The Effect of ESG Disclosure on Corporate Investment Efficiency

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March 2021

Abstract: This paper examines the effects of environmental, social and governance (ESG) disclosure on investment efficiency, using the adoption of Directive 2014/95/EU as a quasi-natural shock on disclosure quality. We document a significant and robust reduction of underinvestment for U.S. firms with significant activities in the EU, which exposes them to the Directive, relative to U.S. firms not affected. These firms are able to raise additional debt after the adoption of the Directive, although there is no evidence of any impact on new capital raised in equity markets. In addition, investment efficiency gains are strongest for firms with ex-ante lower ESG disclosure levels, that are financially constrained, and for firms with more entrenched managers. These results suggest that non-financial disclosure requirements can play a role in mitigating adverse selection problems for underinvesting firms, especially in debt markets, in a manner similar to disclosure of financial information.

Keywords: Disclosure, Non-financial reporting quality, Corporate investment

JEL Classification: G14, G18, K20, G34, Q56

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1. Introduction

Attentiveness on firms' disclosure of environmental, social and governance (ESG) related information is growing rapidly among investors and policymakers alike. In October 2018, institutional investors with $5 trillion in assets under management petitioned the U.S. Securities and Exchange Commission (SEC) to mandate standardized sustainability disclosure by public companies. More recently, an SEC subcommittee recommended that the agency update its reporting requirements to include ESG factors to "take control of ESG disclosure for the U.S. capital markets before other jurisdictions impose disclosure regimes on U.S. issuers and investors alike" (SEC, 2020). Markets worldwide are increasingly requiring some form of sustainability disclosure. As of 2015, twenty-three countries required public companies to issue reports that include ESG topics (IRI, 2015). In particular, listed companies, banks and insurance companies with more than 500 employees must include a non-financial statement as part of their annual public reporting obligations under Directive 2014/95/EU, also called the Non-Financial Reporting Directive ("NFRD"). Although ESG disclosure is not mandated in the U.S., corporations operating in the EU are expected to comply with these rules.

As a response, large companies in the U.S. are increasingly publishing sustainability reports or disclosing material ESG-related risks in their annual reports.[1] According to the Governance and Accountability Institute (G&A, 2020), 90% of S&P 500 firms published sustainability reports in 2019, up from only 20% in 2011. Firms are facing mounting pressure from various stakeholder groups, including investors, employees, consumers, communities, and regulators to disclose ESG-related risks, as growing evidence suggests that sustainability-related issues can materially affect a company's long-term performance (Eccles et al., 2014). ESG may enhance valuations as investors care about corporate externalities (Bonnefon et al., 2019). Likewise, shareholders are increasingly voting for climate-related proposals (Flammer et al., 2019) and asset managers are asking for greater sustainability disclosure. In 2020, BlackRock voted against 53 portfolio companies that it judged to be making insufficient progress on integrating climate risks into both business models and disclosures, including U.S. company ExxonMobil (Financial Times, 2020).

A key concern with mandating ESG reporting standards is whether it can have effects on firms' financial policies and performance. ESG reporting requirements, such as the ones specified in the NFRD, coupled

[1] Following Ioannou and Serafeim (2017), we use the terms "sustainability", "environmental, social and governance" (ESG), "non-financial, and "corporate social responsibility" (CSR) disclosure or reporting interchangeably, to refer to reports broadly focusing on ESG issues.

with increasing investor demands, could have profound impact on companies' ability to raise capital, within the EU and beyond (KPMG, 2019). Although extensive evidence suggests that more and better disclosure can lead to tangible capital-market benefits such as improved liquidity, lower cost of capital, higher asset prices (or firm value), and better corporate decisions (Christensen et al., 2019), very little is known about the effects of ESG disclosure. Assuming that ESG disclosure improves information available to investors, we may expect many of the prior findings to hold. However, mandatory sustainability disclosure may also generate negative externalities. For example, firms that already disclose ESG information may be penalized if they need to further differentiate themselves from their competitors, resulting in higher costs and potential losses of shareholder value (Ioannou and Serafeim, 2017). In addition, regulation may affect firms' cost-benefit trade-off when evaluating whether to obtain external financing or to remain in a given market, leading some firms to choose to abandon certain activities or exit markets altogether (Christensen et al., 2019).

This paper is the first to examine empirically the effects of ESG disclosure on investment efficiency. In principle, ESG reporting can have real effects on firms' investment in the same way as financial disclosures do, given an increase in the quantity and quality of corporate disclosure (Christensen et al., 2017). Financial reporting has been shown to affect firms' investment behavior through multiple channels (Christensen et al., 2019; Leuz and Wysocki, 2016; Roychowdhury et al., 2019): by reducing information asymmetries and agency costs (Biddle and Hilary, 2006; McNichols and Stubben, 2008; Shroff et al., 2014), improving external monitoring and reducing inefficiency in managerial decisions (Bushman and Smith, 2001; Cho, 2015), or by learning from peer reporting (Beatty et al., 2013; Chen et al., 2013; Shroff, 2017). However, it is unclear how much new information will be produced from ESG reporting and whether this will affect firms' investment response and efficiency. In addition, ESG reporting requirements could affect (non-ESG) corporate investment by making ESG activities more or less attractive. Firms may shift their investment mix between ESG to non-ESG activities by scaling back operating investments in favor of sustainability investments.

Following the prior literature on financial reporting and investment efficiency, we examine the relationship between ESG reporting quality and the level of capital investment conditional on whether a firm is more likely to over- or under-invest. More specifically, we distinguish between firms prone to underinvestment because of the adverse selection problem (Myers and Majluf, 1984) and firms likely to overinvest due to managerial empire-building. We construct a panel of 1,240 U.S. firms between 2012 and 2017 by combining

data from Compustat North America, Compustat Geographic Segment data, Bloomberg, CRSP, Thompson Reuters Ownership data, and IBES. Our quasi-experimental approach allows us to assess the causal impact of the NFRD on firms' investment efficiency based on difference-in-difference estimations comparing U.S. firms plausibly exposed to the NFRD (treatment group), to U.S. firms plausibly not exposed to ESG disclosure requirements (control group). Following Grewal et al. (2019), we identify U.S. firms plausibly affected by the Directive using Compustat geographic segment data and the 500 employee-size threshold.

Using this within-country foreign setting, we start by quantifying the impact of the NFRD on U.S. firms' quality of ESG disclosure.[2] Our ESG disclosure measure is obtained from Bloomberg, and ranges from 0 to 100. It provides the widest ESG disclosure coverage available (Grewal et al., 2019; Ioannou and Serafeim, 2017) and attracts the most attention by investors (Eccles et al., 2014). Although U.S. firms, on average, have increased their disclosure quality from less than 14 in 2010 to almost 20 in 2017 (Figure 1), we find that the quality gap between treatment and control firms widens after the adoption of the NFRD (Figure 2). Two examples of such firms are Guess and Costco. Guess, which declares operations in the EU, has seen a sharp increase in the quality of its ESG disclosure in 2014, after confirming to one of the reporting frameworks suggested by the NFRD. On the other hand, Costco which has no presence in the EU, has not changed its reporting behavior during the last decade (Figure 3). We formally test whether the NFRD has led to increases of ESG disclosure quality for firms plausibly exposed using a difference-and-difference approach (Hypothesis 1). Our estimations show that after 2014, firms plausibly exposed to the NFRD increase their ESG disclosure score by 1.78, equivalent to a 10% increase of average disclosure scores during the sample period. These firms are also more likely to adopt frameworks that are compliant with the NFRD, thereby increasing the credibility and comparability of their ESG disclosures.

After establishing that the NFRD constitutes a shock on ESG disclosure quality, we estimate its effect on investment efficiency (Hypothesis 2). We find that post-NFRD, when the likelihood of underinvestment is high, firms plausibly affected by the Directive increase their investment levels by 6.3% of total assets, relative to control firms. This represents a 45% increase of the average investment levels for sample firms (14%). In addition, we find no evidence that firms prone to overinvestment significantly modify their investment behavior. We then proceed to assess whether better ESG disclosure has had an effect on external financing. Our

[2]Our setting is inspired by the work of Sanseverino (2020), which examines the effect of the 2010 United Kingdom Bribery Act on corruption.

results indicate that firms prone to underinvestment are able to raise an additional 8.7% of debt relative to total assets after the adoption of the NFRD, consistent with the increased transparency brought by the disclosure of ESG information mitigating adverse selection issues. On the other hand, firms prone to overinvestment do not appear affected by the NFRD. Furthermore, we find no evidence that increased ESG disclosure affects the issuance of equity nor the average monthly bid-ask spread implied by equity prices. Finally, we find that the improvements in investment efficiency are strongest for firms with an ex-ante lower quality of disclosure, which are more financially constrained, and which are more likely to suffer from managerial entrenchment. Taken together, these results suggest that enhanced ESG disclosure plays a role in reducing information asymmetries, and in particular adverse selection costs that reside in the corporate debt market, leading to investment efficiency gains.

Although our difference-in-difference setting, combined with a plausibly exogenous shock on ESG disclosure quality, allows us to mitigate concerns of confounding factors that may affect our results, we conduct a series of robustness tests to strengthen our analysis. First, we show that our baseline results are robust after modifying the definition of our treatment and control groups to include only European firms and after excluding domestic firms. Second, we conduct a placebo test which either assumes the Directive was adopted in different years or that it was implemented in different regions. Third, we conduct propensity-score matching and entropy balancing to improve the balance of observable firm characteristics of our control group, which serves as a potential counterfactual to what would have happened if the NFRD had not been adopted. Finally, we verify the validity of the parallel trend assumption by showing that there existed no significant pre-trend before the adoption of the NFRD, with and without entropy-balancing. Overall, our results allow us to conclude that ESG disclosure significantly affects investment efficiency.

This paper relates to the literature on accounting disclosure and investment efficiency. Our study is closest to the work of Dou et al. (2019), which tests for changes in investment efficiency around a shock to financial reporting quality, and finds a reduction in underinvestment for firms heavily affected by new accounting standards. Our results are similar in essence as we find that increased ESG disclosure reduces underinvestment of exposed firms, but contrary to their findings, we see no evidence of an effect on bid-ask spreads, nor on new equity issues. In addition, our paper relates to the work of Chen et al. (2013), which provides evidence on the causal relation between the quality of financial reporting and investment efficiency, as

well as the seminal work of Biddle and Hilary (2006) which is the first to examine this relationship separately for firms that tend to over- or under-invest. Contrary to these studies, we are the first to examine whether non-financial disclosure affects investment efficiency. ESG reporting differs from financial accounting by providing information to a wider group of users including numerous stakeholders such as consumers, political activists or even the general public. It is therefore difficult to predict what the effects of ESG disclosure will be. Christensen et al. (2017) argue that in some cases, ESG standards could have greater implications for firm behavior than new accounting standards. Our aim is to assess whether this is the case by focusing on U.S. firms' investment response to the NFRD.

Our study also complements the growing literature examining the effects of ESG disclosure on shareholder value and firm behavior. Ioannou and Serafeim (2017) find that better disclosure is associated with increases in firm value, when examining mandated ESG disclosure in China, Denmark, Malaysia and South Africa. They argue that investors and intermediates in capital markets have started to integrate ESG performance in their valuation models, thereby increasing the importance of sustainability reporting even further. In addition, ESG disclosure may also induce firms to alter their behavior, precisely because investors or other stakeholders are expected to respond to firms' disclosures (Christensen et al., 2019). Recent empirical evidence suggests that firms subject to ESG disclosure requirements tend to expand and adjust their CSR activities (Fiechter et al., 2018; Christensen et al., 2017; Rauter, 2019; Chen et al., 2018). In particular, Fiechter et al. (2018) find that European firms impacted by the EU directive respond to the announcement of the requirements by increasing their CSR expenditures, with poor CSR performers increasing their CSR activities the most.

The rest of the paper is organized as follows. Section 2 provides some background on the EU Directive and describes U.S. firms' ESG disclosure practices and potential exposure to EU requirements. Section 3 describes the related literature and develops our key hypothesis. Section 4 describes our research design, data sources and sample selection process. Section 5 presents the results of our difference-in-difference estimations. Before concluding, section 6 conducts a series of robustness tests including a placebo test, propensity-score matching and entropy balancing.

2. Background

2.1. The EU Non-Financial Reporting Directive

The Non-Financial Reporting Directive (2014/95/EU or NFRD) requires large companies to publish annual reports that include the social and environmental impact of their activities.[3] The objective of this directive is to help investors, consumers, policy makers and other stakeholders evaluate the sustainability performance of large companies and encourage them to develop a responsible approach to business. It amends Accounting Directive 2013/34/EU which specifies the accounting requirements relating to annual financial statements. It came into force in December 2014, with all member states required to transpose it in national law before December 2016.[4] Companies were expected to include non-financial statements in 2018, regarding information relating to the 2017 financial year.

The NFRD concerns public-interest entities with more than 500 employees, including listed companies, banks, insurance companies, and other companies designated as public-interest entities by national authorities. According to the European Commission, the NFRD covers approximately 6,000 large companies and groups across the EU. It also concerns international companies and subsidiaries which meet the scope requirements, including U.S. companies.

The information companies must disclose concerns the following five broad ESG topics: (1) environmental protection, (2) social responsibility and treatment of employees, (3) respect for human rights, (4) anti-corruption and bribery, and (5) diversity on company boards in terms of age, gender, educational and professional background. However, the Directive gives companies significant flexibility in terms of how they disclose relevant information. They may rely on national, EU or international frameworks such as the UN Global Compact, the OECD guidelines for multinational enterprises or ISO 26000. Firms may also choose to follow the guidelines published by the European Commission in June 2017.[5] In addition, the Directive follows the comply or explain principle which requires companies to explain when they have no policy in place for one of the matters listed above. In practice, this principle encourages companies to address ESG performance gaps in order to avoid negative publicity stemming from the public disclosure of these gaps.

According to Baruch College's CSR-Sustainability Monitor, European companies rank among the

[3] The Directive can be found here: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095

[4] The press release of the adoption was released on April 15, 2014, but it was published in the Official Journal of the European Union on November 15, 2014.

[5] More details are provided on the website of the European Commission https://ec.europa.eu/.

best companies worldwide in terms of the scope and quality of information provided in CSR reports. In 2019, European companies dominated the Top 10 ranking by CSR disclosure quality, with PSA Group (Peugot), a French car manufacturer, in lead. Europe is the highest scorer by region followed by East Asia and North America (CSR, 2019). Compared to other regions, reporting in Europe is dispersed across countries rather than concentrated in a few locations. Among top-scoring companies, Germany has five companies in the Top 25, Italy and Spain have two each, and Sweden, Switzerland, and France each have one.

2.2. ESG Disclosure of U.S. Firms

In the U.S, sustainability reporting remains a voluntary practice and attempts to establish new rules have been rejected by Congress in the past few years (Financial Times, 2019). Although there are no mandatory requirements *per se*, U.S. federal securities law require companies to disclose certain environmental, social, and risk-related information. Reporting obligations in the U.S. are set in Regulation S-K of the Securities Act and the Exchange Act, and require disclosure of material ESG factors in periodic reports, under Item 101 (Description of Business), Item 103 (Legal Proceedings), Item 105 (Risk Factors), and Item 303 (Management's Discussion and Analysis of Financial Condition and Results of Operations).

In practice, U.S. public companies increasingly produce sustainability reports. According to the Governance and Accountability Institute (G&A), which has been tracking trends in sustainability reporting and disclosure of publicly-traded companies included in the S&P 500 for a decade, 90% of companies published reports in 2019, compared to 20% in 2011 (G&A, 2020). The institute finds that the volume of reporting has steadily increased each year since 2011 and that the content of the reports has significantly expanded. By 2012, more than half (53%) of the companies were publishing reports, reaching 75% by 2014 and 86% by 2018. However, CSR (2019) find that American companies lag behind their European and Asian counterparts in terms of quality of disclosure with 16 of the bottom 25 ranked companies headquartered in the U.S. In addition, they find significant variation in practices among U.S. companies which they argue is probably due to the lack of standardization in CSR reporting and growing regulatory pressure at home and abroad.

In particular, the scope of the NFRD appears to include international companies. According to a brief by an international law firm, Willkie Farr Gallagher LLP, "the Directive establishes new environmental, social, and governance reporting requirements for covered enterprises, including companies based in the United States" (Thomas and Maguire, 2014). In addition, an article by The CPA Journal (2018) argues that even

though the Directive applies to EU companies, it has implications for U.S. firms : "For now, only the largest U.S. companies that are considered *public interest entities*, including entities operating in member states of the EU that meet the size criteria outlined above, are subject to the rules of the directive."

3. Literature and Hypothesis Development

The importance of CSR information for capital market participants in part stems from mounting evidence of the potential performance, risk and valuation implications of firms' social and environmental policies (Christensen et al., 2019). In particular, several studies document a positive association between voluntary CSR activities and firm value relating to customer satisfaction through better product quality and innovation (Luo and Bhattacharya, 2006), support from external stakeholder (Henisz et al., 2014), investor affect for specific CSR issues (Elliott et al., 2014), or positive media coverage (Cahan et al., 2015). In addition, some studies show that CSR can improve firm performance (e.g., Flammer, 2015; Cornett et al., 2016), a key channel for firm value enhancements. However, Manchiraju and Rajgopal (2017) document negative effects of CSR on firm valuations in India and Kitzmueller and Shimshack (2012), after reviewing numerous studies, argue there is not strong support for CSR having strong effects on profitability. Finally, some argue that the relation between CSR and firm performance depends on mediating factors such as a firm's reputation and competitive advantage (Saeidi et al., 2015) or how it implements its CSR strategy (Tang et al., 2012).

There is also growing evidence suggesting that ESG disclosure itself, in addition to ESG performance, leads to tangible capital markets benefits. These studies find that mandatory disclosures are linked to firm value (Ioannou and Serafeim, 2017), earnings quality (Rezaee and Tuo, 2019) and a lower likelihood of stock price crashes (Tang and Zhong, 2019). Focusing on the EU, Grewal et al. (2019) argue that equity markets perceive that disclosure regulation of nonfinancial information will lead to net costs for firms with weak ESG performance, and benefits for those with a strong performance. In addition, voluntary non-financial disclosure allows firms to reduce their cost of capital, while attracting dedicated institutional investors and analyst coverage (Dhaliwal et al., 2011), and can improve stock price informativeness when it is material for investors (Grewal et al., 2020).

A well-documented benefit of corporate disclosure is mitigating information asymmetries between a firm and its investors (and among more or less informed investors), that give rise to adverse selection and moral hazard problems (e.g., Ross, 1973; Jensen and Meckling, 1976). Although ESG and financial disclosure differ

in terms of the set of stakeholders that rely on each type of information and their range of uses, Christensen et al. (2019) argue that ESG reporting standards have the potential to improve information to investors and other stakeholders and therefore reduce information asymmetries. The magnitudes of the capital-market effects will depend on how much firms currently withhold material ESG information. If new or better ESG information is produced, then capital markets should respond as theory predicts, in the form of improved liquidity, lower cost of capital, and higher asset prices.

For us to expect tangible benefits from ESG disclosure, we must first verify whether the regulatory mandate imposed in the EU can increase the quality and quantity of ESG information produced by U.S. companies operating in the EU. As discussed in the previous section, U.S. companies are required to disclose material information in their regulatory filings in compliance with the U.S. securities regulation and SEC rules. The importance of the capital-market effects from the EU Directive will therefore depend on the extent to which firms currently withhold or disclose material CSR information (Christensen et al., 2019). Grewal et al. (2020) find that on average, U.S. firms provide only about 18% of the material ESG disclosure expected by investors while Peters and Romi (2013) detect a 72% non-compliance rate with SEC filing requirements. Using the Bloomberg ESG Disclosure score, we corroborate the existence of low average levels of disclosure before 2015, as can be seen in Figure 1. Given such a reporting gap, it appears that extra-territorial constraints imposed on U.S. firms by the EU Directive should force out new material information. However, reporting standards, in particular sustainability standards, contain substantial discretion. The EU Directive does not specify the exact structure for firms to disclose non-financial information but rather suggests following established frameworks.[6] Given the possibility of reporting discretion, it remains unclear to what extent firms will actually disclose material information and we must test it empirically. We specify our first hypothesis as follows:

H1: Firms exposed to the NFRD increase the quality and quantity of their ESG disclosure.

If the NFRD increases the availability of ESG disclosure for exposed firms, we further argue that firms will alter their investment behavior. The accounting literature provides considerable evidence of a positive association between financial reporting quality and investment efficiency (Biddle and Hilary, 2006, 2009; Cheng et al., 2013; Dou et al., 2019).[7] More specifically, accounting information can reduce adverse selection prob-

[6] Please refer to recital 9 of the Directive for further information on suggested frameworks.

[7] A firm is considered to be investing efficiently if it invests in every project with a positive NPV as such projects become available

lems between a firm and new investors, such as stockholders or creditors, if financial reports better describe the value of assets in place or of existing investment opportunities (Roychowdhury et al., 2019). If information asymmetry between managers and investors is reduced, investors may be more willing to provide capital and enable financially constrained firms to access new investment opportunities (Myers and Majluf, 1984). Given that CSR information (and CSR performance) can impact firm value or earnings quality, as described above, it may therefore reduce market frictions in a same way as financial information does. In particular, Cheng et al. (2014) hypothesize and find that firms with better CSR performance will face lower capital constraints because of lower agency costs through increased transparency from CSR reporting, and through stakeholder engagement.

A second way through which accounting information can affect investment decisions is by reducing moral hazard costs arising from agency conflicts among various stakeholders in the firm (Roychowdhury et al., 2019). Moral hazard costs arise due to manager-shareholder conflicts whereby managers derive utility from behaviors that are not aligned with the interest of shareholder (e.g., Jensen and Meckling, 1976). In particular, a common manifestation of moral hazard is managers' incentive to over-invest also called empire building. Provided that information is informative about managers' actions and risk-taking preferences, it can be used by shareholders to reduce moral hazard costs. Illustrating these mechanisms, Biddle and Hilary (2009) find that the relation between accounting quality and the level of investment is positive for financially constrained firms, but negative for cash-rich ones. Since constrained firms are more likely to underinvest due to adverse selection costs, but cash-rich firms are more likely to overinvest due to moral hazard frictions, they argue that higher reporting quality reduces both adverse selection and moral hazard costs associated with under- and over-investment. We therefore verify if we find similar results when firms improve their ESG disclosures, and specify the following hypothesis:

H2: After the adoption of the NFRD, exposed firms improve their investment efficiency by reducing agency costs.

Furthermore, we develop three cross-sectional propositions that derive from hypothesis H2. First, given that firms with lower levels of ESG disclosure before the adoption of the Directive have more potential to improve their disclosures, the effects on investment efficiency should be stronger for these firms. More

and does not invest in projects with negative NPV (Roychowdhury et al., 2019).

specifically, if the investment efficiency gains are indeed due to an improvement in the quality of ESG disclosure caused by the NFRD mandate, we can assume that firms with a lower quality of ESG disclosure prior to the NFRD will have larger improvements in investment efficiency. This leads us to define the following hypothesis:

H2(a): After the adoption of the NFRD, firms that have ex-ante lower levels of ESG disclosures experience a larger increase in investment efficiency than those that have more reliable ESG disclosures.

Second, since investment efficiency gains operate through mitigating information asymmetry and allowing firms to raise new capital to fund positive net-present-value projects, we expect firms that have more financial constraints to benefit more from ESG disclosures. We therefore predict that firms that are more financially constrained experience a larger reduction in investment inefficiency after the adoption of the Directive, and define the following hypothesis:

H2(b): After the NFRD, exposed firms that are likely to underinvest and which are more financially constrained, experience a larger increase in investment efficiency.

Third, given the existence of information asymmetry between investors and managers, managers may entrench themselves by misusing free cash flow, self-dealing, and conducting accounting frauds (Chava et al. (2010)). In particular, entrenched managers are more likely to divert capital through payout policies (Hu and Kumar (2003)), and may choose financial policies which are sub-optimal in terms of firm value (Stulz, 1988; Shleifer and Vishny, 1989). As managerial entrenchment is related to inefficient allocation of capital, we can expect stronger investment efficiency gains for firms that are ex-ante more entrenched. Disclosing stakeholder engagements can mitigate information asymmetry and lead to changes in internal managerial practices (Ioannou and Serafeim, 2017), which should benefit the most to firms that are ex-ante more prone to entrenchment and to underinvestment. Therefore, we formulate the following hypothesis:

H2(c): After the NFRD, exposed firms that are likely to underinvest and which are more entrenched, experience a larger increase in investment efficiency.

4. Research Design and Sample Selection

This section describes our identification strategy, which exploits the EU NFRD Directive as a shock on the quality of ESG disclosure, and estimates difference-and-difference regressions comparing U.S. firms plausibly exposed to the directive, to firms *a prior* not affected. We then describe our data sources and our

sample selection process, followed by an overview of our empirical model.

4.1. Identification Strategy

To examine the effects of ESG disclosure on investment efficiency, we use the adoption the NFRD as a shock to ESG reporting quality. We estimate the effects of the NFRD using a difference-in-differences research design, where we compare outcomes for firms plausibly exposed to the NFRD (treatment group) to U.S. firms not plausibly exposed to the NFRD (control group), before and after its adoption in December 2014. Constructing such a control group allows us to establish a counterfactual of what would have happened to large U.S. firms with a EU presence if the NFRD had not been adopted. The identifying assumption is that, in the absence of the Directive, outcomes for both groups of firms would have maintained parallel trends.

Following Grewal et al. (2019), we first identify U.S. firms plausibly affected by the Directive using Compustat geographic segment data. Firms with material revenues in the EU are plausibly considered as conducting business in this region and are *a priori* subject to the NFRD if they meet the size threshold. We therefore start by identifying all firms located in one of the 28 member states as of 2014, the year of the adoption of the Directive. One difficulty is distinguishing between EU and non-EU firms when the segment name is "Europe". In our baseline analysis, we exclude firms that are located in Europe but for which there is no precision as to which country this refers to. For robustness purposes, we verify our results hold when we include these firms in our treatment group (Table 7). Once we have identified all firms operating in the EU, we only keep large firms with more than 500 employees reported in Compustat North America as of 2014. Firms located in the EU or Europe but with less than 500 employees are identified as control firms, as well as companies located in other geographic regions.

4.2. Anecdotal Evidence

We plot average disclosure scores of two treatment firms, Guess and Philip Morris (Panel A), and two control firms, Chevron and Costco (Panel B), in Figure 3. Both Guess and Philip Morris are large firms that operate in the EU for which we observe a substantial increase in ESG disclosure levels post 2014. According to recital (9) of the NFRD, firms subject to the Directive may rely on multiple standards to present sustainability information, including international frameworks such as the United Nations Global Compact (UNGC) and the Global Reporting Initiative (GRI). Guess Jeans, a Los Angeles-based clothing brand and retailer, began reporting ESG using the GRI framework in 2015, thereby complying to the NFRD. Confirm-

ing to these standards in 2015 translated into a jump from 18 to 36 in terms of ESG disclosure score. Philip Morris International Inc., a well-known cigarette and tobacco manufacturing company, joined the UNGC in 2015. It published its first Communication on Progress under the Global Compact focusing on Human Rights, Labor Rights, Environmental Responsibility, and Anti-Corruption measures in 2016. In 2017, it published its first stand-alone sustainability report reflecting its sustainability engagement for year 2016. These reporting practices, which conform to the EU Directive, translate into an increase of its ESG disclosure score from 6 to 51 in 2015, and another increase from 51 to 59 in 2017.

Contrary to these two firms, both Chevron and Costco do not report geographic segments in the EU and have not modified their ESG reporting practices in the years following the NFRD's adoption. They illustrate two different cases of control firms, one with high ESG disclosure and another with low levels pre-NFRD adoption. Chevron, a California-based energy corporation, has been consistently publishing voluntary stand-alone corporate responsibility reports from 2010 until 2018, which explains its relatively constant but high ESG disclosure score of 52. Costco, on the other hand, does not publish annual stand-alone CSR reports and does not follow a specific reporting framework, a behavior that has not changed after the passage of the EU regulation.[8] Both of these companies are examples of firms that appear unaffected by the new rules, contrary to Guess and Philip Morris.

4.3. Data and Sample Selection

We start our analysis with all public companies available in Compustat. We then select firms incorporated in the U.S., which provides some confidence that both treatment and control firms are subject to similar reporting requirements, as well as regulatory or economic shocks that occurred prior to the adoption of the NFRD in 2014. To construct treatment and control groups, we merge the Compustat North America Fundamentals data with Compustat Segment data.[9] After identifying treatment and control groups, we merge Compustat firms with Bloomberg data which provides ESG disclosure scores.[10] To merge the two datasets, we create a link table following the code provided by Freda Song on her website which links compustat gvkey to 9-digit CUSIPs, available in Bloomberg.[11] We also use this table to merge compustat firms with CRSP

[8] To obtain CSR reports, please refer to the GRI database (https://database.globalreporting.org/) or each company's website.

[9] We are thankful to Amanda Sanseverino for sharing her manually cleaned segment data, which also standardizes geographic segment names. For more details on the cleaning procedure, please refer to Sanseverino (2020).

[10] For firms with missing ESG scores in Bloomberg, we assign a score of 0 and assume they do not disclose ESG information.

[11] The link table can be found here: https://www.fredasongdrechsler.com/full-python-code/iclink

data using PERMNO identifiers. We complete the sample with data from the Thomson Reuters Ownership database, which is merged by 8-digit CUSIP from CRSP, and IBES data, which we merge with CRSP by ticker.

The sample period starts in 2012 and ends in 2017 allowing for three years before and after the adoption of the Directive. Following Dou et al. (2019), we set R&D expense to zero if it is missing in Compustat, because companies are not required to disclose their R&D expense if they are immaterial. However, we drop missing observations for all variables included in our baseline regression, as well as negative values of R&D and capital expenditures as suggested by Denis and Sibilkov (2010). Finally, we exclude all financial firms and utility firms with SIC codes between 6,000 and 6,999 and between 4,900 and 4,999. Our final sample consists of 5,366 firm-year observations, representing 1,240 U.S. companies between 2012 and 2017 (6 years). Among these, 162 are treatment firms and 1,078 are control firms.

4.4. Empirical Model

Our identification strategy relies on a difference-in-difference setting that compares firms plausibly exposed to the NFRD (treatment group) to firms plausibly not exposed to the NFRD (control group). Before examining the effects of ESG disclosure on investment, we first verify that treatment firms significantly increase their ESG disclosure quality after the adoption of the Directive, in comparison to control firms (as per hypothesis H1), by estimating the following OLS regression:

$$ESG\_Disclosure_{i,t} = \alpha Treat_i \times After_t + \beta' X_{i,t} + \gamma_i + \theta_t + \epsilon_{i,t} \tag{1}$$

With $ESG\_Disclosure_{i,t}$ the ESG disclosure score reported by Bloomberg, $Treat_i$ an indicator variable equal to one if a firm is plausibly exposed to the NFRD, $After_t$ an indicator variable equal to one for years corresponding to after the adoption of the NFRD (2015-2017), $X_{i,t}$ a vector of control variables, and γ_i and θ_t firm and year fixed effects. Standard errors are clustered at the firm level.

We then examine whether ESG disclosure improves investment efficiency to test hypothesis H2. Following Biddle and Hilary (2009), Cheng et al. (2013) and Dou et al. (2019), we estimate the triple difference-in-difference equation specified below:

$$
\begin{aligned}
Investment_{i,t} = \alpha_1 Treat_i \times After_t + \alpha_2 Treat_i \times After_t \times OverFirm_{i,t} \\
+\alpha_3 After_t \times OverFirm_{i,t} + \alpha_4 Treat_i \times OverFirm_{i,t} \\
+\alpha_5 OverFirm_{i,t} + \beta' X_{i,t} + \gamma_i + \theta_t + \epsilon_{i,t}
\end{aligned} \tag{2}
$$

The dependent variable, total investment ($Investment_{i,t}$), includes both capital and non-capital investment, and is calculated as the sum of R&D expense, acquisition expenditure, and capital expenditure, less the proceeds from sales of property, plants, and equipment, scaled by lagged total assets. $Treat_i$ is an indicator variable equal to one if a firm is plausibly exposed to the NFRD and $After_t$ is an indicator variable equal to one for years corresponding to after the adoption of the NFRD (2015-2017).

$OverFirm_{i,t}$ allows distinguishing between firms that are prone to overinvestment and those that tend to underinvest by ranking firms in our sample into two decile ranks according to cash holdings and negative leverage following Biddle and Hilary (2009). Firms that have larger cash holdings and lower leverage compared to their peers are considered to be prone to overinvestment. $X_{i,t}$ is a vector of control variables. Firm and year fixed effects (γ_i and θ_t) are included to control for time-invariant firm attributes and secular trends, respectively.[12] Standard errors are clustered at the firm level.

To ensure results are not driven by observable firm characteristics, we include an extensive list of firm characteristics in our baseline regressions ($X_{i,t}$): Size (equal to the natural logarithm of total assets), ROA, leverage, investment opportunities (MtB), the ratio of cash-flow from operations to total sales ($CFOSale$), asset tangibility ($AssetTangibility$), an indicator variable if the firm is audited by one of the Big 4 firms ($Big4$), and an indicator variable capturing whether a firm reports a loss in the year or not ($Loss$), an indicator variable equal to one if the firm pays a dividend that year ($Dividend$), bankruptcy risks ($ZScore$), and cash holdings ($Cash$). Following Biddle and Hilary (2009), we also control for key variables that could potentially affect firms' investment behaviors: the percentage of a firm's shares held by institutional investors ($Institutions$) and the number of analysts following the firms' earnings (*Analysts*). We also include measures of the volatility of a firm's cash-flow from operations ($VolCFO$), sales ($VolSales$), and investment ($VolInvestment$). In addition, we control for number of employees, given that it is a key criteria for the application of the NFRD. All variables are described in table 1.

[12]The main effects of $Treatment$ and $After$ are absorbed by firm and year fixed effects.

The first coefficient of interest, α_1, is in front of $Treat_i \times After_t$. A positive estimate would indicate that firms plausibly exposed to the NFRD, that are likely to underinvest, improve their investment efficiency, i.e., they increase their investment after the Directive is adopted in comparison to their peers plausibly not affected by the new rules. The second coefficient of interest is α_2, which measures the effect of $Treat_i \times After_t \times OverFirm_{i,t}$ on investment. The sum of α_1 and α_2 will allow us to examine whether the NFRD has an effect on firms that overinvest.

We start by estimating Equation 2 using a pooled sample which includes all U.S. firms from our treatment and control groups. The difference-in-difference approach mitigates potential biases resulting from fundamental differences between treatment and control firms, as well as from time trends in treatment firm investment unrelated to the adoption of the NFRD. However, there still remains the possibility that confounding factors may affect inferences, which we address by using matching and weighting methodologies. First, we run the analysis on a matched sample, which is obtained using propensity scores. Second, we weigh control firm observations using the entropy balancing procedure (Hainmueller, 2012). Both these methodologies allow us to mitigate the concern that treatment and control firms exhibit different pre-adoption characteristics which could potentially influence changes in investment.

5. Results

In this section, we present summary statistics before assessing the effect of the NFRD on the quality of ESG disclosure. After establishing the NFRD as an ESG disclosure quality shock, we examine the effects on investment efficiency and financing conditions.

5.1. Descriptive Statistics

Summary statistics are reported in Table 2, Panel A for our baseline sample of 1,240 U.S. companies during years 2012-2017, and Panel B separately for treatment (162) and control (1,078) firms. On average, total investment represents 14% of lagged total assets for the full sample of firms, as well as for treatment and control firms, in line with Biddle and Hilary (2009) and Chen et al. (2013).

[Table 2 about here]

On average, firms have $7.2 billions in total assets, return on assets of 5% annually, a 22% leverage, hold 17% of their assets in cash and 22% in property, plant and equipment. They have 11 analysts follow

their earnings and their shares are in majority owned by institutional investors (79%). Overall, the descriptive statistics of our variables are aligned with previous studies, which suggests that our sample is representative. In addition, as found in prior studies, although most control variables are correlated with one another, the magnitudes are not large (Table A.1 of the Appendix). Notable exceptions are $OverFirm$ and $Cash$ (0.73), $OverFirm$ and $Leverage$ (-0.58), $Size$ and $Analysts$ (0.74), $Size$ and $LogNumberEmployees$ (0.68), ROA and $Loss$ (-0.61), and ROA and $ZScore$ (0.62).

However, as can be seen from Panel B, most of the variables differ significantly when we conduct a t-test to examine if the means are equal. In particular, we find that treatment firms are, as expected, larger, have more employees, are more profitable, and payout more dividends. They are also less indebted and have less growth opportunities than their counterparts. The null hypothesis that the two means are equal is not rejected for Investment, CFOSale, Investment volatility, bankruptcy risk, cash and the logged number of employees. This indicates the need to apply covariate balance techniques to ensure the robustness of our difference-in-difference analysis.

5.2. The Effect of NFRD on the Quality of ESG Disclosure

To measure the quality of ESG disclosure, we use a proprietary Bloomberg score which captures the extent of a company's ESG disclosure. Figure 1 shows average quality of ESG disclosure for sample firms increases steadily between 2010 to 2014, pre-adoption of the NFRD, before significantly rising post 2014.

[Figure 1 about here]

The Bloomberg score quantifies a company's transparency in reporting ESG information. It ranges from 0.1 for companies that disclose a minimum amount of ESG data, to 100 for those that disclose every data point collected by Bloomberg. According to Bloomberg, each data point collected is weighted in terms of importance, with greenhouse gas emissions carrying greater weight than other disclosures. The score is also tailored to the industry sector of the company such that disclosure quality is evaluated in terms of the data that is relevant to its industry sector. More specifically, the score measures the amount of ESG data publicly reported by a company, through sustainability reports, annual reports, websites or direct contact with the company, but does not measure ESG performance.

When comparing the quality of ESG disclosure between treatment and control firms, we find that on

average between 2012 and 2017 (Table 2, Panel B), firms plausibly exposed to the NFRD have a better ESG reporting quality (21.13) compared to firms plausibly not exposed (16.31). More importantly, as can be seen in Figure 2, the quality gap between treatment and control firms widens after the adoption of the NFRD.

[Figure 2 about here]

We verify empirically that treatment firms increase the quality of their ESG disclosure post 2014, relative to control firms, as per hypothesis H1, by first examining the results of the estimation of equation 1, presented in Table 3. The coefficient in front of $Treat \times After$ is positive and highly significant, even after controlling for an extensive list of control variables, and including year, industry (Fama French 48) and firm fixed effects (columns 1 and 3) or firm and industry-year fixed effects (columns 3 and 4). On average for the 3-years window, firms affected by the NFRD have a 1.78 higher ESG disclosure score compared to their non-affected counterparts, after the Directive is adopted. This is equivalent to 10% of the average disclosure score for sample firms (17) and 11% of the average disclosure score for control firms (16.31). The effects are smaller when we examine the 2 year window (1.33), but are higher when we include industry-year fixed effects (1.96). In addition, we find that higher cash holdings positively impacts ESG disclosure quality (column 1). Other control variables are not significantly different from zero in the baseline specification. However, in other specifications, we find that asset tangibility, number of employees, institutional holdings, bankruptcy risk, and being audited by Big 4 firms have a positive effect on ESG disclosure, whereas higher profitability is associated with less disclosure.

[Table 3 about here]

In addition, we examine whether the Directive has impacted firms' propensity to improve the comparability and credibility of their ESG disclosure by adopting the GRI reporting framework, which are the most widely used sustainability reporting standards. For this purpose, we replace the dependent variable $ESG\_Disclosure$ by GRI, a dummy variable equal to 1 if a firm adopts the GRI framework, and estimate Equation 1. Results are presented in the Appendix, Table A.2. We find that firms exposed to the Directive are significantly more likely to adopt the GRI. The frequency of exposed firms adopting the GRI increased by 7% to 12% relative to control firms, in the three years that followed the adoption of the Directive, depending

on the specifications. These results suggest that exposed firms not only increased ESG disclosure, but also improved their comparability and credibility.

5.3. ESG Disclosure and Investment Efficiency

In this section, we examine whether firms exposed to ESG disclosure requirements improve their investment efficiency as per hypothesis H2. Table 4 presents the results following the estimation of Equation 2. Columns (1)-(2) show the results for a 3-years window, whereas columns (4)-(5) focus on a 2-years window. Baseline regressions include firm, year and industry fixed effects in columns (1) and (3). We also verify the results are robust to the inclusion of firm and $Industry \times Year$ fixed effects in columns (2) and (4). The estimated coefficient on $Treat \times After$ is positive and statistically significant for all specifications. This suggests that, after the adoption of the NFRD, when the likelihood of underinvestment is high, firms plausibly affected by the NFRD increase their levels of investment more than firms plausibly not affected. More specifically, we find that when the ex-ante likelihood of underinvestment is high, firms affected by the NFRD invest 6.3% of total assets more than control firms in the three years after the adoption year. This represents a 45% increase of the average investment level for sample firms (14%). The effect is smaller when we consider a 2-year window (5.5%) and when we include industry-year fixed effects (4.8%).

[Table 4 about here]

As expected, we find that firm size and leverage positively influence investment, as well as higher growth opportunities, albeit not significantly. Holding more cash and higher shares of tangible assets predict lower levels of investment. Similarly, a higher number of employees or analyst followers is associated with less investment. In addition, we find that institutional ownership plays a positive albeit insignificant role in relation with investment. Overall, these results are in line with the literature examining the role of financial reporting quality and investment.

Regarding firms that are prone to overinvestment, when examining the three-year window (column 1), we find that the sum of the coefficients in front of $Treat \times After$ and $Treat \times After \times OverFirm$ is equal to -1.9%, but it is not significantly different from 0 (p-value of 0.44). Focusing on the 2-year window (column3), we find that the sum of the coefficients does not significantly differ from 0 (p-value of 0.88). This suggests that firms plausibly impacted by the NFRD that are likely to overinvest do not significantly change

their investment behavior. Including industry-year fixed effects provides similar estimates.

In addition, we estimate a simple difference-in-difference regression excluding the $OverFirm$ variable for three subsamples of firms with varying levels of cash and leverage, as reported in Table A.3 of the Appendix. We find that investment efficiency gains are driven by firms in the lowest quintiles of cash levels and highest quintile in terms of leverage, which are firms that are likely to underinvest.

Finally, we verify the validity of the parallel trends assumption, i.e. the assumption that if the NFRD had not been adopted, relative trends in investments would have been the same for treatment and control firms. Although the parallel trends assumption cannot be directly tested because the counterfactual is unobservable, we can use pre-adoption trends as evidence that it holds. As we can see from Figure 4, treatment firms do not significantly differ in terms of investment levels pre-2014, relative to their counterparts, in years 2010 to 2013. We verify that the coefficients for these years are all not significantly different from zero.

[Figure 4 about here]

5.4. ESG Disclosure and Financing

In addition to examining the effect of ESG disclosure on investment efficiency, we investigate whether the adoption of the NFRD has had an impact on firms' sources of financing and cost of equity. We construct two external financing measures following Baker et al. (2003). New equity issues ($NewEquity$) are computed as the ratio of external equity to start-of-year book assets, where external equity is equal to the change in book equity minus the change in retained earnings. New debt issues ($NewDebt$) is equal to the ratio of debt issues to start-of-year book assets, with debt issues obtained as the total change in assets minus the change in book equity. In addition, we construct a measure of the cost of equity using the bid-ask spread. It is obtained as the annual median of monthly quoted spreads (i.e. the difference between the bid and ask price each month).

We report regression results of Equation 2 where we replace the dependent variable by the bid-ask spread (column 1), debt issuance (column 2), and equity issuance (column 3) in Table 5. Our results indicate that firms prone to underinvestment are able to raise more debt after the adoption of the NFRD, consistent with the increased transparency brought by the disclosure of ESG information. More specifically, we find that treatment firms issue an additional 8.73% of debt relative to total assets compared to their counterparts not affected by the Directive. However, we find no evidence of an effect among firms prone to overinvestment (the sum of the coefficients on $Treat \times After$ and $Treat \times After \times OverFirm$ being equal to -0.03 but

with a p-value of 0.4256). Furthermore, we find no evidence of an impact on new equity issuance nor on the bid-ask spread.

Overall, our results seem to indicate that better ESG disclosure helps financially constrained firms issue debt to fund profitable investment projects, but does not improve their equity financing conditions. In comparison, Dou et al. (2019) find that improving accounting quality allowed firms prone to underinvestment to raise both equity and debt, and to reduce information asymmetries on equity markets.

5.5. Cross-sectional Analysis

In this section, we examine the cross-section variation in investment efficiency around the adoption of the NFRD, to provide further evidence on hypothesis H2. In particular, we verify the validity of hypothesis H2(a), H2(b), and H2(c) by estimating Equation 2 separately for firms with high and low ESG disclosure scores before the adoption of the NFRD, for firms with high and low financial constraints, and for firms more or less likely to entrenched.

Table 6, columns (1) and (2) report the results after partitioning for high and low levels of ESG disclosure quality before the adoption of the NFRD. We find that the results are strongest for firms that have ex-ante lower levels of ESG disclosure and are therefore more likely to improve their disclosures post-NFRD. Low ex-ante ESG disclosure firms that underinvest have a coefficient of 8.8% which is almost double the size of the coefficient for firms with high ESG disclosure quality (5.5%). These results show that firms with unreliable ESG disclosure improve their investment efficiency more than those already disclosing sustainability information before the EU mandate, as they *a priori* benefit the most from improved ESG disclosure.

Furthermore, we partition our sample in two additional subsamples: those with above-median levels of change in ESG disclosure post-NFRD, and those with below-median changes. This assures us the results are driven by firms which significantly increase their quality of disclosure after the Directive is adopted, whether or not they have ex-ante high or low levels of ESG disclosure. We find corroborating evidence that the results are driven by these firms, as can be seen from Table A.4

[Table 6 about here]

We then test hypothesis H2(b) by proxying for financial constraint using the Kaplan-Zingales (KZ) Index, which is a relative measurement of reliance on external financing. We construct the KZ index following

Lamont et al. (2001). Companies with a higher KZ-Index are more likely to experience difficulties when financial conditions tighten since they may have difficulty financing their ongoing operations. Table 6, columns (3) and (4) report the results after partitioning for high and low financial constraint subsamples based on whether firms have an above or below median KZ-index. Consistent with hypothesis H2(b) we find that firms with higher financial constraints improve their investment efficiency more than those with low levels of financial constraints. The coefficient on $Treat \times After$ is 6.3% for high KZ firms but only 5.5% for low KZ firms. These results suggest that the NFRD mitigates the adverse selection problem to a greater extent for underinvesting firms that have higher financial constraints.

Finally, we verify whether H2(c) holds, by partitioning the sample of firms into high and low managerial entrenchment pre-NFRD, proxied by the CEO's share of stock ownership. The results reported in columns (5) and (6) indicate that investment efficiency gains for firms likely to underinvest are driven by firms with higher risk of being entrenched. The coefficient on $Treat \times After$ is 8.6% for firms with above median pre-NFRD shares of CEO ownership, and is not significant for firms below median. Furthermore, we verify these results are consistent when we use other proxies for managerial entrenchment: the ratio of CEO salary to total compensation and the ratio of CEO Salary to total sales. The results are presented in Table A.5, in the Appendix. Finally, we also verify that firms with higher risk of being entrenched are those that significantly increase their debt issuance post-NFRD. As can be seen from Table A.7, exposed firms that are likely to underinvest issue an additional 10.5% of debt scaled by total assets, relative to control firms. Overall, these results provide further evidence that increased ESG disclosure mitigates information asymmetry which results in investment efficiency gains.

6. Robustness Analysis

In this section, we conduct a series of robustness tests to provide further confidence in our setting and the internal validity of our research design. We start by examining the sensitivity of our results to choosing different samples (Table 7). First, we reduce the control group to firms that have an international presence, i.e., we exclude domestic firms solely operating in the U.S. We find that the effect of the NFRD on treatment firms prone to underinvestment reduces in magnitude (5.6%) but remains significantly different from zero (column 2). Second, we compare firms exposed to the NFRD to firms also operating in the EU, but not affected by the Directive as they remain below the size threshold as of 2014. We find a much stronger effect

(31%) although significance reduces (column 3). Focusing on this sample allows us to address the concern that the results are driven by the post-EU crisis recovery and extremely low or negative interest rates in the EU, as all firms included in this sample have EU operations and therefore potential access to the EU market. Third, we modify the treatment group by including all firms with a presence in Europe. A key issue with this group is that it includes firms that may not be in the EU and therefore may not be affected by the NFRD. The results presented in column (3) indicate a much smaller effect (2.8%) post-NFRD, in coherence with our expectations, as inclusion of non-EU firms should underestimate the real impact of the NFRD.

A second concern relates to the validity of our difference-in-difference approach which relies on the equal trends assumption, i.e. that no-time varying differences exist between the treatment and control group. In addition to verifying that investment is similar for both treatment and control groups pre-adoption of the NFRD (Figure 4), we conduct a placebo test (Table 8). We start by assigning fake years to the adoption of the Directive: 2013 (column 1) and 2012 (column 2). We then assign fake treatment groups based on different geographic locations. In column (3), we assign U.S. firms with a presence in Asia (or any Asian country) to the treatment group, and in column (4) we assume that U.S. firms present in Australia are the ones plausibly affected by the Directive. Overall, we find no significant effect for these specifications, providing further validity to our setting and confidence in the equal trend assumption.

A third concern is that treatment and control firms appear to differ in terms of observable characteristics (Table 2, Panel B). To mitigate the possibility that confounding factors affect our inferences, we conduct propensity score matching and entropy balancing. Matching and other propensity score methods are techniques that preprocess data prior to the estimation of binary treatment effects under the assumption of selection on observables (Ho et al., 2007; Sekhon, 2009; Hainmueller, 2012). By reweighting or discarding units, these methods permit adjusting the covariate distribution of the control group so that it becomes more similar to the covariate distribution of the treatment group. Preprocessing the data reduces model dependency when examining treatment effects (Abadie and Imbens, 2011).

Propensity-score matching allows us to construct an artificial control group by matching treated firms with a non-treated firm with similar observable characterstics. We compute propensity scores by estimating the following logit regression as of 2012, two years before the adoption of the NFRD:

$$Treat_i = \alpha_0 + \beta' X_i + \lambda_i + \epsilon_i \tag{3}$$

With $Treat_i$ the indicator variable equal to one if a firm is plausibly exposed to the NFRD and X_i the vector of control variables included in the baseline regression defined in Equation 2. Nearest neighbor matching allows us to match 128 treatment firms with control firms that have the closest propensity score. As we can see from Table 9 and Figure 5, covariate balance is significantly improved for all control variables after matching. Standardized mean differences are all less than 0.15 and p-values are significantly larger than 0.05 allowing us not to reject the null hypothesis that the mean values of treatment and control are equal.

We complement our matching approach with entropy balancing, a reweighting method that produces improved covariate balance resulting in estimated treatment effects that are less sensitive to sample composition and model choice (Hainmueller, 2012). More specifically, pre-adoption control firm observations are reweighted to match the distributional properties of the treatment firm observations. Entropy weights are constructed at the firm level based on mean values of control variables for the pre-adoption period (2012-2014), as well as industry dummies (according to the Fama and French 48-Industry classification). As we can see from Table 9, entropy weighting produces nearly identical covariate balance in the pre-adoption period. Standardized mean differences are all below 0.001 except for $CFOSale$, where the SMD is 0.016.

Both methodologies allow us to conclude that the adoption of the NFRD has a positive and significant impact on the investment efficiency of firms that are likely to underinvest. Table 10 presents the results of the baseline regression specified in Equation 2 using both PSM and entropy balancing. The weighted results indicate that the magnitude of the effect is between 4.8% and 5.3%, smaller than what we obtain in our baseline analysis (6.3%). In addition, although the coefficient in front of the triple interaction term is negative and statistically significant, we find that the sum of the two coefficients in front of $Treat \times After$ and $Treat \times After \times OverFirm$ is not significantly different from 0 (p-values equal to 0.10 and 0.19 respectively), indicating no effect on firms that are likely to overinvest.

Finally, we verify that the parallel trend is consistent after matching and entropy balancing. The results provided in Table 11 show that there is no pre-trend before 2015 and that the behavioral response to the NFRD in terms of investment is strongest in 2016. Overall, these results provide evidence on the internal validity of our difference-in-difference setting and mitigate concerns of confounding factors affecting our inferences.

Conclusion

This study is the first to provide empirical evidence on the effects of ESG disclosure on firms' investment efficiency. Our quasi-experimental approach allows us to provide plausibly causal evidence suggesting that the adoption of the EU Directive on non-financial reporting has increased investment levels of potentially exposed U.S. firms which are ex-ante more likely to underinvest, by 6.3% of total assets relative to similar U.S. firms with no exposure to the EU. The results are strongest for firms with initially low levels of ESG disclosure, with more financial constraints, as measured by the KZ index, and which are more entrenched. In addition, our results show that increased quality of ESG disclosure affects firms' issuance of new debt. This suggests that enhanced ESG disclosure plays a role in reducing information asymmetries that reside in the corporate debt market. However, we find no evidence that better ESG disclosure reduces frictions in the equity market.

It is essential to understand the implications of requiring more and better ESG on firms' behavioral response given the increased demand for ESG-related information. Our findings suggest that non-financial reporting plays a role in improving investment efficiency, which can in turn have significant consequences on the real economy. In addition, as we become more aware of the effects of climate change, corporations must play a central role in facilitating the transition towards a more sustainable economy, including in terms of how much information they share with stakeholders.

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Figure 1: Average ESG Disclosure Score for U.S. Firms

This figure presents average levels of ESG disclosure for U.S. firms included in our extended sample from 2010 to 2017. ESG disclosure scores are obtained from Bloomberg. The NFRD was adopted in 2014, as represented by the dashed line.

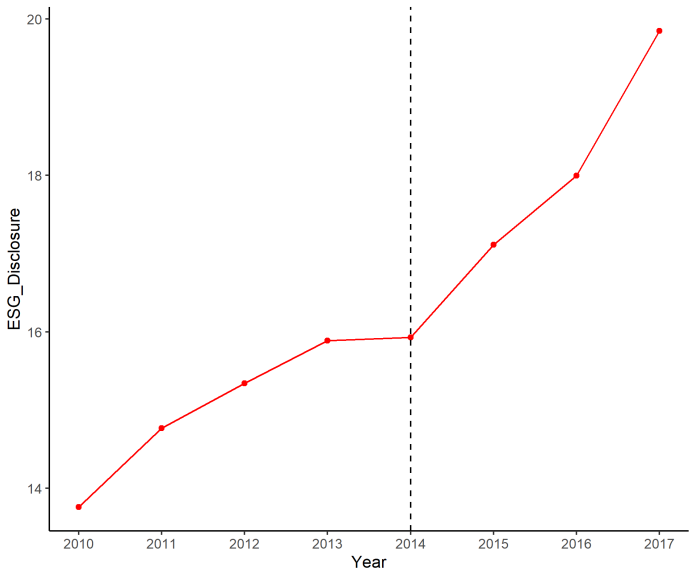


Figure 2: Average ESG Disclosure Score for Treatment and Control Firms

In this figure we plot average levels of ESG disclosure separately for treatment and control firms between 2010 and 2017. ESG disclosure scores are obtained from Bloomberg. The NFRD was adopted in 2014, as represented by the dashed line.

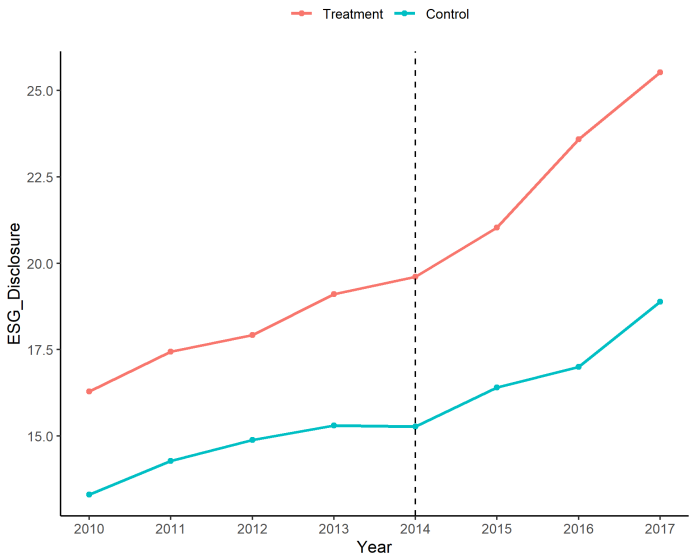
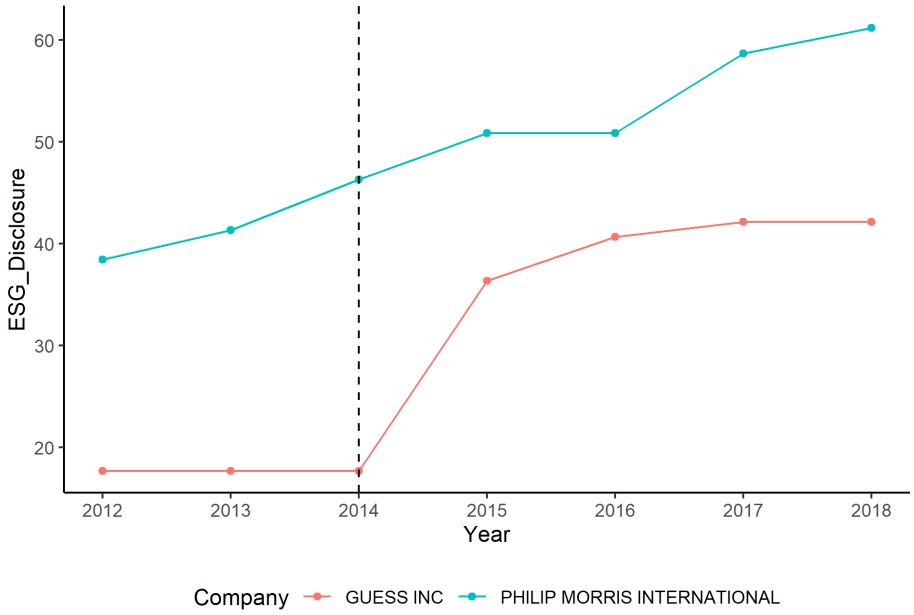


Figure 3: Annual ESG Disclosure Scores of Four U.S. Companies

This figure plots average ESG disclosure scores for two treatment firms, Guess and Philip Morris, and two control firms, Chevron and Costco. ESG disclosure scores are obtained from Bloomberg. The NFRD was adopted in 2014, as represented by the dashed line.

Panel A: Annual ESG Disclosure Scores of Two Treatment Firms



Panel B: Annual ESG Disclosure Scores of Two Control Firms

Figure 4: Parallel Trend

This figure plots coefficient estimates from the baseline regression defined in Equation 2 estimated by replacing $Treat \times After$ with separate interaction indicators for each sample year (other than 2014, which serves as the benchmark). The NFRD was adopted in 2014, as represented by the dashed horizontal line.

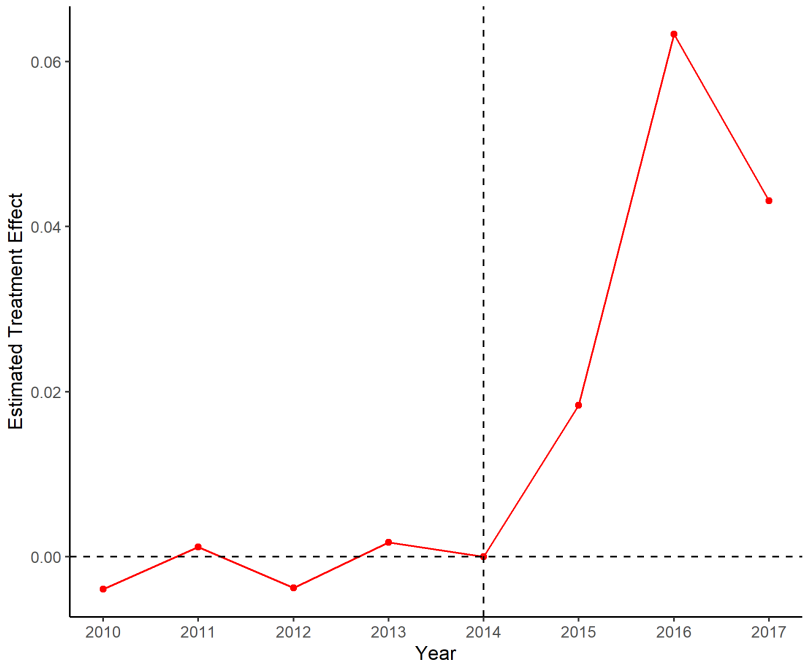


Figure 5: Covariate Balance Before and After Matching

This love plot displays standardized mean differences for all covariates included in the baseline regression defined in Equation 2, before and after matching. Nearest neighbor matching is conducted using propensity scores computed from a logit regression defined in Equation 3. Industry dummies are not presented although they are included in the regression.

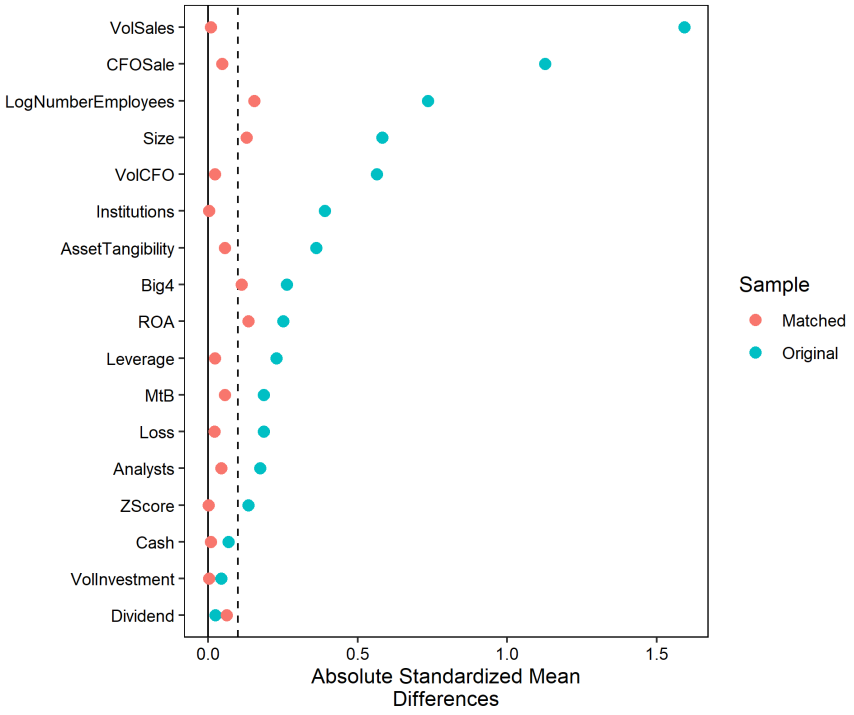


Table 1: Variables and Data Sources

Variable	Definition	Data Source
	A: Dependent Variables	
ESG_Disclosure$_{i,t}$	The ESG disclosure score of firm i in year t, as reported by Bloomberg. It measures the quality and amount of ESG data a company reports publicly, but does not capture the company's ESG performance.	Bloomberg
GRI$_{i,t}$	A dummy variable equal to 1 if firm i in year t has used the Global Reporting Initiative (GRI) framework for its ESG reporting, as reported by Bloomberg. It measures quality of disclosure, and in particular the comparability.	Bloomberg
Investment$_{i,t}$	Investment measure for firm i in year t. It is equal to the sum of research and development expenditures (xrd), capital expenditures (capex), and acquisition expenditures (aqc), net of proceeds from sales of property, plant, and equipment (sppiv), scaled by lagged total assets (at).	Compustat North America
BidAskSpread$_{i,t}$	The yearly median of monthly quoted spreads for firm i in year t, measured as the average of the difference between the bid and ask price for each trading month.	Compustat North America
NewEquity$_{i,t}$	Net equity issuance for firm i in year t. It is measured as the change in book equity minus the change in retained earnings over lagged total assets ($\Delta ceq + \Delta txrd - \Delta re)/lag(at)$), following Baker et al. (2003).	Compustat North America
NewDebt$_{i,t}$	Net debt issuance for firm i in year t. It is measured as the change in assets minus the change in book equity over lagged total assets ($\Delta at - \Delta ceq - \Delta txrd)/lag(at)$, following Baker et al. (2003).	Compustat North America
	B: Independent Variables	
Treat$_i$	An indicator variable equal to 1 if firm i discloses a country-level geographic segment for the EU in 2014, and zero otherwise.	Compustat Segment Data
After$_t$	An indicator variable equal to one if year t is 2014, the year the NFRD directive was adopted, or later, and zero otherwise.	European Commission
OverFirm$_{i,t}$	A ranked variable based on the average of an annual ranked (deciles) measure of cash (che/at) and leverage within an industry. Leverage is multiplied by negative one before ranking so that both variables are increasing in the likelihood of over-investment. Following Biddle and Hilary (2009) and Cheng et al. (2013), the leverage variable used in measuring OverFirm is defined as: dltt over (dltt+csho*prccf) .	Compustat North America
	C: Control Variables	
MtB$_{i,t}$	The market-to-book ratio for firm i in year t. It is calculated as total assets (at) + market value of equity(csho*prccf) - common equity (ceq) - deferred taxes (txdb), scaled by total assets (at).	Compustat North America
Size$_{i,t}$	The natural logarithm of total assets (at) for firm i in year t.	Compustat North America
Leverage$_{i,t}$	The ratio of long-term debt(dltt) + current debt (dlc) and total assets (at).	Compustat North America
ROA$_{i,t}$	The return on assets of firm i in year t, computed as the ratio of net income (ni) and lagged total assets (at).	Compustat North America
Institutions$_{i,t}$	The percentage of firm i's shares held by institutional investors as of year t (InstOwn_Perc).	Thomson Reuters Ownership Database
Analysts$_{i,t}$	The number of analysts covering the earnings per share of firm i in year t.	IBES
CFOSale$_{i,t}$	The ratio of cash flow from operations (oancf) over sales (sale) of firm i in year t.	Compustat North America
AssetTangibility$_{i,t}$	The ratio of property, plant, and equipment (ppent) over total assets (at) for firm i in year t.	Compustat North America
Big4$_{i,t}$	An indicator variable equal to 1 if firm i in year t is audited by one of the Big 4 audit firms (Deloitte, PwC, EY, or KPMG), and zero otherwise.	Compustat North America
Loss$_{i,t}$	An indicator variable equal to 1 if firm i in year t reports a loss, and zero otherwise.	Compustat North America
Dividend$_{i,t}$	An indicator variable equal to 1 if firm i i distributes a dividend in year t, and zero otherwise.	Compustat North America
VolCFO$_{i,t}$	The standard deviation of cash flows from operations (oancf) divided by average total assets (at) from years t-5 to t-1.	Compustat North America
VolInvestment$_{i,t}$	The standard deviation of investment from years t-5 to t-1.	Compustat North America
VolSales$_{i,t}$	The standard deviation of sales (sale) divided by average total assets (at) from years t-5 to t-1.	Compustat North America
ZScore$_{i,t}$	The Z-score for firm i in year t calculated as 3.3*(pi) + (sale) + 0.25*(invt) + 0.5*(act-lct), divided by total assets (at).	Compustat North America
Cash$_{i,t}$	Cash holdings of firm i in year t computed as the ratio of cash (che) over total assets (at).	Compustat North America
LogNumberEmployees$_{i,t}$	The natural logarithm of one plus the number of employees of firm i in year t.	Compustat North America
	D: Variables for cross-sectional analysis	
KZ_i,t	The Kaplan-Zingales Index for firm i in year t. It measures the relative reliance on external financing, and is computed following Lamont et al. (2001).	Compustat North America
$CEO\_Ownership_{i,t}$	Firm i's CEO ownership in year t expressed in % (SHROWN_TOT_PCT). This variable proxies for managerial entrenchment. Alternative measures are CEO salary scaled by total compensation ($CEO\_Salary/TDC2$) or sales ($CEO\_Salary/Sales$).	ExecuComp Annual Compensation
$BoardInd_{i,t}$	An indicator variable which equals to 1 if firm i has an independent board in year t.	ISS Director Data

Table 2: Summary Statistics (2012-2017)

This table reports summary statistics of regression variables, in Panel A for the baseline sample of 1,240 U.S. firms, and in Panel B, for treatment and control firms separately. The sample period spans years 2012 to 2017. Treatment firms are U.S. firms plausibly exposed to the NFRD adopted in 2014, with activities located in the EU and more than 500 employees. Control firms are U.S. firms that plausibly not affected by the NFRD. $Treat$ is an indicator variable equal to 1 if a firm is part of the treatment group, and 0 otherwise, and $After$ equal to 1 for years after the adoption of the NFRD (i.e., 2015-2017). $ESG\_Disclosure$ is a disclosure score provided by Bloomberg. $Investment$ is equal to the sum of capital, R&D and acquisition expenditures, net of proceeds from sales of PPE, and scaled by lagged total assets. $OverFirm$ is a ranked variable based on cash and leverage which identifies the likelihood of overinvestment. $BidAskSpread$ $NewEquity$ and $NewDebt$ are measures of external financing that capture the scaled amounts of new equity and debt issued. Remaining variables are firm characteristics included as controls in the baseline regression defined in Equation 2 and described in Table 1.

A: Full Sample of U.S. Firms

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
ESG_Disclosure	5,366	17.033	11.585	0.000	11.157	18.595	73.967
Investment	5,366	0.142	0.179	−0.046	0.046	0.169	2.595
Treat	5,366	0.150	0.357	0	0	0	1
After	5,366	0.503	0.500	0	0	1	1
TreatxAfter	5,366	0.075	0.264	0	0	0	1
OverFirm	5,366	0.487	0.287	0.000	0.222	0.722	1.000
Institutions	5,366	0.724	0.253	0.0002	0.590	0.920	1.000
Analysts	5,366	10.587	9.037	1	4	15	56
Size	5,366	6.982	1.875	1.495	5.707	8.191	13.004
ROA	5,366	0.016	0.176	−3.308	−0.007	0.086	0.953
Leverage	5,366	0.243	0.252	0.000	0.035	0.365	4.755
MtB	5,366	2.094	3.021	0.385	1.214	2.345	195.062
CFOSale	5,366	−0.407	32.028	−1,355.833	0.038	0.164	1,660.113
AssetTangibility	5,366	0.266	0.239	0.000	0.079	0.384	0.989
Big4	5,366	0.775	0.418	0	1	1	1
Loss	5,366	0.269	0.444	0	0	1	1
Dividend	5,366	0.508	0.500	0	0	1	1
VolCFO	5,366	0.056	0.057	0.001	0.025	0.067	1.039
VolInvestment	5,366	0.102	0.293	0.000	0.022	0.108	9.838
VolSales	5,366	0.001	0.006	0.00000	0.00003	0.001	0.244
ZScore	5,366	1.326	1.215	−17.610	0.751	1.897	8.746
Cash	5,366	0.168	0.186	0.000	0.034	0.232	0.980
LogNumberEmployees	5,366	7.871	2.159	0.000	6.502	9.246	14.648
BidAskSpread	5,355	0.003	0.006	0.00005	0.0003	0.002	0.109
NewEquity	5,154	0.049	0.281	−0.827	−0.011	0.030	7.490
NewDebt	5,299	0.055	0.217	−1.281	−0.024	0.080	4.234

B: Treatment and Control Firms

	Treatment Firms			*Control Firms*			
	N	Mean	Median	N	Mean	Median	p-value
ESG_Disclosure	805	21.13	16.12	4561	16.31	14.05	0.000
Investment	805	0.14	0.10	4561	0.14	0.09	0.178
OverFirm	805	0.50	0.50	4561	0.49	0.44	0.290
Institutions	805	0.79	0.86	4561	0.71	0.79	0.000
Analysts	805	11.78	10.00	4561	10.38	7.00	0.000
Size	805	7.76	7.66	4561	6.84	6.79	0.000
ROA	805	0.05	0.05	4561	0.01	0.04	0.000
Leverage	805	0.22	0.20	4561	0.25	0.21	0.000
MtB	805	1.86	1.58	4561	2.14	1.63	0.000
CFOSale	805	0.12	0.10	4561	-0.50	0.09	0.226
AssetTangibility	805	0.22	0.18	4561	0.27	0.19	0.000
Big4	805	0.86	1.00	4561	0.76	1.00	0.000
Loss	805	0.17	0.00	4561	0.29	0.00	0.000
Dividend	805	0.59	1.00	4561	0.49	0.00	0.000
VolCFO	805	0.04	0.03	4561	0.06	0.04	0.000
VolInvestment	805	0.08	0.04	4561	0.10	0.05	0.126
VolSales	805	0.00	0.00	4561	0.00	0.00	0.000
ZScore	805	1.32	1.27	4561	1.33	1.26	0.812
Cash	805	0.17	0.13	4561	0.17	0.10	0.468
LogNumberEmployees	805	8.77	8.65	4561	7.71	7.86	0.178

Table 3: Impact of the NFRD on the Quality of ESG Disclosure

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on ESG disclosure using a difference-in-difference approach, as defined in Equation 1. Columns (1) and (2) focus on the 2012-2017 periods corresponding to a 3-year window, while columns (3) and (4) focus on a 2-year window. Columns (2) and (4) present results from estimations with yearxindustry fixed effects rather than year and industry fixed effects, where industries are based on the Fama-French 48-industry classification. The dependent variable is a disclosure quality measure provided by bloomberg ($ESG\_Disclosure$). $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	ESG_Disclosure			
DID Window:	2012-2017 (3-Year)		2013-2016 (2-Year)	
Model:	(1)	(2)	(3)	(4)
Variables				
TreatxAfter	1.784***	1.961***	1.331***	1.681***
	(0.5688)	(0.5932)	(0.5075)	(0.5322)
MtB	-0.0793	-0.0033	-0.1103	-0.0957
	(0.1001)	(0.0987)	(0.1127)	(0.1083)
Institutions	-0.0200	0.7993	1.932	2.615*
	(0.9848)	(1.08)	(1.249)	(1.413)
Analysts	0.0213	-0.0213	0.0004	-0.0116
	(0.0544)	(0.0565)	(0.0691)	(0.0714)
Size	0.3419	0.5225	0.2161	0.2969
	(0.3527)	(0.3593)	(0.4199)	(0.4272)
ROA	0.0968	-0.4077	-1.18*	-1.323*
	(0.5708)	(0.5860)	(0.7165)	(0.7120)
Leverage	-0.4728	-0.2147	0.0462	0.3199
	(0.6674)	(0.6749)	(0.6718)	(0.7004)
LogNumberEmployees	0.4188	0.6447*	0.5256*	0.7032**
	(0.3095)	(0.3399)	(0.2945)	(0.3445)
VolCFO	-0.1085	-0.3508	2.703	2.89
	(2.63)	(2.851)	(4.562)	(4.908)
VolInvestment	0.2060	0.2256	1.082	1.17
	(0.2035)	(0.2653)	(0.8665)	(0.8977)
VolSales	18.47	9.535	-7.19	-9.6
	(15.74)	(12.74)	(15.04)	(12.42)
ZScore	0.1305	0.3641*	0.2445	0.3866*
	(0.1835)	(0.1966)	(0.2124)	(0.2276)
Cash	1.826*	1.262	0.9522	0.5913
	(1.076)	(1.136)	(1.142)	(1.176)
Big4	0.5574	0.7489**	0.6363	0.7773*
	(0.3975)	(0.3632)	(0.4029)	(0.3977)
Loss	0.1072	0.0941	0.4342*	0.3967*
	(0.1933)	(0.1928)	(0.2377)	(0.2361)
Dividend	0.2717	0.0670	0.7548	0.4817
	(0.3690)	(0.3737)	(0.5265)	(0.5406)
CFOSale	0.0040	0.0071	0.0048	0.0065
	(0.0034)	(0.0053)	(0.0037)	(0.0046)
AssetTangibility	2.926	1.737	3.867**	3.242
	(1.782)	(1.844)	(1.935)	(2.12)
Fixed-effects				
Year	Yes		Yes	
Industry	Yes		Yes	
Firm	Yes	Yes	Yes	Yes
Year×Industry		Yes		Yes
Fit statistics				
Observations	5,366	5,366	3,598	3,598
R^2	0.92547	0.93043	0.94328	0.94612
Within R^2	0.01607	0.02081	0.02111	0.02686

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 4: ESG Disclosure and Investment Efficiency

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on investment efficiency using a difference-in-difference approach, as defined in Equation 2. Columns (1) and (2) focus on the 2012-2017 periods corresponding to a 3-year window, while columns (3) and (4) focus on a 2-year window. Columns (2) and (4) present results from estimations with yearxindustry fixed effects rather than year and industry fixed effects, where industries are based on the Fama-French 48-industry classification. The dependent variable $Investment$ is equal to the sum of capital, R&D and acquisition expenditures net of sales from PPE, scaled by lagged total assets. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment			
DID Window:	2012-2017 (3-Year)		2013-2016 (2-Year)	
Model:	(1)	(2)	(3)	(4)
Variables				
TreatxAfter	0.0630***	0.0484**	0.0553**	0.0473**
	(0.0206)	(0.0227)	(0.0226)	(0.0235)
TreatxAfterxOverFirm	-0.0822*	-0.0672	-0.0591	-0.0514
	(0.0419)	(0.0421)	(0.0428)	(0.0415)
AfterxOverFirm	0.0405*	0.0543***	0.0276	0.0440**
	(0.0208)	(0.0188)	(0.0209)	(0.0201)
TreatxOverFirm	0.0622	0.0815	-0.1746**	-0.1563*
	(0.0754)	(0.0749)	(0.0870)	(0.0878)
MtB	0.00008	0.00005	0.0028	0.0025
	(0.0034)	(0.0034)	(0.0071)	(0.0067)
Institutions	0.0072	0.0120	-0.0112	-0.0001
	(0.0361)	(0.0368)	(0.0543)	(0.0541)
Analysts	-0.0075***	-0.0075***	-0.0081***	-0.0088***
	(0.0013)	(0.0015)	(0.0020)	(0.0022)
Size	0.2094***	0.2108***	0.3046***	0.3087***
	(0.0229)	(0.0229)	(0.0377)	(0.0368)
ROA	-0.0928	-0.0909	-0.2276	-0.2160
	(0.1061)	(0.1076)	(0.1396)	(0.1364)
Leverage	0.1691***	0.1680***	0.1601***	0.1519***
	(0.0445)	(0.0434)	(0.0464)	(0.0429)
LogNumberEmployees	-0.0349*	-0.0415**	-0.0290	-0.0375
	(0.0201)	(0.0192)	(0.0311)	(0.0287)
VolCFO	0.0603	0.0629	0.2560	0.2779
	(0.1676)	(0.1702)	(0.2899)	(0.2858)
VolInvestment	-0.0535	-0.0523	-0.3523**	-0.3369**
	(0.0372)	(0.0343)	(0.1651)	(0.1539)
VolSales	0.0406	-0.1047	0.2484	-0.0347
	(1.51)	(1.56)	(2.159)	(2.131)
ZScore	-0.0022	-0.0077	-0.0008	-0.0088
	(0.0127)	(0.0131)	(0.0178)	(0.0180)
Cash	-0.4303***	-0.4237***	-0.4841***	-0.4802***
	(0.0627)	(0.0621)	(0.0912)	(0.0873)
Big4	-0.0067	-0.0045	-0.0178	-0.0154
	(0.0157)	(0.0154)	(0.0178)	(0.0178)
Loss	-0.0139	-0.0127	-0.0171	-0.0184
	(0.0132)	(0.0135)	(0.0162)	(0.0164)
Dividend	-0.0105	-0.0096	-0.0156	-0.0176
	(0.0105)	(0.0107)	(0.0160)	(0.0157)
CFOSale	-0.0002	-0.0002	-0.0008	-0.0008
	(0.0002)	(0.0002)	(0.0007)	(0.0006)
AssetTangibility	-0.2264**	-0.2263**	-0.3086**	-0.2830*
	(0.0971)	(0.0944)	(0.1567)	(0.1486)
OverFirm	0.4315***	0.4116***	0.4662***	0.4411***
	(0.0488)	(0.0452)	(0.0674)	(0.0625)
Fixed-effects				
Year	Yes		Yes	
Industry	Yes		Yes	
Firm	Yes	Yes	Yes	Yes
Year×Industry		Yes		Yes
Fit statistics				
Observations	5,366	5,366	3,598	3,598
R^2	0.58746	0.61443	0.66631	0.68853
Within R^2	0.22308	0.21611	0.31724	0.30649

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 5: Bid-ask Spread and New Capital Raised around the adoption of the NFRD

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on bid-ask spreads, new debt and new equity issues. The specification follows the one defined in Equation 2 but replaces investment by external financing measures. $BidAskSpread$ is equal to the year median of monthly quoted stock price spreads. $NewDebt$ and $NewEquity$ are annual measures of new debt and equity issued. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variables:	BidAskSpread	NewDebt	NewEquity
Model:	(1)	(2)	(3)
Variables			
TreatxAfter	-0.0005	0.0873***	0.0294
	(0.0004)	(0.0324)	(0.0223)
TreatxAfterxOverFirm	0.0007	-0.1150*	-0.0108
	(0.0006)	(0.0611)	(0.0497)
AfterxOverFirm	-0.0004	0.0710***	-0.0831**
	(0.0004)	(0.0235)	(0.0338)
TreatxOverFirm	-0.0003	0.0329	0.0838
	(0.0008)	(0.1051)	(0.0816)
OverFirm	-0.0004	0.6110***	0.0754
	(0.0005)	(0.0614)	(0.0547)
Controls	Yes	Yes	Yes
Fixed-effects			
Year	Yes	Yes	Yes
Firm	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Fit statistics			
Observations	5,355	5,299	5,154
R^2	0.84764	0.49049	0.62835
Within R^2	0.08314	0.2824	0.31135

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 6: Cross-sectional Variation in Investment Efficiency around the adoption of the NFRD

This table provide the estimation results from our baseline regression defined in Equation 2, by partitioning the sample. In columns (1) and (2), we partition the sample into high and low pre-adoption ESG disclosure levels. In columns (3) and (4), we partition into high and low financial constraint estimates, proxied by the KZ index. In columns (5) and (6), we partition into high and low manager entrenchment proxied by the stock ownership of the CEO. High and Low partitioning is conducted based on below and above median levels. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment					
Cross-section:	ESG Disclosure		KZ Index		CEO Ownership	
	High	Low	High	Low	High	Low
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
TreatxAfter	0.058**	0.081**	0.063*	0.052*	0.086*	0.008
	(0.028)	(0.034)	(0.036)	(0.029)	(0.045)	(0.026)
TreatxAfterxOverFirm	-0.065	-0.146**	-0.096	-0.078*	-0.105	-0.011
	(0.057)	(0.064)	(0.105)	(0.046)	(0.075)	(0.057)
TreatxOverFirm	-0.058	0.238*	0.134	0.031	0.054	0.024
	(0.088)	(0.127)	(0.140)	(0.064)	(0.101)	(0.111)
AfterxOverFirm	0.015	0.076***	-0.017	0.078***	0.056	0.041
	(0.031)	(0.028)	(0.037)	(0.025)	(0.041)	(0.036)
OverFirm	0.463***	0.498***	0.682***	0.287***	0.346***	0.446***
	(0.074)	(0.077)	(0.085)	(0.042)	(0.063)	(0.079)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed-effects						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	2,301	2,144	2,681	2,681	1,710	1,710
R^2	0.57812	0.58103	0.63386	0.75754	0.62918	0.70383
Within R^2	0.27712	0.25708	0.27691	0.33519	0.35226	0.41229

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 7: Sensitivity to Treatment and Control Groups

This table explores the sensitivity of our baseline OLS estimations of the effect of the NFRD on investment efficiency (Equation 2) to different treatment and control groups. In Column (2) we modify the baseline control group by excluding firms that are domestic only, i.e. we keep only international firms, while in column (3) we restrict our analysis to firms with operations in the EU. Column (4) modifies the treatment group to include firms with activities located in Europe, with no distinction as to whether they are located in the EU or not. The dependent variable $Investment$ is equal to the sum of capital, R&D and acquisition expenditures net of sales from PPE, scaled by lagged total assets. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment			
Sample Change:	Baseline	Control Group (International Firms)	Control Group (EU Firms)	Treatment Group (Europe)
Model:	(1)	(2)	(3)	(4)
Variables				
TreatxAfter	0.0630***	0.0560***	0.3128*	0.0282*
	(0.0206)	(0.0212)	(0.1689)	(0.0169)
TreatxAfterxOverFirm	-0.0822*	-0.0879**	-0.4299**	-0.0402
	(0.0419)	(0.0425)	(0.2171)	(0.0332)
AfterxOverFirm	0.0405*	0.0415*	0.3916*	0.0399*
	(0.0208)	(0.0216)	(0.2147)	(0.0212)
TreatxOverFirm	0.0622	0.0247	-0.0794	0.2354***
	(0.0754)	(0.0727)	(0.3433)	(0.0772)
OverFirm	0.4315***	0.4842***	0.6235*	0.4423***
	(0.0488)	(0.0566)	(0.3356)	(0.0473)
Controls	Yes	Yes	Yes	Yes
Fixed-effects				
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Fit statistics				
Observations	5,366	3,666	883	7,120
R^2	0.58746	0.61073	0.67994	0.58515
Within R^2	0.22308	0.30218	0.44723	0.26429

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 8: Placebo Test

This table presents the results of a placebo test where we modify the adoption date of the Directive and assign treatment to firms exposed to different geographic regions. Estimations are based on modified OLS regressions as defined in Equation 2. In column (1) we assume the directive was adopted in 2012 and $After$ is equal to 1 for years 2013-2015, and 0 for 2010-2012. In column (2), the fake adoption year is 2011 and $After$ is equal to 1 for years 2012-2013, and 0 for 2010-2011. Column (3) examines the effect post 2014 for firms with activities located in Asia, for which $Treat$ is equal to 1. Control firms are all firms that do not have activities located in Asia. Column (4) examines the effect post 2014 for firms with activities located in Australia, for which $Treat$ is equal to 1. Control firms are all firms that do not have activities located in Australia. The dependent variable $Investment$ is equal to the sum of capital, R&D and acquisition expenditures net of sales from PPE, scaled by lagged total assets. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment			
Placebo Year or Location:	2012	2011	Asia	Australia
DID Window:	(3-Year)	(2-Year)	(3-Year)	(3-Year)
Model:	(1)	(2)	(3)	(4)
Variables				
TreatxAfter	0.0025	-0.0123	0.0204	0.0348
	(0.0208)	(0.0248)	(0.0164)	(0.0329)
TreatxAfterxOverFirm	0.0018	0.0380	-0.0170	-0.0528
	(0.0393)	(0.0476)	(0.0319)	(0.0629)
AfterxOverFirm	-0.0019	0.0006	0.0286	0.0314*
	(0.0173)	(0.0245)	(0.0221)	(0.0175)
TreatxOverFirm	-0.0227	-0.0153	0.1956**	-0.0156
	(0.0547)	(0.0792)	(0.0785)	(0.1030)
OverFirm	0.4193***	0.4560***	0.4588***	0.5215***
	(0.0403)	(0.0613)	(0.0484)	(0.0464)
Controls	Yes	Yes	Yes	Yes
Fixed-effects				
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Fit statistics				
Observations	5,107	2,288	7,120	7,120
R^2	0.59444	0.62691	0.58443	0.58237
Within R^2	0.22111	0.29361	0.263	0.25935

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 9: Covariate Balance

This table reports the covariate balance of firm characteristics included as control variables in the baseline OLS regressions, specified in Equation 2, after applying matching (Panel A) and entropy balancing (Panel B). Each table provides mean values and standard deviations in parentheses, for treatment and control firms separately. It reports p-values for t-test of mean differences as well as standardized mean differences (SMD). Nearest neighbor matching is conducted based on firm characteristics as of 2012, with propensity scores are obtained by estimating a logit regression (Equation 3). Entropy Balancing weights are obtained from average levels of firm characteristics during the pre-adoption period (2012-2018). N is the number of firms. A full list of variable definitions and data sources is provided in Table 1.

Panel A: After Matching as of 2012

	Control	Treatment	p-value	SMD
N	128	128		
MtB	1.69 (0.80)	1.64 (0.89)	0.638	0.059
Institutions	0.78 (0.20)	0.78 (0.22)	0.977	0.004
Analysts	11.19 (8.99)	11.59 (9.08)	0.725	0.044
Size	7.40 (1.77)	7.60 (1.59)	0.333	0.121
ROA	0.04 (0.12)	0.06 (0.09)	0.371	0.112
Leverage	0.18 (0.17)	0.18 (0.14)	0.863	0.022
VolCFO	0.05 (0.04)	0.05 (0.03)	0.868	0.021
VolInvestment	0.15 (0.83)	0.15 (0.87)	0.972	0.004
VolSales	0.00 (0.00)	0.00 (0.00)	0.930	0.011
ZScore	1.43 (0.92)	1.43 (0.73)	0.992	0.001
Cash	0.16 (0.14)	0.16 (0.12)	0.946	0.008
Big4	0.82 (0.39)	0.86 (0.35)	0.396	0.106
Loss	0.16 (0.36)	0.15 (0.36)	0.863	0.022
Dividend	0.55 (0.50)	0.52 (0.50)	0.618	0.062
CFOSale	0.11 (0.18)	0.11 (0.12)	0.760	0.038
AssetTangibility	0.21 (0.17)	0.22 (0.15)	0.668	0.054
LogNumberEmployees	8.50 (1.59)	8.71 (1.39)	0.252	0.144

Panel B: After Entropy Balancing (2012-2014)

	Control	Treatment	p-value	SMD
N	847	144		
MtB	1.81 (0.97)	1.81 (0.93)	0.998	<0.001
Institutions	0.78 (0.20)	0.78 (0.23)	0.999	<0.001
Analysts	11.61 (8.41)	11.61 (8.89)	0.999	<0.001
Size	7.60 (1.68)	7.60 (1.61)	1.000	<0.001
ROA	0.05 (0.08)	0.05 (0.07)	0.997	<0.001
Leverage	0.19 (0.16)	0.19 (0.14)	1.000	<0.001
VolCFO	0.04 (0.03)	0.04 (0.03)	0.999	<0.001
VolInvestment	0.10 (0.28)	0.10 (0.31)	1.000	<0.001
VolSales	0.00 (0.00)	0.00 (0.00)	1.000	<0.001
ZScore	1.39 (0.71)	1.39 (0.65)	0.999	<0.001
Cash	0.17 (0.13)	0.17 (0.13)	0.997	<0.001
Big4	0.86 (0.34)	0.86 (0.34)	1.000	<0.001
Loss	0.18 (0.33)	0.18 (0.33)	0.999	<0.001
Dividend	0.52 (0.49)	0.52 (0.48)	1.000	<0.001
CFOSale	0.11 (0.31)	0.11 (0.13)	0.777	0.016
AssetTangibility	0.22 (0.18)	0.22 (0.16)	0.999	<0.001
LogNumberEmployees	8.65 (1.58)	8.65 (1.38)	1.000	<0.001

Table 10: Propensity Score Matching and Entropy Balancing

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on investment efficiency using a difference-in-difference approach, as defined in Equation 2, after matching (column 1) and entropy balancing (column 2). The dependent variable $Investment$ is equal to the sum of capital, R&D and acquisition expenditures net of sales from PPE, scaled by lagged total assets. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment	
Sample:	Matched Sample	Entropy-Balanced
Model:	(1)	(2)
Variables		
TreatxAfter	0.0482*	0.0535**
	(0.0264)	(0.0240)
TreatxAfterxOverFirm	-0.1029*	-0.0938*
	(0.0563)	(0.0511)
AfterxOverFirm	0.0885**	0.0702**
	(0.0408)	(0.0357)
TreatxOverFirm	0.1464*	0.1241
	(0.0817)	(0.0855)
OverFirm	0.3739***	0.4075***
	(0.0522)	(0.0533)
Controls	Yes	Yes
Fixed-effects		
Year	Yes	Yes
Firm	Yes	Yes
Industry	Yes	Yes
Fit statistics		
Observations	1,403	4,929
R^2	0.65167	0.35471
Within R^2	0.44935	-0.13394

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 11: Parallel Trend with Matching and Balancing

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on investment efficiency using a difference-in-difference approach, as defined in Equation 2 where we replace $Treat \times After$ with separate interaction indicators for each sample year (other than 2014, which serves as the benchmark). Column (1) reports the baseline results without weighting, column (2) the estimation for the matched sample, and column (3) the estimation for the entropy-weighted sample. The dependent variable $Investment$ is equal to the sum of capital, R&D and acquisition expenditures net of sales from PPE, scaled by lagged total assets. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment		
Sample:	Unweighted	Matched	Entropy-Balanced
Model:	(1)	(2)	(3)
Variables			
TreatxYear2012	-0.0046	-0.0082	-0.0072
	(0.0130)	(0.0129)	(0.0130)
TreatxYear2013	-0.0021	-0.0099	0.0039
	(0.0097)	(0.0113)	(0.0096)
TreatxYear2015	0.0392*	0.0255	0.0343
	(0.0227)	(0.0281)	(0.0271)
TreatxYear2016	0.0835***	0.0565**	0.0759***
	(0.0226)	(0.0279)	(0.0271)
TreatxYear2017	0.0600**	0.0467	0.0485
	(0.0277)	(0.0351)	(0.0308)
TreatxAfterxOverFirm	-0.0807*	-0.1028*	-0.0931*
	(0.0420)	(0.0562)	(0.0510)
AfterxOverFirm	0.0406*	0.0890**	0.0703**
	(0.0208)	(0.0405)	(0.0356)
TreatxOverFirm	0.0582	0.1431*	0.1209
	(0.0750)	(0.0822)	(0.0854)
OverFirm	0.4313***	0.3732***	0.4086***
	(0.0489)	(0.0520)	(0.0530)
Controls	Yes	Yes	Yes
Fixed-effects			
Year	Yes	Yes	Yes
Firm	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Fit statistics			
Observations	5,366	1,403	4,929
R^2	0.58809	0.65294	0.3567
Within R^2	0.22429	0.45136	-0.13045

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Appendix

Table A.1: Correlations

This table presents the correlation coefficients for the main variables used in the regression analysis. Variable descriptions are provided in Table 1.

	ESG_Disclosure	Investment	Treat	After	TreatxAfter	OverFirm	Institutions	Analysts	Size	ROA	Leverage	MtB	CFOSale	AssetTangibility	Big4	Loss	Dividend	VolCFO	VolInvestment	VolSales	ZScore	Cash
ESG_Disclosure																						
Investment	-0.07****																					
Treat	0.15****	-0.02																				
After	0.11****	0.01	0.00																			
TreatxAfter	0.16****	0.00	0.68****	0.28****																		
OverFirm	-0.09****	0.20****	0.01	0.01	0.01																	
Institutions	0.23****	0.01	0.10****	0.02	0.07****	-0.10****																
Analysts	0.53****	0.02	0.06****	0.01	0.04**	-0.12****	0.36****															
Size	0.59****	-0.09****	0.17****	0.05***	0.14****	-0.42****	0.44****	0.74****														
ROA	0.16****	-0.20****	0.08****	-0.08****	0.05***	-0.08****	0.24****	0.17****	0.30****													
Leverage	0.07****	0.08****	-0.05***	0.12****	0.00	-0.58****	0.03*	0.14****	0.29****	-0.13****												
MtB	0.02	0.09****	-0.03*	0.03*	-0.01	0.21****	0.02	0.05***	-0.08****	-0.24****	0.01											
CFOSale	0.02	-0.01	0.01	0.02	0.00	-0.01	0.04**	0.02	0.03*	0.16****	0.00	-0.02										
AssetTangibility	0.05***	0.01	-0.07****	0.00	-0.05***	-0.42****	-0.02	0.20****	0.24****	0.03*	0.28****	-0.11****	-0.01									
Big4	0.25****	-0.01	0.09****	-0.02	0.06****	-0.15****	0.38****	0.34****	0.48****	0.11****	0.14****	-0.02	0.03*	0.08****								
Loss	-0.18****	0.13****	-0.09****	0.10****	-0.06****	0.08****	-0.25****	-0.17****	-0.31****	-0.61****	0.08****	0.01	-0.05***	0.03*	-0.15****							
Dividend	0.24****	-0.16****	0.07****	0.01	0.07****	-0.18****	0.08****	0.16****	0.34****	0.25****	0.06****	-0.04**	0.02	0.15****	0.14****	-0.32****						
VolCFO	-0.20****	0.22****	-0.12****	-0.04**	-0.11****	0.37****	-0.22****	-0.17****	-0.39****	-0.33****	-0.12****	0.17****	-0.01	-0.15****	-0.18****	0.26****	-0.25****					
VolInvestment	-0.08****	0.12****	-0.02	0.02	-0.03*	-0.04**	-0.06****	-0.03*	-0.05***	-0.16****	0.08****	0.09****	-0.08****	0.04**	-0.03*	0.12****	-0.07****	0.10****				
VolSales	-0.12****	0.08****	-0.07****	0.01	-0.05***	0.16****	-0.26****	-0.16****	-0.29****	-0.20****	-0.08****	0.05****	-0.01	-0.11****	-0.24****	0.14****	-0.12****	0.33****	0.05***			
ZScore	0.08****	-0.24****	0.00	-0.11****	-0.02	0.03*	0.16****	0.01	0.08****	0.62****	-0.34****	-0.14****	0.10****	-0.13****	0.07****	-0.44****	0.20****	-0.17****	-0.17****	-0.06****		
Cash	-0.10****	0.19****	-0.01	0.00	-0.01	0.73****	-0.10****	-0.10****	-0.36****	-0.29****	-0.28****	0.24****	0.00	-0.37****	-0.08****	0.22****	-0.25****	0.49****	0.02	0.16****	-0.21****	
LogNumberEmployees	0.49****	-0.18****	0.18****	0.00	0.13****	-0.24****	0.44****	0.49****	0.68****	0.30****	0.07****	-0.07****	0.03*	0.00	0.37****	-0.32****	0.24****	-0.38****	-0.14****	-0.23****	0.36****	-0.33****

Table A.2: Impact of the NFRD on the Comparability of ESG Disclosure

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on firms' propensity to adopt the GRI framework when disclosing ESG. We use a difference-in-difference approach, as defined in Equation 1. Columns (1) and (2) focus on the 2012-2017 periods corresponding to a 3-year window, while columns (3) and (4) focus on a 2-year window. Columns (2) and (4) present results from estimations with yearxindustry fixed effects rather than year and industry fixed effects, where industries are based on the Fama-French 48-industry classification. The dependent variable is a disclosure quality measure provided by bloomberg ($ESG\_Disclosure$). $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	GRI			
DID Window:	2012-2017 (3-Year)		2013-2016 (2-Year)	
Model:	(1)	(2)	(3)	(4)
Variables				
TreatxAfter	0.0703*	0.1153***	0.0558	0.1005**
	(0.0402)	(0.0439)	(0.0372)	(0.0444)
MtB	-0.0044	0.0015	-0.0098	-0.0057
	(0.0049)	(0.0054)	(0.0090)	(0.0105)
Institutions	0.0232	0.0543	0.0883	0.0974
	(0.0683)	(0.0724)	(0.0812)	(0.0961)
Analysts	-0.0003	-0.0012	-0.0029	-0.0056
	(0.0036)	(0.0037)	(0.0046)	(0.0045)
Size	-0.0172	0.0022	-0.0328	-0.0157
	(0.0288)	(0.0298)	(0.0428)	(0.0471)
ROA	-0.0091	-0.0238	-0.0440	-0.0314
	(0.0349)	(0.0389)	(0.0366)	(0.0404)
Leverage	0.0639	0.0719	0.0087	-0.0210
	(0.0516)	(0.0599)	(0.0593)	(0.0682)
LogNumberEmployees	-0.0058	-0.0059	0.0128	0.0152
	(0.0239)	(0.0260)	(0.0326)	(0.0360)
VolCFO	0.0591	0.1190	0.3637	0.3734
	(0.1944)	(0.2053)	(0.3113)	(0.3189)
VolInvestment	0.0120	0.0090	-0.0637	-0.0426
	(0.0102)	(0.0112)	(0.0593)	(0.0762)
VolSales	0.0375	-0.3267	-0.2909	-0.4722
	(0.3299)	(0.4334)	(0.5335)	(0.5640)
ZScore	0.0106	0.0162	0.0278	0.0286*
	(0.0127)	(0.0130)	(0.0172)	(0.0169)
Cash	0.0469	0.0526	0.0387	0.1060
	(0.0679)	(0.0726)	(0.0836)	(0.0840)
Big4	0.0089	-0.0053	-0.0007	-0.0006
	(0.0121)	(0.0180)	(0.0128)	(0.0201)
Loss	-0.0319*	-0.0257	-0.0235	-0.0193
	(0.0165)	(0.0165)	(0.0207)	(0.0198)
Dividend	0.0041	-0.0002	-0.0259	-0.0559
	(0.0177)	(0.0231)	(0.0303)	(0.0366)
CFOSale	-0.0004	0.0011	-0.0022*	-0.0005
	(0.0008)	(0.0014)	(0.0013)	(0.0017)
AssetTangibility	0.1138	0.1710	0.2619	0.3830*
	(0.1526)	(0.1616)	(0.1886)	(0.2002)
Fixed-effects				
Year	Yes		Yes	
Industry	Yes		Yes	
Firm	Yes	Yes	Yes	Yes
Year×Industry		Yes		Yes
Fit statistics				
Observations	2,910	2,910	1,870	1,870
R^2	0.82034	0.83716	0.8793	0.88817
Within R^2	0.01048	0.01662	0.01922	0.03163

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A.3: Investment Regression by Quintiles of Cash and Leverage

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on investment using a difference-in-difference approach, as defined in Equation 1, but where the dependant variable is $Investment$. Columns (1)-(3) partition the sample into firms with low, medium, and high quintiles of cash, and high, medium, and low quintiles of leverage. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:		Investment	
Cash Quintile:	Low	Medium	High
Leverage Quintile:	High	Medium	Low
Model:	(1)	(2)	(3)
Variables			
TreatxAfter	0.0733**	0.0114	-0.0080
	(0.0296)	(0.0259)	(0.0151)
MtB	-0.0037	0.0166***	0.0050
	(0.0126)	(0.0061)	(0.0033)
Institutions	0.0494	-0.0146	0.0003
	(0.0969)	(0.0835)	(0.0553)
Analysts	-0.0111***	-0.0054*	-0.0027
	(0.0032)	(0.0030)	(0.0017)
Size	0.1725***	0.0551	0.0568**
	(0.0478)	(0.0441)	(0.0242)
ROA	1.371***	0.4255**	-0.1421***
	(0.3148)	(0.1865)	(0.0358)
Leverage	0.4367***	0.4828***	0.0142
	(0.1313)	(0.1320)	(0.0422)
LogNumberEmployees	0.0067	0.1091*	-0.0281
	(0.0191)	(0.0651)	(0.0355)
VolCFO	0.5578	0.4149	-0.1334
	(0.5202)	(0.2909)	(0.1006)
VolInvestment	-0.3185**	-0.7430***	-0.3726*
	(0.1430)	(0.2237)	(0.2164)
VolSales	-2.815	9.144**	8.375
	(10.22)	(4.637)	(6.736)
ZScore	-0.1723***	-0.0811**	0.0028
	(0.0444)	(0.0326)	(0.0098)
Cash	-0.0644	-0.2687	-0.0538
	(0.5868)	(0.1827)	(0.0656)
Big4	-0.0266	-0.0178	0.0086
	(0.0304)	(0.0416)	(0.0185)
Loss	0.0437	0.0202	-0.0396**
	(0.0271)	(0.0242)	(0.0154)
Dividend	0.0464	-0.0226	-0.0162
	(0.0371)	(0.0237)	(0.0178)
CFOSale	0.0204	0.0122	-0.00007
	(0.0507)	(0.0430)	(0.0001)
AssetTangibility	-0.4629*	-0.2728	0.0744
	(0.2547)	(0.1832)	(0.1245)
Fixed-effects			
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Firm	Yes	Yes	Yes
Fit statistics			
Observations	1,220	1,048	1,009
R^2	0.70643	0.83431	0.86799
Within R^2	0.34992	0.32603	0.1148

Firm standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A.4: Sub-sample of Firms Partitioned According to their Change in ESG Disclosure

This table provide the estimation results from our baseline regression defined in Equation 2, by partitioning the sample. In columns (1) and (2), we partition the sample into high and low pre-adoption ESG disclosure levels. In columns (3) and (4), we partition into high and low financial constraint estimates, proxied by the KZ index. In columns (5) and (6), we partition into high and low manager entrenchment proxied by the stock ownership of the CEO. High and Low partitioning is conducted based on below and above median levels. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment	
Sample:	ESG Disclosure Change above median	ESG Disclosure Change below median
Model:	(1)	(2)
Variables		
TreatxAfter	0.079***	0.017
	(0.023)	(0.039)
TreatxAfterxOverFirm	-0.140***	0.023
	(0.045)	(0.081)
TreatxOverFirm	0.147	-0.059
	(0.096)	(0.103)
AfterxOverFirm	0.060**	0.034
	(0.028)	(0.027)
OverFirm	0.441***	0.463***
	(0.070)	(0.069)
Controls	Yes	Yes
Fixed-effects		
Year	Yes	Yes
Industry	Yes	Yes
Firm	Yes	Yes
Fit statistics		
Observations	2,411	2,176
R^2	0.57082	0.57259
Within R^2	0.26203	0.26444

One-way (Firm) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A.5: Alternative Proxies of Corporate Governance and Investment Efficiency

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on investment efficiency using a difference-in-difference approach, as defined in Equation 2. In columns (1) and (2), we partition by the existence of an independent board. In columns (3) to (6), we partition into high and low manager entrenchment proxied by salary scaled by either the total compensation or sales. High and Low partitioning is conducted based on below and above median levels. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variable:	Investment					
Proxies:	Independent Board		Salary/Total Compensation		Salary/Sales	
	Yes	No	High	Low	High	Low
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
TreatxAfter	0.078	0.060***	0.125***	0.011	0.053*	-0.012
	(0.066)	(0.022)	(0.043)	(0.024)	(0.028)	(0.032)
TreatxAfterxOverFirm	-0.210	-0.069	-0.172**	0.005	-0.123**	0.031
	(0.130)	(0.045)	(0.069)	(0.047)	(0.061)	(0.061)
TreatxOverFirm	0.228	0.093	0.040	-0.004	0.085	0.003
	(0.191)	(0.083)	(0.098)	(0.097)	(0.111)	(0.072)
AfterxOverFirm	0.159***	0.037*	0.070*	0.015	0.069	0.004
	(0.058)	(0.022)	(0.040)	(0.029)	(0.043)	(0.030)
OverFirm	0.338***	0.445***	0.313***	0.432***	0.452***	0.289***
	(0.125)	(0.054)	(0.064)	(0.077)	(0.080)	(0.043)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed-effects						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	579	4,787	1,709	1,709	1,710	1,710
R^2	0.70999	0.59235	0.63770	0.73492	0.72223	0.62743
Within R^2	0.47236	0.22069	0.35802	0.40084	0.39993	0.30949

One-way (Firm) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A.6: Independent Board and External Financing

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on bid-ask spreads, new debt and new equity issues, after partitioning the sample by the degree of manager entrenchment. The specification follows the one defined in Equation 2 but replaces investment by external financing measures. We partition by the existence of an independent board. $BidAskSpread$ is equal to the year median of monthly quoted stock price spreads. $NewDebt$ and $NewEquity$ are annual measures of new debt and equity issued. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variables:	BidAskSpread		NewEquity		NewDebt	
Indep. Board:	Yes	No	Yes	No	Yes	No
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
TreatxAfter	-0.0006	-0.0006	0.082	0.026	0.101	0.083**
	(0.0007)	(0.0004)	(0.070)	(0.025)	(0.105)	(0.036)
TreatxAfterxOverFirm	0.0008	0.0008	-0.238	-0.004	-0.250	-0.097
	(0.0009)	(0.0007)	(0.152)	(0.054)	(0.236)	(0.067)
TreatxOverFirm	-0.0009	-0.0003	0.228	0.093	0.273	0.049
	(0.001)	(0.0009)	(0.219)	(0.090)	(0.323)	(0.112)
AfterxOverFirm	-0.0004	-0.0004	0.073	-0.092**	0.133**	0.074***
	(0.0004)	(0.0004)	(0.058)	(0.036)	(0.065)	(0.026)
OverFirm	-0.0009	-0.0004	0.038	0.071	0.514***	0.622***
	(0.0007)	(0.0006)	(0.097)	(0.060)	(0.115)	(0.069)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed-effects						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	1,710	1,708	1,689	1,687	1,689	1,687
R^2	0.78750	0.83177	0.52864	0.56424	0.55237	0.64770
Within R^2	0.18333	0.17292	0.13813	0.17750	0.36307	0.46756

One-way (Firm) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table A.7: Manager Entrenchment and External Financing

This table presents the results from OLS regressions estimating the treatment effect of the NFRD on bid-ask spreads, new debt and new equity issues, after partitioning the sample by the degree of manager entrenchment. The specification follows the one defined in Equation 2 but replaces investment by external financing measures. We partition into high and low manager entrenchment proxied by the stock ownership of the CEO, based on below and above median levels. $BidAskSpread$ is equal to the year median of monthly quoted stock price spreads. $NewDebt$ and $NewEquity$ are annual measures of new debt and equity issued. All specifications include year, firm and industry fixed effects, as well as all baseline control variables. $Treat$ is an indicator variable equal to 1 for firms plausible exposed to the NFRD, and $After$ indicates year post-adoption of the NFRD in 2014. $OverFirm$ is a ranking variable based on cash and leverage that captures the likelihood of a firm to overinvest. Standard errors are clustered at the firm level. A full list of variable definitions and data sources is provided in Table 1.

Dependent Variables:	BidAskSpread		NewEquity		NewDebt	
CEO Ownership:	High	Low	High	Low	High	Low
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
TreatxAfter	-0.0005	0.0002	0.015	0.064	0.105*	0.040
	(0.0003)	(0.0003)	(0.033)	(0.041)	(0.059)	(0.036)
TreatxAfterxOverFirm	0.001	-0.0004	0.039	-0.091	-0.123	-0.081
	(0.0007)	(0.0004)	(0.088)	(0.076)	(0.106)	(0.078)
TreatxOverFirm	-0.002	-0.0000	-0.128	0.006	-0.056	-0.010
	(0.001)	(0.0004)	(0.084)	(0.149)	(0.153)	(0.171)
AfterxOverFirm	-0.0006	-0.0001	-0.041	-0.009	0.070	0.105**
	(0.0004)	(0.0001)	(0.034)	(0.048)	(0.052)	(0.048)
OverFirm	0.0001	-0.0004*	0.018	0.129	0.469***	0.635***
	(0.0007)	(0.0002)	(0.050)	(0.111)	(0.087)	(0.105)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed-effects						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	1,710	1,708	1,689	1,687	1,689	1,687
R^2	0.78750	0.83177	0.52864	0.56424	0.55237	0.64770
Within R^2	0.18333	0.17292	0.13813	0.17750	0.36307	0.46756

One-way (Firm) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*