm-clustered, robust standard errors. Variables are as defined in Appendix 3.A.1
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL\_2_{mandate}(FYE_{var})$	**2.7622****	**7.6232*****	**-0.2542**	**0.9437**
	(1.98)	**(3.19)**	**(-0.12)**	**(0.56)**
$Size_{t-1}$	6.9046***	2.6681***	11.6117***	7.4914***
	(9.88)	(2.76)	(12.99)	(9.60)
$Leverage_{t-1}$	1.1287	1.1685	1.0094	-0.3233
	(0.49)	(0.38)	(0.33)	(-0.12)
MTB_{t-1}	0.0136	0.0177	-0.0230	0.0261
	(0.36)	(0.30)	(-0.67)	(0.74)
ROA_{t-1}	16.2717	-13.1430	6.0939	51.3273**
	(0.78)	(-0.47)	(0.24)	(2.19)
Age_{t-1}	1.4264**	2.7601***	-0.1762	1.8757***
	(2.19)	(2.80)	(-0.21)	(2.58)
Avg. $Returns_{t-1}$	-21.0186*	-24.2258	-31.6154**	-16.1763
	(-1.80)	(-1.30)	(-2.14)	(-1.24)
$Cash_{t-1}$	15.8953***	16.4260**	17.9608***	11.7586*
	(3.21)	(2.18)	(2.75)	(1.90)
$Dividend_{t-1}$	13.9282	26.4388	26.1781	12.2562
	(0.44)	(0.82)	(0.69)	(0.31)
$CAPEX_{t-1}$	-25.7530	-41.5741	6.7781	-10.9269
	(-1.26)	(-1.31)	(0.23)	(-0.45)
Sales $Growth_{t-1}$	-0.0240	-2.2957***	0.2598	1.9539***
	(-0.04)	(-2.78)	(0.35)	(2.83)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	913	913	913	913
Adj. R^2	0.293	0.169	0.361	0.226

Table 3.8 The Moderating Effect of External Monitoring

This table shows the effect of XBRL adoption on ESG Score, Governance Score, Social Score, and Environmental Score conditional on external monitoring. In Panel A, we proxy for external monitoring using analyst coverage with $HIGH_{Analysts}$ representing firms with the value of *Analysts* greater than annual median value. In Panels B and C, we proxy for external monitoring using institutional ownership and blockholding, respectively. $HIGH_{IOP}$ ($HIGH_{Blockholder}$) is an indicator equal to 1 for those firms with the value of institutional ownership *IOP* (*Blockholder*) greater than its annual median value. The t-statistics for firm-clustered, robust standard errors are shown in parentheses below the coefficients. For definitions of *Analysts*, *IOP* (i.e. institutional ownership), and *Blockholder*, see Appendix 3.A.1
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Proxied using High/Low Analysts Coverage				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	0.7285	0.7849	0.3958	0.7061
	(1.59)	(1.03)	(0.58)	(1.28)
$HIGH_{Analysts}$	-0.1383	0.0367	-1.8649***	0.1353
	(-0.42)	(0.07)	(-3.88)	(0.35)
$XBRL_{mandate} * HIGH_{Analysts}$	**1.5908*** **	**2.4924*** **	**2.6740*** **	**0.7904* **
	(4.44)	**(4.19)**	**(5.05)**	**(1.84)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	19,340	19,340	19,340	19,340
Adj. R^2	0.407	0.030	0.337	0.327
Panel B: Proxied using High/Low Institutional Ownership (IOP)				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	0.5327	-0.1585	0.7121	0.7543
	(1.20)	(-0.21)	(1.09)	(1.42)
$HIGH_{IOP}$	-1.4109***	-2.8274***	-3.2887***	0.1657
	(-3.96)	(-4.77)	(-6.29)	(0.39)
$XBRL_{mandate} * HIGH_{IOP}$	**1.6980*** **	**4.6021*** **	**1.6641*** **	**0.0468**
	(4.92)	**(8.00)**	**(3.28)**	**(0.11)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	20,345	20,345	20,345	20,345
Adj. R^2	0.399	0.037	0.331	0.319
Panel C: Proxied using High/Low Blockholders Presence				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	0.7021	0.9289	0.6500	0.7409
	(1.56)	(1.24)	(0.98)	(1.37)
$HIGH_{Blockholders}$	-0.7713**	-0.9868*	-1.8248***	-0.0104
	(-2.44)	(-1.87)	(-3.93)	(-0.03)
$XBRL_{mandate} * HIGH_{Blockholders}$	**1.2722*** **	**2.3980*** **	**1.4440*** **	**0.0394**
	(3.67)	**(4.15)**	**(2.84)**	**(0.10)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	20,349	20,349	20,349	20,349
Adj. R^2	0.399	0.039	0.330	0.319

Table 3.9 The Moderating Effect of Firm Opacity

In this table, we present the effects of XBRL adoption on the four ESG performance measures (i.e., ESG Score, Governance Score, Social Score, and Environmental Score) conditional on financial reporting opacity. The sample consists of XBRL adopters during the period 2009–2012 as mandated by U.S. SEC. In Panel A, $HIGH_{AbsDDM}$ is and indicator equal to 1 for those firms with the value of $AbsDDM$ are higher than its annual median value. In Panel B, $HIGH_{AbsMJM}$ is an indicator equal to 1 for those firms with the value of $AbsMJM$ higher than its annual median value. In Panel C, we divide high opacity firm using $HIGH_{Opaque}$, which represents firms with value of $Opaque$ greater than its annual median value. We show t-statistics in parentheses below the coefficients for firm-clustered, robust standard errors. $AbsDDM$, $AbsMJM$, and $Opaque$ are firm opacity proxies as defined in Appendix 3.A.1
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Proxied using High/Low AbsDDM				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	1.5769***	2.2747***	1.9195***	0.7405
	(3.80)	(3.29)	(3.16)	(1.49)
$HIGH_{AbsDDM}$	-0.3949	-0.8139*	0.1182	-0.7848**
	(-1.39)	(-1.72)	(0.28)	(-2.31)
$XBRL_{mandate} * HIGH_{AbsDDM}$	**0.5324***	**1.1927****	**-0.2566**	**0.9842*****
	(1.67)	**(2.25)**	**(-0.55)**	**(2.59)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	21,773	21,773	21,773	21,773
Adj. R^2	0.401	0.019	0.334	0.325
Panel B: Proxied using High/Low AbsMJM				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	1.3146***	2.2415***	1.7319***	0.2860
	(3.21)	(3.29)	(2.88)	(0.58)
$HIGH_{AbsMJM}$	-0.7230***	-0.5914	-0.1240	-1.3380***
	(-2.71)	(-1.33)	(-0.32)	(-4.20)
$XBRL_{mandate} * HIGH_{AbsMJM}$	**1.1140*****	**0.8962***	**0.4792**	**2.0547*****
	(3.75)	**(1.81)**	**(1.10)**	**(5.79)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	22,035	22,035	22,035	22,035
Adj. R^2	0.402	0.032	0.333	0.329
Panel C: Proxied using High/Low Opaque				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	0.7343*	0.9885	1.7155***	-0.1061
	(1.78)	(1.43)	(2.83)	(-0.21)
$HIGH_{Opaque}$	-1.6412***	-2.3031***	-0.2049	-1.8717***
	(-5.52)	(-4.61)	(-0.47)	(-5.25)
$XBRL_{mandate} * HIGH_{Opaque}$	**1.8225*****	**2.6142*****	**0.1649**	**2.5405*****
	(5.64)	**(4.82)**	**(0.35)**	**(6.56)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	21,207	21,207	21,207	21,207
Adj. R^2	0.366	0.019	0.292	0.284

Table 3.10 The Moderating Effect of Managerial Risk-Taking

This table shows the results for the effect of XBRL adoption on ESG Score, Governance Score, Social Score, and Environmental Score conditional on managerial risk aversion. In Panel A, $CEODuality$ equals 1 for the firm-year observations when CEO also serves as the chairman of its board of directors. In Panel B, $CEOTenure$ measure the number of years since the current CEO was appointed. In Panel C, $MaleCEO$ is and indicator equal to 1 when the CEO is male. We show t-statistics in parentheses below the coefficients using firm-clustered, robust standard errors. $CEODuality$, $CEOTenure$ and $MaleCEO$ are defined in 3.A.1 .
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

Panel A: Proxied using CEO Duality				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	1.5683***	3.0057***	1.2702*	1.0452*
	(3.02)	(3.49)	(1.65)	(1.70)
CEO Duality	-2.3232***	-3.3141***	-3.0893***	-1.0013**
	(-6.75)	(-5.80)	(-6.04)	(-2.45)
$XBRL_{mandate} * CEO\ Duality$	**2.0093*** **	**2.4526*** **	**2.5865*** **	**1.0022** **
	(5.27)	**(3.88)**	**(4.57)**	**(2.21)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	15,949	15,949	15,949	15,949
Adj. R^2	0.513	0.138	0.458	0.444
Panel B: Proxied using CEO Tenure				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	2.5392***	3.5528***	2.6487***	1.8780***
	(4.98)	(4.21)	(3.50)	(3.11)
CEO Tenure	-0.2946	-1.4052***	-0.3440	0.5136
	(-0.95)	(-2.74)	(-0.75)	(1.39)
$XBRL_{mandate} * CEO\ Tenure$	**0.6199***	**2.0558*** **	**0.4264**	**-0.3396**
	(1.71)	**(3.42)**	**(0.79)**	**(-0.79)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	15,842	15,842	15,842	15,842
Adj. R^2	0.512	0.137	0.458	0.444
Panel C: Proxied using CEO Gender				
Dependent Variable	ESG Score	Governance Score	Social Score	Environmental Score
	(1)	(2)	(3)	(4)
$XBRL_{mandate}$	2.8998***	4.6581***	2.7999***	1.7688***
	(6.20)	(6.01)	(4.03)	(3.19)
Male CEO	-5.1649***	-6.4299***	1.0504	-5.3127***
	(-4.21)	(-3.16)	(0.58)	(-3.65)
$XBRL_{mandate} * Male\ CEO$	**3.0885** **	**4.0931***	**-2.8662**	**3.9275*** **
	(2.43)	**(1.95)**	**(-1.52)**	**(2.61)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	15,949	15,949	15,949	15,949
Adj. R^2	0.512	0.137	0.457	0.444

Table 3.11 Mandatory XBRL Reporting and Shareholder Voting Behavior

This table summarizes the results for the effect of XBRL adoption on the level of support obtained (in terms of the proportion of shareholders' "for" votes cast) for the management- and shareholder-sponsored proposals during the shareholder meetings. In Panel A, we classify the ESG proposals based on the type of sponsor: Management (column 2) and Shareholder (column 3) and also show the results using routine (non-ESG) proposals (column 4). In Panel B, ESG proposals are classified into environmental, social, and governance proposals based on their ISS classification codes and description. All regressions include firm-level controls used in the main analyses presented in Table 3.3. In addition, proposal-and meeting-level controls include management recommendation ("For" or not) and meeting type (annual general meeting, extraordinary general meeting, special meeting, etc.).
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

Panel A: Classified by Proposal Sponsors

	ESG Proposals			Routine Proposals
	Both (1)	Management (2)	Shareholder (3)	Both (4)
$XBRL_{mandate}$	**0.5722*** (6.77)**	**0.4471*** (5.70)**	**-3.0786** (-2.07)**	**0.0186 (0.12)**
Proposal/Meeting Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	301,682	294,671	6,676	48,696
Adj. R^2	0.549	0.202	0.571	0.738

Panel B: Classified by Proposal Types

	All ESG (1)	Governance (2)	Social (3)	Environmental (4)
$XBRL_{mandate}$	**0.5722*** (6.77)**	**0.5774*** (6.99)**	**1.3875 (0.88)**	**-2.6264 (-1.15)**
Proposal/Meeting Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	301,682	298,871	1,657	879
Adj. R^2	0.549	0.393	0.656	0.531

Table 3.A.1 Variable definitions

Variables	*Description*
Main Dependent Variables:	
ESG Score	Measurement of the firm's ESG performance based on public data collected by Refinitiv. It combines the three different pillars, i.e., environmental, social, and governance pillar scores.
Governance Score	The Governance Pillar Score is a sub-score of ESG Score that only captures the firms' corporate governance characteristics related to shareholders rights, takeover defences, managerial compensation, board structure, etc.
Environmental Score	The Environmental Pillar Score shows firms assessment on environmental aspects such as emission, biodiversity, waste management, energy use, water use, product innovation etc.
Social Score	The Social Pillar Score shows evaluation of the firms for social characteristics including community engagement, human rights, data privacy, product quality, workers safety & health, diversity & inclusion, etc.
Other Dependent Variables:	
ESG Controversy Score	Refinitiv assess firms on 23 ESG controversy topics and assigns them the ESG controversies. Any controversial scandal related to these ESG topics results in a degradation of the Controversy Score.
ESG Combined Score	This combines the ESG score with the ESG controversy Score to provide "a comprehensive evaluation" of the firms sustainability commitment and conduct.
Voting Support	The proportion of "for" votes received in support of voting proposals sponsored by management and shareholders during the shareholder meetings.
Control Variables:	
Size	The natural logarithm of total assets.
Leverage	The ratio of the sum of short-term debt and long-term debt to total assets.
MTB	The natural logarithm of ratio of market value to book value
ROA	The ratio of operating income before depreciation to total assets
Age	The natural logarithm of age of firm based on the months listed on Compustat
Avg. Returns	Average monthly returns over last 12 months
Cash	Ratio of cash balances over total assets.
Dividend	Ratio of cash dividends over total assets.
CAPEX	The log transformed ratio of capital expenditures over total assets.
Sales Growth	The difference between total sales and last year's total sales divided by last year's total sales.
Partitioning Variables:	
Institutional Ownership	The ratio of the number of shares owned by all 13f institutional investors to the total number of shares. Quarterly ownership annualized by taking average in a calendar year.
# Blockholders	The average number of blockholders who have investment positions in the firm in a given year. Blockholders are defined as institutional investors with more than 5% ownership of the firm.
# Analysts	Average number of investment analysts covering a firm. Annual measure is computed using the average number of earnings estimates available for the firm in each quarter.
SD residual	Following Dechow and Dichev (2002), for each firm, it is the standard deviation over past five year (t-4 to t) of the error term obtained from regressing total current accruals on the cash flow from operations and its lead and lag values.
Discretionary Accruals	Absolute value of discretionary accruals using modified Jones (1991) model.
Opaque	Following Hutton, Marcus, and Tehranian (2009), it is the sum total of absolute discretionary accruals over past 3 years to take a multi-year perspective to account for any inconsistencies in firms' earnings management policies.
CEO Duality	An indicator showing whether the firm's CEO also serves as the chairman of its board of directors in a given year.
CEO Tenure	Number of years since the CEO took the position.
Male CEO	An indicator representing male CEOs.

Table 3.A.2 Alternative Estimations (Staggered Difference-in-Differences Estimators)

The table reports alternative difference-in-difference estimations to test the robustness of results of our baseline model specifications shown in Table 3. Panels A and B employ the Callaway and Sant'Anna (2021) and the Sun and Abraham (2021) estimators, respectively, to account for heterogeneities in treatment effects. For the restricted sample used in these two estimations, we replicate the baseline model in Panel C. All coefficients are provided with t-statistics shown in parentheses below them. All models have firm-clustered, robust standard errors. Variables are as defined in Appendix 3.A.1.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Callaway and Sant'Anna's (2021) Estimation				
Dependant Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL_{mandate}$	**2.2289*** (3.92)**	**4.1489*** (3.70)**	**1.7017*** (2.71)**	**0.8226 (1.06)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	6,561	6,561	6,561	6,561
Number of Firms	1,055	1,055	1,055	1,055

Panel B: Sun and Abraham's (2021) Estimation				
Dependant Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL_{mandate}$	**4.7176*** (3.86)**	**5.3342 (1.44)**	**3.2742*** (2.83)**	**3.6986* (1.86)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	6,561	6,561	6,561	6,561
Number of Firms	1,055	1,055	1,055	1,055

Panel C: Baseline Estimation on the Constrained Sample				
Dependant Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL_{mandate}$	**2.1064*** (3.48)**	**4.14074*** (4.16)**	**2.4379*** (2.57)**	**0.53319 (0.78)**
Control Variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	6,561	6,561	6,561	6,561
Number of Firms	1,055	1,055	1,055	1,055

Table 3.A.3 Alternative Estimations (Industry Fixed Effects Instead of Firm Fixed Effects)

This table replicates the results the results in Table 3 by regressing ESG Score, Governance Score, Social Score, and Environmental Score on $XBRL_{mandate}$ and control variables. However, we replace firm fixed effects in Equation (1) by industry fixed effects. Similar to Table 3, $XBRL_{mandate}$ is an indicator that takes value 1 for firms filing their financial statements in XBRL format when mandated by the SEC regulation and zero otherwise. All the three XBRL implementation phases are included within $XBRL_{mandate}$. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variables are as defined in 3.A.1.
***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$XBRL_{mandate}$	**1.6988***	**1.2416**	**2.2304***	**1.9002****
	(1.88)	**(1.07)**	**(1.83)**	**(1.96)**
$Size_{t-1}$	7.5814***	4.4019***	10.8662***	8.0950***
	(47.38)	(21.40)	(48.44)	(46.03)
$Leverage_{t-1}$	-1.3573	-1.2392	-1.7543	-0.8499
	(-1.56)	(-1.13)	(-1.49)	(-0.86)
MTB_{t-1}	0.0001***	0.0003***	0.0001***	-0.0001
	(2.76)	(12.86)	(3.01)	(-0.85)
ROA_{t-1}	2.2263	7.7994	-7.9461	-0.2968
	(0.49)	(1.45)	(-1.58)	(-0.07)
Age_{t-1}	2.2097***	3.6754***	2.2377***	1.0641***
	(8.10)	(10.20)	(6.11)	(3.49)
Avg. $Returns_{t-1}$	5.0744*	-3.3702	4.4456	13.0475***
	(1.83)	(-0.83)	(1.20)	(4.00)
$Cash_{t-1}$	11.5134***	1.1055	16.8354***	16.9468***
	(6.36)	(0.48)	(6.89)	(8.09)
$Dividend_{t-1}$	58.8531***	33.8454***	81.6513***	62.8326***
	(4.73)	(2.90)	(4.74)	(4.76)
$CAPEX_{t-1}$	-2.3222	5.1133	7.0883	-3.3822
	(-0.31)	(0.55)	(0.72)	(-0.41)
Sales $Growth_{t-1}$	0.0022***	-0.0011	0.0009	0.0046***
	(2.65)	(-1.06)	(0.67)	(5.39)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	22,495	22,495	22,495	22,495
Adj. R^2	0.469	0.195	0.512	0.418

Table 3.A.4 Alternative Estimations (Other ESG Performance Measures)

This table provides results of regressing Controversy Score and ESG Combined Score on the variable $XBRL_{mandate}$ as well as control variables. $XBRL_{mandate}$ is an indicator that takes value 1 for firms filing their financial statements in XBRL format when mandated by the regulation and zero otherwise. It encompasses the implementation of all the three XBRL phases. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variables are as defined in Appendix 3.A.1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

Dependent Variable	Controversy Score (1)	ESG Combined Score (2)	Controversy Score (3)	ESG Combined Score (4)
$XBRL_{mandate}$	**-0.8318**	**1.3976*** **	**-0.7224**	**1.4075**
	(-0.72)	**(2.64)**	**(-0.50)**	**(1.60)**
$Size_{t-1}$	-3.7398***	1.7074***	-6.1400***	5.8091***
	(-5.54)	(4.49)	(-19.28)	(32.51)
$Leverage_{t-1}$	-1.1389	-1.2572	0.1495	-0.9841
	(-0.68)	(-1.30)	(0.15)	(-1.17)
MTB_{t-1}	0.0000	0.0001***	-0.0000	0.0001**
	(0.67)	(4.22)	(-0.09)	(2.04)
ROA_{t-1}	13.9515**	6.7339***	11.6680***	6.3699
	(2.46)	(2.62)	(2.81)	(1.30)
Age_{t-1}	-2.3584***	1.2015***	-0.3557	1.9572***
	(-3.33)	(2.58)	(-1.18)	(7.52)
Avg. $Returns_{t-1}$	4.9740	3.1870	4.5123	5.6426**
	(0.97)	(1.64)	(0.87)	(2.01)
$Cash_{t-1}$	3.6775	-0.7574	-14.3514***	7.8472***
	(1.37)	(-0.50)	(-6.63)	(4.50)
$Dividend_{t-1}$	-1.5100	3.2956	-11.1055	49.4256***
	(-0.20)	(0.80)	(-1.32)	(4.38)
$CAPEX_{t-1}$	11.8427	-5.1507	9.8122	-2.3796
	(1.45)	(-1.12)	(1.20)	(-0.34)
Sales $Growth_{t-1}$	0.0011	0.0032***	0.0022**	0.0018**
	(0.97)	(5.73)	(2.24)	(2.29)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm/Industry Effects	Firm	Firm	Industry	Industry
Number of Observations	22,647	22,647	22,495	22,495
Adj. R^2	0.043	0.388	0.203	0.366
Number of Firms	3,260	3,261	3,261	3,261

Table 3.A.5 Pre-Treatment Placebo Test for XBRL Reporting and ESG Performance

This table replicates the results from Table 5 to test for the parallel trend assumption on ESG measures before the XBRL mandate. We assign a placebo treatment starting 2005 instead of actual XBRL implementation in 2009, using similar market float criteria. In this test, we include only the pre-treatment years in our sample, i.e., 2002 to 2009. Coefficients are provided with t-statistics in parentheses below. All models have firm-clustered, robust standard errors. Variables are as defined in Appendix Table 3.A.1. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	ESG Score (1)	Governance Score (2)	Social Score (3)	Environmental Score (4)
$\text{PlaceboXBRL}_{mandate}$	**-0.5146**	**-1.1976**	**-2.2605**	**0.3308**
	(-0.27)	**(-0.43)**	**(-0.95)**	**-0.13**
Size_{t-1}	-1.1656	-1.1089	0.6843	-1.6573
	(-1.30)	(-0.90)	(0.49)	(-1.61)
Leverage_{t-1}	-1.2718	-3.945	2.8628	-1.4819
	(-0.50)	(-1.07)	(0.82)	(-0.51)
MTB_{t-1}	-0.0021***	-0.0072***	0.0016	-0.0001
	(-2.67)	(-5.76)	(1.35)	(-0.11)
ROA_{t-1}	9.8235	-3.724	16.1791	14.0065
	-0.89	(-0.22)	(0.99)	(1.00)
Age_{t-1}	0.78	1.3077	-0.3086	1.818
	(0.76)	(1.02)	(-0.19)	(1.46)
Avg. Returns_{t-1}	16.5769***	19.1736**	12.0845	16.7936**
	(2.77)	(2.07)	(1.38)	(2.37)
Cash_{t-1}	-13.5361***	-18.0852***	-2.7202	-9.9671**
	(-3.10)	(-3.47)	(-0.39)	(-2.02)
Dividend_{t-1}	-1.6458	3.1554	-9.2526	-3.6586
	(-0.21)	(0.25)	(-0.53)	(-0.46)
CAPEX_{t-1}	-15.9671	-13.0004	-18.5196	-21.4629
	(-1.38)	(-0.77)	(-1.07)	(-1.62)
Sales Growth_{t-1}	0.0061***	0.0022***	0.0056***	0.0071***
	(18.87)	(9.90)	(12.87)	(19.52)
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	4,662	4,662	4,662	4,662
Adj. R^2	0.381	0.0387	0.388	0.339
Number of Firms	1,056	1,056	1,056	1,056

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CHAPTER 4
Corporate Investment and Stock Market Valuation

4.1 Abstract

We study the driving forces behind the positive association observed between corporate investment and stock market valuation, and how they interact with managerial equity incentives and informativeness of investment. We build a dynamic model where managers use investment choices to influence investors' opinions about firms' future prospects and increase the market valuation. The incentives to manipulate the valuation processes increase with managerial eq-

uity incentives and informativeness of investment. Our empirical findings support the model's predictions that the tendency of using investment to boost market valuation is stronger when managerial stock ownership is high or when earnings quality is low (i.e., there is strong reliance on investment for information).

4.2 Introduction

Are firms' investment decisions affected by the deviation of market valuation from fundamentals or can the level of investment lead market value to deviate from firms' underlying fundamentals? The connections between corporate investment and stock market valuation have been examined by numerous studies, with conflicting results. Among them, Morck et al. (1990) and Blanchard, Rhee, and Summers (1993) argue that nonfundamental movements in stock prices do not possess explanatory power on real investment decisions. In constrast, Barro (1990), Galeotti and Schiantarelli (1994) and Chirinko and Schaller (1996) find that stock prices can influence real investment spending. Stock market valuation can impact investments through several channels. First, Gilchrist, Himmelberg, and Huberman (2005) and Baker, Stein, and Wurgler (2003) investigate an equity issuance channel and argue that firms can exploit high stock prices by issuing new shares at inflated prices and thus lowering the cost of capital and increasing investments (see also, e.g., Chirinko and Schaller, 1996; Campello and Graham, 2013; Warusawitharana and Whited, 2016). Dow and Gorton (1997), Subrahmanyam and Titman (1999) and more recently, Chen, Goldstein, and Jiang (2007) emphasize the managerial learning channel and show that stock prices aggregate information from many different participants who do not communicate directly with the firms. Thus, stock prices may contain information that managers do not have. The greater the amount of private information in stock prices, the more managers can learn from them and use the information to guide their investment policies.

Despite extensive research on the real effects of the stock market, most studies focus on the direction that runs from stock market valuation to investment decisions. Ovtchinnikov and McConnell (2009) model the relation between investment and stock prices in the opposite direction. In particular, they find that an improvement in growth opportunities as manifested in the investment of capital leads to an increase in stock prices.

Moreover, a more natural question that arises is what happens if firms do not issue equity to fund their projects? Pecking order theory popularized by Myers and Majluf (1984) argues that firms tend to rely on internal sources of funds and prefer debt to equity. Polk and Sapienza (2008), instead of resorting to the equity issuance channel, put forward a catering channel, where market participants can misprice the stock market according to the levels of investment made by managers. Similarly, Jensen (2005) argues that when stock prices get high, in order to produce performance required to justify the overvalued stock price, managers may engage in excessive spending and invest in negative-net present value risky projects that the market thinks are value-enhancing. To the extent that managers can use investments to boost or maintain stock prices, a positive relation between investment and stock price can arise without triggering the effects of cheap equity financing and price inefficiency. In this study, we examine the catering channel through which managers' investment decisions lead stock price valuation to deviate from underlying fundamentals by catering to investors' information needs regarding future firm performance.

We start with a standard dynamic structural model featuring a manager who makes investment decisions by acting in the best interest of shareholders, and corporate insiders do not have superior information over outsiders. Then, we extend the neoclassical model by considering information asymmetry between inside managers and outside investors and a team of self-interested managers who aim to optimize the expected value of their utility functions, which is the weighted average of the discounted present value of dividends to shareholders and their equity stakes in the firm. Uninformed investors are not able to perceive firms' future growth potential due to information asymmetry and have to extract additional information from investment decisions to set stock prices. Given that investors price the market based on levels of investment, managers are motivated to boost their market-based compensation through the investment decisions they have made for the firm. Incentives to manipulate the valuation processes are more prevalent when managers' compensation packages are strongly linked to their firm's market value and investors rely more on investment policies to evaluate the firm's profitability.

We define misinvestment as the difference of investments between a model with perfect alignment of interests and information transparency and a model with conflicts of interests and information asymmetry. Such deviation of investment gauges the catering effect of investment, in which managers use investment to enhance investors' forecasted value for the firm and their associated market-based compensation. The model simulation results show that both misinvestment and misvaluation rise with the levels of equity incentives granted to managers and the degree of investment informativeness. Equity-based compensation and reliance on investment to predict firms' future prospects also enlarge the effects of investment on misvaluation, based on our model-generated data.

Next, we use empirical data to corroborate our theoretical results. Using ordinary least squares (OLS) estimation with firm and year fixed effects, we find that the coefficient on investment of misvaluation is positive and significant, which is consistent with the view that managers tend to take advantage of investment to boost market valuation. We also show that the evidence continues to hold in a simultaneous-equation two-step generalized methods of moments (GMM) regression framework, in which misvaluation and investment both appear as dependent variables and regressors in the equations.[26] The simultaneous-equation GMM allows for the correlation of the residuals across these equations and thereby accounts for simultaneity between investment and stock misvaluation (MacKay and Phillips, 2005; Brown and Petersen, 2011).

We then proceed with an investigation of the influence of managerial equity holdings and earnings report quality (ERQ) on the sensitivity of stock market misvaluation to investment (note that a lower ERQ indicates a higher tendency of uninformed investors to resort to investment choices for information). First, we document that the association between investment and misvaluation is stronger when ERQ is low, as captured by higher discretionary accruals, analysts' forecast errors and a larger *F-Score* (Dechow et al., 2011). Second, we find that, consistent with the model predictions, the effects of investment on misvaluation are more pronounced for firms with greater CEO or top management team's stock ownership and a higher delta, which gauges the sensitivity of executives' wealth to stock prices. Finally, we provide additional analyses by examining the implications of insider sale transactions and managerial CAPEX guidance. In particular, we show that the tendency of investment policy's manipulation to create stock mispricing is more prominent preceding insider sales as captured by a positive net sales ratio (NSR).[27] Moreover, investment is related to higher insider sales' trading profits. We further discover that, based on the evidence from managerial CAPEX guidance, the stock price response to the *actual* investment is attenuated when the level of managerial CAPEX guidance forecast errors is low (i.e., the information quality of CAPEX guidance is high).

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[26]Specifically, we use the first differences of the variables to account for firm fixed effects, and employ the twice-lagged levels of the same variables as instruments.

[27]A positive NSR occurs when the total number of insider sales transactions is larger than the total number of insider purchase transactions.

The study adds to the literature that explores the managerial incentives to influence market valuation. Baker, Greenwood, and Wurgler (2009) suggest that managers increase the supply of the securities for which investors are willing to pay a premium for. Focusing on the design of executives' compensation contracts, Bizjak, Brickley, and Coles (1993) find that a short-termist manager has an incentive to manipulate market inferences about a firm's prospects through observable investment choices. Strobl (2014) argues that managers overinvest to induce information production by outside investors. Our approach emphasizes the effect of investment policies on guiding investors' opinions about firms' future profitability. Most importantly, we show that such incentives to influence market evaluations through investment generates a positive relation observed between corporate investment and stock valuation.

Second, our research contributes to the bulk of the literature that examines the association between corporate investment and stock market valuation. The most common view on this relationship is that firms issue overvalued stocks and use the proceeds for investment, making the stock market an important predictor of real investment decisions (e.g., Baker, Stein, and Wurgler, 2003). Nonetheless, Polk and Sapienza (2008) cast doubt on the equity issuance channel and posit that managers of firms with short-horizon shareholders could cater to current investment if market participants misprice firms based on the observed investment choices. Strobl (2014) shows that managers overinvest in suboptimal projects to increase information flows to the market. In contrast to Strobl (2014) and Polk and Sapienza (2008), our arguments are predicated on the argument of Jensen (1986) that managers might *not* act in the best interests of shareholders and derive private benefits by investing the excess cash. Our framework extends beyond the work of Polk and Sapienza (2008), since we show that stock ownership imparts short-termism in managers and causes them to misallocate investments, even if shareholders are long-term investors.

The presence of equity compensation packages diverges the interests of corporate insiders from those of long-term shareholders and the positive relation observed between investment and stock market valuation is symptomatic of agency problems that cannot be resolved (or that are even worsened) by using stock ownership.

Last, our paper is related to the theoretical literature that assesses the influence of agency frictions on corporate outcomes. Nikolov and Whited (2014), Morellec, Nikolov, and Schürhoff (2012) and Wu (2018) establish a utility function for managers and find that managers' self-interest has a non-negligible impact on the corporate decision-making process. Similar to Wu (2018), we consider the fact that investors might not have full knowledge of firms' future profitability and have to extract additional information from corporate decisions made by managers. We show that managers have the incentives to manipulate investors' opinions by investing beyond the optimal level, which explains the positive association between investment and the stock market.

The remainder of the paper is structured as follows. Section 2 develops a dynamic structural model where managers make investment decisions each period to maximize their expected value of utility and presents the impact of insider ownership and information asymmetry on misinvestment based on the model-simulated data. Section 3 shows our baseline empirical results and examines the influence of CEO stock ownership and earnings quality on the sensitivity of misvaluation to investment. Section 4 provides additional evidence based on insider trading profits and managerial CAPEX guidance forecast errors. Section 5 concludes the paper.

4.3 Model Setup and Solutions

The standard neoclassical investment model assumes that managers make investment decisions by equating the marginal adjustment cost of investment with its marginal value (Mussa, 1977). Recently, Nikolov and Whited (2014), Morellec, Nikolov, and Schürhoff (2012) and Wu (2018) find that managers' self-interest has a nontrivial impact on corporate policies. In this section, we present a dynamic model of investment with managerial incentives and the information role of investment. We specify self-interested managers' utility problems in which managers set their firms' investment decisions each period to maximize their expected value of utility. We consider an infinitely-lived firm in discrete time. As in Wu (2018), in each period, the manager chooses how much to invest in capital goods by observing the underlying profitability shocks. Unlike managers, investors are only able to perceive realized profits as well as managers' investment decisions. The realized profit is not a sufficient statistic for investors to understand the firm's future growth opportunities as the future profitability may vary with its persistence and uncertainty levels which are not readily observable for outsiders. Investors have to extract additional information such as managers' investment decisions to improve their knowledge of the firm's future performances and aid them in setting more efficient stock prices. The informativeness of investment thereby generates endogenous price reactions. Following Nikolov and Whited (2014), managers are concerned about the discounted present value of dividends to equity holders (shareholders' utility) as well as the value of stock prices since equity stakes are part of the managers' compensation package.

4.4 Basic Setup

We first consider a standard neoclassical setting where managers act in the best interests of shareholders and there are no information asymmetry between managers and investors. We use the superscript F to denote this fundamental scenario. The firm is characterized by a production technology that uses only one input: capital (K_t^F). Denote τ as the corporate tax rate and α as the curvature on the profit function. Capital stock is subject to a depreciation rate of δ. z_t is the stochastic profitability shock managers observe when making investment decisions. After-tax profits observed by the managers are therefore:

$$\Pi(z_t, K_t^F) = (1-\tau)z_t(K_t^F)^\alpha + \tau\delta K_t^F.$$

The stochastic profitability shocks evolve according to an AR(1) process:

$$\log(z_{t+1}) = \rho\log(z_t) + \varepsilon_{t+1},$$

where ρ is the autocorrelation coefficient and ε_{t+1} is an i.i.d. random variable with a normal distribution of zero mean and variance of σ^2. As capital depreciates at a rate of δ, the capital at time $t+1$ becomes:

$$K_{t+1}^F = (1-\delta)K_t^F + I_t^F.$$

Due to the presence of installation costs or the costs of disrupting the old production process, convex capital adjustment costs are modelled for the investment process:

$$G(I_t^F, K_t^F) = \frac{1}{2}\gamma\frac{(I_t^F)^2}{K_t^F}.$$

As in Riddick and Whited (2009), a firm can finance its capital with internal liquidity before resorting to external equity. If $\Pi(z_t, K_t^F) - I_t^F - G(I_t^F, K_t^F) > 0$, the firm is making dividend distributions to equity holders. If $\Pi(z_t, K_t^F) - I_t^F - G(I_t^F, K_t^F) < 0$, the firm is issuing equity to cover the financing shortfalls with per-unit cost of η. Therefore, we define dividends to the existing equity holders as:

$$d(z_t, K_t^F) = \big(\Pi(z_t, K_t^F) - I_t^F - G(I_t^F, K_t^F)\big)\times(1+\eta\mathbf{1}_{\{(\Pi(z_t,K_t^F)-I_t^F-G(I_t^F,K_t^F))<0\}})$$

Managers act in the best interest of shareholders and maximize the expected discounted streams of dividends to equity holders with a constant discount rate of r, by solving the following Bellman equation:

$$V^F(z_t, K_t^F) = \max_{I_t^F}\{d(z_t, K_t^F) + \frac{1}{1+r}\mathbf{E}_{z_{t+1}|z_t}[V(z_{t+1}, K_{t+1}^F)]\}. \tag{4.1}$$

The first term represents the immediate dividends inflow/outflows to equity holders and the second term represents the continuation value of the firm. The expectation is taken by integrating over the conditional distribution of z_t. I_t^F is considered as the first-best investment level to maximize shareholders' value.

We extend the neoclassical model by first considering information asymmetry between the inside managers and outside investors. z_t is *not* known by investors. Uninformed investors make forecasts by extracting information from announcements about investment policies made by the managers. We use superscript S to denote firm value and corporate policies from the perspectives of investors. At t, investors predict the value of profitability at time $t+1$ (denoted as $\tilde{z}_{t+1}$) based on the levels of investment (denoted as I_t^S/K_t^S). Also, due to the persistence of earnings level, investors can recover partial information about future profitability by observing the current realized profits. We assume a linear relationship between investors' predicted value of the profitability $\tilde{z}_{t+1}$ and capital stock K_{t+1}^S:

$$\log(\tilde{z}_{t+1}) = aI_t^S/K_t^S + \kappa\log(z_t), \tag{4.2}$$

where κ controls the degree of information concerning future profitability, investors can recover by observing the current profitability of the firm. a measures the informativeness of investment uninformed investors use to make forecasts of future profitability. For simplicity, we assume that a unit level of degree of informativeness for earnings, i.e., $\kappa = 1$, and a captures the informativeness of investments relative to earnings' informativeness. A high κ relative to a indicates good quality of earnings and their usefulness to predict future profitability. Therefore Eq. (4.2) can be viewed as a form of partial learning by these uninformed investors. The forecasted value of profits which are used by investors to set stock market prices is:

$$\Pi^S(\tilde{z}_t, K_t^S) = (1-\tau)\tilde{z}_t(K_t^S)^\alpha + \tau\delta K_t^S.$$

Given the forecasted profitability process, the dividend perceived by the market participants is:

$$d(z_t, K_t^S) = \big(\Pi(z_t, K_t^S) - I_t^S - G(I_t^S, K_t^S)\big) \times (1+\eta\mathbf{1}_{\{(\Pi(z_t,K_t^S)-I_t^S-G(I_t^S,K_t^S))<0\}}),$$

and the market value of the firm is:

$$V^S(\tilde{z}_t, K_t^S) = \max_{I_t^S}\{d(\tilde{z}_t, K_t^S) + \frac{1}{1+r}\mathbf{E}_{\tilde{z}_{t+1}|\tilde{z}_t}[V(\tilde{z}_{t+1}, K_{t+1}^S)]\}. \tag{4.3}$$

Next, we model managers' utility functions. Part of a manager's income is stock compensation, and managers aim to maximize the market value of the stock as well as the dividend flows to equity holders. We use the superscript M to denote the corporate policies managers choose to maximize their value of utility. Managers choose the optimal path of capital by maximizing their discounted present value of utility functions given by:[28]

$$U(z_t, K_t^M) = \max_{I_t^M}\{\beta V^S + (1-\beta)V^F\}, \tag{4.4}$$

where $U(z_t, K_t^M)$ in Eq. (4.4) denotes the managers' utility, β determines their

[28]Different from Wu (2018), managers stay indefinitely with the firm and wage income is a fixed component of their utility function.

ownership fraction on their company stocks, V^S and V^F correspond to stock market value and fundamental value of the firm. In the absence of information asymmetry ($a = 0$) and managerial equity incentives ($\beta = 0$), managers' utility $U(z_t, K_t^M)$ is equivalent to fundamental firm value V^F, which represents the expected sum of the discounted present value of dividends to shareholders, and investment policies I_t^M is equivalent to its fundamental level I_t^F. By considering managers' utility as a combination of both market value and fundamental value, the model has the implication that managers, by overinvesting to increase V^S, may destroy the fundamental component of firm value. The presence of β also captures the documented positive relation between CEO compensation and market capitalization (Gabaix and Landier, 2008). The setting also abstracts from Bolton, Scheinkman, and Xiong (2006) in which, by introducing differences of opinions among investors, the optimal compensation contract may emphasize the speculative component in the stock price and lead stock prices to deviate from underlying fundamentals; moreover, such short-termism can become an equilibrium outcome.

Investors forecast profitability and price stock value according to the levels of investment. Therefore, managers, with the presence of equity incentives, are motivated to bolster the firm's market value by overinvesting as long as the benefits of boosting investors' perceptions of earnings outweigh the costs of losing dividends as investment is one source of cash outflows. The existence of information asymmetry and equity incentives induces managers to act as if capital is more productive compared to a situation where managers act in the best interests of shareholders. The level of misinvestment, shown by the difference of I_t^M and I_t^F in the model, provides a lens to test the catering effect of investment in which managers use investments to promote their market-based compensation by catering to investors' information needs for the firm's future prospects.

4.4.1 Simulated policy and value functions

The solution of the model must be solved numerically. The numerical solution for the basic model setup is obtained by using an iterative algorithm (value iteration). The parameter selection follows closely the estimation results in Nikolov and Whited (2014) that are further calibrated to match the moments from the model-generated data and the moments from the actual data as shown in Nikolov and Whited (2014, Table IV). Managerial stock ownership, β, is set to equal 0.051 following Nikolov and Whited (2014). In the model, the degree of investment informativeness (relative to earnings informativeness) is set to equal 0.5. Panel A of Table 4.1 presents firm-level actual moments extracted from Nikolov and Whited (2014) and simulated moments; and Panel B of Table 4.1 lists the calibrated parameters used in the simulation. Table 4.1 reveals that the model successfully replicates the mean and standard deviation of investment, dividend distributions, profits and Tobin's q. In general, the results show that the selected parameters provide a good fit for the empirical data.

Based on the calibrated parameters shown in Table 4.1, we next examine the investment policy as well as firm value. The top left and the bottom left panels of Figure 4.1 depict the levels of misinvestment ($\frac{I_t^M}{K_t^M} - \frac{I_t^F}{K_t^F}$), defined as the difference between investment rates in the benchmark case with non-zero managerial equity incentives and information asymmetry (β=0.18, α=0.50) and the case where β and a are equal to zero. All investment levels are scaled by their capital levels at period t. The top and bottom right panels depict the deviation of market value from fundamental value ($V_t^S/V_t^F - 1$). The top (bottom) left panel shows the relation between misinvestment ($MisInv$) and β (a) and the top (bottom) right panel shows the relation between misvaluation ($MisV$) and β (a). These results show that both misinvestment and misvaluation increase with the levels of equity incentives granted to managers (β) and the degree of investment informativeness (a) . To the extent that managers invest more than what is best for shareholders in order to influence investors' forecasts about firms' productivity, any deviations of investments from the optimal level that maximizes shareholders' value capture the catering effect of investment. The upward-sloping trends shown in Figure 4.1 demonstrate that the catering effect of investment is stronger when managers own a larger fraction of their company stocks and investors are more likely to glean information about future firm performance from investment policies.

4.4.2 Empirical Predictions

With the model intuition at hand, we now turn to examine the model predictions for empirical regression results. It is helpful to conduct comparative static statistics to examine the impact of model parameters on investment regressions. In particular, we investigate the effect of managerial compensation contracts and investment informativeness on (1) whether firms' misvaluation is more dependent on investment, and (2) whether firms' investment is more sensitive to the misvaluation. We estimate the following equations based on the model-generated data:

$$MisV = b_0 + b_1 Inv + u, \;\; Inv = c_0 + c_1 MisV + c_2 Fund\ q + c_3 Cash\ flow + e. \tag{4.5}$$

$MisV$ (computed as $\frac{V_t^S - V_t^F}{K_t^M}$) represents the levels of misvaluation. Inv (computed as $\frac{I_t^M}{K_t^M}$) is investment-to-capital ratio. $Fund\ q$ (computed as $\frac{V_t^F}{K_t^M}$) represents the ratio of fundamental firm value to capital stock. $Cash\ flow$ (computed as $\frac{\tilde{z}_t (K_t^M)^\alpha}{K_t^M}$) is profit-to-capital ratio. b_1 shows the effect of investment in elevating market valuations and c_1 is the sensitivity of investment to misvaluation, which replicates the regression models from Campello and Graham (2013). The intent of these reduced-form regressions is to understand the effects of model parameters β and a in altering the sensitivity of investment to market valuation observed in the real world. The dotted line of Figure 4.2 plots the estimated effects of investment on market valuation (b_1) and the solid line delineates the estimated effects of misvaluation on investment (c_1). The dotted lines of both panels show that, when the direction runs from misvaluation to investment, an increase of either managerial equity incentives (β) or the degree of investment informativeness (a) is associated with a higher impact of investment on market misvaluation (b_1) . The solid line of the left panel shows that, when the direction runs from investment to misvaluation, an increase in managerial equity incentives (β) leads to higher investment sensitivity to misvaluation (c_1). For the solid line in the right panel, it reveals that investment sensitivity to misvaluation (c_1) rises initially with a. Then c_1, though positive, starts to decline with a when the a is sufficiently high.In all, the positive association of b_1 with β or a implies that firms have stronger incentives to use investments to boost market valuations when managerial equity incentives or investment informativeness is high, even though such incentives are not necessarily captured by the OLS coefficients of investment on misvaluation (c_1).

4.4.3 Price Impact of Equity Transactions

The model presented above rests on the assumption that equity transaction costs remain the same regardless of the levels of misvaluation. Therefore, the model implies that there is a connection between investment and misvaluation in the absence of an equity financing channel. In this section, we aim to relax this assumption and allow misvaluation to operate by virtue of lowering equity financing costs. High equity prices can relax financing constraints and affect corporate decisions since firms can issue equity and use their proceeds to fund investment opportunities (Baker, Stein, and Wurgler, 2003; Warusawitharana and Whited, 2016; Campello and Graham, 2013). Managers can use a high level of investment to mislead uninformed investors and the consequential high market prices can lower the costs of financing. In this section, we attempt to map the misvaluation onto the costs of equity financing. Specifically, we rewrite equity financing parameter $\tilde{\eta}$ as a linear function of the ratio of fundamental value to market value:

$$\tilde{\eta}_t = \eta(1 + \rho(\frac{V_t^F}{V_t^M} - 1)). \tag{4.6}$$

When ρ is equal to zero, market valuations driven by firms' investment policies become irrelevant for the costs of funds. The costs of equity financing stays at η regardless of the market value. When ρ is positive, the value of V_t^M has a negative impact on the costs of funds. Specifically, the higher the market value V_t^M vis-à-vis the fundamental value V_t^F, the lower the costs of equity financing. By imposing a positive value for ρ, we manage to model the endogenous nature of external financial constraints by allowing investment policies to have an effect on the costs of funds.

We proceed to reproduce the relationship in Figure 4.1 with both ρ=0 and ρ=0.5. The solid line of Figure 4.3 delineates the relation between model parameters (namely β or a) and misinvestment ($MisInv$) or misvaluation ($MisV$) in which equity financing costs remain the same regardless of the levels of misvaluation (ρ=0). The dashed line of Figure 4.3 delineates the scenario in which equity financing costs decrease with overvaluation (ρ=0.5). In all graphs, the dashed line stays above the solid line. It shows that for the same level of managerial stock ownership β and investment informativeness a, an equity financing channel with positive ρ leads to a higher level of misinvestment and misvaluation. This is in line with the view of, for example, Campello and Graham (2013), that a value-maximizing manager responds to misvaluation by issuing overvalued equity and investing the proceeds. Therefore, they can use investments as a signal to improve the valuation of the firm, which in turn drives down the costs of equity capital, and consequentially leads to more (mis)investment.

4.5 Empirical Evidence

In the following sections, we test our theoretical findings with empirical evidence.

4.5.1 Data Sample

The sample starts with all U.S. firms covered by the Compustat industry annual and quarterly file between 1980 and 2015. Consistent with the extant literature, we exclude financial firms, utility, and quasi-government firms (i.e., firms with SIC codes between 6000 and 6999 or 4900 and 4999 or 9000 and 9999). Following Almeida, Campello, and Weisbach (2004), we also delete the firms that have sales or asset growth exceeding 100% to eliminate the effect of business discontinuities. We drop the observations with missing values in assets or sales and firms with capital stock less than USD 1 million to eliminate the effect of outliers. Information of analysts' earnings forecast is drawn from the Institutional Brokers Estimate System (I/B/E/S) and CEO compensation data are taken from the Compustat Executive Compensation (ExecuComp) database.

4.6 Variables definitions and descriptive statistics

We next introduce the main regression variables used in the empirical analyses with the data name in the Compustat industry annual/quarterly file shown in parenthesis. Investment (denoted as Inv) is capital expenditure (*capx*) normalized by gross property, plant, and equipment (*ppegt*). Cash flow (denoted as $Cash\ flow$) is income before extraordinary items (*ib*) plus depreciation (*dp*), normalized by gross property, plant and equipment (*ppegt*). The calculation of a firm's intrinsic value follows closely the method in Dong, Hirshleifer, and

Teoh (2020) and is similar to the calculation of Lee, Myers, and Swaminathan (1999). Specifically, we estimate the intrinsic value by employing a residual income model (RIV) (Ohlson, 1995; Frankel and Lee, 1998). Intrinsic value is winsorized at the 1st and 99th percentiles of their distributions to mitigate the concerns of measurement errors. Details for calculating the intrinsic value are shown in Appendix A. Misvaluation (denoted as $MisV$) is defined as the ratio of stock price (*prcc_ q*) in the following quarter of the current fiscal year to a firm's intrinsic value at the current year end. It corresponds to the inverse of value-to-price ratio used in Dong, Hirshleifer, and Teoh (2020). Apart from Dong, Hirshleifer, and Teoh (2020), there is strong support for the use of the price-to-value ratio as an indicator of mispricing (e.g., Lee, Myers, and Swaminathan, 1999; Frankel and Lee, 1998; Ali, Hwang, and Trombley, 2003). Fundamental q (denoted as $Fund\, q$) is built in a similar way to market-to-book ratio except that we substitute intrinsic value for stock price. That is, fundamental q is computed as the intrinsic value multiplied by the number of shares outstanding (*csho*) plus total assets (*at*) minus book value of equity (*ceq*) minus deferred tax (*txdb*), normalized by gross property, plant, and equipment (*ppegt*). We winsorize these variables at the 1st and 99th percentiles of their distributions. Finally, we delete observations that report non-missing values in our baseline regressions discussed in the next section.

Table 4.2 reports the sample descriptive statistics for our main variables in levels and in first-differences. Panel A shows the mean, standard deviation, 25th, 50th and 75th percentiles of our variables in levels. The average value of the investment rate is 0.126, which is comparable to the values in the extant literature (e.g., Nikolov and Whited, 2014). The average value of misvaluation is 1.497, which is comparable to the inverse of the average value-to-price ratio shown in Dong, Hirshleifer, and Teoh (2020), which is around 0.6. Fundamental q is heavily skewed to the right with the average value (4.077) substantially higher than its median value (2.498).[29] To account for firm fixed effects in the GMM estimation, we use the first differences of the variables. Hence, we also present the mean, standard deviation, and 25th, 50th, and 75th percentiles of the first-difference variables in Panel B of Table 4.2. Most of the variables are centered around zero after first-differencing.

Another goal is to compare the investment-misvaluation relation between firms with a higher degree of investment informativeness versus firms with a lower degree, and firms with high managerial stock ownership versus firms with low managerial stock ownership. However, the extent to which investors extract information from firms' investment policies is difficult to measure. We thus use earnings report quality (ERQ) to gauge the degree of investors resorting to investment strategies (due to the low information quality of earnings) to predict firms' future economic standings. We use three variables to capture ERQ: 1) $|DACC|$ is defined as absolute value of residuals from a modified Jones (1991) model (Dechow, Sloan, and Sweeney, 1995).[30] 2) *Analyst Forecast Error* is computed as the total quarterly absolute value of median earnings forecast minus actual earnings, in each year, scaled by the year-end stock price. 3) *F-Score* is a scaled probability based on a misstatement prediction documented in Dechow et al. (2011) as a signal of the likelihood of earnings management

[29] Note that our average value of Fundamental q is larger than Tobin's q in Erickson and Whited (2012) and Peters and Taylor (2017) since we do not remove current assets from our numerator. Compared to the construction of Campello and Graham (2013), we deflate the value by capital stock rather than total assets and do not truncate the ratio at the value of 10.

[30] Specifically, it is the absolute value of the residuals from the following regression for each year and each two-digit SIC code industry: $TA_{it} = \alpha_0 + \alpha_1(\Delta Rev_{it} - \Delta Rec_{it}) + \alpha_2 PPE_{it} + e_{it}$, where TA_{it} indicates the total accruals for firm i at year t (computed as income before extraordinary items minus net cash flow from operating activities) scaled by average total assets; ΔRev_{it} is the change in sales revenues divided by average total assets; ΔRec_{it} is the change in accounts receivables scaled by average total assets; and PPE_{it} is the gross amount of property, plant, and equipment scaled by average total assets.

or misstatement.[31]

We rely on the information of stock holdings of both the CEO and the top management team (TMT) as defined in the ExecuComp database to evaluate the moderating effect of managerial ownership. Stock ownership is defined as the number of stocks owned by the CEO or TMT divided by number of common shares outstanding.[32] We also look at total delta, which is the change in the value of stock and option holdings (based on the formula of Black and Scholes (1973)) for every dollar change of stock price. Specifically, it is defined as $delta = \frac{\partial Black-Scholes\ value}{\partial Price}$.

Panel C of Table 4.2 shows the summary statistics for our sorting variables. The mean stock ownership level of the CEO is 1.41% and the value is slightly smaller than that in Nikolov and Whited (2014) due to the more recent period the data sample covers, though it is very close to the mean value reported in Nyman and Golbe (2017). The average stock ownership of the TMT is smaller than that of the CEO stock ownership. The 75th percentile of *F-Score* is close to one, indicating that around one quarter of our sample is identified as above normal risk for an *F-Score* cutoff of 1.00 (Dechow et al., 2011).

[31] Specifically, we compute $logit = 7.893 + 0.790 * RSST\_accr + 2.518 * \Delta AR + 1.191 * \Delta INVEN + 1.979 * \%SFT + 0.171 * \Delta CashSales$˘$0.932 * \Delta ROA + 1.029 * Issue$, where $RSST\_accr$ is the change in working capital accruals, plus the change in net non-current operating assets, plus change in net financial assets, scaled by average total assets; ΔAR/ΔINVEN/ΔROA is the change in accounts receivables/inventory/return on assets, scaled by average total assets; %SFT is the percentage of soft assets (total assets – net PP&E – Cash). ΔCashSales is the change in cash sales (sales minus accounts receivables), scaled by average total assets; and $Issue$ indicates the issuance of long-term debt or common stock. The probability that a company is fraudulently reporting is $Prob = \frac{logit}{1 + logit}$ and the *F-Score* is the probability of misstatement divided by the unconditional probability of misstatement, which is *F-Score* = $Prob$ / 0.0037.

[32] It is computed as ExecuComp item *shrown_excl_opts* divided by the total number of shares outstanding (Nikolov and Whited, 2014)

4.6.1 Estimation Results

In this section, we investigate the influence of managerial ownership and earnings quality on managers' incentives to use investment to boost misvaluation; a lower earnings quality indicates a higher tendency of uninformed investors to rely on investment for information. We first present the regression outcomes for the full sample, using both OLS and GMM estimation methods. Then we split the samples according to managerial stock ownership and earnings quality and compare the estimation outputs across subsamples.

4.6.2 Baseline results

As a prequel to our cross-sectional evidence, we show the baseline results for the effects of investment (Inv) on stock market misvaluation ($MisV$) from OLS regression with firm and year fixed effects. As in Campello and Graham (2013), we include, as independent variables, cash flow, fundamental q and misvaluation for investment regression. Specifically, we estimate:

$$MisV = b_0 + b_1 Inv + b_2 Cash\ flow + b_3 Fund\ q + v_i + v_t + u_{it}, \tag{4.7}$$

in which $MisV$ is the ratio of stock price over the next quarter to a firm's intrinsic value computed as stated in Appendix A (the inverse of value-to-price ratio used in Dong, Hirshleifer, and Teoh (2020)). By using the stock price in the following quarter, the estimation also partly mitigates reverse causality concerns since it is hard to argue that managers make investment decisions based on the stock price in the next quarter. $Fund\ q$ is the fundamental q built based on the estimated intrinsic value, and $Cash\ flow$ is the cash flows. In the OLS estimation, we include firm fixed effects (denoted as v_i) to account for time-invariant firm-specific characteristics and the control of year fixed effects (denoted as v_t) accounts for concomitant national trends. The results for the OLS estimation are presented in Column 1 of Table 4.3. We also present the results for the regression of investment on misvaluation as a reference for the following GMM regression results. Consistent with the theoretical prediction that managers use investment strategies to impact market inferences about firms' prospects, the estimated coefficient on investment of misvaluation is positive and statistically significant at the 1% probability level. We also investigate the effects of total investment, which is the combination of capital expenditure (CAPEX) and R&D expenses, on misvaluation. As shown in Column 3, the positive impact of investment on misvaluation remains even we account for R&D expenses.[33]

In addition, we employ simultaneous-equation two-step GMM regressions where misvaluation and investment both appear as dependent variables and regressors in the equations. By doing so, we permit the misvaluation to depend on investment decisions and vice versa. The joint estimation of all the parameters of the system of equations allows the correlation of the residuals to be reflected across these equations. We also include cash flow and fundamental q as independent variables for misvaluation and investment regression. We employ GMM estimation methodology with first-difference variables to control for firm fixed effects.[34] Using first differences of the variables also allows endogenous right-hand side variables to be instrumented with their twice-lagged values (MacKay and Phillips, 2005). Specifically, we estimate the following

[33]Despite R&D being an important component of corporate investment, nonetheless, we prefer to keep capital expenditure as our primary measure of corporate investment in our following tests since R&D could depress earnings and is considered as a way to manipulate earnings (e.g., real earnings management). Therefore, whether RD can improve stock price over the next quarter could be ambiguous. In addition, half of the firms do not report R&D expenditures in their statement, according to Koh and Reeb (2015), treating missing R&D as zero can misclassify non-reporting R&D firms as firms with no R&D activities. Finally, the technical report of Luo (2016) argues that CAPEX is largely undertaken in-house whereas R&D can be contracted, and CAPEX is the most predominant investment form, consisting of about 67% of the sum of capex, R&D, and M&A.

[34]The simultaneous equations estimation using GMM can be implemented using the STATA command *gmm* or *3sls*.

system of equations using GMM:

$$\Delta MisV = b_0 + b_1 \Delta Inv + b_2 \Delta Cash\ flow + b_3 \Delta Fund\ q + u \quad (4.8)$$

$$\Delta Inv = a_0 + a_1 \Delta MisV + a_2 \Delta Cash\ flow + a_3 \Delta Fund\ q + e \quad (4.9)$$

where Δ is the first-difference operator. All other variables are as defined previously. u and e are random error terms that can be correlated in the second-step estimation.

Columns 2 and 4 of Table 4.3 provide a view on the relation between investment and misvaluation based on GMM estimation. The coefficients on Inv of misvaluation equation are all positive and statistically significant at the 1% level, verifying the model predictions that managers tend to affect stock prices with their investment choices. Also consistent with the equity-issuance interpretation, the estimated coefficients on misvaluation of the investment regression are positive and significant. However, the Hansen's J statistics are too large to survive the overidentification tests. We thus need to interpret these results with caution.[35] We thereafter estimate the moderating effects of ERQ and managerial ownership using the OLS estimation of Eq. (4.7) with firm and year fixed effects.

4.6.3 Earnings Quality and Managerial Ownership

We now investigate the influence of managerial ownership and earnings quality by dividing the sample according to ERQ and managerial stock ownership. Uninformed investors, due to information asymmetry, are more likely to extract information based on investment policies when the degree of the informativeness for earnings is low, that is, the ERQ is poor. Moreover, the model shows

[35] GMM estimations with the third lag in the levels as the instruments and both the second and third lags in the levels as the instruments produce similar output.

that, when managers' compensation is largely linked to the stock market performance, they are more spurred to influence market participants' opinions about firm prospects through investment choices. According to such predictions, the association between investment and misvaluation should be stronger when insiders' stock ownership levels are higher and earnings quality is poorer.

We start by sorting our samples into high and low ERQ and reproduce our baseline results. As mentioned above, we use three measures to capture firms' earnings quality, and group firms accordingly. We assign firms in the highest yearly tercile of $|DACC|$ to the group of Low ERQ. We also look at *Analyst Forecast Error* and firms that are in the highest tercile of *Analyst Forecast Error* on an annual basis are assigned to the Low ERQ. Lastly, we rely on *F-Score* to predict earnings manipulations and assign firms in the highest yearly tercile of *F-Score* to the group of Low ERQ.

The coefficient estimates presented in Table 4.4 show that Low ERQ firms demonstrate a stronger relationship between misvaluation and investment. When we measure ERQ with $|DACC|$ and *F-Score*, as shown in Columns 1 and 2, Columns 5 and 6 of Table 4.4, the coefficients on Inv are only statistically significant for the subsample of firms identified as having low earnings report quality. Although the coefficients on Inv for *Analyst Forecast Error* are significant for both subsamples, the p-value corresponding to Chow's test of differences shows that the magnitude of the coefficient on Inv of $MisV$ for High ERQ is significantly smaller than that for Low ERQ.

Our model suggests that managerial ownership is an important determinant of managers' tendency to impact stock valuation through their investment policies. We therefore move on to evaluate this argument by separately examining the subsamples that differ in terms of managerial ownership. We present our cross-sectional analysis results on the basis of managerial ownership in Table 4.5. Low-(high-)stock ownership (OWN_CEO/OWN_TEAM) is defined as firms with CEO/TMT stock ownership in the lowest (highest) tercile of the yearly sample distribution, whereas low-(high-)delta ($Delta\_CEO/Delta\_TEAM$) is classified as firms with CEO/TMT total delta in the lowest (highest) tercile of the yearly sample distribution.

Based on Columns 1 and 3 of Panel A in Table 4.5, the coefficients on Inv of $MisV$ are positive and statistically significant for the subsample of high-stock ownership; in contrast, Columns 2 and 4 of Panel A for the low-stock ownership subsample show that the coefficients are insignificant and nearly twice as small. Panel B of Table 4.5 shows the impact of managers' total delta. Again, the coefficients on Inv of $MisV$ are only statistically significant at the 5% level for the high-delta subsample, irrespective of the CEO's or TMT's delta. The economic size for the subsample of high-CEO delta (high-TMT delta) is double that for low-CEO delta (low-TMT delta). Consistent with our model predictions, higher levels of insider stock ownership or larger CEO pay sensitivity to the firm's stock value motivates managers to boost market valuations via investment decisions.

Collectively, the replication of the OLS specification lends support for our model predictions that investors are more reliant on investment policies to form opinions about a firm's future prospects when the firm's earnings informativeness is low, or its managerial ownership is high.

4.7 Additional Tests

4.7.1 Evidence from insider sale

Managers should care more about stock price inflation following their insider sales. We therefore obtain insider trading information from the Thomson Financial Insider Filings Data (TFN), which contains insider trading for all executives reported on SEC Forms 3, 4, 5 and 144, over the period from 1990 to 2015. We aggregate the number of their open market purchases and sales in a given firm-year. To measure the direction of insider trading (i.e., whether buying or selling) in a given firm-year, we compute NSR analogously to that of Frankel and Li's (2004) net purchase ratio. That is, the NSR is equal to $(Sell - Buy)/(Buy + Sell)$. Buy indicates the total number of purchase transactions in a given firm-year and $Sell$ denotes the total number of insider sales transactions in a given firm-year. We re-examine the investment-misvaluation relation depending on insiders' NSR in the following year. Regression results for the positive NSR and negative NSR subsamples are shown in Panel A of Table 4.6. The coefficient on Inv is only statistically significant for the subsample of firms in which there is a larger number of upcoming insider sale transactions relative to insider purchases. Also, the economic magnitude of Inv coefficient for positive NSR (Coef.=3.559) is 18 times greater than that of negative NSR (Coef.=0.243). The results are therefore consistent with the view of managers being more apt to influence stock prices with investment choices preceding a greater tendency of insider sales.

In addition, we evaluate the effects of investment on increasing future abnormal profits of insider sales. The abnormal trading profits are estimated using the following transaction-specific regression of daily returns on the Fama and French (1992) and Carhart (1997) four factors over the next 180, 120, and 90 days after each transaction: $R_{it} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + hHML_t + sSML_t + mUMD_t + v_{it}$. The abnormal trading profit is equal to α $(-\alpha)$ for purchases (sales). We also create an indicator variable for insider sales ($InsiderSale$) and interact it with the firm's Inv in the previous fiscal year. We control for firm-specific characteristics that may correlate with insider trading profits. All the control variables are measured in the previous year. For instance, following Lakonishok and Lee (2001), we control for size ($Size$) and the book-to-market ratio (BTM). In addition, following Brochet (2010), we include stock returns (RET, a measure of momentum to capture insiders' potential contrarian behavior), stock return idiosyncratic volatility (VOL), a dummy variable for R&D (RD_dummy), and $Turnover$ (defined as the aggregate trading volume one year before the trade, scaled by total number of shares outstanding). We also incorporate the return on assets (ROA) and sales growth ($Sale\_growth$) as controls for the impact of firm performance and the natural logarithm of analyst coverage ($AnalystC$) to account for the firm's information environment(e.g., Dai, Parwada, and Zhang, 2015). All regressions include firm and year fixed effects.

We present the estimation results of the insider trading profits estimated over the next 180 days (Column 1), 120 days (Column 2) and 90 days (Column 3) in Panel B of Table 4.6. After the inclusion of full set of control variables, the joint significance of $Inv \times InsiderSale$ and Inv (with all p values less than 0.000) indicates that, overall, managers can generate better abnormal insider trading profits with higher levels of corporate investment. The coefficients on $Inv \times InsiderSale$ are positive and statistically significant at the 1% probability level for all windows, implying that the abnormal profits arising from corporate investment are largely dominated by insider sales transactions. Taken together, we provide evidence that managers' personal insider trading benefits from their open market sales can be an important driver of their propensity to influence stock prices through investment strategies.

4.7.2 The Issuance of CAPEX Guidance

Nonearnings guidance such as CAPEX guidance has recently spurred investors' appetites and has been advocated by influential voices (Lu, Hung-Yuan, and Wu Tucker, 2012). Several studies examine the role of managers' voluntary CAPEX guidance in reducing information asymmetry between managers and investors (Luo, 2016) and enhancing investment efficiency (Bae, Biddle, and Park, 2021). Managers can often bundle capital expenditures with CAPEX guidance to convey information about the firm's growth opportunities to investors (Lu, Hung-Yuan, and Wu Tucker, 2012; Luo, 2016). If CAPEX guidance serves as a good substitute for actual capital expenditures which investors can use to make inferences about a firm's growth potential, investors will react mildly to the actual capital expenditures when the CAPEX guidance can provide a proper guideline. As in Bae, Biddle, and Park (2021), we compute managerial CAPEX guidance forecast errors, that is, the difference between the actual capital expenditures and CAPEX guidance. We then use managerial CAPEX guidance forecast errors to capture the quality of CAPEX guidance. We predict that the stock price response to the actual CAPEX is weaker when the level of managerial CAPEX guidance forecast errors is low (i.e., the information quality of CAPEX guidance is high), and vice versa.

We retrieve our data from FactSet for a sample of Standard Poor's (S&P) 500 firms. CAPEX guidance typically includes an estimated dollar amount of the firm's overall capital spending (Lu, Hung-Yuan, and Wu Tucker, 2012). We use the absolute value of the deviation of midpoint estimates of CAPEX guidance from the actual CAPEX (all normalized by gross property, plant and equipment) to capture managerial CAPEX guidance forecast errors. We create a dummy variable that is equal to one for observations whose managerial CAPEX guidance forecast errors in the previous year (denoted as $high\_div$) are above the median (and zero otherwise), and we interact it with Inv. The regression results examining the effects of CAPEX guidance forecast error are presented in Table 4.7. Aside from adding controls of year fixed effects, cash flow, fundamental q, we include (2-digit SIC code) industry fixed effects in Column 1 and firm fixed effects in Column 2. In both specifications, the coefficients on $high\_dev$ are negative, albeit insignificant with the inclusion of firm fixed effects. It suggests that the market responds negatively when management CAPEX guidance diverges from the actual CAPEX. The positive and significant coefficients on $Inv \times high\_dev$ in both Columns 1 and 2 show that firms with high managerial CAPEX guidance forecast errors demonstrate a strong association between investment (i.e., the actual CAPEX) and stock market misvaluation. It is thereby consistent with the argument that the low information quality of CAPEX guidance toughens the role of actual investment in influencing stock price.

4.8 Conclusions

We construct a dynamic structural model to provide insights into how managers' investment decisions can influence stock market valuation. We consider the effects of stock ownership and information asymmetry between the inside managers and outside investors. Managers in this framework are motivated to use investment decisions to cater to investors' opinions about firms' future prospects and influence market valuation, which creates a catering channel that allows the direction to run from investment choices to market valuation. The model can be employed to understand the contribution of equity-based managerial compensation to the association between firm policies and market valuation. Consistent with the model predictions, our empirical findings show that the incentives to manipulate the valuation process are stronger when managers are granted with greater stock ownership or the informativeness of earnings is lower.

The positive correlation between corporate investment and market valuation is consistent with the bulk of the literature (Campello and Graham, 2013; Baker, Stein, and Wurgler, 2003); however, the interpretation behind the association differs. Although holding an equity stake aligns managers' incentives with investors' interests, we show that self-interest-maximizing managers may exploit the information asymmetry and invest beyond the optimal levels to influence investors' valuation process and increase managerial utility. Hence the study contributes to the literature that examines a catering channel (e.g., Polk and Sapienza, 2008) and managerial incentives to influence market valuation (Jensen, 2005). The dynamic model, however, falls short since it does not embed managers' turnover risk and shareholders' investment horizons. Managers who are less likely to be discharged for making suboptimal investment decisions are more prone to influencing market valuation with investment choices. Investors with short horizons might be more concerned about the market-based value than the fundamental value, which is the expected present value of dividend streams. Hence, our paper suggests a host of additional research avenues for the investigation of investment policies well beyond accounting quality and managerial compensation.

4.9 Appendix

We estimate intrinsic value based on the residual income valuation (RIV) model originated by Ohlson (1995). As a follow-up, Frankel and Lee (1998) construct a method for estimating fundamental equity value. With the assumption of clean surplus relation, the change in book value of equity is equal to earnings minus dividends. The current-year equity value V_0^{RIV} is expressed as a function of book values and discounted value of an infinite sum of expected abnormal earnings.

$$V_0^{RIV} = B_0 + \sum_{t=1}^{T} E_0[\frac{X_t^a}{(1+r_e)^t}], \tag{4.10}$$

where $X_t^a = X_t - r_e \times B_{t-1}$ is abnormal earnings with X_t referring to earnings in year t, B_{t-1} referring to book value of equity in year $t-1$ and r_e is the cost of equity in year 0. I remove observations with negative book value of equity. X_t^a can also write $X_t^a = (ROE_t - r_e) \times B_{t-1}$ and ROE_t is the return on equity in year t. Following Dong, Hirshleifer, and Teoh (2020), we use a three-period forecast horizon:

$$V_0^{RIV} = B_0 + \frac{(FROE_1 - r_e)B_0}{1+r_e} + \frac{(FROE_2 - r_e)B_1}{(1+r_e)^2} + \frac{(FROE_3 - r_e)B_2}{(1+r_e)^2 r_e},$$

where $FROE_t$ is the forecasted return on equity in year t and is computed as $\frac{FEPS_t}{B_{t-1}}$, where $FEPS_t$ is the Institutional Brokers' Estimate System (I/B/E/S) mean forecasted EPS in year t (e.g., FY1 of I/B/E/S consensus earnings estimates for $FEPS_1$) and B_{t-1} is the book value per share in year $t-1$. Following Dong, Hirshleifer, and Teoh (2020), if the EPS forecast for any horizon is not available, it is substituted by the EPS forecast for the previous horizon and compounded at the long-term growth rate as provided by I/B/E/S. If the long-term growth rate is not available from I/B/E/S, the EPS forecast for the first preceding available horizon is used as a substitute for $FEPS_t$. We cap the value of any of these $FROE_t$ at 1 if $FROE_t > 1$. Finally, the last term of the equation discounts the residual income in year 3 as a perpetuity.

With the assumption of clean surplus relation, future book values of equity can be written as

$$B_t = B_{t-1} + FEPS_t(1 - k),$$

where $FEPS_t$ is the I/B/E/S mean forecasted EPS for year t. k is the dividend payout ratio and is determined by the ratio of dividends per share to earnings per share in year t. Following Lee, Myers, and Swaminathan (1999) and Dong, Hirshleifer, and Teoh (2020), if k is negative (owing to negative earnings per share), we divide dividends by (0.06×total assets), that is, assuming that earnings are 6% of total assets on average, to obtain an estimate of the payout ratio. We also set k equal to one when $k > 1$.

The RIV model requires the input of a discount rate that corresponds the riskiness of future cash flows to shareholders. The annualized cost of equity r_e is determined using the CAPM model, where beta is estimated using the monthly stock returns of the last five years. We require the sample to have at least two years of available data in stock returns. We obtain the information for risk-free rate and the market risk premium from Kenneth R. French-Data Library. Following Dong, Hirshleifer, and Teoh (2020), any estimate of the CAPM cost of capital that is outside the range of 5%-20% is winsorized to lie at the border of the range. Misvaluation is then computed as the ratio of the stock price in the following quarter ($prcc\_q$) to the firm's V_0^{RIV}.

Table 4.1 Target Moments and Parameters

Panel A summarizes the actual and model-simulated moments calculated on an annual basis and Panel B lists the parameters used to generate the moments. The actual moments are drawn from Nikolov and Whited (2014, Table IV). The definitions of parameters can be found in Section 4.4.

Panel A. Sample moments									
Moments	Model	Actual							
Average investment	0.14	0.12							
SD of investment	0.12	0.08							
Average distribution	0.12	0.05							
SD of distribution	0.05	0.04							
Average profits	0.21	0.16							
SD of profits	0.09	0.06							
Average Q	2.85	2.01							
SD of Q	0.68	0.72							
Panel B. Parameter setup									
Parameter	α	γ	η	ρ	σ	τ	r	β	a
Value	0.83	0.84	0.35	0.64	0.36	0.2	0.04	0.05	0.50

Table 4.2 Summary Statistics

The table shows the mean, standard deviation, 25th, 50th and 70th percentiles of the main regression variables based on OLS (Panel A) and GMM (Panel B), as well as the sorting variables (Panel C) for U.S. firms from 1980 to 2015. Inv is capital expenditures normalized by gross property, plant and equipment. $Total\_Inv$ is investment plus R&D expenditure normalized by gross property, plant and equipment. Misvaluation ($MisV$) is defined as the ratio of stock price over the next quarter to the firm's intrinsic value (the inverse of Value-to-Price ratio used in Dong, Hirshleifer, and Teoh (2020)). The calculation of firm's intrinsic value is similar to that of Lee, Myers, and Swaminathan (1999). Fundamental q ($Fund\ q$) is computed as the intrinsic value multiplied by number of shares outstanding plus total assets minus book value of equity minus deferred tax, normalized by gross property, plant and equipment. $Cash\ flow$ is income before before extraordinary items plus deprecation, normalized by gross property, plant and equipment. $\Delta\ x$ denotes the variables after first-difference. OWN_CEO is the ownership of CEO, which is defined as the number of shares (excluding options) owned by CEOs divided by number of common shares outstanding. OWN_TEAM is the average ownership of top management team as defined in the ExecuComp. $Delta\_CEO$ ($Delta\_TEAM$) is the change in the value of stock and option holdings (based on the Black and Scholes (1973) formula) for every dollar change of stock price from CEO (top management team). $|DACC|$ is defined as the absolute value of residuals from a modified Jones (1991) model (Dechow, Sloan, and Sweeney, 1995). $Analyst\ Forecast\ Error$ is defined as the absolute value of median earnings forecast minus actual earnings, scaled by the year-end stock price. *F-Score* is a scaled probability based on a misstatement prediction documented in Dechow et al. (2011).

Variables	Obs.	Mean	SD	p25	p50	p75
Panel A. OLS regression variables:						
Inv	12,857	0.126	0.097	0.068	0.102	0.153
Total_Inv	12,857	0.199	0.215	0.087	0.140	0.232
MisV	12,857	1.497	2.143	0.685	1.073	1.716
Fund q	12,857	4.077	5.693	1.491	2.498	4.475
Cash flow	12,857	0.239	0.316	0.104	0.187	0.315
Panel B. GMM regression variables:						
ΔInv	12,857	-0.007	0.089	-0.031	-0.002	0.021
ΔTotal_Inv	12,857	-0.007	0.116	-0.035	-0.002	0.025
ΔMisV	12,857	0.019	2.205	-0.252	0.006	0.260
ΔFund q	12,857	-0.032	3.003	-0.317	-0.010	0.321
ΔCash flow	12,857	-0.012	0.237	-0.046	0.000	0.037
Panel C. Sorting variables:						
Managerial ownership						
OWN_CEO	5,408	1.415	4.252	0.075	0.221	0.674
OWN_TEAM	5,752	0.503	1.481	0.039	0.100	0.318
Delta_CEO	5,542	2056.654	5730.549	363.312	768.061	1686.616
Delta_TEAM	5,871	709.652	1545.946	161.489	309.873	641.192
Earnings report quality						
|DACC|	9,475	0.114	0.148	0.027	0.063	0.145
Analyst Forecast Error	12,857	0.016	0.126	0.001	0.004	0.012
F-Score	9,198	0.688	0.510	0.323	0.496	0.957

Table 4.3 OLS and GMM Regressions of Full Sample

The table presents OLS and GMM estimation output for the full U.S. sample from 1980 to 2015. For OLS estimation, the model is specified as

$$MisV = b_0 + b_1 Inv + b_2 Cash\ flow + b_3 Fund\ q + v_i + v_t + u_{it},$$

in the upper panel and

$$Inv = b_0 + b_1 Mis + b_2 Cash\ flow + b_3 Fund\ q + v_i + v_t + u_{it},$$

in the lower panel, where v_i (v_t) indicates firm (year) fixed effects. For the GMM estimation, all the regression variables are first-differenced to control for firm fixed effects and are instrumented with their second lags in levels:

$$\begin{aligned} \Delta MisV &= b_0 + b_1 \Delta Inv + b_2 \Delta Cash\ flow + b_3 \Delta Fund\ q + u, \\ \Delta Inv &= a_0 + a_1 \Delta MisV + a_2 \Delta Cash\ flow + a_3 \Delta Fund\ q + e, \end{aligned}$$

where Δ is the first-difference operator. u and e are random error terms and they can be correlated in the second-step estimation. Investment (Inv) is capital expenditures ($CAPEX$) normalized by gross property, plant, and equipment in Columns 1 and 2, and is the sum of capital expenditures and R&D expenditure ($Total\_Inv$) in Columns 3 and 4. Fundamental q ($Fund\ q$) is computed as the intrinsic value multiplied by number of shares outstanding plus total assets minus book value of equity minus deferred tax, normalized by gross property, plant, and equipment. Misvaluation ($MisV$) is defined as the ratio of the stock price over the next quarter to the firm's intrinsic value. $Cash\ flow$ is income before before extraordinary items plus deprecation, normalized by gross property, plant, and equipment. Robust standard errors adjusted for firm level clustering are given in brackets. J statistics and adjusted R-squared (R_a^2) are shown at the bottom. ***, ** and * indicate significance at the 1%, 5%, and 10% probability levels, respectively.

	(1)	(2)	(3)	(4)
	CAPEX		Total_Inv:	CAPEX + R&D
	OLS	GMM	OLS	GMM
Dependent Variable: MisV				
Inv	1.839***	55.579***	1.839***	23.937***
	(0.48)	(1.39)	(0.48)	(0.31)
Cash flow	-0.979**	-	-0.979**	-6.261**
		26.873***		
	(0.39)	(6.44)	(0.39)	(3.08)
Fund q	-0.039**	-0.325	-0.039**	-0.138
	(0.02)	(0.49)	(0.02)	(0.13)
Constant	1.662***	-0.002	1.662***	0.119***
	(0.08)	(0.08)	(0.08)	(0.04)
R_a^2	0.299		0.305	
Dependent Variable: Inv				
MisV	0.003***	0.012***	0.008***	0.040***
	(0.00)	(0.00)	(0.00)	(0.00)
Cash flow	(0.01)	0.475***	0.083**	0.266**
	0.001**	(0.11)	(0.03)	(0.12)
Fund q	0.001**	0.006	0.003***	0.006
	(0.00)	(0.01)	(0.00)	(0.01)
Constant	0.093***	0.000	0.153***	-0.005***
	(0.00)	(0.00)	(0.01)	(0.00)
Obs.	12,857	12,857	12,857	12,857
J stats.	N/A	93.219	N/A	204.537
R_a^2	0.424	N/A	0.734	N/A

Table 4.4 Cross-Sectional Analyses: Earnings Report Quality

The table presents the OLS estimation output of studying the effects of investment on misvaluation by dividing the samples according to earnings report quality (ERQ). The dependent variable is misvaluation ($MisV$) and the model is specified as follows:

$$MisV = b_0 + b_1 Inv + b_2 Cash\ flow + b_3 Fund\ q + v_i + v_t + u_{it}.$$

In Columns 1 and 2, low (high) ERQ is defined as firms with absolute residuals from a modified Jones (1991) model ($|DACC|$) in the highest (lowest) tercile of the yearly sample distribution. In Columns 3 and 4, low (high) ERQ is defined as firms with analysts forecast error in the highest (lowest) tercile of the yearly sample distribution. In Columns 5 and 6, low (high) ERQ is defined as firms with *F-Score* in the highest (lowest) tercile of the yearly sample distribution. Investment (Inv) is capital expenditures normalized by gross property, plant and equipment. Fundamental q ($Fund\ q$) is computed as the intrinsic value multiplied by number of shares outstanding plus total assets minus book value of equity minus deferred tax, normalized by gross property, plant, and equipment. Misvaluation ($MisV$) is defined as the ratio of the stock price over the next quarter to the firm's intrinsic value. $Cash\ flow$ is income before before extraordinary items plus deprecation, normalized by gross property, plant, and equipment. v_i (v_t) indicates firm (year) fixed effects. Robust standard errors adjusted for firm level clustering are given in brackets. p value of significant difference on Inv corresponding to Chow's test of differences between high and low earnings quality are presented. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	|DACC|		Analyst Forecast Error		F-Score	
	Low ERQ	High ERQ	Low ERQ	High ERQ	Low ERQ	High ERQ
Inv	2.753***	-0.342	2.176**	0.852**	1.626***	1.853
	(0.82)	(0.90)	(1.04)	(0.42)	(0.57)	(1.76)
Cash flow	-0.985**	-0.056	-2.398***	0.708**	-0.018	-2.767*
	(0.41)	(0.72)	(0.83)	(0.29)	(0.30)	(1.44)
Fund q	-0.052***	-0.089***	-0.033**	-0.088***	-0.062***	-0.030
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Constant	1.743***	1.821***	1.745***	1.559***	1.588***	1.870***
	(0.11)	(0.19)	(0.08)	(0.09)	(0.12)	(0.13)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
p of sig. dif.	0.000		0.022		0.777	
Obs.	3079	3211	3815	4956	3050	3070
R_a^2	0.433	0.211	0.255	0.527	0.359	0.303

Table 4.5 Cross-Sectional Analyses: Ownership

The table presents the OLS estimation output of studying the effects of investment on misvaluation by dividing the samples according to executives' inside ownership. The dependent variable is misvaluation ($MisV$) and the model is specified as follows:

$$MisV = b_0 + b_1 Inv + b_2 Cash\ flow + b_3 Fund\ q + v_i + v_t + u_{it}.$$

In Panel A, low-(high-)stock ownership is defined as firms with CEO's/top management team's stock ownership (OWN_CEO/OWN_TEAM) in the lowest (highest) tercile of the yearly sample distribution. In Panel B, low-(high-)delta ($Delta\_CEO/Delta\_TEAM$) is defined as firms with CEO's/top management team's total delta in the lowest (highest) tercile of the yearly sample distribution. Inv is capital expenditures normalized by gross property, plant, and equipment. Fundamental q ($Fund\ q$) is computed as the intrinsic value multiplied by number of shares outstanding plus total assets minus book value of equity minus deferred tax, normalized by gross property, plant, and equipment. Misvaluation ($MisV$) is defined as the ratio of the stock price over the next quarter to the firm's intrinsic value. $Cash\ flow$ is income before before extraordinary items plus deprecation, normalized by gross property, plant and equipment. v_i (v_t) indicates firm (year) fixed effects. Robust standard errors adjusted for firm level clustering are given in brackets. ***, ** and * indicate significance at the 1%, 5%, and 10% probability levels, respectively.

Panel A. stock ownership				
	High	Low	High	Low
	5 OWN_CEO	OWN_CEO	5 OWN_TEAM	OWN_TEAM
	(1)	(2)	(3)	(4)
Inv	2.211**	1.093	2.429***	1.159
	(0.88)	(1.08)	(0.73)	(1.22)
Cash flow	-0.483	-0.282	-0.588	-0.121
	(0.49)	(0.82)	(0.47)	(0.87)
Fund q	-0.029**	-0.112***	-0.023*	-0.138***
	(0.01)	(0.04)	(0.01)	(0.04)
Constant	1.726***	2.041***	1.617***	2.108***
	(0.17)	(0.20)	(0.16)	(0.21)
Obs.	1768	1836	1897	1951
R_a^2	0.360	0.094	0.396	0.111
Panel B. delta				
	High	Low	High	Low
	5 Delta_CEO	Delta_CEO	5 Delta_TEAM	Delta_TEAM
	(5)	(6)	(7)	(8)
Inv	2.551**	0.821	2.291**	0.866*
	(1.04)	(0.56)	(0.94)	(0.50)
Cash flow	-0.605	-0.084	-0.186	0.004
	(0.43)	(0.29)	(0.34)	(0.32)
Fund q	-0.027*	-0.089**	-0.026*	-0.094**
	(0.01)	(0.04)	(0.02)	(0.04)
Constant	1.887***	1.746***	1.739***	1.712***
	(0.21)	(0.13)	(0.18)	(0.13)
Obs.	1767	1927	1888	2040
R_a^2	0.200	0.440	0.357	0.442

Table 4.6 Evidence Based on Insider Sales

Panel A of the table presents the OLS estimation output of investment on misvaluation ($MisV$) by sorting the sample based on insiders' Net Sales Ratio (NSR) in the following year. The model is specified as follows:

$$MisV = b_0 + b_1 Inv + b_2 Cash\ flow + b_3 Fund\ q + v_i + v_t + u_{it}.$$

Inv is capital expenditures normalized by gross property, plant and equipment. Fundamental q ($Fund\ q$) is computed as the intrinsic value multiplied by number of shares outstanding plus total assets minus book value of equity minus deferred tax, normalized by gross property, plant, and equipment. Misvaluation ($MisV$) is defined as the ratio of the stock price over the next quarter to the firm's intrinsic value. $Cash\ flow$ is income before before extraordinary items plus deprecation, normalized by gross property, plant, and equipment. v_i (v_t) indicates firm (year) fixed effects. Panel B shows the transaction-level regressions examining the effect of investment decision on insider sales' trading profits ($Profits$) estimated over 180 days, 120 days and 90 days. The model is specified as follows:

$$Profits = b_0 + b_1 InsiderSale \times Inv + b_2 Inv + b_3 InsiderSale + Controls + v_i + v_t + u_{it}.$$

$InsiderSale$ is an indicator variable for insider sales. p-value of joint significance of Inv and $InsiderSale \times Inv$ is shown. Robust standard errors adjusted for firm level clustering are given in brackets.***, ** and * indicate significance at the 1%, 5%, and 10% probability levels, respectively.

Panel A. Sorting by Net Sale Ratio

	(1) Positive NSR	(2) Negative NSR
Inv	3.559**	0.243
	(1.73)	(0.55)
Cash flow	-2.846*	-0.981*
	(1.56)	(0.57)
Fund q	-0.002	-0.052**
	(0.03)	(0.02)
Constant	1.636***	1.855***
	(0.12)	(0.15)
Obs.	2,333	1,414
R_a^2	0.464	0.614

Panel B. Trading profits for insider sale

	(1) 180 days	(2) 120 days	(3) 90 days
InsiderSale ×Inv	0.200***	0.192***	0.190***
	(8.59)	(6.93)	(6.07)
Inv	-0.098***	-0.097***	-0.100***
	(-7.95)	(-6.57)	(-5.94)
Joint Sig. of (Inv+InsiderSale×Inv)	0.000	0.000	0.000
InsiderSale	-0.162***	-0.166***	-0.177***
	(-34.67)	(-30.32)	(-28.34)
Size	0.002	-0.000	0.001
	(1.55)	(-0.10)	(0.29)
Sale_growth	0.001	0.002	0.003
	(0.36)	(0.69)	(0.72)
AnalystC	-0.000	0.000	0.001
	(-0.05)	(0.29)	(0.50)
ROA	-0.001	-0.002	-0.002
	(-0.84)	(-1.55)	(-1.60)
VOL	0.004	-0.008	0.001
	(0.10)	(-0.16)	(0.01)
RD_dummy	0.001	0.001	0.004
	(0.47)	(0.38)	(0.78)
BTM	-0.000	-0.000	-0.000
	(-0.63)	(-0.08)	(-0.08)
RET	-0.001	-0.000	-0.000
	(-1.58)	(-0.79)	(-0.12)
Turnover	0.001	0.001	0.001
	(1.59)	(1.63)	(1.16)
Obs.	62,740	62,740	62,740

Table 4.7 CAPEX Guidance of S&P500 Firms

The table presents the OLS estimation output for S&P500 firms examining whether the impact of investment on misvaluation differs across firms with various managerial CAPEX guidance forecast errors (i.e., the differences between actual capital expenditures and CAPEX guidance). The model is is specified as follows:

$$MisV = b_0 + b_1 Inv \times high\_dev + b_2 Inv + b_3 high\_dev + b_4 Cash\ flow + b_5 Fund\ q + u_{it}.$$

Firms with above-median managerial CAPEX guidance forecast errors are coded as one for $high\_dev$ and zero otherwise. Inv is capital expenditures normalized by gross property, plant, and equipment. Fundamental q ($Fund\ q$) is computed as the intrinsic value multiplied by the number of shares outstanding plus total assets minus book value of equity minus deferred tax, normalized by gross property, plant, and equipment. Misvaluation ($MisV$) is defined as the ratio of the stock price over the next quarter to the firm's intrinsic value. $Cash\ flow$ is income before before extraordinary items plus deprecation, normalized by gross property, plant, and equipment. Industry (Firm) and year fixed effects are included in Column 1 (2). Robust standard errors are given in brackets. ***, ** and * indicate significance at the 1%, 5%, and 10% probability levels, respectively.

	(1)	(2)
Dependent Variable: MisV		
Inv × high_dev	2.538**	2.156*
	(1.10)	(1.28)
Inv	-0.367	-1.763**
	(0.68)	(0.76)
high_dev	-0.278*	-0.239
	(0.16)	(0.15)
Cash flow	1.517***	0.488
	(0.41)	(0.31)
Fund q	-0.134***	-0.125***
	(0.02)	(0.02)
Constant	1.598***	1.973***
	(0.14)	(0.15)
Fixed effects	Industry and Year FE	Firm and Year FE
Obs.	481	451
R^2_a	0.352	0.628

Figure 4.1 Misinvestment and Misvaluation

β determines managers' faction of ownership of their company's stocks. a modulates the degree of informativeness of investment. The top and bottom left panel depicts the levels of misinvestment ($\frac{I_t^M}{K_t^M} - \frac{I_t^F}{K_t^F}$) in percentage terms, defined as the difference in investment rates between the benchmark case and the case where β and a are equal to zero. The top and bottom right panel depicts the ratio of the market value to the fundamental value minus one ($V_t^S/V_t^F - 1$). The top (bottom) left panel show the relation between misinvesment and β (a) and the top (bottom) right panel shows the relation between misvaluation and β (a). All the other parameters are set at the baseline values, expect for the parameter of interest.

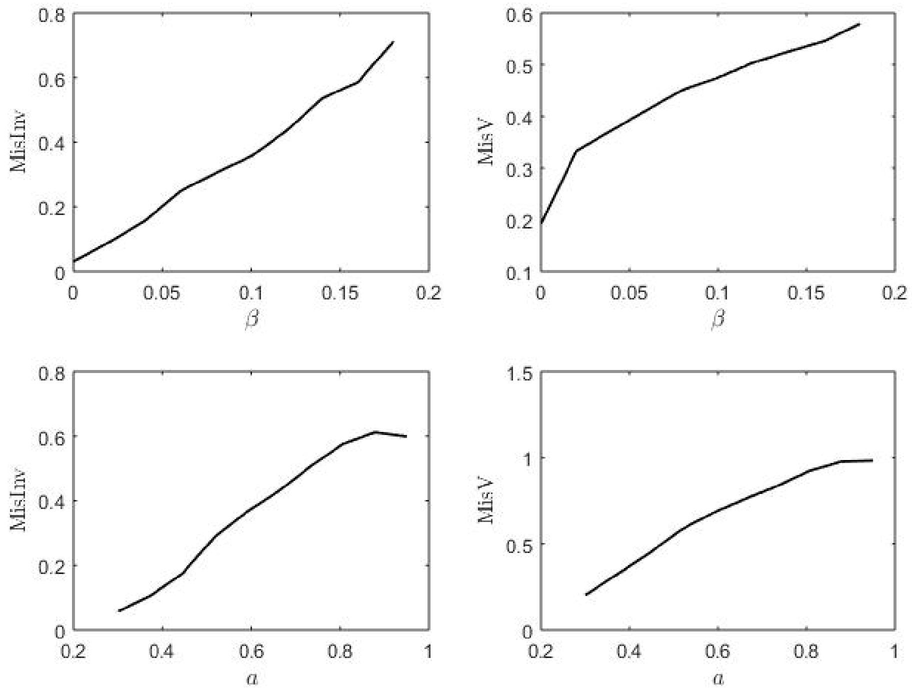


Figure 4.2 Regression Coefficients with Simulated Data

β determines managers' faction of ownership of their company's stocks. a modulates the degree of informativeness of investment. The dotted line depicts the coefficients (b_1) of regressing misvaluation on investment: $MisV = b_0 + b_1 Inv + u$. The solid line depicts the coefficients on the misvaluation (c_1) of regressing investment on misvaluation, fundamental q and cash flow:
$Inv = c_0 + c_1 MisV + c_2 Fund\ q + c_3 Cash\ flow + e$.

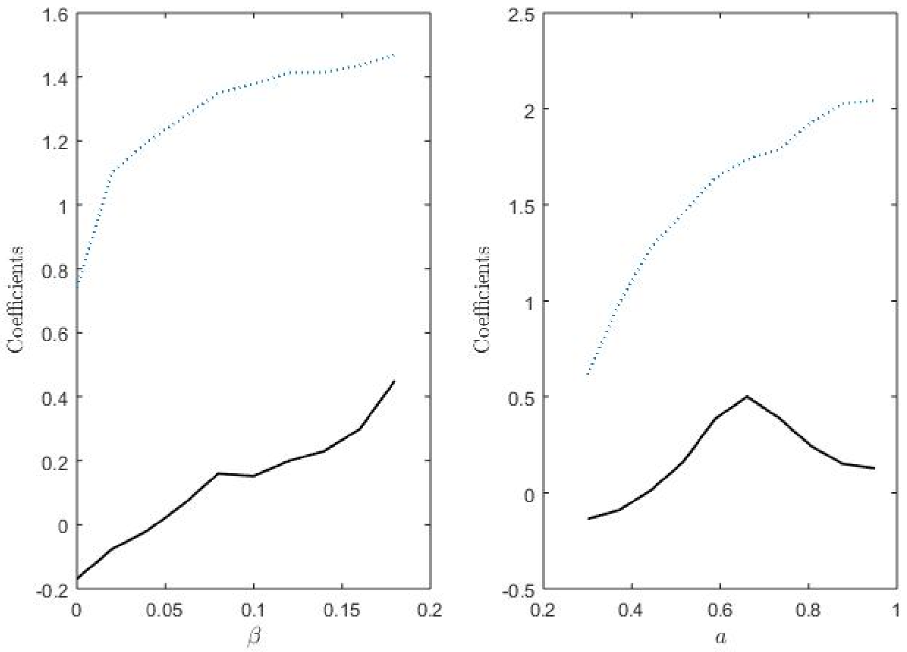
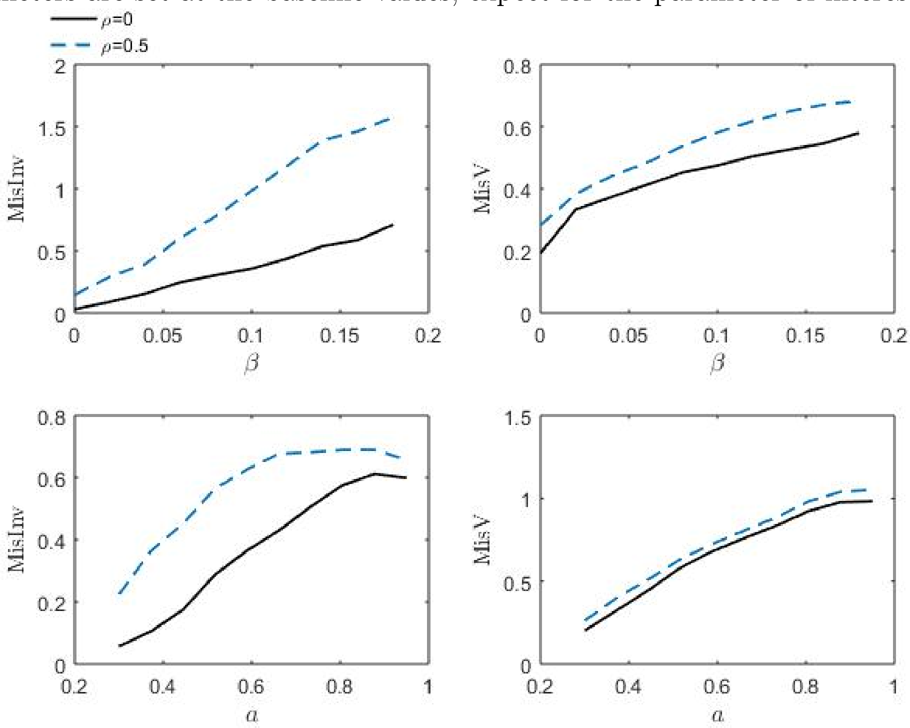


Figure 4.3 Misinvestment and Misvaluation - Equity Financing Channel

β determines managers' faction of ownership of their company's stocks. a modulates the degree of informativeness of investment. The solid line delineates the scenario in which equity financing costs remain the same regardless of the levels of misvaluation (ρ=0). The dashed line delineates the scenario in which equity financing costs decrease with overvaluation (ρ=0.5). The top and bottom left panel depicts the levels of misinvestment ($\frac{I_t^M}{K_t^M} - \frac{I_t^F}{K_t^F}$) in percentage terms, defined as the difference in investment rates between the benchmark case and the case in which β and a are equal to zero. The top and bottom right panel depicts the ratio of the market value to the fundamental value minus one ($V_t^S/V_t^F - 1$). The top (bottom) left panel show the relation between misinvesment and β (a) and the top (bottom) right panel shows the relation between misvaluation and β (a). All the other parameters are set at the baseline values, expect for the parameter of interest.



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CHAPTER 5

Summary and Conclusions

5.1 Summary of Findings

This dissertation sets out different studies that investigate the consequences of corporate transparency. More specifically, in Chapter 2, I investigate whether CSR transparency may affect stakeholder decision-making. In Chapter 3, we study whether an increase in transparency toward financial information processing costs produces stakeholder attention externalities toward non-financial disclosure. Lastly, in Chapter 4, we investigate how the level of corporate transparency may incentivize managers' use of investments to affect corporate valuation.

In the chapter titled *CSR Information and Regulatory Activity*, I show how CSR information affects stakeholder decision-making. Jurisdictions around the world are currently considering CSR transparency mandates (Christensen, Hail, and Leuz, 2021). Given that the rationale for this mandate is the generation of social externalities, investigating whether stakeholders incorporate CSR information into their decision-making is of first-order importance. The chapter shows that an important stakeholder group such as regulators increases its enforcement activity toward firms on which CSR information is available. Nevertheless, despite CSR information affecting regulatory monitoring, this is not attributable to regulators' learning. Indeed, the findings are more consistent with regulators incorporating CSR information because of deterrence considerations. Indeed, a CSR mandate on firms will impose a reputational cost given that regulatory activity (e.g., inspections and violations) will be disclosed. In turn, this will increase the marginal benefit of regulatory activity. In conclusion, the chapter shows that CSR disclosure does not carry additional information content to regulators. Nevertheless, the disclosure itself serves as a signal that can help regulators maximize deterrence as it imposes a reputational cost on the firm.

The chapter titled *The Non-Financial Spillovers of Financial Information Processing Costs: Evidence from the U.S. XBRL Mandate* emphasizes how an increase in transparency and easier financial information processing can create market participant attention spill-over towards other sources of information.

Regulators often push for an increase in transparency after corporate scandals. One of the underlying assumptions is that, by forcing firms to be more transparent on specific dimensions, this will incentivize desirable behaviors and discourage undesirable ones (Christensen, Hail, and Leuz, 2021; Fiechter, Hitz, and Lehmann, 2022). In our third chapter, we conjecture that the level of attention by market participants toward specific issues may encourage firms toward desirable behaviors. As market participants have limited resources to process information (Blankespoor, 2019), they are constrained to process all the available information. More specifically, by relaxing constraints associated with processing financial information, this will free up resources to process other sources of information, such as ESG information. This increase in attention will incentivize firms' desirable behaviors and improve ESG outcomes. We exploit a regulation that relaxed constraints associated with processing financial information, and we show that firms improve their ESG policies. The economic magnitude of ESG performance is approximately 5% more than in the pre-regulation period. To this end, the third chapter shows substantial real effects towards ESG behavior in the absence of any mandate. In other words, when financial information is available for quick processing in a standardized format, market participants are able to pay more attention to non-financial disclosures and incentivize firms to improve their non-financial outcomes.

Lastly, in the chapter *Corporate Investment and Stock Market Valuation*, we show how transparency shapes firms' agent behavior. More specifically, when a firm's information environment is opaque, self-interest-maximizing managers may exploit investments as a signal to increase market valuation. We extend the literature that explores the relationship between corporate investments and stock market valuation (Baker, Stein, and Wurgler, 2003; Polk and Sapienza, 2008; Strobl, 2014), by showing how managers influence this relationship given the level of the firm's transparency. Importantly, while in the second and third chapters the thesis explores the relationship between corporate transparency and *external* stakeholder decision-making, in the fourth chapter it explores the relationship *within* the firm.

5.2 Limitations and Future Developments

While each of the three manuscripts presented in this dissertation empirically addresses different concerns that may arise with specific research designs, they are not without limitations. Firstly, in Chapter 2, despite the evidence suggesting that CSR information helps regulators maximize deterrence, it still remains an open question whether, on aggregate, this is welfare-improving. To this extent, future research should estimate firms' compliance costs, which is a non-trivial estimation. However, by reasonably assuming that firms' workplace violations have enormous social costs (Johnson, 2020), compliance costs should be very high to offset the benefits after the adjustment of enforcement activity on newly covered CSR firms. Moreover, the chapter does not show whether regulators, within the newly CSR-covered firms, increase deterrence on firms whose workplace safety is more important in the construction of CSR ratings. To this extent, future research should be able to isolate a group of firms on which the importance of workplace safety for the construction of CSR rating is greater than others. Ideally, if deterrence considerations are indeed driving regulatory activity, regulators should prioritize firms for which the weight of workplace safety in the construction of CSR rating is greater.

In Chapter 3, while we show robust empirical evidence of an increase in firms' ESG outcomes following the XBRL mandate, we fail to disentangle whether this is attributable only to market participants' increased attention toward ESG issues. An alternative explanation may be consistent with firms adjusting their ESG policies in response to changes in market participants' information processing costs. This is consistent with literature that shows how firms adjust disclosure practices in anticipation of changes in market participants' information processing costs (Blankespoor, 2019; Blankespoor, deHaan, and Marinovic, 2020). Future work may explore whether market participants are more sensitive to ESG issues after they benefit from a reduction in information processing costs.

Lastly, in Chapter 4, despite providing evidence that a low level of transparency may influence firms' managers to misallocate investments to influence stock market valuation, we do not explore whether an increase in corporate transparency will discourage the manipulation process that the fourth chapter documents. We leave the effectiveness of this potential solution for future research.

5.3 References

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