CORPORATE SOCIAL RESPONSIBILITY, PENSION ASSUMPTIONS, AND RISKY ASSET ALLOCATIONS IN DEFINED BENEFIT PENSION PLANS

By

DONGHYEOK JANG

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Student: Donghyeok Jang

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This dissertation has been accepted and approved in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Finance by:

Youchang Wu	Chairperson
John Chalmers	Core Member
Brandon Julio	Core Member
Jeremy Piger	Institutional Representative

and

Krista Chronister	Vice Provost for Graduate Studies

Original approval signatures are on file with the University of Oregon Division of Graduate Studies.

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DISSERTATION ABSTRACT

Donghyeok Jang

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Title: Corporate Social Responsibility, Pension Assumptions, and Risky Asset Allocations in Defined Benefit Pension Plans

I explore the role of corporate social responsibility (CSR) in mitigating agency issues in defined benefit (DB) pension plan management. Strong CSR firms tend to engage less in earnings management associated with executive options granting and CFOs' pay sensitivity to the stock value (Delta) through the assumed long-term rate of returns on pension assets. Furthermore, strong CSR firms are less likely to manipulate the pension discount rate in response to a change in the pension funding gap. I also investigate whether CSR influences firms' decision to make risky investments with pension assets. OLS analysis indicates that a standard deviation increase in the Material CSR score is associated with a 0.063 (1.93) percentage points decreases in assumed returns (equity allocation) in pension plans. Using BP Deepwater Horizon oil spill event as an exogenous shock, I provide supporting evidence for the causal link between firms' CSR performance and the pension policies.

CURRICULUM VITAE

NAME OF AUTHOR: Donghyeok Jang

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:

University of Oregon, Eugene

Arizona State University, Tempe

Chungbuk National University, Cheongju, South Korea

DEGREES AWARDED:

Doctor of Finance, 2022, University of Oregon

Master of Arts in Applied Mathematics, 2016, Arizona State University

Bachelor of Business Administration, 2008, Chungbuk National University

AREAS OF SPECIAL INTEREST:

Empirical Corporate Finance

Corporate Social Responsibility

Environmental, Social, and Governance

Corporate Pension Plans

WORKING PAPERS:

Size and Investment Performance: Defined Benefit vs. Defined Contribution Pension Plans, 2021, Joint with Youchang Wu (University of Oregon)

Corporate Social Responsibility, Pension Assumptions, and Risky Asset Allocations in Defined Benefit Pension Plans, 2022

Environmental, Social, and Governance (ESG), and Firm Ownership Structures, 2022, Joint with John Chalmers (University of Oregon)

PROFESSIONAL EXPERIENCE:

Appointed Researcher, Korea Institute for Industrial Economics and Trade, 2016 - 2017

AWARDS:

People's Choice Award & Honorable Mention, Three-Minute Thesis Competition, University of Oregon, 2021

Robin & Roger Best Teaching Award, Lundquist College of Business, University of Oregon, 2020, 2021

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CHAPTER 1. INTRODUCTION

Corporate social responsibility (CSR) has been an important part of U.S. firms' operations. According to the 2020 report on U.S. sustainable and impact investing trends published by Social Investment Forum, since 1995 the size of the US sustainable investment universe, measured at $639 billion, has increased to $16.6 trillion, a compound annual growth rate of 14%. Also, incorporating CSR factors in investments has been adopted widely in both public and private asset markets [e.g., Barber et al. (2021); Bauer et al. (2021); Zaccone and Pedrini (2020); Riedl and Smeets (2017)]. With the growing attention, numerous studies have examined what role CSR plays in various corporate policies such as value creation, employee satisfaction, tax management, and financial reporting [e.g., Kim et al. (2012); Deng et al. (2013); Dimson et al. (2015); Flammer (2015); ; Davis et al. (2015)]. Yet, the finance literature lacks systematic investigation into whether CSR influences corporate pension plan management.

Among many mechanisms, pension assumptions are within managers' reach to manipulate reported corporate profits (Bergstresser et al. (2006)).[1]Managers enjoy significant discretion to choose assumed long-term rate of returns on pension assets to manage corporate earnings.[2] Also, the risk-shifting behavior in pension asset management, caused by agency problem between shareholders and plan participants, may make the plan sponsors chase too much risk and put the retirement welfare of pension members in danger. The managers' discretion in pension assumptions and the conflict of interest in pension asset management prompt important research questions. How do managers at socially responsible firms make pension assumptions? Would their behaviors regarding the pension assumptions differ from those at socially irresponsible firms? Do strong CSR firms have a different degree of risk-taking in pension asset investments?

The concept of CSR and what it is intended to measure in corporate economics are still somewhat abstract, even though the term "CSR" has become increasingly popular in the economics and finance literature. In the literature, in which researchers examine the value-improving role of CSR [e.g., Dimson et al. (2015); Flammer (2015); Dyck et al. (2019)], numerous studies are based on Benabou and Tirole (2010) and largely agree that

[1]Fundamentally, there are three components required to characterize the annual cost of DB plans: a service cost, an interest cost, and an offsetting assumed long-term rate of returns on pension assets. To offset the interest and service costs, managers use significant leeway in assuming the returns on pension assets. The reconciliation between the assumed and actual returns happens over very long amortization periods.

[2]Bergstresser et al. (2006) describe a simple example of how the assumed returns affect reported earnings: a firm with $100 of operating assets, a 4 percent of return ($4) on the operating assets, $20 of pension assets, and a 10 percent of assumed returns ($2) on the pension assets. If the firm increases the assumed returns to 11%, its net income immediately increases by 5% (or $0.2). More specifically, the assumed returns are used to offset annual DB pension costs, and the cost-offsetting returns are not realized actual returns on pension assets but the assumed returns.

CSR measures firms' incentive to improve social welfare to the extent that it improves the value of stakeholders, including shareholders.[3] In addition, the accounting literature, where studies focus on how CSR impacts firms' financial reporting [e.g., Trebucq and Russ (2005); Pyo and Lee (2013); Liu et al. (2017)], views CSR as firms' incentive to be trustworthy, ethical, and honest in their operations. In this paper, in company with the previous studies, I contend that CSR promotes firms' incentive to operate pension plans honestly and to manage pension assets for the broad range of stakeholders.

In terms of the relation between firms' CSR performance and assumed returns on pension assets, earnings manipulation through aggressive pension assumption is evidently socially unacceptable, as pension accounting involves the alteration of financial reports, which may weaken the credibility of financial reporting.[4] Also, Jones (1995) argues that when firms' operations are based on trust and cooperation with members of society, they have an incentive to show their commitment to behave ethically. Atkins (2006) states that "being transparent in firms' financial reporting" is what the investing and consuming public really means by social responsibility. Hence, at socially responsible firms that implement CSR activities to meet ethical demands in society, managers are less likely to manipulate assumed returns on pension assets to disguise the firms' underlying performance. Therefore, I predict that managers at strong CSR firms are less likely to opportunistically manipulate pension assumptions, and that do not exhibit aggressive choice of assumed returns on pension assets.

To provide evidence to the relation between CSR and corporate pension assumptions, I start with specific cases where managers have incentives to manipulate pension assumptions. First, I investigate CEOs' gaming behavior with option activities to see whether CSR alleviates managerial incentives to manipulate reported earnings. Bergstresser et al. (2006) explain the gaming behavior in two directions: a CEO has incentive to manipulate the assumed returns upward to boost reported earnings in periods when she exercises options, and to manipulate the returns downward to decrease reported earnings in periods when options are granted. This opportunistic behavior is empirically documented (Balsam et al. (2005) and Wei (2004). Second, I examine whether CSR mitigates incentives, arising from executive pay sensitivity to stock performance (Delta) [e.g., Core and Guay (2002)], to manipulate earnings. Previous studies document that when managers' compensation structure is tied well to the stock value, which can be measured by Delta, it can provide the managers with incentives to manipulate earnings [e.g., Bergstresser and Philippon (2006); Jiang et al. (2010); Burns and Kedia (2006)]. In addition, I explore underfunded

[3] Lins et al. (2017) also study whether CSR creates value, but argue that it measures firms' trust, which enables the firms to cooperate in society. See CHAPTER 2 for detailed discussion.

[4] Regarding tax management, Huseynov and Klamm (2012) and Davis et al. (2015) find socially responsible firms have lower tax payment/expense. They argue socially responsible firms may be socially acceptable to reduce the tax costs, countering the view that a firm that cheats the government may cheat its shareholders.

firms to examine whether pension discount rate is also influenced by their CSR standings, since these firms may attempt to manipulate the discount rate (actuarial assumption) to artificially improve the funding ratio without making an adequate amount of contribution to the pension assets [e.g.,Amir and Gordon (1996); Asthana (1999)].[5]

Next, CSR may influence the level of risk in pension asset investments. Shivdasani and Stefanescu (2010) show that firms incorporate DB pension assets and liabilities into their own capital structure, and that DB plan participants are just like long-term creditors of the firms. Studying internal governance mechanisms in DB plans, Phan and Hegde (2013) find that there is a clear agency problem between shareholders and pension members, as firms with bad pension plan governance increase equity holdings in pension plan assets as well as dividend payout ratio. Also, Pontiff et al. (1990) shows acquirers transfer wealth from DB plan participants to shareholders by terminating the target's DB plans after the acquisition. The risk-shifting behavior, documented in Jensen and Meckling (1976), then indicates how pension members would form objectives toward asset management in DB pension plans: the plan participants would require the sponsors to manage the pension assets safely, by reducing the proportion of pension assets invested in risky equity securities. Thus, given that CSR addresses firms' responsible actions with respect to a broad range of stakeholders, which include pension members, I hypothesize that socially responsible firms would reduce the riskiness of pension asset investments for their pension plan participants, by decreasing the proportion of pension assets invested in equity securities. I note that some firms can invest more in CSR than others, and through the investment they can change their CSR performance. This implies that a firm's CSR performance is highly likely to be determined endogenously with its fundamentals. Hence, I do not claim the hypotheses above necessarily indicate a strong causal relationship between CSR and pension management. Rather, in this paper, I attempt to document how strong and poor CSR firms are different with respect to pension policies by testing the hypotheses.

Using a sample of 7,568 firm-year observations (1,107 unique firms), in which firms' ESG ratings are provided by Truvalue Labs, during the period 2008-2018, I show CSR deters executives from opportunistically choosing the assumed returns during the periods of option grants. As Balsam et al. (2005) shows, managers have incentive to manipulate earnings downward prior to option grants to decrease the exercise price. I find that in poor CSR firms, CEOs whose option grants are at the sample median decrease assumed returns on pension assets by 4 basis points, compared to CEOs with zero option grants. However, in good CSR firms, CEOs do not display such behavior. This implies that

[5]Since the 1990s, the pension discount rate of corporations has been based on Moody's Aaa corporate bond yield due to a ruling by SEC. Accordingly, Andonov et al. (2017) find that public DB pension plans have more freedom, compared to private DB plans, to choose the discount rate. However, Amir and Gordon (1996) and Asthana (1999) document firms also make liberal choice on the pension discount rate based on their needs.

CSR reduces CEOs' incentives arising from option grants to manipulate reported earnings through pension assumptions. Next, as to the incentives arising from executives' pay sensitivity (Delta), CFOs' Delta is positively associated with assumed returns among low CSR firms. The results indicate that one unit increase in CFOs' Delta is associated with 0.1 basis points increase in assumed returns at poor Social Capital firms. However, CFOs at firms with superior Social Capital performance do not aggressively assume returns on pension assets when their Delta moves up. Also, when it comes to the discount rate, I find Human Capital and Business Model & Innovation dimensions effectively mitigate the incentives to manipulate the rate for better funding status at firms with underfunded plans.

Next, I find that firms' CSR ratings have a significant negative effect on the assumed returns as well as the equity asset allocations in pension plans, controlling for observable plan- and firm-related factors that can affect the choice of assumed returns and risk-taking in pension asset investments. The negative associations of firms' CSR score with the assumed returns and equity allocation are stronger for materially important CSR measures. For example, one standard deviation increase in Material CSR score (immaterial CSR score) is associated with decreases in the equity allocations by 1.98 (1.18) percentage points. My results suggest that CSR guides plan sponsors to report earnings honestly, and to manage pension assets safely in favor of plan participants. Further, the stronger impacts of materially important CSR measures on the pension management variables indicate that the pension policy has valuation implications [see e.g., Grewal et al. (2016); Khan et al. (2016)].

I also explore which CSR areas are particularly important in corporate pension policies. The Sustainability Accounting Standards Board (SASB) has defined five CSR dimensions using 26 sustainability topics: Leadership & Governance, Environment, Human Capital, Social Capital, and Business Model & Innovation. Examining the associations of the different CSR dimension scores with the pension management would provide insight regarding what CSR areas are important to mitigate the managers' incentive to manipulate earnings and to deal with the agency problem between equity holders and plan participants. I find that, among the five CSR dimensions, the Business Model & Innovation dimension, which incorporates environmental, human, and social topics in a company's value-creation process, is the driving force behind the relation between firms' overall CSR performance and assumed returns. The results indicate that one standard deviation increase in Business Model & Innovation score is associated with 0.076 percentage points decrease, which is greater than 0.063 percentage points decrease estimated with Material CSR score, in assumed returns. Also, I show this particular CSR dimension aligns the interest of the managers with that of plan participants in pension asset management.

It is critical to note that firms' CSR ratings and their pension management variables can be endogenously determined. On one hand, firms with strong CSR score may manage

pension assets safely and do not attempt aggressive pension assumptions. On the other hand, firms that safely manage pension assets and do not engage in the unethical pension accounting may be able to obtain higher CSR performance levels. To mitigate the endogeneity issue and support the validity of my findings on the relation between CSR and pension management, I use the 2010 BP Deepwater Horizon oil spill to conduct a quasi-natural experiment. The unexpected industrial disaster tremendously raised public attention on social responsibility of firms whose operations were closely related to the shock. If the increased public attention improved firms' CSR performance levels following the shock[6], then the changes in the firms' CSR levels would allow me to examine the associations of CSR with pension assumptions and equity allocations in cleaner settings. By assigning the treatment to firms in extractive, petroleum, and chemical industries, I find that the oil spill indeed positively affected the treated firms' CSR performances, and that these firms tended to have lower assumed returns and equity allocations in the years following the event. I also present the robustness of the findings by checking the parallel trends assumption and performing placebo tests.

This work contributes to the large literature on earnings management. The literature has emphasized accruals as a tool for earnings management, following Jones (1991)[7]. For example, Teoh et al. (1998) find evidence of opportunistic managerial manipulation of discretionary accruals in periods when firms sell shares. However, a lot of researchers have attempted to specify alternative routes to detect manipulated earnings. Krull (2004) finds evidence that firms shift income from one subsidiary to another, located in an area with a more favorable accounting or tax regime, to optimize taxes and reported earnings. Mande et al. (2000) document that during the 1990s recession, Japanese firms who had a promising long-term R&D vision significantly cut their R&D expenses, displaying myopic earnings-increasing behavior. Bergstresser et al. (2006), as mentioned earlier, show that managers use assumed returns on pension assets as a tool for earnings manipulation, and that they assume the returns more aggressively as the assumptions have a greater impact on reported earnings. Based on the findings in the study, I identify firms' CSR performance as an important factor that keeps managers from engaging in earnings manipulation through pension assumptions.

My study also adds to the literature where researchers examine the relationship between

[6]Dyck et al. (2019) find that institutional investors play a significant role in improving CSR performance, and that the Deepwater oil spill, which raised the investors' attention, increased the firms' CSR performance levels. I also provide empirical results which show that among the treated firms the ones with greater institutional ownership experienced more significant changes in assumed returns and equity asset allocation.

[7]The Jones (1991) model is considered the most popular one in the earnings management literature. The model estimates abnormal accruals, and is based on earlier work by Healy (1985) and DeAngelo (1986), in which the authors use the change in total accruals from the estimation period to proxy for the expected non-discretionary accruals in the event period. Jones (1991) proposes a model that controls for the effect of the company's economic circumstances on non-discretionary accruals, by relaxing the assumption of constant non-discretionary accruals made in the earlier work.

CSR and earnings management. Using the KLD database, Trebucq and Russ (2005) find social strengths (concerns) tend to be related with lower (higher) accruals, suggesting that ethical managers who take care of their stakeholders do not manipulate earnings. Using multinational data, Chih et al. (2008) find that although strong CSR firms are less likely to engage in earnings smoothing and earnings loss avoidance, they are more likely to manage accruals aggressively. Next, Pyo and Lee (2013) show the negative association between CSR and the accruals is more pronounced when firms voluntarily publish CSR reports. Kim et al. (2012) document that socially responsible firms are less likely to have aggressive accrual management, to manipulate real operating activities, and to receive AAERs (Accounting and Auditing Enforcement Releases). Lastly, Liu et al. (2017) find that family firms tend to have higher CSR performance, and that these firms engage less in accrual-based earnings management. This literature has a limitation in that it mostly relies on the discretionary accruals, which are estimated, as a tool to manipulate earnings. I contribute to the literature by using assumed long-term rate of returns on pension assets, which are observed annually, to detect earnings manipulation, following Bergstresser et al. (2006).

This paper also contributes to the growing literature that investigates associations of firms' CSR performance levels with firm-level outcomes. Dimson et al. (2015) find that financial markets positively react to successful CSR-related activism, by showing such CSR engagements generate sizable abnormal returns. Flammer (2015), focusing on CSR proposals that pass or fail by a small margin of votes, shows that adoption of close-call CSR proposals leads to positive announcement returns and superior accounting performance. Lins et al. (2017) find that firms that entered the 2008 financial crisis with high CSR ratings have significantly higher crisis-period stock returns than their counterparts. It is worthwhile to note that conflicting evidence has also been reported in the literature, which shows negative effects of CSR on firm value. Measuring stakeholders' preferences for CSR by their political affiliation, Di Giuli and Kostovetsky (2014) find that an expansion of CSR policies is associated with future stock underperformance and a long-run deterioration in ROA. Krüger (2015), focusing on corporate behavior in the form of publicly observable events, documents that investors react negatively to the release of positive CSR news. While this literature mostly focuses on shareholder value with a few exceptions[8], I provide evidence that pension members, who are included in a broad range of stakeholders, benefit when the plan sponsors exhibit great CSR performance.

[8]Studying whether CSR creates value for acquiring firms' shareholders, Deng et al. (2013) show merged firms' employees tend to be laid off less in mergers where high CSR acquirers are involved than in mergers where low CSR acquirers are involved. Greening and Turban (2000) examine whether firms' CSR performance attracts job applicants, and show that prospective applicants are more likely to pursue jobs from socially responsible firms than from firms with poor CSR reputations. Edmans (2012) shows job satisfaction is positively linked to firm value, using the list of "100 Best Companies to Work in America". These findings show positive effects CSR has on the broad range of stakeholders.

Lastly, this study adds to the literature where researchers look into factors such as tax benefits and financial conditions that govern risk-taking in corporate pension plans. Black (1980) and Tepper (1981) show pension plans should be funded with debt rather than equity to deliver greater after-tax cash flows to shareholders. Rauh (2009) presents evidence that firms with underfunded DB plans and weak credit ratings invest a larger proportion of pension assets in safe assets. Anantharaman and Lee (2014) show the compensation incentives of managers, measured by Delta and Vega, affect equity asset allocation in pension plans. Cocco and Volpin (2005) and Phan and Hegde (2013) find that governance mechanisms exert pressure on managers to choose judicious risk-taking in DB pension asset allocations. I make a contribution to this literature by demonstrating new evidence that CSR is indeed an important driving force behind firms' choices on risky asset allocations.

CHAPTER 2. LITERATURE REVIEW

I review sets of related literature in this chapter: first, I review previous works that theorize the concept of CSR in the context of corporate economics. Second, I discuss the literature in which researchers investigate the relation between CSR and earnings management. Third, I review the literature that explores mechanisms of earnings management. Lastly, I discuss previous papers that investigate factors that determine riskiness in corporate DB pension asset management.

Theories of CSR

Over the last two decades, the term "CSR" has become popular in the finance and accounting literature [e.g., Putnam (1993); Trebucq and Russ (2005) Kim et al. (2012); Deng et al. (2013); Dimson et al. (2015); Dyck et al. (2019)]. However, as the concept of CSR is somewhat abstract and multi-dimensional, the literature does not share an identical definition for the term. In this chapter, I describe what firm-level CSR is intended to measure in the different literature, and how it can be associated with corporate pension policies.

The literature on the relation between CSR and firms' performances is largely based on Benabou and Tirole (2010), in which the authors summarize growing theoretical literature on CSR, offering three different views on the impact of CSR on firm value: the first view is that CSR allows management to take a long-term perspective and to maximize intertemporal profits, consistent with the interests of universal owners. The second view is that CSR acts as an efficient channel to express personal values on behalf of their stakeholders, which can be considered as a form of delegated philanthropy. Lastly, the third view is that CSR reveals insider oriented corporate philanthropy or a managerial agency problem. From the first two perspectives, CSR measures firms' incentive to improve social welfare to the extent that it increases the value of a broad range of stakeholders, which includes shareholders. [9]

Also, CSR represents social capital, which is viewed as a propensity of people in a society to cooperate to produce socially efficient outcomes Putnam (1993, 2000). Lins et al. (2017) state that social capital is divided into four dimensions: (1) personal relationships, (2) social network support, (3) civic engagement, and (4) trust and cooperative norms (Scrivens and Smith (2013)), and that much of the work in economics and finance focuses on the last two dimensions.[10] According to Lins et al. (2017), trust and cooperative norms, which the authors focus on, enable cooperation and collective actions in society. They lead to positive outcomes such as economic growth through reduction in transaction costs and

[9] In Benabou and Tirole (2010), the first two views on CSR imply a positive impact of CSR on firm value, while the third suggests CSR activities would be value destroying. The literature on CSR and firm value documents both positive and negative impacts of CSR.

[10] See Section 1 in Lins et al. (2017) for a detailed discussion on social capital as well as trust.

more efficient allocation of resources. The authors' view is consistent with how practitioners commonly describe CSR: the commitment of a business to contribute to sustainable economic development, working with employees, their families, the local community, and society at large to improve the quality of life (Scrivens and Smith (2013)).

Further, in the accounting literature, the role of CSR in firms' operations is primarily based on the theories of CSR documented in Garriga and Melé (2004) [e.g., Kim et al. (2012); Davis et al. (2015); Huseynov and Klamm (2012)]. Building upon the definition of CSR[11] suggested by Carroll (1979), the authors classify CSR theories into four groups: (1) ethical theories, (2) political theories, (3) integrative theories, and (4) instrumental theories. Ethical theories argue that firms must accept CSR as an ethical obligation, and political theories suggest that firms should seek ways of formalizing their willingness to improve the society where they operate. Integrative theories suggest that firms need to incorporate social demands into their operations since their success hinges upon society.[12] Under the ethical, political, and integrative theories of CSR, the literature views CSR as firms' or managers' incentives to be trustworthy, ethical, and honest in their operations such as financial reporting.

All the views on CSR above are not mutually exclusive. For instance, a manager's great incentive to be ethical and honest in managing his or her firm can, in turn, improve social welfare as well as value of the firm; also, when a firm enhances its commitment to the society, its manager would be increasingly encouraged to have a high standard of behavior.[13]

CSR and Earnings Management

With the growing attention on CSR, previous papers study the relation between CSR and earnings management. First, Trebucq and Russ (2005) examines the relationship between CSR records and accounting accruals based on the data from the KLD database, using a sample of 587 U.S. firms over the 1990-2001 period. The authors find positive social characteristics (strengths) tend to be related with lower accruals, while social concerns are associated with higher accruals. They conclude that ethical managers who take care of their stakeholders do not manipulate earnings. Chih et al. (2008) investigate CSR and earnings management using multinational data on 1,653 corporations in 46 countries. To detect earnings management, several proxies are used in the study: accruals, earnings

[11] The most widely accepted definition of CSR in the literature is "The social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time," offered by Carroll (1979).

[12] Instrumental theories of CSR regard CSR as a just tool to create wealth for shareholders. Under this view, CSR activity is accepted only if it creates monetary value (e.g., McWilliams and Siegel (2000)).

[13] The finance literature views corporate governance as a component or prerequisite of CSR. For instance, Tsoutsoura (2004) shows firms are more sensitive to CSR practices when board members hold a large number of shares, and Ntim and Soobaroyen (2013) document that well-governed firms engage more in CSR activities. Their findings suggest that corporate governance positively affects the adoption of CSR practices.

smoothing, and earnings loss avoidance. They provide mixed evidence with respect to CSR and different earnings management proxies. The authors find that although strong CSR firms are less likely to engage in earnings smoothing and earnings loss avoidance, they are more likely to manage accruals aggressively. Next, to examine the association between CSR and earnings quality, Pyo and Lee (2013) measure managers' willingness to pursue CSR activities by the level of donation expenses, instead of CSR or ESG ratings. Studying publicly-traded Korean firms, the authors document that firms active in CSR are more likely to report earnings with higher quality (lower discretionary accruals) relative to the firms who are not active in CSR. Further, they find the negative association between CSR and the accruals is more pronounced when firms voluntarily publish CSR reports. Lastly, Kim et al. (2012) examine a broad set of financial reporting characteristics to detect earnings management: accrual management, real activities manipulation, and AAERs (Accounting and Auditing Enforcement Releases against top executives). [14] The authors document the negative effects of CSR on the measures of earnings management, using the KLD database: they find socially responsible firms are less likely to have aggressive accrual management, to manipulate real operating activities, and to be subject to SEC investigations of GAAP violations as reported in AAERs. A limitation in the literature on the relation between CSR and earnings management is that the measure of earnings management mostly relies on the discretionary accruals, which can be only estimated. I add to the literature by measuring earnings management with assumed long-term rate of returns on pension assets, which are observed annually.

Mechanisms of Earnings Management

Next, the literature on earnings management has identified a large number of earnings management techniques.[15] First, Jones (1991) tests whether firms that would benefit from import relief such as tariff increases and quota reductions attempt to manage earnings downward during import relief investigations by the U.S. International Trade Commission. As the investigations explicitly focus on accounting numbers, managers have incentives to manage earnings to increase the likelihood of receiving import relief and increase the amount of relief granted. By using an estimate of the discretionary component of total accruals as the measure of earnings management, the author finds that managers decrease earnings during import relief investigations. Following Jones (1991), Teoh et al. (1998) examine the relation between earnings management and long-run performance of initial

[14] Kim et al. (2012) use four measures of real activities manipulation: (1) abnormal discretionary operating cash flows, (2) abnormal production costs, (3) abnormal discretionary expenses, and (4) a combined measure of real activities manipulation. The abnormal levels of the first three real activities are measured by the residual from the authors' models, estimated by year and industry fixed effects. See Appendix in Kim et al. (2012) for details.

[15] Healy and Wahlen (1999) review the earnings management literature, providing a list of specific accruals used to manage earnings such as claim loss reserves for property causality insurers, and loan loss provisions for banks.

public offerings. The authors' study is motivated by the stylized fact in the IPO literature that initial public offerings underperform after the issue. They argue that buyers, who are guided by earnings but are unaware that earnings are inflated by the excessive use of accruals, could pay too much. But, as information about a firm's earnings is revealed over time, the investors may recognize that earnings are manipulated upward, and therefore lose their optimistic expectation about the firm's future performance. Thus, the larger the earnings management at the time of the offering, the bigger the eventual price correction. Using a sample of IPO firms in the U.S., the authors show that IPO issuers with aggressive earnings management have a poorer long-run stock market performance than IPO issuers with conservative earnings management. Next, Krull (2004) identifies the opportunity to manage earnings with permanently reinvested earnings (PRE), as firms can delay financial statement recognition of U.S. taxes on foreign subsidiary earnings by designating it as PRE. While multinational corporations (MNCs) with foreign tax rates above the U.S. tax rate do not owe U.S. taxes on repatriations, MNCs with foreign tax rates below the U.S. tax rate do. These firms have an incentive to manage earnings by increasing PRE when pre-managed earnings fall below their earnings targets. The author shows firms with pre-managed earnings below analysts' forecasts (incentive) and an average foreign tax rate less than the U.S. tax rate (ability) indeed increase reported PRE to boost earnings. Also, discretionary investment expenditures can be used to manage reported earnings. Investigating incentives to manage earnings and executive horizon, Dechow and Sloan (1991) find that CEOs in their final years of office cut R&D expenditures to improve short-term earnings performance, when their incentive compensation is based on corporate earnings. Lastly, Bergstresser et al. (2006) identify pension assumptions as a mechanism for earnings manipulation. That is, corporate managers opportunistically choose assumed long-term rates of return on DB pension plan assets. The authors find that as the size of pension assets gets larger relative to the firms' operating cash flows, managers are more incentivized to engage in aggressive pension assumptions to boost reported earnings.

Risk-taking in Pension Asset Management

Lastly, let us turn to the literature in which researchers investigate asset allocations in corporate DB pension plans. Rauh (2009) studies whether risk shifting dominates risk management in the U.S. corporate DB pension plans. The two theories provide conflicting incentives with respect to managing cash flow risks: while risk management suggests that cash flow shocks to financially constrained firms can lead to bankruptcy, risk shifting indicates managers can increase the value of equity by taking risky projects. DB plans provide a good setting to test the opposing incentives, as funding status displays how constrained a plan is, and investment decisions on pension assets reveal how managers react to the financial constraints. The author shows risk management dominates risk shifting on average, by documenting that sponsors who have pension plans with poor funding

status and weak credit ratings invest heavily in safe assets, while sponsors with well-funded plans and strong credit ratings allocate a large share of pension assets to equity assets. Next, Anantharaman and Lee (2014) study whether managerial incentives arising from compensation structure affect the extent of risk shifting vs. risk management incentives in DB pension plans. The authors argue that empirical evidence in Rauh (2009) is puzzling in that, in DB pension plans, risk shifting behavior should be theoretically strong. This is because with more risky investments, shareholders benefit from less contribution made into the plan in good times, while only pension beneficiaries suffer when the risky investments prove to be a failure. They provide an explanation for this puzzle: managerial risk aversion. The authors find risk shifting behavior in DB plans is stronger with high vega (wealth-risk sensitivity) and weaker with Delta (wealth-price sensitivity). This is consistent with the explanation, as high Delta can lead managers to avoid risk when they are underdiversified, and high vega can cancel the risk-avoiding behaviors induced by Delta. Next, Cocco and Volpin (2005) and Phan and Hegde (2013) show that governance mechanisms impact riskiness in DB pension asset allocations. These two papers are discussed in detail in the following chapter.

CHAPTER 3. HYPOTHESES DEVELOPMENT

Although the previous literature has thoroughly studied whether CSR affects various firms' operations such as firm valuation, tax management, and financial reporting [e.g., Dimson et al. (2015); Davis et al. (2015); Kim et al. (2012)], whether it associates with corporate pension policies has not yet been explored, which is the fundamental motivation of this study.

In this paper, I mainly investigate the role of CSR in two areas in corporate pension policies—pension assumptions and asset allocations— which are shown to be influenced by corporate managers' opportunistic behavior and conflict of interest among different stakeholders, respectively, in the literature [e.g., Bergstresser et al. (2006); Cocco and Volpin (2005)]. First, managers have discretion to influence assumed returns on pension assets. They use the assumed returns to manipulate corporate earnings (Bergstresser et al. (2006)). This mechanism is viable due to two factors: annual costs arising from managing DB plans are offset by the assumed returns rather than realized actual returns on pension assets; the offset costs are reported on the firms' income statement. Thus, by having aggressive assumed returns, managers can significantly boost reported earnings. The manipulation is likely to misguide stakeholders about the firms' underlying performance. Next, when it comes to the pension asset allocations, Phan and Hegde (2013) find that plan sponsors with good corporate governance take more risks by allocating a large share of their plan assets to equities, and that firms' decision to invest heavily in equities are positively correlated with higher average pension returns, better fund status, and lower contribution. However, Cocco and Volpin (2005) provide competing evidence against Phan and Hegde (2013), by documenting that bad pension plan governance, which is proxied by the number of insider members on the board of trustees, increases equity holdings in pension plan assets and dividend payout ratio. Although those two papers contradict each other when it comes to the role of governance as a medium between risk-taking in asset allocations and pension plan performance, they clearly reveal there is an agency issue, which can affect pension asset allocations, between shareholders and pension members.

I conjecture that CSR measures firms' or managers' incentive to operate pension plans honestly, and to manage pension assets in the interest of a broad range of stakeholders rather than focusing on shareholders. It is important to note that some firms can invest more than others in CSR, and that the investment can change the firms' CSR performance.

Whether CSR influences pension assumptions is an open empirical question I set out to answer. However, given that aggressive pension return assumption is used to manipulate reported earnings (Bergstresser et al. (2006), I expect firm-level CSR score is negatively associated with assumed returns. Earnings manipulation is clearly socially undesirable. It often ignores generally accepted accounting principles (GAAP) to significantly alter

reported earnings, and, in extreme cases, it can lead to fraudulent behaviors by a company. The alteration of financial reports reduces the reliability of financial statement information, misleading a broad range of stakeholders as well as potential investors in the financial markets about the firm's performance. Further, considering the view on CSR as social capital in Lins et al. (2017), socially responsible firms are anticipated to act ethically and honestly to improve the welfare of a broad range of stakeholders. Taking all into account, it is hard to find any rationales as to why socially responsible firms would engage in earnings manipulation by choosing aggressive assumed returns on pension assets; instead, it is reasonable to expect firms with good CSR performance would have less aggressive pension return assumptions. Thus, my null hypothesis on the relation between firm-level CSR performance and assumed returns is "Firms' CSR performance levels are negatively associated with assumed returns on pension assets."

Next, I expect CSR plays an important role in pension asset allocations through influencing the agency issue between shareholders and plan participants. Along with Cocco and Volpin (2005) and Phan and Hegde (2013), Pontiff et al. (1990) document the agency problem between the two groups by showing that, during acquisition events, wealth transfer from plan participants is a source of gain for shareholders. The presence of the agency problem is also supported by the view in Shivdasani and Stefanescu (2010), in which the authors show that DB pension assets and liabilities are incorporated into firms' capital structure. That is, pension members in DB plans are long-term creditors of corporations. Then, the risk-shifting described by Jensen and Meckling (1976)[16] can be applied to the perspective of pension asset management. Shareholders would require the sponsor to increase riskiness in pension asset management, while pension members would need the firm to manage pension assets safely, by reducing exposure to risky assets. Since CSR measures firms' commitment to manage pension assets in the interest of a broad range of stakeholders, which includes plan participants, rather than focusing on shareholders, I expect socially responsible firms would manage pension assets safely. Specifically, my hypothesis on the relation between firms' CSR performance and equity allocations is, in a null form, "Firms' CSR performance levels are negatively associated with equity allocations in DB plans." I note that I do not study the optimal asset allocations in corporate DB plans[17]; rather, I study whether CSR addresses the agency problem between shareholders and plan participants, and how socially responsible firms handle the agency issue in pension asset

[16] Jensen and Meckling (1976) document the risk-shifting behavior, shedding light on agency problem between shareholders and debt holders. The authors show levered firms who act in favor of their shareholders like to adopt excessively risky strategies to gamble even if they have negative expected returns, since the shareholders get to keep the profits from the risky decisions while debt holders lose if the decisions turn out to be a failure.

[17] Theoretically, DB plans should mostly consist of fixed-income securities for tax benefits and timely matches between the bond maturities and retirement of plan participants [e.g., Black (1980); Tepper (1981)]. However, a high equity asset allocation in corporate defined benefit plans, which amounts to about 50% of pension assets on average, is still a puzzle in the literature (Li et al. (2020)).

management.

Lastly, it is worthwhile to acknowledge that the hypotheses above do not necessarily convey a causal relationship between CSR and corporate pension policies. As I explained in the beginning of this chapter, firms can invest or divest in CSR practices strategically, and their CSR performance would be plausibly influenced by such actions. Since both CSR and pension policies are likely to be determined endogenously by firm fundamentals, I do not attempt to interpret my findings in this study to claim strong causal relationships. Instead, I seek to document how differently pension plans are managed according to the sponsors' CSR ratings.

CHAPTER 4. DATA

In this chapter, I describe the data sources and provide summary statistics, univariate, and correlation analyses for the sample of firms used in this paper.

CHAPTER 4.1. Data Sources

I obtain data on firms' CSR performance from Truvalue Labs ESG (Environment, Social, and Governance) database. Although ESG and CSR are not exactly the same concept[18], they share the fundamental idea that business entities should integrate non-economic factors such as environment and governance to achieve sustainable economic growth. Also, ESG ratings are a very common measure of firm-level CSR in the financial economics literature [e.g., Dimson et al. (2015); Lins et al. (2017); Dyck et al. (2019)]. Truvalue Labs, where I obtain firm-level CSR data, is the first ESG data vendor that integrates the Sustainability Accounting Standards Board's (SASB) materiality framework, which allows users to identify material categories by company, and that provides continuously-updated ESG data for more than 16,000 worldwide securities at daily frequency. SASB has developed the materiality framework to find which Environment, Social and Governance (ESG) issues are likely to be material for different industries. For example, Air Quality category is not material for a retail firm but is for a mining firm. Unlike many traditionally ESG data providers, Truvalue Labs aims at "what firms do" rather than "what firms say". Instead of focusing on company-reported regulatory filings, it uses artificial intelligence technology to process information from various sources such as government agency studies, trade blogs, and reports from NGOs. What further sets Truvalue Labs apart from the traditional vendors is that to maintain the data transparency, it leaves any overall company ESG score or individual category score as a missing value when there is no data obtained from its data sources. This differs from the traditional ESG data providers' common practices, as they often fill data gaps with industry averages or projections.

Following the SASB's framework, Truvalue Labs provide two types of scores representing firms' CSR performance: first, All Category score (CSR score hereafter) which indicates firms' overall CSR performance as an aggregate of all 26 categories defined by SASB [19],

[18]Technically, CSR and ESG are not the same concept: while CSR has been developed based on the idea that the economy-oriented market capitalism cannot be sustainable without caring environmental and social values, the concept of ESG states the three factors— Environment (E), Social (S), and Governance (G)— must be balanced to achieve greater sustainable economic growth. It is a common misconception that ESG strategies do not care about economic growth; rather, ESG is more market-oriented than CSR. The reason why ESG does not have E (Economy) factor is not that Environment and Social pillars are more important than Economy, but it premises that maximizing investors' economic value is the ultimate goal. [See Elkington (1998) and Brundtland Commission (1987) for more discussion on the history of sustainable economic growth.]

[19]For detailed information on the 26 categories defined by SASB, check https://www.sasb.org/standards/materiality-map

and second, Materiality ESG score (Material CSR score hereafter), which aggregates only the materially important categories' performances. Previous studies show that materially important CSR performance predicts future financial performance meaningfully [e.g., Grewal et al. (2016); Khan et al. (2016)]. Additionally, Truvalue Labs provide five-dimension scores, as SASB's sustainability topics are broadly organized under five dimensions: Leadership & Governance, Environment, Human Capital, Social Capital, and Business Model & Innovation. First, Leadership & Governance involves the management of issues that are inherent to the business model or common practice in the industry and that are in potential conflict with the interest of broader stakeholder groups. Environment includes environmental impacts that may affect the firm's financial condition either through the use of nonrenewable, natural resources as inputs to the production or through harmful releases into the environment. Social capital relates to the expectation that a business will contribute to societies such as local communities and the public in return for a social license to operate. Human capital addresses the management of a company's human resources as key assets to delivering long-term value. Lastly, Business Model & Innovation addresses the integration of environmental, human, and social issues in a firm's value-creation process. Those five-dimension scores are independently defined by the 26 category scores, and do not overlap each other. A firm's Human Capital score, for instance, is determined by its labor practices, employee health & safety, and employee engagement, diversity & inclusion category scores, and the three category scores are not used to generate any other dimension scores. Figure A2 shows which sustainability categories are included in each dimension.

Truvalue Labs provides three different types of scores with respect to the period of time that firms' CSR performances are measured: Pulse score represents short-term CSR performance, and focuses on events of the day; Insight score represents long-term CSR performance, and is derived from the Pulse score using an exponentially-weighted moving average with a 6-month half-life; lastly, Momentum score measures the trend of a firm's CSR performance, and is derived from the slope of Insight score over a 12-month time period. Therefore, each CSR, Materiality CSR, dimension, and category score exist in Insight, Pulse, and Momentum formats. For example, taking CSR score, there are CSR Pulse, CSR Insight, and CSR Momentum scores. In the Appendix, Tables A3 and A4 provide summary statistics and correlation analysis on annualized CSR and Materiality scores in the three formats, respectively. Material CSR scores are generally more volatile than CSR scores in all formats-Insight, Pulse, and Momentum-, and Insight score is the least volatile measure of firms' CSR performances. Both CSR and Material CSR scores are positively correlated across the three formats, and Insight and Pulse scores are highly correlated with the maximum coefficient of 0.91. Correlations of Momentum scores with Insight and Pulse scores are relatively lower. Figure A2 presents Apple's CSR Insight, Pulse, and Momentum scores over the 2008-2020 period at a daily frequency. As one

can see, the firm's Pulse score is more volatile than the Insight score, since Pulse score is intended to measure daily CSR performance while Insight score focuses on the long-term performance. The firm-level CSR performances used in this study are derived from Pulse scores. Since Truvalue Labs provide data at a daily frequency, I annualize all CSR score, Material CSR score, and five-dimension scores, by calculating the averages of the scores with data from the end of each month through 2008-2018 for my analysis.

Next, I download accounting and pension data from the Compustat Fundamental and Pension annual data files. I require that all firm-years have non-missing data for asset allocations, assumed returns, discount rate, actual returns, pension plan size, and pension liabilities, because these variables are required for all multivariate analysis. I require leverage-both book and market-to be non-negative to exclude irregular firms. Lastly, I measure total institutional ownership as a percentage of common shares outstanding, using the WRDS Thomson Reuters Institutional (13f) Holdings. I drop firm-years exceeding 100% of total institutional ownership.

WRDS-based data sets-Compustat, Pension annual, and Thomson Reuters Institutional (13f) Holdings- are firstly matched using CUSIP and then merged to the Truvalue Labs ESG dataset by Ticker symbol. To mitigate the effect of outliers, I winsorize all continuous variables at the 1% and 99% levels. My final sample consists of 7,568 firm-year observations and covers 1,107 unique firms during the period 2008-2018.[20]

CHAPTER 4.2. Summary Statistics

In Table 1, I present summary statistics of plan and firm characteristics of the sample in Panel (A) and B, respectively. Pension Asset Allocation—Debt, Equity, Other, and Real Estate (%)—represent the proportion of pension assets invested in such assets.[21] The variables reported in the summary statistics are described in Table A1. Panel (A) reports that the proportion of pension assets invested in equity securities on average is about 46%. The observed highly aggressive asset allocations in corporate pensions are consistent with the previous literature [e.g., Rauh (2009) and Li et al. (2020)]. Panel (A) also shows that Plan Size, a natural logarithm of fair value of pension assets, is smaller than Pension liabilities, a natural logarithm of present value of pension liabilities, resulting in the negative Funding Status (%). The sample firms in this study have about 79% funded pension plans on average, and the average funding level is very close to the 80% funding ratio threshold suggested by Pension Benefit Guarantee Corporation (PBGC).[22] Panel (B)

[20]Tests that require managers' compensation information (EXECUCOMP) have a smaller sample size. For example, in CHAPTER 5.1, where I investigate incentives to manipulate the assumed returns arising from managers' option activity, the sample consists of 7,155 firm-year observations with 864 unique firms.

[21]Debt asset allocation does not necessarily represent safe investment, since it includes not only government bonds but also corporate bonds.

[22]The Pension Protection Act of 2006 requires private sector pension plans that are less than 80% funded to report annually additional information, so that PBGC can better monitor the situation.

presents that Material CSR score is slightly higher and more volatile than CSR score on average. The average Market-to-Book ratio greater than 100% and Z-score close to 3.0 suggest that, on average, the sample firms are growth firms and financially healthy.

I plot the cross-sectional distribution of assumed returns and pension discount rates during the sample period in Figure 1. Panel (A) documents the mean assumed returns of the sample firms with one standard deviation intervals, and yields on ten-year Treasury securities by year. I observe the mean assumed returns has declined from 8 percent to about 6 percent over the sample period. The decreasing trend of assumed returns is different from the movement of the returns in Bergstresser et al. (2006), where the authors find the median assumed returns is constant at 9 percent over the 1991-2001 period. However, the gap between the median assumed returns and yields on Treasury securities is greater than 3 percentage points every year in the sample period. Though not presented in the paper, yields on ten-year Treasury securities have decreased from 8 percent to 2.91 percent over the last three decades, while the mean assumed returns of firms sponsoring pensions has declined from 9 percent to only 6 over the sample period. Considering that firms, in general, hold a mixture of equity and fixed-income securities in their pension plans, the significant gap between the two returns suggests increasing optimism about the contribution that the equity component makes to the total returns. Next, Panel (B) plots the mean pension discount rates of the sample firms, and Moody's Aaa corporate bond yield by year. As one can see, the mean discount rates generally follow the bond yield. This is because the pension discount rate, which is used to calculate the present value of pension liabilities, should be based on the Moody's Aaa corporate bond yield by the rule set by the SEC's Chief Accountant in 1993. This reflects Andonov et al. (2017) in which the authors find that compared to private DB pension plans, public DB pension plans have greater discretion to choose the discount rate. But, in the figure, the average discount rate is not exactly matched to the bond yield: the gap implies there is some degree of discretion remaining for the choice of the discount rates in corporate DB plans [e.g., Amir and Gordon (1996); Asthana (1999)]. In the Appendix, Figure A3 plots assumed returns and pension discount rates of two firms, Armstrong World Industry and General Electronics. Both firms decrease the assumed returns and discount rates, following the declining trend of yield on ten-year Treasury securities and Moody's Aaa corporate bond yield over the sample period, respectively.

CHAPTER 4.3. Univariate Analysis

I conduct t-tests to assess the aggregate effects of Material CSR performance on pension plan and firm characteristics. Table 2 presents the univariate analyses of the relation between Material CSR score and the main plan and firm variables. Strong CSR is a dummy variable, which is one for firms that have Material CSR score above or equal to the

contemporaneous cross-sectional median, and zero otherwise. All variables are winsorized at the 1st and 99th percentiles. I cluster the standard errors at the firm level. Panel (A) of the table shows the univariate analysis results for plan-related variables, and Panel (B) presents the results for firm-related variables. The tests show not only whether CSR performance is a crucial factor governing assumed returns and equity allocations, but also whether Truvalue Labs' ESG data are different from the traditional ESG data.

In Table 2, I find, in the univariate setting, Material CSR score plays a significant role in determining riskiness in pension asset management in DB plans. In column (1) in Panel (A), the coefficient of Strong CSR is -1.94 and statistically significant at the 5% level, which indicates firms with weaker CSR performance have significantly lower equity asset allocations compared to their counterparts with higher CSR performance. However, I do not find Material CSR score is a driving force behind the aggressive pension assumptions, as the coefficient of Strong CSR in Column (2) in Panel (A) is not statistically significant. Interestingly, funding status between firms with high CSR performance and their counterparts with low CSR performance is considerably different: the coefficient of Strong CSR in Column (5) in Panel (A) is -0.021 and statistically significant at the 1% level. This is surprising, as it is natural to believe socially responsible firms would maintain a high level of funding ratio. I find that the univariate output of this statistically significant difference in average funding status between the two groups is driven by financial firms. Table A2 presents SIC 2-digit top- and bottom-10 Material CSR Score industries, and top-10 funding ratio industries. The table shows that a lot of industries in the financial sector have considerably poor CSR ratings, while having well-funded pension plans on average.

Next, there is some evidence that Truvalue Labs' ESG data deviate from widely-used ESG data such as MSCI ESG ratings. The traditional ESG data used in the literature often show that firms with superior CSR performance tend to be bigger, and have higher leverage and larger operating cash flows [e.g., Deng et al. (2013); Lins et al. (2017)]. Even though ESG data used in this study agree with the commonly used ones with respect to leverage and operating cash flows, there is a disagreement in firm size: firms with superior CSR performance, relative to firms with inferior CSR performance, have higher leverage (by 0.021 percentage points) and larger operating cash flows (by 0.007 percentage points), but are smaller (by 0.489 percentage points). Total institutional ownership also shows a statistically significant mean difference between the two groups. The coefficient in Column (7) in Panel (B) is positive and statistically significant at the 1% level. The observed higher total institutional ownership of Strong CSR firms goes along with the findings in Nofsinger et al. (2019) and Starks et al. (2017), where the authors document that institutional investors tend to avoid stocks with CSR concerns, and firms with better CSR profiles tend to have investors with longer investments horizons, respectively.

CHAPTER 4.4. Correlation Analysis

Table 3 provides Pearson (Spearman) correlations between the key variables. Consistent with the univariate test results in CHAPTER 4.3, Material CSR score negatively correlates with equity allocation and firm size, and positively correlates with book leverage and operating cash flows. The CSR performance does not seem to correlate significantly with assumed returns in DB plans. A large positive correlation between the assumed returns and equity allocation paints a picture that an increase in risk-profile in pension asset investments impacts managerial assumptions on the long-term rate of returns on the pension assets. A negative correlation between the assumed returns and Z-score appears to suggest that aggressive pension assumptions may be triggered by firms' poor financial conditions. Plan size is highly correlated with almost every plan-level variable. Larger plans have higher assumed returns, funding ratio, and actual returns. The positive association between plan size and actual returns echoes the economies of scale in DB plans documented in Jang and Wu (2020)[23]. Interestingly, institutional ownership is significantly correlated with all the main variables used in the correlation tests in a statistically meaningful way, except for book leverage. Firms with a higher level of institutional ownership invest less in equity assets and have lower assumed returns and funding ratio, despite the larger plan size and higher actual returns.

[23]See Section 6.2.1 and Table 9 in Jang and Wu (2020) for more details, where the authors investigate scale economies using actual plan returns instead of risk-adjusted performance measures.

CHAPTER 5. CSR AND OPPORTUNISTIC PENSION ASSUMPTIONS

In this chapter, I explore the role of CSR in mitigating incentives, arising from specific cases, to manipulate pension assumptions in an effort to provide evidence to the association between CSR and pension assumptions. First, I focus on managers' gaming behavior with respect to option activities, following Bergstresser et al. (2006). Then, I examine whether CSR alleviates incentives, arising from managers' Delta, to manipulate earnings. Lastly, I turn to the incentives, emerging from funding gap at underfunded companies, to manipulate pension discount rates.

CHAPTER 5.1. Managers' Gaming Behavior with respect to Option Activity

Managers have incentives to manipulate earnings prior to option exercises or grants, as the gain realized from a stock option relies on the difference between the exercise price determined on the option grant date and the market price on the exercise date. The CEOs' gaming behavior regarding option, described in Bergstresser et al. (2006), has two directions: first, a CEO manipulates the assumed returns upward to boost reported earnings and to temporarily increase share price, when she exercises options. And second, a CEO manipulates the assumed returns downward to decrease reported earnings and to temporarily depress stock price, when options are granted. With this opportunistic behavior, managers can increase the monetary gain from option activities. Previous studies find empirical evidence of such behavior. Wei (2004) studies whether corporate insiders exercise stock options based on private information, and whether the private information is related to earnings management. The author finds these insiders boost earnings aggressively in the pre-exercise period. Also, based on Chauvin and Shenoy (2001)[24], Balsam et al. (2005) provide evidence that corporate insiders manage earnings downward to decrease the exercise price before the option grants, by showing a negative relation between discretionary accruals and subsequent option grants. Managing reported earnings only for the private gain is not socially responsible, since it deteriorates credibility of financial statements, thereby misguiding the public about the firm's financial status. Hence, I predict that managers in socially responsible firms do not exhibit the opportunistic behavior with respect to option activity through pension assumptions.

[24] Chauvin and Shenoy (2001) investigate abnormal stock price changes prior to executive stock option grants to study executives' incentive and opportunity as to managing the timing of their communications of private information just before the option grants. They find a significant abnormal decrease in stock prices prior to the CEO option grant dates.

Following Bergstresser et al. (2006), in which the authors assess the role that managerial option activity plays in setting assumed returns, I estimate the following model to investigate whether firms' CSR performance status mitigates the managers' opportunistic behaviors:

$$\begin{aligned} depvar_{i,t} &= \alpha + \beta_1 OptionExercise_{i,t} + \beta_2 OptionGrant_{i,t} + \\ &\beta_3 OptionExercise_{i,t} \times StrongCSR_{i,t} + \beta_4 OptionGrant_{i,t} \times StrongCSR_{i,t} \\ &+\gamma Returns_{i,t} + \sigma Returns_{i,t-1} + \theta_t + \rho_k + \epsilon_{i,t}, \end{aligned} \tag{1}$$

where i specifies firm, t specifies year, the dependent variable is assumed returns, $OptionExercise$ is realized value on CEO's option exercise divided by the firm's market equity, $OptionGrant$ is fair value of options granted to CEO divided by the firm's market equity, $StrongCSR$ is a dummy variable, which is one for firms that have Material CSR performance above or equal to the contemporaneous cross-sectional median, and zero otherwise, and θ_t are year fixed effects, and ρ_k are industry fixed effects. β_1 and β_2 indicate impacts of option exercise and grant on assumed returns at weak CSR firms, respectively. Balsam et al. (2005) and Wei (2004) suggest that β_1 would be positive and β_2 would be negative, as CEOs can increase the gain from stock options, by manipulating earnings upward when exercising options and manipulating it downward when options are granted. Coefficients in interest are β_3 and β_4, as they reveal whether CEOs' incentives, arising from option exercise and grant, to manipulate assumed returns are different at strong CSR firms. I expect β_3 (β_4) is negative (positive), as CEOs at strong CSR firms would not opportunistically choose the assumed returns to increase the private gains from options. Specifically, these CEOs are expected to have lower (higher) assumed returns in the periods of option exercise (grant), compared to their counterparts at weak CSR firms. Table A1 describes the variables in detail. I cluster standard errors by firm for all specifications. I also employ year × industry fixed effects. The baseline model (Equation 1) considers only the industry and year fixed effects.

Table 4 reports the results. Even though I do not find statistically significant coefficients of $OptionExercise$ on assumed returns, the results show evidence of CEO's gaming behavior when options are granted.[25] In Column (2), the negative coefficient of $OptionGrant$ on the assumed returns, which is significant at the 5% level, is consistent with the CEO's gaming behavior that they manipulate earnings downward by decreasing the assumed returns on pension assets, when options are granted. The coefficient of $OptionGrant$ in Column (2) implies that for a CEO whose option grants, scaled by the firm's market equity, are

[25] About 50% (3,569) of firm-year observations have non-zero granted options. Strong CSR and Weak CSR groups have roughly the same number of non-zero option grants: 1,804 (Weak CSR) vs. 1,756 (Strong CSR).

at median (0.03%), a baseline effect on the assumed returns, compared to CEO with zero option grants, is -4 basis points at poor CSR firms.[26] However, I find that CEOs do not display such behavior at strong CSR firms. The coefficients of $OptionGrant \times StrongCSR$ are positive and statistically significant in both columns. Taking Column (2), where the coefficient of $OptionGrant \times StrongCSR$ is 2.1, the results indicate that for strong CSR firms the impact of option grant on assumed returns is no longer negative. To understand its economic significance, consider a CEO whose option grant amounts to the sample median (0.03%). The interaction effect implies that the CEO chooses the assumed returns 6.3 basis points higher, compared to CEOs at weak CSR firms with zero option grants. This provides evidence of a role that CSR plays in alleviating the CEOs' opportunistic behavior with options.

Next, to examine which CSR dimension performances mitigate incentives, arising from CEO option activity, to manipulate earnings, I re-run Equation 1 replacing $StrongCSR$ dummy variable with each CSR dimension indicators that represent firms with strong CSR dimension performances. For example, $StrongGovernance$ is a dummy variable which is one for firm-year observations that have Leadership & Governance score that is greater than or equal to the contemporaneous sample median Leadership & Governance score. The remaining firm-year observations are classified as weak Governance group. The baseline specification for the tests has Year × Industry fixed effects. Table 5 presents the results. I do not find statistically significant evidence that CSR dimensions mitigate CEOs' opportunistic behavior regarding option activity. The interaction terms of $OptionExercise$ and $OptionGrant$ with nearly all strong CSR dimension indicator variables have insignificant coefficients. Specifically, from columns (1) to (4), $StrongGovernance$, $StrongEnvironment$, $StrongHumanCapital$, and $StrongSocialCapital$ do not show any strong interaction impacts with $OptionExercise$ and $OptionGrant$ on assumed returns in a statistically significant way. However, in the last column, I find evidence that Business Model & Innovation dimension limits the managers' gaming behavior when options are granted. The negative coefficient of $OptionGrant \times StrongBusinessModel$ on the assumed returns is statistically significant at the 10% level. This implies that at firms that perform strongly in Business Model & Innovation dimension, CEOs do not manipulate earnings downward by having lower assumed returns on pension assets when options are granted, compared to CEOs at firms with weak Business Model & Innovation performance.

In sum, CEOs' gaming behavior with respect to option activity to manipulate earnings is effectively restricted in socially responsible firms. In particular, Business Model & Innovation dimension is important to mitigate CEOs' incentive to opportunistically manipulate earnings.

[26] The median of $OptionGrant$ is 0.03%. The baseline effect is calculated as 0.03 × -1.3=-0.04.

CHAPTER 5.2. Executive Pay Sensitivity and Assumed Returns

Executive wealth sensitivity to stock performance (Delta) also relates with incentives to manage earnings. Previous studies find that managerial equity holdings and the structure of their annual compensation provide managers with incentives to manipulate earnings, as the manipulation that increases the stock price will positively affect the managers' wealth. For example, identifying the use of discretionary accruals as a tool to manipulate reported earnings, Bergstresser and Philippon (2006) show that the earnings manipulation is more pronounced at firms where the CEO's total compensation is more tied to the stock value and option holdings. The authors use the discretionary accruals to measure the degree of earnings manipulation for two reasons: first, reported income includes not only cash flows but also changes in firm value that are not yet reflected in current cash flows. Second, the changes in firm value largely involves a great deal of managerial discretion, and therefore the discretionary accruals capture the difference between firms' cash flows and reported earnings. Jiang et al. (2010) also find the positive relation between discretionary accruals and managers' wealth sensitivity to stock value (Delta)[27]. Further, Burns and Kedia (2006) show CEOs' Delta is significantly positively related to the likelihood of misreporting. That is, CEOs with higher Delta are more likely to have aggressive accounting restatement. Hence, I expect that executive Delta is positively related to the assumed returns on pension assets, and that managers in socially responsible firms do not manage reported earnings for the private gain. In other words, at firms where CSR performance level is high, executive Delta would not be positively associated with the assumed returns.

To investigate whether CSR mitigates incentives, arising from executive pay sensitivity to stock performance (Delta)[28], to manipulate earnings through the assumed returns on pension assets, I run the following model:

$$\begin{aligned} depvar_{i,t-1} &= \alpha + \beta_1 Delta_{i,t-1} + \beta_2 StrongDimension_{i,t-1} + \\ &\beta_3 Delta_{i,t-1} \times StrongDimension_{i,t-1} + \gamma Returns_{i,t} + \\ &\sigma Returns_{i,t-1} + \theta_{t\times_k} + \epsilon_{i,t}, \end{aligned} \tag{2}$$

where i specifies firm, t specifies year, the dependent variable is assumed returns, $Delta$ is the wealth sensitivity to the stock value of a manger at firm i in year $t-1$, $StrongDimension$ is a dummy variable for each of the five CSR dimensions, which is one for firms that have the dimension score above or equal to the contemporaneous cross-sectional median dimension score, and 0 otherwise, $\theta_{t\times_k}$ are year $\times$ industry fixed effects. β_1 captures the impact of managers' Delta on earnings manipulations at firms with weak CSR dimension performance. Jiang et al. (2010) and Burns and Kedia (2006) suggest β_1 would be positive, as

[27] Jiang et al. (2010) show the positive relation between Delta and aggressive earnings manipulation only for CFOs. CEOs do not display such relation in a statistically significant way.

[28] Executives' Delta is estimated following Core and Guay (2002).

executives whose compensation schemes are heavily tied to the stock value have incentives to manipulate earnings upward, expecting the boosted earnings will positively influence the stock performance. β_3 is the coefficient in interest, as it shows whether the CSR dimensions mitigate managers' incentive, arising from the pay sensitivity, to manipulate the assumed returns upward.[29] I control for current and lagged actual plan returns, and cluster standard errors by firm for all specifications.

Table 6 reports the results regarding CFOs' Delta.[30] First, in the last three columns in the table, I find CFO Delta, at firms with week Human Capital, Social Capital, and Business Model & Innovation performances, is positively associated with assumed returns on pension assets. This suggests that, at these firms, CFOs with high Delta tend to aggressively assume the returns on pension assets to manipulate reported earnings. The positive relation between CFO Delta and assumed returns is also economically meaningful. Taking Column (3), a move from the 10th percentile to 90th percentile in CFO Delta increases the assumed returns by 28 basis points at weak Social Capital firms.[31] Next, I find the CFOs' incentives, arising from Delta, to manipulate reported earnings is mitigated by Social Capital Dimension. The coefficient of $CFODelta \times StrongSocialCapital$ is negative and statistically significant at the 10% level. This indicates that CFOs at strong Social Capital firms, whose Delta is at the sample median (45.95), have assumed returns on pension assets 4.5 basis points lower than their counterparts have at weak Social Capital firms (calculated as 45.95 × -0.001). In summary, although CFOs' Delta is strongly positively related with the assumed returns, firms' standings in Social Capital dimension effectively alleviate the CFOs' incentives to manipulate reported earnings.

CHAPTER 5.3. Pension Discount Rate and Funding Gap of Underfunded Plans

Pension funding status has significant impacts on pension policies as well as corporate financial policies. For example, due to mandatory contribution, Rauh (2006) shows that an underfunded status of DB pension plans has negative effects on corporate investment policies, and Bakke and Whited (2012) find that underfunded firms have lower receivables, R&D, and employment growth. This implies that for firms that have underfunded pension

[29] I do not find evidence that firms' overall CSR standings ($StrongCSR$), which is determined by the firms' Material CSR score, effectively mitigate the incentive, arising from Delta, to manipulate earnings. Hence, in CHAPTER 5.2 the baseline specification (2) has the indicator variable for strong CSR dimension performances instead of $StrongCSR$.

[30] I do not find any evidence that CEO Delta is related with the assumed returns in a statistically significant way, which echoes findings in Jiang et al. (2010), where the authors state CFOs are in charge of financial reporting and show CFOs' compensation structure provide them with incentives to manage earnings. The test results on CEOs' Delta are not reported for space reasons.

[31] The economic magnitude of CFO Delta on assumed returns is calculated as follows: (245.18 (90th percentile) - 5.64 (10th percentile)) × 0.0012=0.19.

plans an increase in funding gap, which is a difference between pension assets and liabilities, can put significant financial distress to the firms. Also, private DB plan sponsors are required to report additional information on pension plan management to PBGC (Pension Benefit Guarantee Corporation) if the funding ratio goes below 80%. Hence, to avoid the financial stress arising from underfunded DB pension plans, firms may have incentives to manipulate the pension discount rate upward to artificially improve the funding ratio. Even though Bergstresser et al. (2006) documents that setting of discount rates assumptions is the domain of plan actuaries and that the rates have been based on the Moody's Aa interest rate index since 1993[32], there is a set of empirical evidence showing firms have some degree of freedom in choosing discount rates. Amir and Gordon (1996) find that firms with relatively larger pension liabilities and higher leverage tend to choose more aggressive discount rates. Asthana (1999) shows that firms with the smaller profitability, operating cash flows, and tax liability are more likely to make a liberal choice on pension discount rates. Manipulating the discount rate upward to artificially make the funding ratio higher without making an adequate amount of contribution may relieve the temporary stress, but in the long term, if the manipulation becomes a habit, retirement welfare of plan participants would be in peril. Since the manipulation disguises the true picture of firms' funding status, under the theories of CSR I expect that socially responsible firms would not manipulate the discount rate to artificially improve the funding status, thereby maintaining honesty in pension policies.

As an increase in funding gap deteriorates plan funding status, firms would have strong incentives to manipulate the pension discount rate to artificially improve the funding ratio. To test this hypothesis, I run the following model:[33]

$$\begin{aligned} depvar_{i,t-1} = \alpha + \beta_1 FundingGap_{i,t} + \beta_2 StrongDimension_{i,t} + \\ \beta_3 FundingGap_{i,t} \times StrongDimension_{i,t} + \gamma Returns_{i,t} + \\ \sigma Returns_{i,t-1} + \theta_{t\times_k} + \epsilon_{i,t}, \end{aligned} \tag{3}$$

where i specifies firm, t specifies year, the dependent variable is pension discount rate, $FundingGap$ is the difference between pension assets and pension liabilities, scaled by pension assets at firm i in year t, $StrongDimension$ is a dummy variable for each of the five CSR dimensions, which is one for firms that have the dimension score above or equal to the contemporaneous cross-sectional median dimension score, and 0 otherwise, and $\theta_{t\times_k}$ are year $\times$ industry fixed effects. β_1 the effect of funding gap on manipulations

[32] Andonov et al. (2017) also document that public DB pension plans have more freedom in choosing pension discount rate compared to private DB plans.

[33] I find firms' overall CSR standings, which is determined by Material CSR score, do not keep the firms from having an aggressive discount rate. The results are not reported for space reasons. In CHAPTER 5.3 the baseline specification (2) has the indicator variable for strong CSR dimension performances instead of $StrongCSR$.

of pension discount rate. I expect that β_1 is positive, as underfunded firms would want to avoid financial distress caused by the poor funding status and mandatory contribution [e.g., Rauh (2006); Bakke and Whited (2012)]. β_3 is the coefficient in interest, since it reveals whether the CSR dimensions alleviate the incentive, arising from increasing funding gap, to manipulate the discount rate. I control for current and lagged actual plan returns, and cluster standard errors at the firm-level.

Table 7 reports the results. In the last column, I find evidence that firms with weak Business Model & Innovation standings manipulate the pension discount rate upward to artificially improve the funding status, as the funding gap increases. The coefficient of $FundingGap$ indicates that one unit increase in funding gap is associated with an increase in the discount rate by 0.113 percentage points at weak Business Model firms. However, at strong Business Model firms, the incentive to manipulate the discount rate is considerably alleviated. The coefficient of $FundingGap \times StrongBusinessModel$ is negative and statistically significant at the 1% level. This implies that strong Business Model firms, whose funding gap is at the sample median (70.8%), have a pension discount rate 7.6 basis points lower than their counterparts, with weak Business Model & Innovation performance, do. One interesting finding in Table 7 is that there are some disagreements when it comes to the sign of coefficients of interacted terms. For example, while the coefficient of $FundingGap \times StrongGovernance$ is positive at the 10% level, $FundingGap \times StrongHumanCapital$ and $FundingGap \times StrongBusinessModel$ have negative coefficients in a statistically significant way. This suggests strong Governance firms have greater incentives to manipulate pension discount rates compared to weak Governance firms. Based on the definitions of the CSR dimensions provided by the SASB, my interpretation of the results is that different signs of the coefficients show some stakeholders benefit from the discount rate manipulation, while others experience loss. It could be a case that manipulating the discount rate upward to improve the funding status benefits shareholders, since the plan sponsor would not need to make a huge contribution to make up the pension deficit and may increase dividend payout. This can plausibly explain the positive coefficient of $FundingGap \times StrongGovernance$. In contrast, since the discount rate manipulation eventually hurts firms' ability to pay pension benefits to plan participants in the future, firms who care a lot about their employees would honestly set the discount rate. Therefore, strong Human Capital firms likely to have less sensitivity of funding gap to pension discount rate compared to weak Human Capital firms, as shown with the negative coefficient of $FundingGap \times StrongHumanCapital$.

To summarize this chapter, I provide evidence that CEOs' incentives, arising from option activities, to manipulate earnings through the pension return assumption are mitigated by the firms' CSR status. As for the incentives stemming from executives' Delta, I find CFOs at firms with superior Social Capital performance do not aggressively assume re-

turns on pension assets. Also, I show that superior CSR status in particular dimensions— Human Capital, and Business Model & Innovation— alleviates incentives to manipulate discount rate upward to artificially improve plan funding status.

CHAPTER 6. CSR, ASSUMED RETURNS, AND EQUITY ASSET ALLOCATION

In this chapter, I assess the impact of CSR on assumed returns on pension assets and equity asset allocation. In other words, I study whether firms' CSR ratings affect the choice of assumed returns on pension assets and the agency issue between shareholders and plan participants in pension asset management.

CHAPTER 6.1. CSR and Assumed Returns

I examine the relation between firms' CSR performance and assumed returns on pension assets using the following specification:

$$depvar_{i,t} = \alpha + \beta CSR_{i,t-1} + \gamma' Y_{i,t-1} + \theta_t + \rho_k + \epsilon_{i,t}, \tag{4}$$

where the dependent variable is the assumed returns on pension assets of firm i in year t, $CSR_{i,t-1}$ is CSR performance of firm i in year $t-1$, which is represented by CSR and Material CSR score, $Y_{i,t-1}$ are a set of control variables in year $t-1$, θ_t are year fixed effects, and ρ_k are industry fixed effects. I control for firm size, as Jang and Wu (2020) show it plays a significant role in determining pension plan investment performance. It is plausible that managers choose the expected rate of return assumption on pension assets based on the performance. I control for market-to-book ratio, since investment opportunities firms face could influence managers' opportunistic behaviors in pension accounting. Additionally, following Anantharaman and Lee (2014), I control for Z-score, operating cashflows, and standard deviation of the cashflows, since when firms are distressed, or too cash-constrained, they could more likely boost earnings through the pension accounting. For plan-related variables, I control for plan size, funding status, and current and lagged plan actual returns, as actual returns are strongly associated with the assumed returns (Bergstresser et al. (2006)). Lastly, the baseline specification controls for a rough measure of pension duration, since plans with longer duration (younger participants) invest heavily in risky assets to hedge against the participants' future salary increases (Sundaresan and Zapatero (1997); Rauh (2009)). This, in turn, would impact the managerial assumptions on the expected returns on pension assets. Table A1 defines variables in detail. All independent variables in the specification are lagged to mitigate the simultaneity issue, and I cluster standard errors by firm. I also employ year $\times$ industry fixed effects. The baseline model (Equation 4) considers only the year and industry fixed effects. In untabulated results, I do not find both CSR and Material CSR scores have enough statistical significance in explaining the assumed returns with firm fixed effects. As Bergstresser et al. (2006) state, since the assumed returns have fairly smaller with-in firm variation compared to

other firm-related variables, using firm fixed effects is not likely to offer consistent coefficient estimations. Hence, I employ industry and year fixed effects for the main specification. I address this issue later in CHAPTER 7, by having a quasi-natural experiment with firm fixed effects.

Table 8 reports the results estimated from the equation 4. I control for year and industry fixed effects in the first two columns, and year × industry fixed effects in the last two columns. In all specifications, I include all plan- and firm-related control variables. Firstly, I observe only Material CSR score has statistically significant impacts on the assumed returns: in columns (2) and (4), the coefficients on Material CSR score are around -0.004 and statistically significant at the 5% level, while the coefficients on CSR score in columns (1) and (3) are statistically insignificant. The fact that the coefficient estimations for the impact of CSR score on the assumed returns are not statistically significant tells us materially important CSR performance rather than the immaterial performance keeps managers from aggressively assuming the expected returns on pension assets. The negative association of Material CSR score with the assumed returns is not only statistically significant, but also is economically meaningful. Taking Column (4), one standard deviation increase in Material CSR score (17.55) is associated with 0.063 percentage points decrease in assumed returns (calculated as 17.55 × 0.0036). Consistent with Bergstresser et al. (2006), coefficients on current and lagged plan actual returns are positive and statistically significant at the 1% level in all specifications. In Panel (B) of the table, I additionally control for the equity asset allocation to see whether the impact of Material CSR score, which is statistically meaningful in Panel (A), stays significant after controlling for the exposure to risky assets in pension asset management. Although both economic and statistical significance is reduced[34], I still observe a negative sign for the coefficient of Material CSR score in Panel (B). While the coefficients of the Material CSR performance are statistically significant in both columns, interpreting the economic significance is problematic. This is because my hypotheses predict that firms' Material CSR score is expected to affect both equity asset allocation and assumed returns, which in turn makes the reduced model of equation 4 more endogenous. Nevertheless, results in Panel (B) indicate that the impact of Material CSR score on assumed returns is beyond the influence that the exposure to risky assets in pension plans has on the returns.

Next, to examine whether each CSR dimension score impacts assumed returns in pension plans, I estimate equation 4 again, replacing the main independent variable-CSR and Material CSR scores- by each CSR dimension score. Table 9 reports the results.[35] I em-

[34]Taking the specifications where industry by year fixed effects are used, the coefficient of Material CSR score is -0.0036 at the 5% level in Panel (A) and -0.0025 at the 10% level in Panel (B).

[35]The number of observations used in each model in Table 9 is smaller compared to the number in Table 8. Firms may have missing dimension scores even if they have non-missing CSR or Material CSR scores, since Truvalue Labs leaves each category score missing when there is no related information on the firms.

ploy year and industry, and year × industry fixed effects for each dimension score, and all specifications in the table control for the same plan- and firm-related variables as in Table 8. Standard errors are clustered by firm.

I find that only Business Model & Innovation score negatively influences the assumed returns in a statistically meaningful way, and that both economic magnitude and statistical power of the relation are stronger compared to those of Material CSR score in Table 8. In columns (9) and (10), the coefficients on Business Model & Innovation score are statistically significant at the 5% and 1% levels, respectively. To interpret the economic magnitude, taking Column (10), one standard deviation increase in Business Model & Innovation score (12.77) decreases the assumed returns by about 0.076 percentage points (calculated as 12.77 × 0.006). Considering that the coefficients on Material CSR score are significant at the 5% level, and that its economic magnitude is 0.063 percentage points decrease in assumed returns in Table 8, Business Model & Innovation performance, which incorporates all environmental, human, and social issues in a firm's value-creation process, is the driving force that deters managers from engaging in the unethical pension accounting to boost earnings. A puzzling finding is that, though statistically insignificant, the coefficient on Human Capital score is positive in Column (6) in Table 9. This, along with the fact that Human Capital score is determined by three category performances—Labor practices, Employee health & safety, and Employee engagement, diversity & inclusion—appears to suggest that Human Capital performance does not incorporate benefits plan participants would gain from restricting earnings manipulation through pension accounting.

CHAPTER 6.2. CSR and Equity Asset Allocation

To examine the relation between firms' CSR performance and equity asset allocations, I estimate the equation 4. The dependent variable is now the proportion of pension assets invested in equity securities. The equity allocation models include additional controls: a percentage of common shares held by institutional investors, as institutional shareholders could have different objectives toward pension asset management and pension benefits discount rate following Anantharaman and Lee (2014). Kisser et al. (2017) document that sponsors with underfunded plans choose higher discount rates depending on funding status. Although higher discount rates allow plan sponsors to have lower pension contributions, they eventually shift the risk of retirees outliving the sponsors' financial resources from shareholders to pension members. This can affect overall investment risk in pension asset management, reflecting an agency problem between shareholders and plan participants. All variables used in the tests are described in Table A1 in detail. As in CHAPTER 6.1, in all specifications, standard errors are clustered at the firm-level, and all right-hand side variables are lagged.

Table 10 presents the results of the tests on the association of firms' CSR performance

with equity asset allocations in DB plans. As in Table 8, I employ year and industry fixed effects for the first two columns, and year × industry fixed effects in the last two columns. For all specifications in the table, I include all plan- and firm-related controls. The results show that Material CSR score has stronger effect on the equity allocation in DB plans than CSR score has. In columns (2) and (4), Material CSR score has the coefficients of -0.1052, and -0.1062, respectively, at the 1% levels; on the other hand, the coefficients of CSR score in columns (1) and (3) are smaller (-0.0681, and -0.0699, respectively) and less statistically significant (5% levels). The stronger association of Material CSR score with equity allocation implies that materially important CSR performances are a driving force behind firms' choice on the risk-profile in pension asset investments. The relation between Material CSR score and equity allocation is also economically significant. One standard deviation increase in Material CSR score (17.55) moves the equity allocation down by 1.93% (calculated as 17.55 × -0.11). My findings echo the hypothesis on the relation between firms' CSR and risk-taking in pension asset management: Firms with higher CSR performance, who are deemed to care a lot about a broad range of stakeholders, manage their pension assets more safely by reducing the proportion of pension assets invested in risky assets. Coefficients of pension discount rate are positive and statistically significant at the 1% level in all specifications. Although the regulations guide firms to choose the discount rate based on the Moody's Aa interest rate index, the great association between the discount rate and equity allocation suggests that pension discount rate reflects riskiness in pension asset allocations. Funding status also has strong negative coefficients in all models at the 1% level. This implies that as funding status gets better, the firm decreases the risk-profile in pension asset investment. Further, firm size and market-to-book ratio are negatively associated with equity allocations at the 1% level in all models, which suggests big and growth firms tend to manage pension assets safely.[36]

Now, I investigate whether each CSR dimension performance influences riskiness of pension asset investments. To do so, I estimate the models used in Table 10, replacing CSR and Material CSR scores by each CSR dimension score. Table 11 presents the results.[37] I use year and industry, and year × industry fixed effects for all dimension scores. All specifications control for the same plan- and firm-related variables as in Table 10. I cluster the standard errors at the firm-level. Similar to the Table 9 results, I find only Business Model & Innovation performance is associated with equity allocations in DB plans in a statistically significant way. In the last two columns, coefficients of Business Model & Innovation score are negatively related to equity allocations at the 5% level. The economic

[36]In with-in firm regressions, both CSR and Material CSR scores do not have enough statistical power in explaining equity allocations in DB plans. This implies that unobserved heterogeneity across firms plays a considerable role in determining the risk-profile in pension asset allocations.

[37]The number of observations used in each model in Table 11 is smaller compared to the number in Table 10 for the same reason described in the footnote 36.

impact of the dimension score is meaningful as well. Taking Column (10), one standard deviation increase in Business Model & Innovation score (12.77) is associated with 1.19 percentage points decrease in equity allocations (calculated as 12.77×0.093). Although the economic magnitude is smaller compared to that of Material CSR score on equity allocations (1.93 percentage points in Table 10), the results, along with the results in Table 9, indicate that Business Model & Innovation dimension is a crucial CSR dimension that determines pension policies on assumed returns and equity asset allocations. Again, I do not find Human Capital score is associated with equity allocations statistically significantly, though the coefficients of Human Capital score in columns (5) and (6) are negative. This is surprising, considering that plan participants would theoretically gain from the safer pension asset management, and that a large part of pension members in DB plans includes employees, which Human Capital area focuses on.

In sum, my findings in this chapter show that firms' CSR score is negatively associated with assumed returns, and that it leads firms to manage their pension assets more safely by reducing the exposure to risky assets. However, it is important to note that all the test specifications so far in CHAPTER 5 and CHAPTER 6 do not have firm fixed effects and that my interpretation of the results is prone to endogeneity issues. I discuss and address this problem in the following chapter.

CHAPTER 7. A QUASI-NATURAL EXPERIMENT: THE BP DEEPWATER HORIZON OIL SPILL

As Deng et al. (2013) points out, the reverse causality problem is common in previous studies on the relation between CSR and firm value [e.g., McWilliams and Siegel (2000); Jiao (2010)]. Specifically, it is not certain whether well-performing firms do social goodness or socially responsible firms perform well. Although I require all independent variables in regression tests to be lagged, unfortunately, my study also faces the same endogeneity problem: it is not certain whether firms with superior CSR standings manage pension assets safely and do not attempt aggressive pension assumptions, or firms who safely manage pension assets and do not engage in the unethical pension accounting obtain higher CSR performance levels. Further, due to the lack of firm fixed effects in the multivariate analyses so far, my findings may be subject to firm-level confounders. To mitigate these issues, I conduct a quasi-natural experiment using the BP Deepwater Horizon oil spill.

The BP Deepwater Horizon oil spill was an industrial disaster that began on April 20, 2010, in the Gulf of Mexico on the BP-operated Macando Prospect, and that discharged 4.9 million barrels of oil according to the U.S. federal government estimation. The oil spill is considered as one of the largest environmental disaster in American history. While the immediate public response was focused on BP, the event soon raised the public attention on all related industries such as petroleum and chemical industries. It is not surprising that the attention spread to those industries, as principal customers of chemical firms are extractive and petroleum firms.

> *"First of all, there's a lot the public is not permitted to know about these concoctions because of our broken Federal toxics law ... This failed law makes it hard for EPA to release health and safety data to the public on chemicals and provides* ***way too much secrecy for chemical companies"****.*
>
> *-Review of the use of dispersants in response to the Deepwater Horizon oil spill, Special Hearing, July 15th, 2010– Washington, DC* [38]

Dyck et al. (2019) argue the shock created by the oil spill increased the importance that investors assign to firms' CSR commitment, and find firms affected most by the event indeed display higher CSR performance levels. Following the study, I use this unexpected event as an exogenous shock that increase CSR performances of the affected firms. Some

[38] Full minutes of the hearing is available at https://www.govinfo.gov/content/pkg/CHRG-111shrg63179/html/CHRG-111shrg63179.htm

may question that the oil spill event only serves as a negative shock to CSR performance levels in the affected industries, considering the nature of ESG data in this study. Unlike traditional ESG databases, Truvalue Labs does not focus on corporate disclosure; instead, they concentrate on sources such as reports from NGOs, media, and SNS. Hence, even if a firm heavily affected by the oil spill discloses positive CSR or ESG reports, the information would not be captured by Truvalue Labs. However, there is an ample set of anecdotal evidence that firms that seemed significantly hit by the oil spill invested notable effort to be socially responsible. For instance, according to an article from *Wall Street Journal* published on Apr 30th, 2011, during 2011 BP invested $1.6 billion in their alternative energy business, which takes total investment since 2005 to $6.6 billion. Also, an article from *Forbes* published on Oct 4th, 2011, notes Chevron initiated a unique project that tests the viability of using solar energy to produce oil, which uses over 7,600 mirrors to focus the sun's energy onto a solar boiler. I also provide empirical evidence that the oil spill event positively effects the CSR performance levels of affected industries.

For the test, I use a generalized difference-in-differences approach using the period 2009-2012 with the following specification:

$$depvar_{i,t} = \alpha + \beta Treated \times Post + \gamma' Y_{i,t} + \theta_i + \rho_t + \epsilon_{i,t}, \tag{5}$$

where the dependent variables are the firms' CSR and Material CSR scores, assumed returns, and equity allocation, and $Treated$ is a dummy variable which equals one for firms who operate in extractive, petroleum, and chemical industries and zero otherwise, $Post$ is also a dummy variable, which is one for the period 2011-2012 and zero otherwise. I use a two-digit Standard Industrial Classification (SIC) code to identify the treated firms. Firms operating in two-digit SIC 13, 28, and 29 post-oil spill event are considered treated. $Y_{i,t}$ are control variables, θ_i are firm fixed effects, and ρ_t are year fixed effects. The coefficient of interest is β, as it reveals, through the different dependent variables, the impact of the exogenous shock on the treated firms' CSR performance, assumed returns, and equity allocation in DB plans. Models, which include CSR and Material CSR scores, and the assumed returns as dependent variables, share the same control variables as in the specification used in Table 8, and the equity allocation model has the same controls as in Table 10.

In Table 12, I report generalized difference-in-differences estimates. For all specifications in the table, I control for plan- and firm-related variables, and firm and year fixed effects. Firstly, in the first two columns, I find the positive and significant effects of the unexpected oil spill event on the treated firms' CSR and Material CSR score. For instance, these firms increased the materially important CSR performance by 3.39 points after the disaster. This shows that the treated firms strengthened their CSR performance levels after the disaster, despite the costs that the firms may have had to pay to improve the

CSR performances. The results in columns (1) and (2) suggest that the treated firms were indeed in dire need of pursuing higher CSR performance levels following the oil spill. Next, my findings in Column (3) and (4), where I investigate the effect of the Deepwater Horizon event on the assumed returns and equity allocation, respectively, are similar to the results obtained in Table 8 and Table 10. Following the oil spill, the treated firms exhibited less aggressive assumed returns on pension assets and lower equity allocations. Specifically, the results indicate that these firms decreased the assumed returns and equity allocations by 0.22 and 3.37 percentage points, respectively, after the oil spill event. To address serial correlation, I re-run the Equation 5, collapsing pre- and post-event periods each into one observation (Bertrand et al. (2004)). The results are reported in Table A5 in Appendix, and qualitatively consistent with the estimates in Table 12. Lastly, although, in this paper, I find the BP oil shock influenced firms' CSR performances as well as pension management practices in all the treated industries on average, it is worth noting that Dyck et al. (2019) argue institutional investors played a crucial role to improve firms' CSR performances during the BP oil event. In Table 13, I report that the level of institutional ownership among the treated firms following the oil spill event is significantly associated with the assumed returns and equity allocation in a statistically meaningful way. Specifically, the results indicate that, after the oil spill event, for the treated firms one percentage point increase in institutional ownership is associated with 0.5 and 15 basis points decrease in assumed returns and equity allocation, respectively. This supporting evidence echoes findings in the authors' work.

To visually examine whether the results are driven by the trends prior to the oil spill event, I employ a non-parametric approach with event-year dummies. This particular specification is used only to provide the pictorial arguments. Using the non-parametric approach, I estimate changes in dependent variables—CSR score, Material CSR score, assumed returns, and equity allocation— relative to the excluded year, 2010, and plot the estimates to trace out the effect of treatment.[39] In Figure 2, I plot the non-parametric estimates of event-year dummies on CSR score, and Material CSR score in Panel (A) and (B), respectively, with the 95% confidence intervals. Year 2010 is omitted, as it is the year when the oil spill event occurred. As one can see, the results in Table 12 on CSR performances are not driven by trends prior to the oil spill, since the estimates before the event, Year 2010, are not statistically different from 0. The increases in both CSR and Material CSR scores after the event support the results in Column (1) and (2) in Table 12. Figure 3 displays the non-parametric estimates of event-year dummies on assumed returns and equity allocation in Panel (A) and (B), respectively. I observe that, in both panels, the estimates are not statistically different from zero prior to the event, and that they decrease

[39]Control variables used in the non-parametric approach are as same as in Table 12 for each dependent variable.

after the event. This supports the corresponding results in Table 12.

Next, to further examine the robustness of the test results obtained through a generalized difference-in-differences approach, I run two placebo tests: the first test restricts the sample period to 2008-2010, letting year 2009 be the year when the treatment occurs, and the second test assigns the treatment to firms in Real Estate and Education Services industries (two-digit SIC 65, and 82). Table 14 presents the results. All models have the same control variables and firm and year fixed effects as in Table 12. In the first two columns, where I limit the sample period to 2008-2010, I find the treatment has no statistical power in explaining assumed returns and equity allocation. Also, in columns (3) and (4), where the treatment is given to firms operating in electronics and communication industries, the $Treated \times Post$ variable does not have any statistically significant explanatory powers. The results indicate that the reported estimates in Table 12 are not likely to be caused spuriously.

Another concern about the quasi-natural experiment with the BP oil spill event is that the shock created by the oil spill may have created other channels that, in turn, influence the assumed returns and equity allocations of the treated firms. That is, the negative impact of the event on the assumed returns and equity allocation reported in Table 12 might be caused by changes in some other plan- and firm-related variables rather than changes in CSR performance around the BP oil spill. To address this problem, I plot averages of plan- and firm-related variables that may have affected the assumed returns and equity allocations of the treated firms around the event in Figure 4 with 95% confidence intervals. The choice of the variables is based on the correlation analysis results in Table 3. The plan returns are adjusted by the control firms' contemporaneous plan returns. The figure shows that every variable stays almost constant around the event.

To further examine that the results in Table 12 are not driven by changes in other key variables, I report t-test results on mean differences of the variables around the event in Table 15, focusing on the treated firms. The results indicate that every selected variable does not have statistically different means around the BP oil spill event. This again supports my claim that improvement in CSR performance following the BP oil spill event is likely to be the underlying channel that the treated firms reduce the assumed returns and equity allocations after the event.

To summarize, the results in this chapter show that following the exogenous shock (BP oil spill event), which positively impacts materially important CSR performance of treated firms, the firms reduce both assumed returns and equity allocations in DB plans. This suggests a causal link to the negative impacts of firms' CSR performance on the pension assumptions and the risk-taking in pension asset investments presented in the previous chapter.

CHAPTER 8. CONCLUSION

With the growing attention on CSR, numerous studies have investigated the role of CSR in corporate economics [e.g., Dimson et al. (2015); Flammer (2015); Di Giuli and Kostovetsky (2014); Krüger (2015)]. However, whether firms' CSR measures are associated with corporate pension (DB) policies has not been examined. In this paper, I explore the role of CSR in mitigating managers' incentives to manipulate pension assumptions. I also ask whether CSR influences pension asset investment decisions. As shareholders and pension plan participants have different expectations as to how plan sponsors should manage riskiness in pension asset management, studying the association between firms' CSR performance levels and equity asset allocations in pension plans would reveal how socially responsible firms handle the agency issue.

Using Truvalue Labs' ESG data to measure firm-level CSR performance on 7,568 firm-year observations (1,107 unique firms), I provide new evidence that corporate social responsibility (CSR) deters managers from manipulating earnings through defined benefit (DB) pension assumptions. Executives' incentive, arising from option activities, to manipulate earnings through the pension assumptions is effectively mitigated by the firms' CSR status. While executives at weak CSR firms manipulate earnings downward by decreasing the assumed returns on pension assets when options are granted, such behavior does not exist at strong CSR firms. Next, as for the incentives arising from executives' Delta, I find that CFOs at firms with superior Social Capital performance do not aggressively assume returns on pension assets to manipulate reported earnings. Lastly, my results indicate firms with superior performances in Human Capital and Business Model & Innovation dimensions are less likely to manipulate the pension discount rate upward to artificially improve the funding ratio.

I also document the negative impact of CSR score on both assumed returns and risk-taking in pension asset investment, which suggests that socially responsible firms report earnings honestly, and that their interest in pension asset management is more aligned with the pension members rather than the shareholders. To suggest a causal link to the association between CSR and pension policies, I use the 2010 BP Deepwater oil spill as a natural experiment. Assigning the treatment to firms in extractive, petroleum and chemical industries, I find that these firms indeed improved CSR performance following the oil spill, and that they exhibited reduced assumed returns as well as equity allocations. I provide several robustness checks to show the changes in CSR score around the event are likely to be the main channel for the shifts in the pension management variables.

The relation between CSR and pension policies prompts many questions to be answered, not limited to DB plans. For instance, the private pension plan universe has experienced a great shift from defined benefit to defined contribution plans. Although pension benefits

are guaranteed by sponsors and PBGC in DB plans, in DC plans the benefits are only determined by total amount of contribution made by an individual and his or her investment performance. Whether CSR affects sponsors' choice of investment menu, fund flow sensitivity to performance in the menu, and, in turn, investment performance in general are fruitful future research questions.

FIGURES

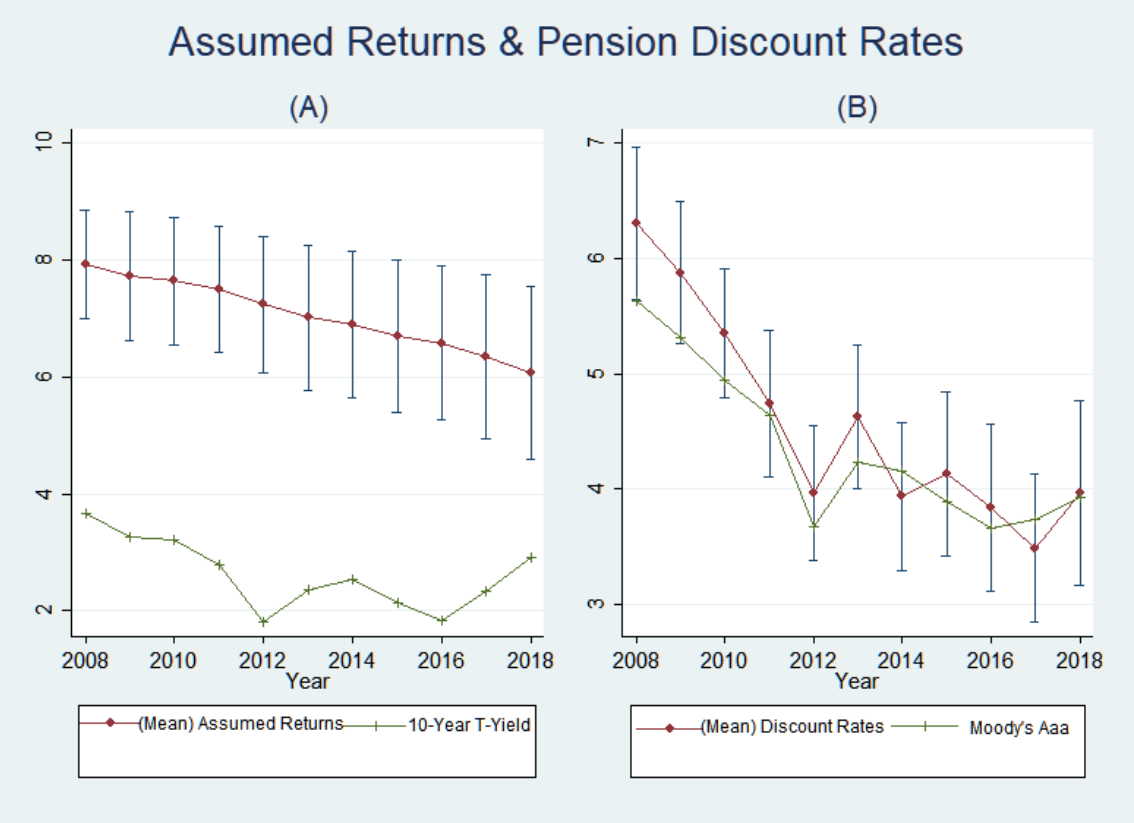

Figure 1: **Assumed Returns and Pension Discount Rates**

The figure plots the assumed rate of returns on pension assets and pension discount rates. Panel (A) plots the mean assumed returns drawn from the sample firms with one standard deviation interval and yield on ten-year government bonds over the 2008-2018 period. Panel (B) plots the mean pension discount rates drawn from the sample firms with one standard deviation interval and Moody's Aaa corporate bond yield.

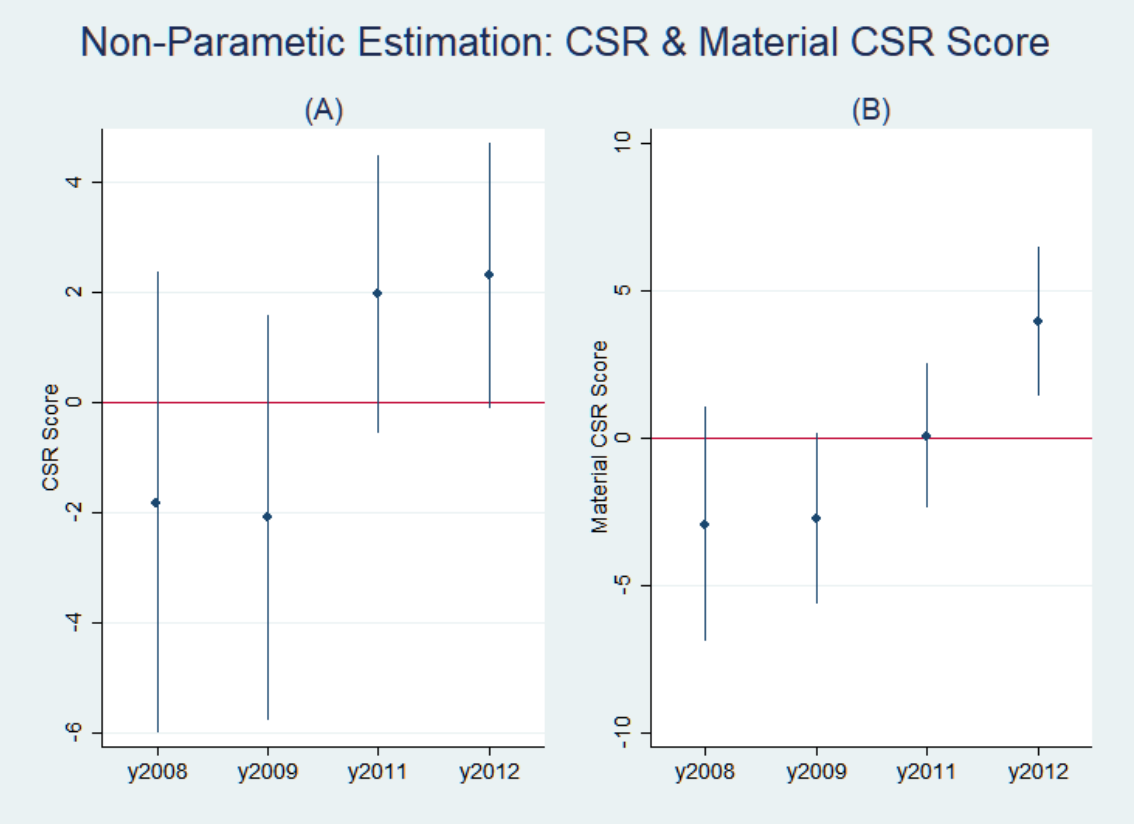

Figure 2: **Non-parametric Estimation for CSR and Material CSR Scores Around BP Deepwater Horizon Oil Spill**

Panels (A) and (B) show the non-parametric estimation for CSR and Material CSR scores around BP oil spill event, respectively. The control variables follow the models in the first two columns of Table 12. Year 2010 is omitted. Both panels show 95% confidence intervals for each estimation.

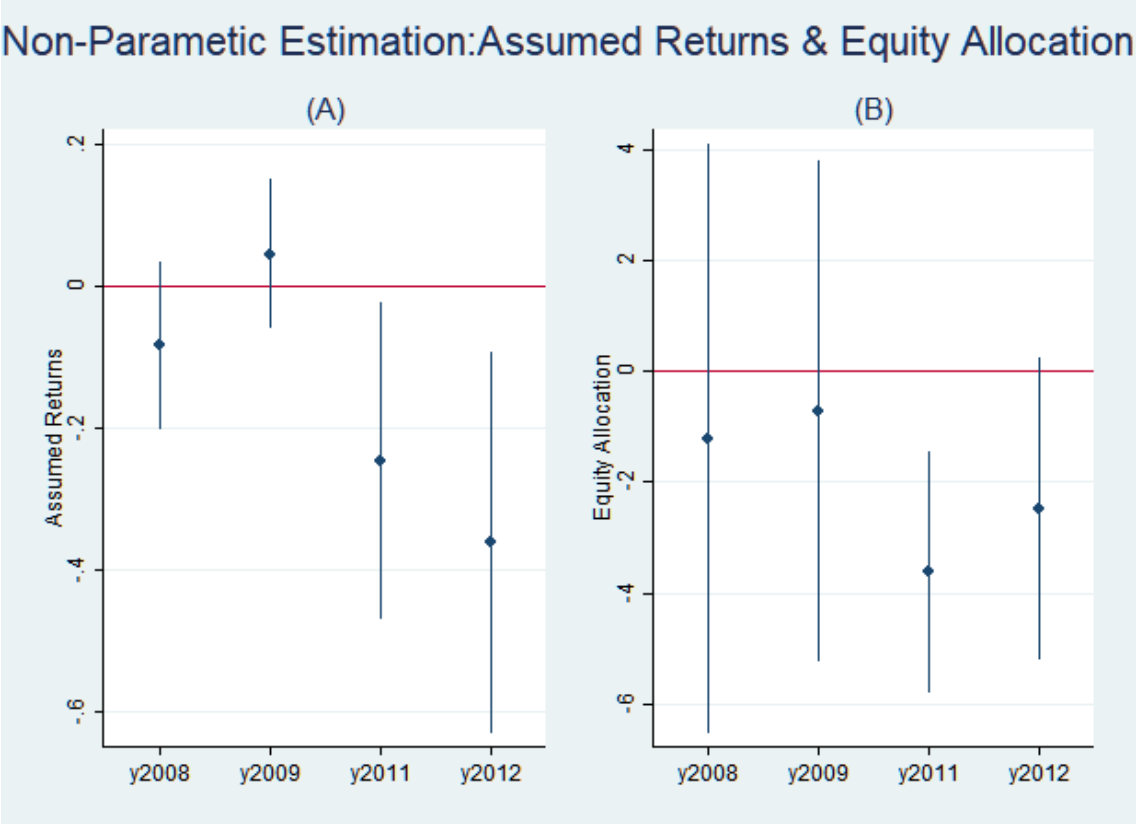

Figure 3: **Non-Parametric Estimation for Assumed Returns and Equity Allocation Around BP Deepwater Horizon Oil Spill**

Panels (A) and (B) show the non-parametric estimation for assumed returns and equity allocation around BP oil spill event, respectively. The control variables follow the models in the first two columns of Table 12. Year 2010 is omitted. Both panels show 95% confidence intervals for each estimation.

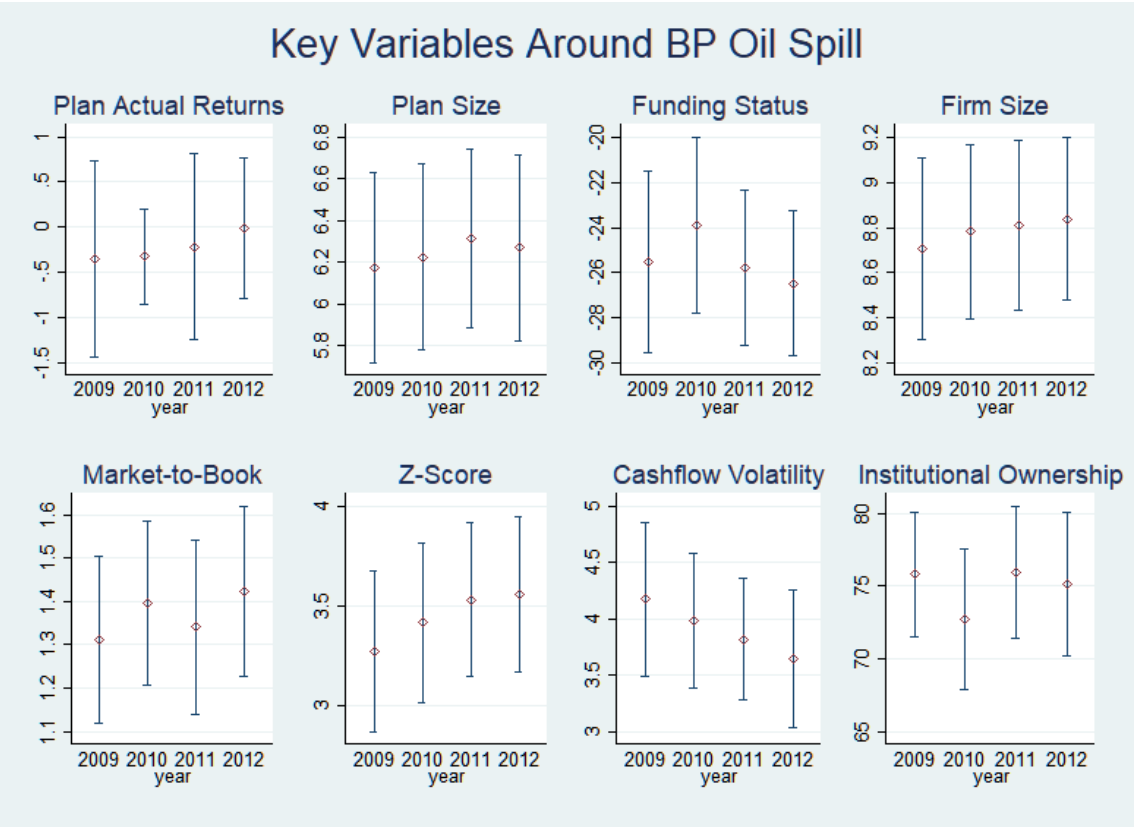

Figure 4: **Key Variables Around BP Oil Spill**

The figure plots the averages of the treated firms' plan- and firm-related variables that may affect assumed returns and equity allocations directly, based on Table 3 results, around the BP oil spill event that occurred in 2010. Plan Returns are adjusted by the control firms' contemporaneous plan returns. Each graph shows 95% confidence intervals.

TABLES

Table 1: **Summary Statistics of Pension Plan and Firm characteristics**

This table shows descriptive statistics of defined benefit pension plan and firm characteristics. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Panel (A) shows DB plan characteristics. Pension Asset Allocation - Debt, Equity, Other, and Real Estate (%) represent proportion of pension assets invested in such assets. Assumed Long-term Rate of Returns (%) is assumed long-term rate of returns on pension assets. Discount Rate (%) is pension plan discount rate. Plan Returns (%) is actual returns on pension assets. Plan Size is natural logarithm of fair value of pension assets. Pension Liabilities is natural logarithm of present value of pension obligation. Funding Status (%) is fair value of pension assets minus present value of pension liabilities, divided by the fair value of pension assets. Contribution is pension plan contribution, scaled by pension assets. Panel (B) shows firm characteristics. Table A1 describes the variables. All variables are winsorized at the 1st and 99th percentiles.

Panel A: Plan-Level Characteristics					
	Mean	SD	P1	P50	P99
Pension Asset Allocation - Debt (%)	38.938	20.442	0.000	37.500	100.000
Pension Asset Allocation - Equity (%)	45.891	21.832	0.000	51.000	86.100
Pension Asset Allocation - Other (%)	7.658	13.976	0.000	1.000	75.300
Pension Asset Allocation - Real Estate (%)	1.336	2.876	0.000	0.000	14.000
Pension Benefits Discount Rate (%)	4.461	1.051	1.340	4.300	7.060
Assumed Long-term Rate of Returns (%)	6.992	1.362	2.000	7.280	9.000
Plan Returns (%)	4.461	11.119	-39.394	7.256	20.726
Plan Size	5.727	2.093	0.789	5.762	10.091
Pension Liabilities	6.008	2.004	1.270	6.043	10.260
Funding Status (%)	-21.326	19.260	-80.217	-21.150	35.507
Contribution (%)	5.997	6.700	0.000	4.212	34.459
Panel B: Firm-Level Characteristics					
	Mean	SD	P1	P50	P99
CSR Score	54.738	15.174	14.783	54.693	89.811
Material CSR Score	55.618	17.547	9.335	56.261	93.106
Book Leverage (%)	26.720	17.902	0.000	25.097	85.201
Market-to-Book (%)	129.556	85.991	14.512	104.691	490.842
Firm Size	8.555	1.739	4.406	8.432	13.008
Operating Cashflows (%)	8.110	5.966	-7.256	7.713	26.714
Cashflow Vol. (%)	2.786	2.514	0.145	2.059	13.436
Z-score	2.927	1.932	-1.030	2.668	9.945
Inst. Ownership (%)	73.522	20.644	7.879	78.911	99.126

Table 2: **Univariate Tests on Plan and Firm Characteristics**

This table shows univariate analyses on the relations between CSR performance, and plan and firm characteristics. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Variables used in the table are described in Table A1. Strong CSR is a dummy variable, which is one for firms that have Material CSR score above or equal to the contemporaneous cross-sectional median, and zero otherwise. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

Panel A: Plan Characteristics

VARIABLES	(1) Equity Allocation	(2) Assumed Returns	(3) Discount Rate	(4) Plan Size	(5) Funding Status	(6) Plan Returns	(7) Contribution
Strong CSR	-1.940**	-0.024	0.014	0.031	-0.021***	0.001	0.168
	(-2.27)	(-0.45)	(0.51)	(0.30)	(-2.59)	(0.59)	(0.88)
Fixed Effects	Year	Year	Year	Year	Year	Year	Year
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Observations	7,568	7,459	7,568	7,568	7,568	7,568	7,555
Adjusted R-squared	0.050	0.170	0.604	-0.001	0.047	0.632	0.049

Panel B: Firm Characteristics

VARIABLES	(1) Firm Size	(2) Book Leverage	(3) Market-to-Book	(4) Operating Cashflows	(5) Cashflow Vol.	(6) Z-Score	(7) Inst. Ownership
Strong CSR	-0.489***	0.021***	0.014	0.007***	0.001	-0.029	0.025***
	(-5.49)	(2.64)	(0.32)	(2.68)	(1.20)	(-0.31)	(2.70)
Fixed Effects	Year	Year	Year	Year	Year	Year	Year
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Observations	7,568	7,553	6,328	7,567	7,565	6,135	7,568
Adjusted R-squared	0.020	0.011	0.024	0.010	0.020	0.005	0.006

Table 3: **Correlation Tests on Plan and Firm Characteristics**

This table presents the correlations between the main variables. Pearson (Spearman) correlations are reported below (above) the diagonal. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Variables used in the correlation tests are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Correlations in bold are significant at $\leq 10\%$ level. The variable names are represented by numbers due to space limitations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Material CSR Score (1)	1	**-0.041**	-0.009	0.007	-0.013	**-0.078**	0.009	**0.03**	**-0.162**	**0.028**	**0.068**	**0.076**	**0.054**	-0.001	**0.055**
Equity Allocation (2)	**-0.041**	1	**0.473**	**0.241**	-0.001	0.007	**0.025**	**-0.041**	**-0.063**	**-0.104**	-0.012	-0.018	**-0.059**	**-0.023**	**-0.083**
Assumed Long-term Rate of Returns (3)	-0.009	**0.473**	1	**0.599**	**0.305**	**0.097**	-0.015	**-0.041**	**0.12**	**-0.162**	**0.026**	0.019	**-0.094**	**-0.098**	**-0.092**
Discount Rate (4)	0.007	**0.241**	**0.599**	1	**0.11**	**0.073**	**-0.277**	**0.105**	**0.049**	**-0.167**	**-0.019**	**0.065**	**0.021**	**-0.051**	**-0.059**
Plan Size (5)	-0.013	-0.001	**0.305**	**0.11**	1	**0.279**	**0.055**	**-0.241**	**0.716**	**-0.051**	**0.123**	**0.084**	**-0.183**	**-0.143**	**0.158**
Funding Status (6)	**-0.078**	0.007	**0.097**	**0.073**	**0.279**	1	**0.149**	**-0.328**	**0.19**	**0.092**	**-0.075**	**-0.077**	**-0.124**	**0.075**	**-0.079**
Plan Returns (7)	0.009	**0.025**	-0.015	**-0.277**	**0.055**	**0.149**	1	**-0.041**	0.01	**0.062**	-0.014	-0.006	**-0.026**	0.037*	**0.029**
Contribution (8)	**0.03**	**-0.041**	**-0.041**	**0.105**	**-0.241**	**-0.328**	**-0.041**	1	**-0.09**	0.016	**-0.046**	**0.06**	**0.081**	**0.092**	**0.032**
Firm Size (9)	**-0.162**	**-0.063**	**0.12**	**0.049**	**0.716**	**0.19**	0.01	**-0.09**	1	**-0.122**	**0.026**	**-0.079**	**-0.344**	**-0.154**	**0.126**
Market-to-Book (10)	**0.028**	**-0.104**	**-0.162**	**-0.167**	**-0.051**	**0.092**	**0.062**	0.016	**-0.122**	1	**0.117**	**0.557**	**0.092**	**0.654**	**0.072**
Book Leverage (11)	**0.068**	-0.012	**0.026**	**-0.019**	**0.123**	**-0.075**	-0.014	**-0.046**	**0.026**	**0.117**	1	**0.105**	**0.054**	**-0.46**	0.017
Operating Cashflows (12)	**0.076**	-0.018	0.019	**0.065**	**0.084**	**-0.077**	-0.006	**0.06**	**-0.079**	**0.557**	**0.105**	1	**0.097**	**0.491**	**0.156**
Cashflow Vol. (13)	**0.054**	**-0.059**	**-0.094**	**0.021**	**-0.183**	**-0.124**	**-0.026**	**0.081**	**-0.344**	**0.092**	**0.054**	**0.097**	1	**0.092**	**-0.036**
Z-Score (14)	-0.001	**-0.023**	**-0.098**	**-0.051**	**-0.143**	**0.075**	0.037*	**0.092**	**-0.154**	**0.654**	**-0.46**	**0.491**	**0.092**	1	**0.116**
Inst. Ownership (15)	**0.055**	**-0.083**	**-0.092**	**-0.059**	**0.158**	**-0.079**	**0.029**	**0.032**	**0.126**	**0.072**	0.017	**0.156**	**-0.036**	**0.116**	1

Table 4: **CSR Score and CEO's Opportunistic Behavior with Option**

This table reports regression estimates from Equation 1. The dependent variable is the assumed returns on pension assets. The sample consists of 7,155 firm-year observations (864 firms) drawn from the 2008-2018 period. Strong CSR is a dummy variable which is one for firms that have Material CSR score above or equal to the contemporaneous cross-sectional median, and zero otherwise. Variables used in the analyses are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

	(1)	(2)
VARIABLES	Assumed Returns	Assumed Returns
Option Exercise	-0.299	-0.457
	(-0.40)	(-0.96)
Option Grant	-1.295	-1.362**
	(-1.26)	(-2.11)
Strong CSR	-0.013	-0.016
	(-0.22)	(-0.39)
Option Exercise X Strong CSR	0.702	0.970
	(0.86)	(1.58)
Option Grant X Strong CSR	2.088*	2.090**
	(1.75)	(2.22)
Plan Returns	0.033***	0.041***
	(6.89)	(9.67)
Lagged Plan Returns	0.022***	0.026***
	(6.62)	(7.94)
Fixed Effects	Year & Ind	Year X Ind
Cluster	Firm	Firm
Observations	6,155	6,155
Adjusted R-squared	0.264	0.229

Table 5: **CSR Dimension Scores and CEOs' Opportunistic Behaviors with Option**

This table reports regression estimates from Equation 1 using the five CSR dimension scores. The sample consists of 7,155 firm-year observations (864 firms) drawn from the 2008-2018 period. The dependent variable is the assumed returns on pension assets. For each CSR dimension, the Strong group represents firm-year observations that have the dimension score above or equal to the contemporaneous cross-sectional median. The remaining firm-year observations are classified as the weak group. Variables used in the analyses are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1) Assumed Returns	(2) Assumed Returns	(3) Assumed Returns	(4) Assumed Returns	(5) Assumed Returns
Option Exercise	-0.273	-0.022	0.284	0.486	-0.263
	(-0.45)	(-0.02)	(0.47)	(0.79)	(-0.44)
Option Grant	-0.713	-0.329	-0.407	-0.237	-1.596
	(-0.61)	(-0.22)	(-0.33)	(-0.21)	(-1.25)
Strong Governance	-0.044				
	(-0.75)				
Strong Environment		-0.131**			
		(-1.99)			
Strong Human Capital			0.063		
			(1.11)		
Strong Social Capital				-0.016	
				(-0.25)	
Strong Business Model					-0.090
					(-1.40)
Option Exercise X Strong Governance	0.467				
	(0.46)				
Option Grant X Strong Governance	1.232				
	(1.01)				
Option Exercise X Strong Environment		0.183			
		(0.18)			
Option Grant X Strong Environment		0.512			
		(0.32)			
Option Exercise X Strong Human Capital			-0.507		
			(-0.73)		
Option Grant X Strong Human Capital			0.357		
			(0.26)		
Option Exercise X Strong Social Capital				-1.083	
				(-1.35)	
Option Grant X Strong Social Capital				-0.893	
				(-0.67)	
Option Exercise X Strong Business Model					0.512
					(0.81)
Option Grant X Strong Business Model					2.151*
					(1.72)
Plan Returns	0.039***	0.037***	0.038***	0.039***	0.038***
	(6.69)	(6.34)	(6.06)	(6.10)	(6.53)
Lagged Plan Returns	0.026***	0.024***	0.027***	0.028***	0.025***
	(6.27)	(6.18)	(5.89)	(6.09)	(6.04)
Fixed Effects	Year X Ind	Year X Ind	Year X Ind	Year X Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm	Firm
Observations	5,646	5,474	5,427	5,311	5,597
Adjusted R-squared	0.217	0.230	0.219	0.222	0.228

Table 6: **CSR Dimension Scores: CFO Delta and Assumed Returns**

This table reports regression estimates of CFO Delta on assumed returns on pension assets using the five CSR dimension scores. The dependent variable is assumed returns on pension assets. The sample consists of 5,904 firm-year observations (807 firms) drawn from the 2008-2018 period. For each CSR dimension, the Strong group represents firm-year observations that have the dimension score above or equal to the contemporaneous cross-sectional median. The remaining firm-year observations are classified as the weak group. Variables used in the analyses are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1) Assumed Returns	(2) Assumed Returns	(3) Assumed Returns	(4) Assumed Returns	(5) Assumed Returns
CFO Delta	0.0005	0.0005	0.0007**	0.0012***	0.0006**
	(1.23)	(1.27)	(2.27)	(3.41)	(2.17)
Strong Governance	-0.1051				
	(-1.33)				
Strong Environment		-0.1420*			
		(-1.85)			
Strong Human Capital			-0.0097		
			(-0.13)		
Strong Social Capital				-0.0059	
				(-0.07)	
Strong Business Model					-0.0643
					(-0.78)
CFO Delta X Strong Governance	0.0004				
	(0.73)				
CFO Delta X Strong Environment		0.0004			
		(0.94)			
CFO Delta X Strong Human Capital			0.0000		
			(0.09)		
CFO Delta X Strong Social Capital				-0.0009*	
				(-1.94)	
CFO Delta X Strong Business Model					0.0004
					(0.78)
Plan Returns	0.0378***	0.0355***	0.0366***	0.0388***	0.0373***
	(5.42)	(4.98)	(4.97)	(5.35)	(5.35)
Lagged Plan Returns	0.0265***	0.0247***	0.0271***	0.0283***	0.0247***
	(5.59)	(4.92)	(4.86)	(5.30)	(5.23)
Fixed Effects	Year X Ind	Year X Ind	Year X Ind	Year X Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm	Firm
Observations	4,182	4,124	3,998	3,928	4,215
Adjusted R-squared	0.2177	0.2366	0.2190	0.2224	0.2326

Table 7: **CSR Dimension Scores: Funding Gap and Pension Discount Rates of Underfunded Plans**

This table reports regression estimates of funding gap on pension discount rates for firms that have underfunded pension plans using the five CSR dimension scores. The dependent variable is pension discount rates. The sample with underfunded pension plans consists of 6,885 firm-year observations (1,066 firms) drawn from the 2008-2018 period. For each CSR dimension, the Strong group represents firm-year observations that have the dimension score above or equal to the contemporaneous cross-sectional median. The remaining firm-year observations are classified as the weak group. Variables used in the analyses are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1) Discount Rates	(2) Discount Rates	(3) Discount Rates	(4) Discount Rates	(5) Discount Rates
Funding Gap	0.009	0.005	0.028	0.007	0.113***
	(0.94)	(0.55)	(1.38)	(0.46)	(4.01)
Strong Governance	0.081**				
	(2.16)				
Strong Environment		0.002			
		(0.05)			
Strong Human Capital			-0.015		
			(-0.52)		
Strong Social Capital				-0.010	
				(-0.26)	
Strong Business Model					-0.066*
					(-1.89)
Funding Gap X Strong Governance	0.135**				
	(2.12)				
Funding Gap X Strong Environment		0.142**			
		(2.53)			
Funding Gap X Strong Human Capital			-0.024*		
			(-1.71)		
Funding Gap X Strong Social Capital				0.004	
				(0.17)	
Funding Gap X Strong Business Model					-0.108***
					(-3.79)
Plan Returns	0.006	0.006	0.006	0.007	0.006
	(1.58)	(1.47)	(1.57)	(1.64)	(1.61)
Lagged Plan Returns	0.010***	0.009***	0.010***	0.011***	0.010***
	(3.56)	(3.51)	(3.57)	(3.62)	(3.73)
Fixed Effects	Year X Ind	Year X Ind	Year X Ind	Year X Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm	Firm
Observations	4,984	4,926	4,766	4,591	5,043
Adjusted R-squared	0.560	0.567	0.563	0.533	0.555

Table 8: **CSR Score and Assumed Returns**

This table reports regression estimates of CSR score and Material CSR score on assumed returns on pension assets. The estimates are obtained from Equation 4. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Plan-related control variables include plan size, funding status, current and lagged plan actual returns, and pension duration. Firm-related control variables include firm size, market-to-book ratio, Z-score, operating cash flows, and standard deviation of the cash flows. Control variables are described in CHAPTER 6.1 and Table A1. In Panel (B), I additionally control for equity asset allocation in pension plans. All independent variables are lagged by one year, except the current plan actual returns. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

Panel A VARIABLES	(1) Assumed Returns	(2) Assumed Returns	(3) Assumed Returns	(4) Assumed Returns
CSR Score	-0.0022		-0.0025	
	(-1.43)		(-1.51)	
Materiality CSR Score		-0.0037**		-0.0036**
		(-2.51)		(-2.28)
Funding Status	-0.0084***	-0.0084***	-0.0081***	-0.0081***
	(-3.98)	(-3.98)	(-3.59)	(-3.60)
Plan Returns	0.0128***	0.0125***	0.0158***	0.0155***
	(3.82)	(3.77)	(3.99)	(3.92)
Lagged Returns	0.0148***	0.0146***	0.0149***	0.0147***
	(6.75)	(6.70)	(5.47)	(5.43)
Plan Size	0.3049***	0.3064***	0.3079***	0.3096***
	(9.43)	(9.46)	(8.94)	(8.96)
Duration	-0.0006	-0.0006	-0.0007	-0.0007
	(-0.34)	(-0.32)	(-0.38)	(-0.36)
Firm Size	-0.2405***	-0.2437***	-0.2479***	-0.2512***
	(-6.16)	(-6.22)	(-5.93)	(-5.99)
Market-to-Book	-0.0309	-0.0314	-0.0217	-0.0214
	(-0.63)	(-0.64)	(-0.40)	(-0.39)
Z-Score	-0.0009	0.0000	-0.0082	-0.0077
	(-0.04)	(0.01)	(-0.35)	(-0.33)
Operating Cashflows	0.0005	0.0002	-0.0008	-0.0011
	(0.09)	(0.04)	(-0.15)	(-0.20)
Cashflows Vol.	-0.0353***	-0.0353***	-0.0386***	-0.0384***
	(-3.24)	(-3.24)	(-3.23)	(-3.22)
Fixed Effects	Year & Ind	Year & Ind	Year X Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm
Observations	4,984	4,984	4,984	4,984
Adjusted R-squared	0.5426	0.5438	0.5264	0.5273

Table 8: CSR Score and Assumed Returns (Continued)

Panel B VARIABLES	(1) Assumed Returns	(2) Assumed Returns
Material CSR Score	-0.0028**	-0.0025*
	(-1.98)	(-1.71)
Equity Allocation	0.0204***	0.0204***
	(11.56)	(11.14)
Funding Status	-0.0046**	-0.0049**
	(-2.38)	(-2.46)
Plan Returns	0.0099***	0.0126***
	(3.39)	(3.82)
Lagged Returns	0.0076***	0.0078***
	(3.72)	(3.52)
Plan Size	0.2882***	0.2907***
	(9.68)	(9.34)
Duration	-0.0021	-0.0019
	(-1.14)	(-1.03)
Firm Size	-0.2026***	-0.2055***
	(-5.41)	(-5.22)
Market-to-Book	0.0154	0.0286
	(0.32)	(0.56)
Z-Score	0.0015	0.0013
	(0.08)	(0.07)
Operating Cashflows	-0.0036	-0.0049
	(-0.76)	(-0.96)
Cashflows Vol.	-0.0214**	-0.0242**
	(-2.03)	(-2.18)
Fixed Effects	Year & Ind	Year X Ind
Cluster	Firm	Firm
Observations	4,984	4,984
Adjusted R-squared	0.6171	0.6084

Table 9: **CSR Dimension Scores and Assumed Returns**

This table reports regression estimates of CSR dimension scores on assumed returns on pension assets using the five CSR dimension scores. The estimates are obtained from Equation 4. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Plan-related control variables include plan size, funding status, current and lagged plan actual returns, and pension duration. Firm-related control variables include firm size, market-to-book ratio, Z-score, operating cash flows, and standard deviation of the cash flows. Control variables are described in CHAPTER 6.1 and Table A1. All independent variables are lagged by one year, except the current plan actual returns. The dependent variable is assumed returns on pension assets. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Governance Score	-0.0010	-0.0010								
	(-0.50)	(-0.46)								
Environment Score			-0.0020	-0.0021						
			(-0.82)	(-0.83)						
Human Capital Score					-0.0001	0.0003				
					(-0.07)	(0.16)				
Social Capital Score							-0.0013	-0.0021		
							(-0.65)	(-0.98)		
Business Model Score									-0.0052**	-0.0060***
									(-2.57)	(-2.79)
Plan Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	Year & Ind	Year X Ind	Year & Ind	Year X Ind	Year & Ind	Year X Ind	Year & Ind	Year X Ind	Year & Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Observations	4,216	4,216	4,434	4,434	4,112	4,112	3,880	3,880	4,505	4,505
Adjusted R-squared	0.5559	0.5379	0.5301	0.5136	0.5171	0.4978	0.5741	0.5539	0.5540	0.5405

Table 10: **CSR Score and Equity Allocation**

This table reports regression estimates of CSR score and Material CSR score on equity asset allocation in pension asset management. The estimates are obtained from Equation 4. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Plan-related control variables include plan size, funding status, pension benefits discount rate, current and lagged plan actual returns, contribution, and pension duration. Firm-related control variables include firm size, market-to-book ratio, Z-score, a percentage of common shares held by institutional investors, operating cash flows, and standard deviation of the cash flows. Control variables are described in CHAPTER 6.2 and Table A1. All independent variables are lagged by one year, except the current plan actual returns. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1) Equity Allocation	(2) Equity Allocation	(3) Equity Allocation	(4) Equity Allocation
CSR Score	-0.0681**		-0.0699**	
	(-2.17)		(-2.03)	
Material CSR Score		-0.1052***		-0.1062***
		(-3.22)		(-2.97)
Discount Rate	5.4231***	5.4590***	5.7231***	5.7524***
	(3.88)	(3.95)	(3.73)	(3.80)
Funding Status	-0.1639***	-0.1635***	-0.1569***	-0.1565***
	(-3.18)	(-3.19)	(-2.84)	(-2.84)
Plan Returns	0.2594***	0.2521***	0.2984***	0.2890***
	(4.28)	(4.19)	(4.06)	(3.97)
Lagged Returns	0.1559***	0.1518***	0.1891***	0.1850***
	(3.52)	(3.42)	(3.53)	(3.45)
Plan Size	1.7555**	1.8147**	1.5957**	1.6630**
	(2.39)	(2.49)	(2.08)	(2.17)
Contribution	-0.2635***	-0.2558**	-0.2880**	-0.2799**
	(-2.63)	(-2.55)	(-2.53)	(-2.45)
Duration	0.0610	0.0622	0.0685	0.0696
	(1.45)	(1.49)	(1.50)	(1.54)
Firm Size	-3.3784***	-3.4918***	-3.2789***	-3.4007***
	(-4.12)	(-4.28)	(-3.76)	(-3.92)
Market-to-Book	-2.3508**	-2.3638**	-2.4846**	-2.4752**
	(-2.15)	(-2.17)	(-2.06)	(-2.06)
Z-Score	0.6103	0.6300	0.5132	0.5265
	(1.33)	(1.39)	(1.05)	(1.09)
Operating Cashflows	0.0920	0.0847	0.1013	0.0925
	(0.92)	(0.84)	(0.90)	(0.82)
Cashflows Vol.	-0.7646***	-0.7647***	-0.7629***	-0.7589***
	(-3.30)	(-3.32)	(-3.10)	(-3.09)
Inst. Ownership	-0.06*	-0.06*	-0.06*	-0.06*
	(-1.95)	(-1.96)	(-1.90)	(-1.91)
Fixed Effects	Year & Ind	Year & Ind	Year X Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm
Observations	4,707	4,707	4,707	4,707
Adjusted R-squared	0.1759	0.1795	0.1417	0.1455

Table 11: **CSR Dimension Scores and Equity Allocation**

This table reports regression estimates of CSR Dimension scores on equity asset allocation in pension asset management. The estimates are obtained from Equation 4. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. Plan-related control variables include plan size, funding status, pension benefits discount rates, current and lagged plan actual returns, and pension duration. Firm-related control variables include firm size, market-to-book ratio, Z-score, a percentage of common shares held by institutional investors, operating cash flows, and standard deviation of the cash flows. Control variables are described in CHAPTER 6.2 and Table A1. All independent variables are lagged by one year, except the current plan actual returns. The dependent variable is equity allocations. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Governance Score	-0.0713	-0.0722								
	(-1.63)	(-1.50)								
Environment Score			0.0312	0.0383						
			(0.57)	(0.65)						
Human Capital Score					-0.0056	-0.0059				
					(-0.15)	(-0.14)				
Social Capital Score							0.0682	0.0547		
							(1.27)	(0.92)		
Business Model Score									-0.0928**	-0.0925**
									(-2.21)	(-2.04)
Plan Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fixed Effects	Year & Ind	Year X Ind	Year & Ind	Year X Ind	Year & Ind	Year X Ind	Year & Ind	Year X Ind	Year & Ind	Year X Ind
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Observations	3,969	3,969	4,185	4,185	3,864	3,864	3,649	3,649	4,228	4,228
Adjusted R-squared	0.1679	0.1245	0.1626	0.1245	0.1681	0.1208	0.1764	0.1268	0.1707	0.1336

Table 12: **BP Oil Spill: Impacts on CSR Scores, Assumed Returns, and Equity Allocation**

This table reports regression estimates from Equation 5 for the years 2009-2012, which surrounds the Deepwater Horizon oil spill that occurred on May, 2010. The dependent variables are, from column (1)-(4), CSR Score, Material CSR Score, assumed returns on pension assets, and equity allocation in pension plans, respectively. *Treated* is a dummy variable which is 1 for firms in extractive, petroleum, and chemical industries (13, 28, and 20 in 2-digit SIC industries) and zero otherwise, and *Post* is a dummy variable which is 1 for the post-event period (2011-2012) and zero otherwise. From Column (1) to (3), Plan-related control variables include plan size, funding status, current plan actual returns, and pension duration. For the same columns, Firm-related control variables include firm size, market-to-book ratio, Z-score, operating cash flows, and standard deviation of the cash flows. For Column (4), I have additional controls, pension benefits discount rate, plan contribution, and a percentage of common shares held by institutional investors. Control variables are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	CSR Score	Material CSR Score	Assumed Returns	Equity Allocation
Treated X Post	4.067**	3.391**	-0.219**	-3.370**
	(2.16)	(2.22)	(-2.38)	(-2.04)
Funding Status	-0.054	0.085	-0.007	-0.076
	(-0.73)	(1.06)	(-1.61)	(-0.87)
Plan Returns	0.009	-0.035	0.004**	0.123***
	(0.20)	(-1.00)	(2.57)	(3.95)
Plan Size	-2.507	-3.977**	0.350	-3.258
	(-1.22)	(-2.18)	(1.08)	(-0.72)
Duration	0.029	0.058	0.010	0.129*
	(0.40)	(0.73)	(1.44)	(1.82)
Firm Size	-5.611*	-0.699	-0.204	1.439
	(-1.96)	(-0.22)	(-1.42)	(0.48)
Market-to-Book	1.343	1.558	0.079	-0.682
	(0.76)	(0.87)	(1.31)	(-0.55)
Z-Score	-1.251*	-0.250	-0.059**	-0.057
	(-1.88)	(-0.37)	(-2.50)	(-0.12)
Operating Cashflows	-0.067	-0.025	0.001	-0.018
	(-0.66)	(-0.25)	(0.18)	(-0.23)
Cashflows Vol.	-0.127	-0.255	-0.013	-0.278
	(-0.41)	(-0.93)	(-1.25)	(-1.10)
Discount Rate				1.581
				(1.24)
Contribution				-6.254
				(-0.85)
Inst. Ownership				-0.001
				(-0.01)
Fixed Effects	Firm & Year	Firm & Year	Firm & Year	Firm & Year
Cluster	Firm	Firm	Firm	Firm
Observations	1,940	1,940	1,837	1,856
Adjusted R-squared	0.012	0.007	0.270	0.063

Table 13: **BP Oil Spill: Role of Institutional Investors**

This table reports regression estimates from Equation 5 for the years 2009-2012, which surrounds the Deepwater Horizon oil spill that occurred on May, 2010. Following Dyck et al. (2019), I examine the role of institutional investors in enhancing firms' CSR performances and managing pension plans during the oil spill. The dependent variables are assumed returns on pension assets and equity allocation in pension plans. The pre- and post-event periods are collapsed into one observation, following Bertrand et al. (2004). *Treated* is a dummy variable which is 1 for firms in extractive, petroleum, and chemical industries (13, 28, and 20 in 2-digit SIC industries) and zero otherwise, and *Post* is a dummy variable which is 1 for the post-event period (2011-2012) and zero otherwise. *Inst.Ownership* is a percentage of common shares held by institutional investors. Plan-related control variables include plan size, funding status, current plan actual returns, and pension duration. Firm-related control variables include firm size, market-to-book ratio, Z-score, operating cash flows, and standard deviation of the cash flows. For Column (2), I have additional controls, pension benefits discount rate and plan contribution. Control variables are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1) Assumed Returns	(2) Equity Allocation
Treated X Post	0.112	6.786
	(0.66)	(1.39)
Inst. Ownership	-0.009**	-0.063
	(-2.22)	(-1.41)
Treated X Inst. Ownership	-0.025	-0.068
	(-0.93)	(-0.59)
Post X Inst. Ownership	-0.001	-0.037
	(0.52)	(-1.37)
Treated X Post X Inst. Ownership	-0.005***	-0.154***
	(-2.83)	(-2.61)
Plan Controls	YES	YES
Firm Controls	YES	YES
Fixed Effects	Firm	Firm
Cluster	Firm	Firm
Observations	1,347	1,361
Adjusted R-squared	0.190	0.079

Table 14: **BP Oil Spill: Placebo Tests**

This table reports regression estimates from Equation 5 for two different placebo tests. The first placebo test (columns (1) and (2)) restricts the sample period to 2008-2010. The second placebo test (columns (3) and (4)) assigns the treatment to firms in Real Estate and Education Services industries (65 and 82 in 2-digit SIC industries). The dependent variables are assumed returns on pension assets, and equity allocation in pension plans. In the first two columns, *Treated* is a dummy variable which is one for firms in extractive, petroleum, and chemical industries (13, 28, and 20 in 2-digit SIC industries) and zero otherwise, and *Post* is a dummy variable which is one for the 2009-2010 period, and zero otherwise. In the last two columns, *Treated* is a dummy variable which is one for firms in Real Estate and Education Services industries (65 and 82 in 2-digit SIC industries) and zero otherwise, and *Post* is a dummy variable for the 2011-2012 period and zero otherwise. For columns (1) and (3), Plan-related control variables include plan size, funding status, current plan actual returns, and pension duration. For the same columns, Firm-related control variables include firm size, market-to-book ratio, Z-score, operating cash flows, and standard deviation of the cash flows. For columns (2) and (4), I have additional controls, pension benefits discount rate, plan contribution, and a percentage of common shares held by institutional investors. Control variables are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

	(1)	(2)	(3)	(4)
	Sample Period: 2008-2010		Treated: Real Estate & Education Services	
VARIABLES	Assumed Returns	Equity Allocation	Assumed Returns	Equity Allocation
Treated X Post	-0.013	1.154	0.336	1.896
	(-0.23)	(0.52)	(0.85)	(0.76)
Funding Status	-0.210	4.640	-0.807*	-4.100
	(-0.79)	(0.60)	(-1.71)	(-0.45)
Plan Returns	0.058	2.777	0.420***	10.750***
	(0.54)	(0.97)	(2.66)	(3.34)
Plan Size	0.061	2.662	0.374	-3.473
	(0.43)	(0.48)	(1.13)	(-0.78)
Duration	-0.008	-1.359	1.017	15.524**
	(-0.04)	(-0.17)	(1.40)	(2.19)
Firm Size	0.011	-4.395	-0.238	1.375
	(0.10)	(-1.07)	(-1.53)	(0.46)
Market-to-Book	0.012	-0.635	0.082	0.199
	(0.22)	(-0.33)	(1.41)	(0.14)
Z-Score	-0.009	0.508	-0.066***	-0.192
	(-0.38)	(0.75)	(-2.72)	(-0.40)
Operating Cashflows	0.363	-1.528	0.152	1.177
	(1.36)	(-0.16)	(0.31)	(0.14)
Cashflows Vol.	-2.391**	10.916	-1.267	-30.884
	(-2.27)	(0.26)	(-1.40)	(-1.28)
Discount Rate		-0.236		1.443
		(-0.22)		(1.12)
Contribution		-4.221		-2.094
		(-0.67)		(-0.43)
Inst. Ownership		-16.767**		-8.306
		(-2.09)		(-1.14)
Fixed Effects	Firm & Year	Firm & Year	Firm & Year	Firm & Year
Cluster	Firm	Firm	Firm	Firm
Observations	1,299	1,311	1,932	1,956
Adjusted R-squared	0.101	0.006	0.258	0.048

Table 15: **BP Oil Spill: Mean Difference Tests on Key Variables Around the Event**

This table reports the mean difference t-test results on the key variables of the treated firms in Table 12 around the BP oil spill event that occurred in 2010. Treated Firms operate in extractive, petroleum, and chemical industries (13, 28, and 20 in 2-digit SIC industries). Pre-event period represents firm-year observations during the 2009-2010 period, and Post-event period represents firm-year observations during the 2011-2012 period. The pre- and post-event periods are collapsed into one observation for each firm. The variables are selected based on the correlation test results in Table 3. Plan Returns are adjusted by the control firms' contemporaneous plan returns. Variables used in the analyses are described in Table A1. All variables are winsorized at the 1st and 99th percentiles.

	Pre		Post				
Variables	Obs.	Mean	Obs.	Mean	Diff	t-stat	p-val
Control-adjusted Plan Returns	147	-0.34	159	-0.11	-0.229	-0.5	0.60
Plan Size	147	6.199	159	6.291	-0.092	-0.40	0.68
Funding Status	147	-24.685	159	-26.145	1.46	0.80	0.43
Firm Size	147	8.746	159	8.826	-0.081	-0.40	0.68
Market-to-book	133	1.355	146	1.384	-0.03	-0.30	0.76
Z-Score	145	3.348	157	3.546	-0.199	-1.00	0.32
Cashflow Vol.	147	4.075	159	3.732	0.345	1.10	0.26
Institutional Ownership	147	74.222	159	75.558	-1.336	-0.55	0.57

APPENDIX

Environment

- GHG Emissions
- Air Quality
- Energy Management
- Water & Wastewater Management
- Waste & Hazardous Materials Management
- Ecological Impacts

Leadership & Governance

- Business Ethics
- Competitive Behavior
- Management of the Legal & Regulatory Environment
- Critical Incident Risk Management
- Systemic Risk Management

Business Model & Innovation

- Product Design & Lifecycle Management
- Business Model Resilience
- Supply Chain Management
- Materials Sourcing & Efficiency
- Physical Impacts of Climate Change

Social Capital

- Human Rights & Community Relations
- Customer Privacy
- Data Security
- Access & Affordability
- Product Quality & Safety
- Customer Welfare
- Selling Practices & Product Labeling

Human Capital

- Labor Practices
- Employee Health & Safety
- Employee Engagement, Diversity & Inclusion

Figure A1: **SASB's Sustainability 26 Categories and 5 Dimensions**

Source: Sustainability Accounting Standards Board.
https://www.sasb.org/standards/materiality-map/

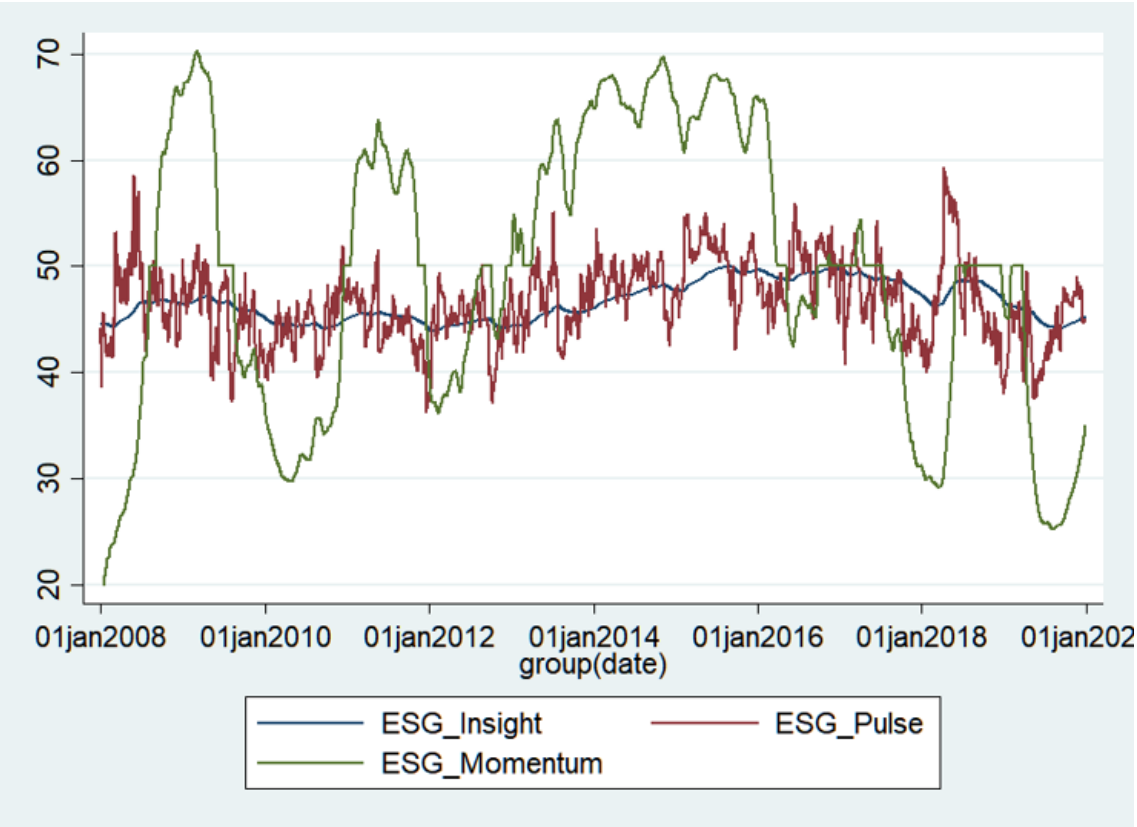

Figure A2: **Apple's Insight, Pulse, and Momentum Scores**

This figure shows Apple's ESG Insight, Pulse, and Momentum Scores over the 2008-2020 period at a daily frequency. Blue, red, and green lines represent Insight, Pulse, and Momentum Scores, respectively. Pulse score represent short-term ESG performance, and focuses on events of the day; Insight score represents long-term ESG performance, and is derived from the Pulse score using an exponentially-weighted moving average with a 6-month half-life; lastly, Momentum score measures the trend of a firm's ESG performance, and is derived from the slope of Insight score over 12-month time period.

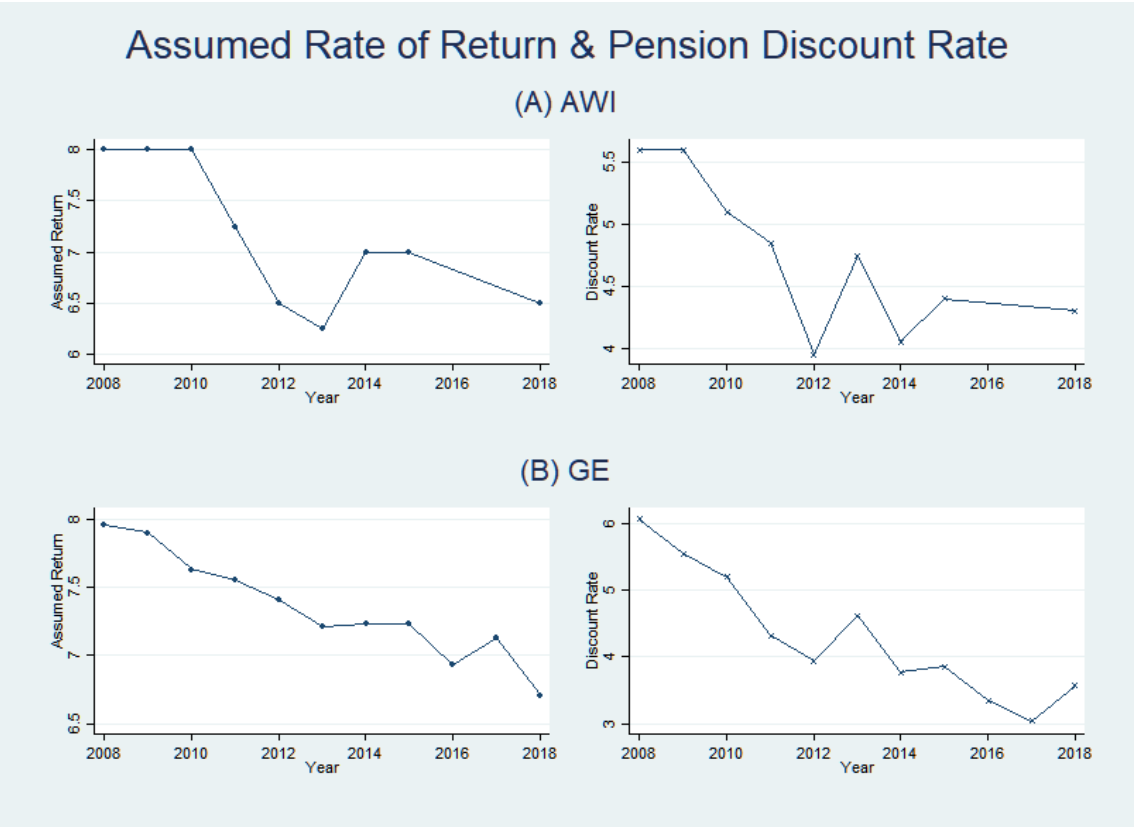

Figure A3: **Assumed Rate of Returns and Pension Discount Rates of Armstrong World Industry and General Electronics**

This figure shows the assumed returns, and pension discount rates of two firms over the sample period. Panel (A) plots the annual movement of assumed returns and discount rates of Armstrong World Industry, and Panel (B) shows that of General Electronics over the 2008-2018 period.

Table A1: **Variable descriptions**

CSR Score	Annualized all ESG categories Pulse score. Source: Truvalue Labs
Material CSR Score	Annualized Materiality Pulse score. Source: Truvalue Labs
Governance Score	Annualized Leadership & Governance Pulse score. Source: Truvalue Labs
Environment Score	Annualized Environment Pulse score. Source: Truvalue Labs
Human Capital Score	Annualized Human Capital Pulse score. Source: Truvalue Labs
Social Capital Score	Annualized Social Capital Pulse score. Source: Truvalue Labs
Business Model Score	Annualized Business Model & Innovation Pulse score. Source: Truvalue Labs
Strong (Weak) Governance	A dummy variable which is 1 (0), if a firm has Governance Score above or equal to (below) contemporary sample median Governance Score. Source: Truvalue Labs
Strong (Weak) Environment	A dummy variable which is 1 (0), if a firm has Environment Score above or equal to (below) contemporary sample median Environment Score. Source: Truvalue Labs
Strong (Weak) Human Capital	A dummy variable which is 1 (0), if a firm has Human Capital Score above or equal to (below) contemporary sample median Human Capital Score. Source: Truvalue Labs
Strong (Weak) Social Capital	A dummy variable which is 1 (0), if a firm has Social Capital Score above or equal to (below) contemporary sample median Social Capital Score. Source: Truvalue Labs
Strong (Weak) Business Model	A dummy variable which is 1 (0), if a firm has Business Model Score above or equal to (below) contemporary sample median Business Model Score. Source: Truvalue Labs
Equity Allocation	Proportion of pension assets invested in equity securities (PNATE). Source: COMPUSTAT Pension Annual
Assumed return	Assumed long-term rate of return on pension assets (PPROR). Source: COMPUSTAT Pension Annual
Discount Rate	Discount rate actuarial assumption (PBARR). Source: COMPUSTAT Pension Annual
Funding Status	Fair value of pension assets (PPLAO) minus pension liabilities (PBPRO), divided by pension assets. Source: COMPUSTAT Pension Annual
Funding Gap	Absolute value of pension assets (PPLAO) minust pension liabilities (PBPRO), scaled by pension assets. Source: COMPUSTAT Pension Annual
Contribution	Plan contribution (PBEC), scaled by pension assets (PPLAO). Source: COMPUSTAT Pension Annual
Plan Returns	Actual returns on pension assets (PBARAT/PPLAO). Source: COMPUSTAT Pension Annual
Plan Size	Natural log of fair value of pension assets (PPLAO). Source: COMPUSTAT Pension Annual
Duration	Ratio of annual pension service cost (PPSC) to the sum of service cost and interest cost (PPIC). Source: COMPUSTAT Pension Annual
Firm Size	Natural log of total assets (AT). Source: COMPUSTAT
Market-to-Book	(Market equity + total debt + preferred stock liquidating value(PSTKL) - deferred taxes and investment tax credits(TXDITC))/total assets(AT), Market equity = Stock price (PRCC_F) X Shares outstanding (CSHPRI), Total Debt = Short-term Debt (DLC) + Long-term Debt (DLTT). Source: COMPUSTAT
Z-Score	Altman Z-Score. 3.3*pre-tax income(NI+XINT+TXT)/total assets(AT) + 0.6*Market Equity/Total Liabilities(LT) + 1.2*(Current assets (ACT) - Current liabilities(LCT)/total assets(AT)+1.4*retained earnings(RE)/total assets(AT) +0.999*Sales(SALE)/total assets(AT). Source: COMPUSTAT
Operating Cashflows	Operating income before depreciation (OIBDP), scaled by total assets(TA). Source: COMPUSTAT
Cashflow Volatility	Standard deviation of Operating Cashflows, requiring at least 3 years of data. Source: COMPUSTAT
Institutional Ownership	The percentage of common shares held by institutional investors (INSTOWN_PERC). Source: WRDS Thomson Reuters Institutional (13f) Holdings
Option Exercise	Value realized on option exercise (OPT_EXER_VAL) divided by market equity. Source: COMPUSTAT, and EXECUCOMP Annual Compensation
Option Grant	Grant date fair value of options granted (OPTION_AWARDS_FV) divded by market equity. Source: COMPUSTAT, and EXECUCOMP Annual Compensation
Delta	Manager's pay sensitivity with respect to a 1% change in stock price, estimated following Core and Guay (2002)

Table A2: **Top and Bottom 10 CSR Industries & Top 10 Funding Status Industries**

Panel (A) of this table shows industry average Material CSR scores for top 10, and bottom 10-CSR industries. Panel (B) presents industry average pension funding status of top 10 funding status industries. Industries are defined by the two-digit SIC codes.

Panel A

Top 10 CSR Industries	Ind_Avg	Bottom 10 CSR Industries	Ind_Avg
Home Furniture, Furnishings and Equipment Stores	73.686	**Depository Institutions**	46.708
Construction - Special Trade Contractors	69.893	**Security & Commodity Brokers, Dealers, Exchanges & Services**	45.617
Automotive Repair, Services and Parking	69.337	Transportation Services	43.542
Personal Services	68.151	Tobacco Products	42.827
Electric, Gas and Sanitary Services	64.115	Holding and Other Investment Offices	41.738
Textile Mill Products	63.545	Educational Services	40.834
Electronic & Other Electrical Equipment & Components	62.999	**Nondepository Credit Institutions**	39.862
Fabricated Metal Products	62.994	**Insurance Carriers**	36.882
Motor Freight Transportation	62.763	Automotive Dealers and Gasoline Service Stations	35.850
Transportation Equipment	62.283	**Insurance Agents, Brokers and Service**	34.233

Panel B

Top 10 Funding Status Industries	Ind_Avg
Educational Services	0.0123
Depository Institutions	-0.0677
Transportation Services	-0.0679
Real Estate	-0.0925
Nondepository Credit Institutions	-0.1187
Insurance Agents, Brokers and Service	-0.1252
Tobacco Products	-0.1399
Heavy Construction, Except Building Construction, Contractor	-0.1482
Railroad Transportation	-0.1541
General Merchandise Stores	-0.1612

Table A3: **Summary Statistics of Insight, Pulse, and Momentum Scores (CSR & Material CSR)**

This table shows Summary statistics of annualized Insight, Pulse, and Momentum Scores for both CSR and Material CSR. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. All variables are winsorized at the 1st and 99th percentiles.

	Mean	SD	P1	P50	P99
CSR Insight	54.360	13.319	21.249	54.414	84.448
Material CSR Insight	55.478	15.667	14.304	56.564	88.612
CSR Pulse	54.460	15.347	14.604	54.325	89.949
Material CSR Pulse	55.618	17.547	9.335	56.261	93.106
CSR Momentum	50.715	20.883	10.004	50.000	91.138
Material CSR Momentum	51.007	20.962	9.769	50.000	90.899

Table A4: **Correlation Tests on Insight, Pulse, and Momentum Scores (CSR & Material CSR)**

This table presents the correlations between annualized Insight, Pulse, and Momentum Scores for both CSR and Material CSR. Pearson (Spearman) correlations are reported below (above) the diagonal. The sample consists of 7,568 firm-year observations (1,107 firms) drawn from the 2008-2018 period. All variables are winsorized at the 1st and 99th percentiles. Correlations in bold are significant at $\leq 10\%$ level. The variable names are represented by numbers due to space limitations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
CSR Insight (1)	1	**0.735**	**0.875**	**0.678**	**0.302**	**0.216**
Material CSR Insight (2)	**0.735**	1	**0.635**	**0.908**	**0.158**	**0.3**
CSR Pulse (3)	**0.875**	**0.635**	1	**0.701**	**0.518**	**0.315**
Material CSR Pulse (4)	**0.678**	**0.908**	**0.701**	1	**0.294**	**0.5**
CSR Momentum (5)	**0.302**	**0.158**	**0.518**	**0.294**	1	**0.571**
Material CSR Momentum (6)	**0.216**	**0.3**	**0.315**	**0.5**	**0.571**	1

Table A5: **BP Oil Spill: Addressing Serial Correlation**

This table reports regression estimates from Equation 5 for the years 2009-2012, which surrounds the Deepwater Horizon oil spill that occurred on May, 2010. The dependent variables are, from column (1)-(4), CSR Score, Material CSR Score, assumed returns on pension assets, and equity allocation in pension plans, respectively. The pre- and post-event periods are collapsed into one observation, following Bertrand et al. (2004). *Treated* is a dummy variable which is 1 for firms operate in extractive, petroleum, and chemical industries (13, 28, and 20 in 2-digit SIC industries) and zero otherwise, and *Post* is a dummy variable which is 1 for the post-event period (2011-2012) and zero otherwise. From Column (1) to (3), Plan-related control variables include plan size, funding status, current plan actual returns, and pension duration. For the same columns, Firm-related control variables include firm size, market-to-book ratio, Z-score, operating cash flows, and standard deviation of the cash flows. For Column (4), I have additional controls, pension benefits discount rate, plan contribution, and a percentage of common shares held by institutional investors. Control variables are described in Table A1. All variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the firm level, and t-stats are reported in parentheses. Coefficients marked ***, **, and * are significant at the 1%, 5%, and 10% significance levels, respectively.

VARIABLES	(1) CSR Score	(2) Material CSR Score	(3) Assumed Returns	(4) Equity Allocation
Treated X Post	3.082*	3.264**	-0.276**	-2.475*
	(1.94)	(2.45)	(-2.47)	(-1.77)
Plan Controls	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Fixed Effects	Firm	Firm	Firm	Firm
Cluster	Firm	Firm	Firm	Firm
Observations	1,365	1,365	1,351	1,365
Adjusted R-squared	0.018	0.013	0.168	0.063

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