The Dark Side of ESG Information: Evidence from Corporate Investment

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ABSTRACT

This paper investigates the impact of environmental, social, and governance (ESG) information on corporate investment using a large-scale expansion of Refinitiv (Asset4)'s ESG rating coverage to Russell 2000 index firms as a quasi-natural experiment. Our analysis uncovers a significant reduction in corporate investment among the affected firms following this expansion, a result that remains robust across various endogeneity and robustness tests. This decline is not attributable to the resolution of overinvestment agency issues, an increase in the cost of capital, or a substitution effect from ESG initiatives, but is instead driven by diminished future expected cash flows, which ultimately reduces the valuation of investment projects and leads to a decline in investment. Our findings underscore a previously overlooked negative consequence of ESG information, offering new insights into its implications for firms.

Keywords: ESG Information, Corporate Investment, Expected Cash Flows, Cost of Capital, Overinvestment

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1. Introduction

In recent years, environmental, social, and governance (ESG) information has become widely used by various stakeholders, including investors, employees, and consumers, in their decision-making processes. For instance, according to the Forum for Sustainable and Responsible Investment, U.S. sustainable investments that explicitly incorporate ESG information reached $8.4 trillion in 2022, representing approximately 12.6% of total assets under management. With the growing prominence of ESG information for stakeholders and the accompanying external pressures, understanding its impact on underlying firms has become a critically important topic, drawing significant attention from both the public and academia. Recent research has predominantly focused on the potential implications of ESG information for the sustainable practices of underlying companies (e.g., Christensen, Floyd, Liu, and Maffett, 2017; Fiechter, Hitz, and Lehmann, 2022; Tomar, 2023). However, its influence on broader corporate decisions remains underexplored.

To fill this void, this paper provides one of the first studies investigating how ESG information shapes corporate investment. Understanding this effect is important, as investment decisions are a primary determinant of firm value and have significant macroeconomic consequences.[1] Our study specifically focuses on the impact of ESG rating information, as it serves as a critical channel for stakeholders to quickly access and assess firms' sustainability performance. By examining the relationship between ESG rating information and investment decisions, we can gain deeper insights into its broader implications for corporate strategy and long-term performance.

The impact of ESG information on corporate investment remains an open question, influenced by various mechanisms. In a frictionless environment, classical capital budgeting theory posits that managers make optimal investment decisions by evaluating the net present value (NPV) of projects (Jordan, Ross, and Westerfield, 2003; Brealey, Myers, and Allen, 2014; Krüeger, Landier, and Thesmar, 2015). NPV is calculated by discounting projects' future expected cash flows at the cost of capital, making both expected cash flows and hurdle rates critical factors in investment decisions. However, agency frictions arising from asymmetric information can distort investment choices (Roychowdhury, Shroff, and Verdi, 2019). Managers may overinvest in value-destroying projects (Jensen, 1986), leading to excessive investment. Conversely, the frictions may result in

[1] Fluctuations in investment can amplify the cyclical dynamics of the business cycle, as documented in the macroeconomic literature (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997).

credit rationing (Myers and Majluf, 1984), causing underinvestment.

ESG information may influence corporate investment decisions by altering the two key factors in capital budgeting—expected cash flows and hurdle rates or shaping agency frictions. From a capital budgeting perspective, ESG information might affect corporate investment through the expected cash flow and hurdle rate channels. From the expected cash flow perspective, companies receiving low ESG scores may see declines in future expected cash flows due to negative customer response, whereas firms with high scores may benefit from favorable reactions from customers (Darendeli, Fiechter, Hitz, and Lehmann, 2022; Meier, Servaes, Wei, and Xiao, 2023; Duan, Li, and Michaely, 2024; Houston, Lin, Shan, and Shen, 2024). From the cost of capital perspective, firms with poor ESG ratings may face higher costs of capital as investors avoid or underweight them, while those with strong ratings could enjoy a lower cost of capital (Hong and Kacperczyk, 2009; Luo and Balvers, 2017; Pástor, Stambaugh, and Taylor, 2021; Bolton and Kacperczyk, 2021). If the negative effects for low ESG rating firms dominate, higher capital costs and lower future expected cash flows would reduce the valuation of investment, ultimately dampening corporate investment.[2] However, this effect could be reversed if the positive responses garnered by firms with high ESG ratings outweigh the negative influences. Thus, the net effect on investment depends on which of these forces dominate.

From an agency perspective, ESG ratings provide additional insights into a firm's fundamental information (Pedersen, Fitzgibbons, and Pomorski, 2021), thereby mitigating information asymmetry between capital providers and firms. This enhanced transparency can improve access to external financing, potentially alleviating the underinvestment problem and fostering higher levels of investment (Myers and Majluf, 1984). Conversely, the increased transparency may also empower shareholders to more effectively monitor and discipline managers, which could reduce managers' incentives for overinvestment and, consequently, lead to a decrease in investment and an improvement in investment efficiency (Biddle, Hilary, and Verdi, 2009). Therefore, the overall effect of ESG information on corporate investment—whether positive or negative—remains to be explored in this study.

Empirically establishing the effect of ESG information on corporate investment decisions poses

[2]The dominance of the negative effect is especially possible if stakeholders' and shareholders' reactions to ESG information are asymmetric. Indeed, in an important paper, Krüger (2015) finds that stock markets respond strongly to negative ESG events but weakly to positive ones.

challenges due to endogeneity concerns. For example, mandatory ESG disclosure settings face identification challenges, such as potential anticipation, early adoption, or avoidance by firms (Leuz, 2018). To address these issues, we exploit an ESG information shock, i.e., a plausibly exogenous expansion of ESG ratings for a subset of firms. In 2015, Refinitiv (formerly Asset4) significantly broadened its coverage to include firms from the Russell 2000 index (Choi, Ferri, and Macciocchi, 2024). This expansion notably increased the ESG information available for Russell 2000 companies, given Refinitiv's status as a leading provider of ESG ratings (Darendeli et al., 2022), and should be largely independent from individual firms' corporate investment decisions. Leveraging this exogenous shock, we employ a difference-in-differences (DiD) methodology to estimate the impact of ESG information on corporate investment. We designate Russell 2000 index companies as the treated group and those without Refinitiv ESG ratings as the control group. Our regression analyses reveal a significant drop in corporate investment. We observe a 4.1 percentage point decline in investment, which is roughly 11% of the standard deviation of investments in our sample. Our back-of-envelope calculation suggests that the total decrease in investment for the treated firms in a year is estimated to be around $72 billion, highlighting the economic significance of this decline.

One concern with our empirical design is that control firms not covered by Refinitiv ESG ratings may differ systematically from treated firms—for instance, they tend to be smaller—and such differences could confound our results on corporate investment. We mitigate this endogeneity concern in several ways. First, our baseline regressions control for time-varying firm characteristics and and year fixed effects, directly accounting for observable heterogeneity between the treated and control groups. Second, we estimate a dynamic treatment effect model to test for pre-existing investment trends. Our results support the parallel-trend assumption, as treated and control firms exhibit indistinguishable investment patterns prior to the ratings expansion, with divergence only emerging afterward. Third, we use Russell 1000 firms—already covered by Refinitiv ESG ratings as of 2010—as an alternative control group. As argued by Rosenbaum (1987) and Roberts and Whited (2013), employing an alternative control group with substantially different characteristics from the previous control group provides a strong test for omitted variable bias. If unobserved heterogeneity between the treatment and control groups were driving our results, estimates using this alternative group should differ substantially. Instead, we find that the decline in investment remains robust. Fourth, we conduct falsification tests by shifting the treatment event to periods

before or after the expansion event, or by assigning treatment status to Russell 1000 firms, and find no significant effects—consistent with the ratings expansion driving the decline in investment. Finally, we replicate our analysis using the largest 1,000 unrated firms as the control group and by constructing a matched control group via propensity score matching. Our results also remain robust. Additionally, we strengthen the external validity of our results by extending our analyses to a broader sample period from 2001 to 2021 that incorporates firms gradually added to Refinitiv's ESG ratings and finding a consistent reduction in investment once firms receive ESG rating coverage.

We then turn to identify the potential mechanism underlying the reduced investment. From a capital budgeting perspective, the observed reduction in corporate investment may be attributed to a decline in future expected cash flows, which diminishes the valuation of investment projects. This explanation is supported by our findings of reduced corporate performance and diminished future cash flows. To further substantiate this channel, we examine whether managers indeed revise their expectations downward in response to Refinitiv's ESG ratings expansion. Our analysis reveals a significant reduction in management earnings forecasts, supporting that the decline in expected cash flows is likely to be the primary mechanism behind managers' decision to reduce investment. Our further investigation documents that the reduced expected cash flows after the expansion event is likely to be driven by reduced sales. Our subsample analyses show asymmetric effects between firms receiving high and low ESG ratings. Firms with low ESG ratings experience significant adverse effects on management earnings forecast, sales, and investment. Firms with high ESG ratings show no significant changes. The asymmetry in sales responses likely reflects consumers' greater sensitivity to negative information, while positive information may have negligible impact (Eli and Rao, 2011; Williams, 2015; Krüger, 2015).

We also examine alternative channels. The reduction in corporate investment may be attributed to an increased cost of capital. However, our analysis does not reveal a significant rise in either the cost of debt or the cost of equity following the expansion of ESG ratings. Moreover, there are no notable changes in the amount of debt and equity raised by firms after the shock. Our further subsample analyses show no significant changes in the cost of capital for treated firms with either high or low ESG ratings, further suggesting that the cost of capital is not the primary driver of the observed decline in investment.

From an agency perspective, the decline in corporate investment after the expansion of ESG

ratings contradicts the expectation of addressing underinvestment. However, it aligns with the prediction of reducing overinvestment. If this channel were dominant, firms would eliminate unprofitable overinvestment, thereby improving investment efficiency. However, our empirical analyses reveal significant reductions in return on assets, return on equity, and future cash flow ratio for treated firms after the shock. Additionally, we observe a notable decrease in the sensitivity of investment to growth opportunities for treated firms, indicating reduced investment efficiency. These findings contradict the hypothesis that the decline in corporate investment results from a reduction in overinvestment.

We also discuss whether the observed decline in capital investments reflects a substitution effect driven by increased ESG activities. If this effect dominates, we would expect a corresponding increase in ESG-related activities—yet no such increase is observed. Furthermore, if this effect dominates, companies would likely prioritize curtailing inefficient or marginal projects first, as these are less costly to eliminate when reallocating resources toward ESG initiatives. This would enhance capital investment efficiency. However, our empirical findings contradict this hypothesis. Additionally, non-financially constrained firms—which have ample financial resources to support both ESG-related activities and capital investments—should experience no investment reductions, as substitution effects would not arise. However, we observe a consistent and significant decline in investment among these firms, contradicting the theoretical prediction. Collectively, these results suggest that the reduction in corporate investment is unlikely to be driven by a substitution effect from ESG initiatives.

Finally, we conduct additional heterogeneity tests to explore the factors that may amplify the negative effects of the ESG rating shock on corporate investment. Our empirical analyses reveal that the decline in investment is particularly more pronounced for firms that are exposed to severe climate-related concerns and smaller companies with fewer resources to absorb the shock. Additionally, firms facing intense competition—where alternative products are readily available to consumers—are also more vulnerable to the negative impact of the shock.

This paper contributes to the growing literature on the impact of ESG information. Using ESG disclosure regulation shocks, previous studies (Christensen et al., 2017; Fiechter et al., 2022; Tomar, 2023) demonstrate that Corporate Social Responsibility (CSR) information disclosure can enhance corporate sustainability performance. In addition, several papers explore ESG rating

expansion shocks. For example, Darendeli et al. (2022) examine the effect of ESG information on stakeholder decision-making, specifically on supply-chain contracting decisions. Errico (2023) investigates whether regulators adjust their enforcement activities in response to firms' ESG information. Different from these studies focusing on corporate sustainable behavior, we uncover a distinct and underexplored effect: ESG information significantly reduces capital investment.[3] As a result, we broaden the discussion from sustainable practices to more general, value-related corporate activities.

Our findings also contribute to the understanding of the channel through which ESG information shapes corporate behavior, revealing that the impact operates primarily through the expected cash flow channel, rather than by addressing agency problems or altering the cost of capital. This insight adds to ongoing debates about whether ESG information can influence the cost of capital by shifting investment from non-green to green firms (Pástor et al., 2021; Bolton and Kacperczyk, 2021; Berk and Binsbergen, 2025). Our findings align with the recent work of Berk and Binsbergen (2025), which shows that ESG divestment has no detectable effect on the cost of capital for firms. Furthermore, our paper also adds to the recent work of Meier et al. (2023), Derrien, Krueger, Landier, and Yao (2024) and Duan et al. (2024), which emphasizes the cash flow channels of ESG information by focusing on how consumers react to ESG information. While their study mainly focuses on the impact of ESG information on consumers' consumption and corporate sales, we offer a fresh angle by exploring how ESG information influences corporate investment decisions.

Our study also provides additional insights into whether ESG information can drive positive social outcomes. Prior work, such as Pástor et al. (2021), suggests that ESG rating information may incentivize capital reallocation from brown to green firms, lowering green firms' cost of capital while raising brown firms'. This divergence in financing costs is expected to expand green firms' investments and growth while shrinking brown firms', thereby generating positive societal impact. However, empirical evidence on cost-of-capital effects remains mixed: some studies find green firms benefit from lower capital costs relative to brown ones (Hong and Kacperczyk, 2009; Bolton and Kacperczyk, 2021; Flammer, 2021), while others show no such effects (Derrien et al., 2024; Berk and Binsbergen, 2025; Chava, Kim, and Lee, 2025; Rómulo, Krueger, and Van Dijk, 2025). Fur-

[3]Our paper relates to the contemporaneous work of Lu (2024), which studies the effect of ESG ratings on investment efficiency. Our paper differs by examining their impact on investment levels and uncovering distinct channels through which ESG information shapes corporate investment.

thermore, recent research challenges whether starving brown firms of capital achieves social good, as financial constraints may reduce their capacity for social responsible investments (Xu and Kim, 2022; Hartzmark and Shue, 2022; De Haas, Martin, Muûls, and Schweiger, 2024). Our paper advances this debate by directly testing the impact of ESG information on corporate investment. We document an asymmetric response: low-ESG firms reduce investment, while high-ESG firms exhibit no significant change. This suggests ESG information may increase the relative scale of sustainable firms in the society but at the cost of shrinking overall business growth. Additionally, our analysis finds no evidence that cost of capital drives this shift; instead, it identifies the expected cash flow as the primary channel.

Lastly, this paper contributes to the literature on corporate investment and its determinants. Prior studies have linked corporate investment decisions to various factors, including growth opportunities (Timothy and Whited, 2000; Hennessy, Levy, and Whited, 2007), financial constraints (Almeida and Campello, 2007), policy uncertainty (Gulen and Ion, 2016; Kim and Kung, 2017), and financial disclosure (Roychowdhury et al., 2019). Our research adds to this body of work by examining a new factor—ESG information—and its influence on corporate investment decisions. This perspective is crucial, as the incorporation of ESG information in decision-making by various stakeholders has emerged as one of the most significant developments in the markets in recent years. By assessing its implications for corporate investment decisions, we enrich our understanding of the real consequences of ESG consideration.

The rest of the paper is organized as follows: Section 2 reviews the relevant literature and outlines the hypotheses. Section 3 describes the empirical design, data, and key variables. Section 4 examines the effects of ESG information on corporate investment, while Section 5 explores potential mechanisms behind these effects. Section 6 presents heterogeneity of the effects. Finally, Section 7 summarizes our findings.

2. Related Literature and Hypotheses

In a frictionless environment, managers make optimal investment decisions by evaluating the net present value (NPV) of potential projects. According to established principles in corporate finance (Jordan et al., 2003; Brealey et al., 2014), the optimal strategy is to undertake projects with a

positive NPV while rejecting those with a negative NPV. The NPV is determined by discounting the project's expected cash flows with a hurdle rate. Consequently, corporate investment decisions are influenced by both the expected cash flows and the hurdle rates.

However, in the presence of agency frictions arising from information asymmetry, distortions in corporate investment decisions may occur. For instance, moral hazard models argue that managers might engage in excessive investment in value-destroying projects, such as empire building and diversified acquisitions (Jensen, 1986). This results in investment levels exceeding the optimal amount. Conversely, adverse selection between managers and investors can also result in credit rationing for corporations (Myers and Majluf, 1984), leading to underinvestment. In this scenario, investment levels fall short of the optimal amount. Consequently, the agency frictions can cause deviations from the optimal investment strategies predicted by classical capital budgeting theories.

ESG information may influence corporate investment decisions by altering the two important factors in capital budgeting or shaping agency conflicts. From a capital budgeting perspective, ESG information may influence corporate investment decisions through its impact on expected cash flows and hurdle rates. Over the past decade, ESG information has gained increasing importance in the decision-making process of various stakeholders of companies, including investors and consumers (Dasgupta, Huynh, and Xia, 2023; Dai, Liang, and Ng, 2021; Darendeli et al., 2022; Houston and Shan, 2022). Their ESG consideration may drive changes in corporate investment through expected cash flows and hurdle rates. First, regarding expected cash flows, firms with low ESG ratings may face declines in future cash flows due to adverse consumer reactions (Dai et al., 2021; Darendeli et al., 2022; Meier et al., 2023; Duan et al., 2024; Houston et al., 2024; Derrien et al., 2024). For instance, Darendeli et al. (2022) finds that corporate customers terminate contracts with suppliers whose ESG ratings deteriorate. Meier et al. (2023), using granular barcode-level sales data from retail stores, reports that lower corporate environmental and social ratings lead to reduced sales. Similarly, Duan et al. (2024) examines consumer store visit data, documenting consumers' sensitivity to ESG scores. Therefore, firms with poor ESG ratings may experience lower future expected cash flows, whereas those with strong ratings may benefit from increased expected cash flows due to positive consumer responses.[4]

[4]Please see Gillan, Koch, and Starks (2021) for an excellent survey of the research on firms' ESG attributes and their impact on performance and value.

Second, regarding hurdle rates, firms with poor ratings may be shunned or underweighted by investors, leading to a higher cost of capital, while firms with good ESG ratings might benefit from a lower cost of capital (Pástor et al., 2021; Hong and Kacperczyk, 2009; Luo and Balvers, 2017; Bolton and Kacperczyk, 2021). Bolton and Kacperczyk (2021) shows that carbon-intensive firms tend to offer higher returns, as investors demand compensation for their exposure to carbon emission risks. Additionally, Pástor et al. (2021) suggests that green assets have lower expected returns due to investors' preference for sustainability and the need to hedge against climate risks. These findings indicate that firms with high ESG ratings may enjoy a lower cost of capital, while firms with low ESG ratings may face a higher cost of capital.

From an agency perspective, ESG ratings offer valuable insights into a company's environmental, social, and governance performance, reflecting its core fundamentals (Pedersen et al., 2021). The disclosure of a company's ESG score significantly improves investors' access to ESG information, thus reducing information asymmetry between capital providers and managers. Previous research has identified information asymmetry as a major financial friction and a substantial barrier for firms seeking capital (Leland and Pyle, 1977; Myers and Majluf, 1984; Tirole, 2006). Myers and Majluf (1984) demonstrated that information asymmetry discourages firms from raising external capital and can lead them to forgo profitable projects. By mitigating information asymmetry, ESG information could potentially alleviate the underinvestment problem and increase corporate investment. Conversely, ESG information may lead to a reduction in investment by mitigating overinvestment agency problems. By providing more comprehensive information about firms, ESG ratings enhance monitoring capabilities for shareholders and bolster managerial discipline, which can help curb excessive or unprofitable investments (Biddle et al., 2009; Chen, Hope, Li, and Wang, 2011). In this scenario, ESG information could result in a decrease in capital investment.

In sum, from a capital budgeting viewpoint, firms with low ESG ratings may experience lower expected cash flows and higher costs of capital, diminishing project valuation and leading to reduced investment. Firms with high ESG ratings may see increased expected cash flows and lower costs of capital, driving higher levels of investment. Thus, the net effect on investment depends on which of these forces prevails. From an agency perspective, ESG information enhances information transparency, potentially boosting investment by alleviating underinvestment problems or reducing it by curbing overinvestment issues. Ultimately, despite the various channels through which

ESG information may affect corporate investment, the precise impact remains an open empirical question. Our paper aims to explore this relationship and uncover the underlying mechanisms at work.

3. Empirical Design and Data

3.1. Empirical Design

Asset4, a leading provider of ESG data, started to provide ESG data and analyses in 2002. Following its acquisition by Refinitiv (formerly Thomson Reuters) in 2009, its coverage was Russell 1000 firms. Refinitiv initiated a significant expansion of its ESG rating coverage, incorporating companies from the Russell 2000 index in 2015 (Choi et al., 2024).[5] This marked the largest single increase in the agency's ESG ratings portfolio. This expansion is notable given Refinitiv's status as a leading ESG rating provider, as confirmed by a recent survey of NGOs, think tanks, and academics (Wong, Brackley, and Petroy, 2019) and an OECD report (Boffo and Patalano, 2020). Major asset managers, such as BlackRock, have extensively used Refinitiv's ESG ratings to assess investment risks,[6] and the significance of these ratings is also well-documented in academic literature (Dyck, Lins, Roth, and Wagner, 2019; Dai et al., 2021; Darendeli et al., 2022). Furthermore, this expansion represents an exogenous shock to the amount of ESG information available for Russell 2000 firms. While Refinitiv likely anticipated increased demand for the expanded coverage, it is improbable that the timing and scale of this expansion were influenced by the corporate investment decisions of individual Russell 2000 companies. Therefore, the expansion of ESG ratings is very likely to be exogenous to individual firms' corporate investment decisions.

We use the expansion of ESG ratings as a quasi-natural experiment and apply a difference-in-differences methodology to estimate their causal effect on the investment decisions of the treated firms. The model is specified as follows:

$$Y_{i,t} = \alpha + \beta \times \text{Treated}_i \times \text{Post}_t + \Gamma' X_{i,t} + \delta_i + \sigma_t + \varepsilon_{i,t}, \tag{1}$$

[5]Based on the Refinitiv ESG rating coverage data and corroborated by Choi et al. (2024), the expansion to Russell 2000 firms began in 2015. Our data analysis further supports this initiation year.

[6]See "BlackRock taps Thomson Reuters' ASSET4 for global ESG data," Responsible Investor, Aprill 11, 2011.

where $Y_{i,t}$ denotes corporate investment. The variable *Treated* is an indicator variable equal to one for Russell 2000 firms and zero for firms not covered by Refinitiv ESG ratings.[7] Our sample period extends from 2014 to 2018, with 2016-2018 as post treatment years. The variable *Post* is equal to one for years 2016 to 2018, and zero otherwise. Although Refinitiv began including Russell 2000 firms to its ESG ratings in 2015, the ratings for these firms were only available by the end of that year (Choi et al., 2024). Hence, following Choi et al. (2024), we define years 2016 to 2018 as post-treatment years. The five-year period allows us to balance having sufficiently long pre- and post-treatment windows while minimizing potential confounding effects from other CSR events (Darendeli et al., 2022).[8] Additionally, X includes firm-level controls. We also account for firm-fixed effects δ_i and year-fixed effects σ_t. The coefficient β of the interaction term captures the effect of ESG ratings expansion on corporate investment decisions.

A potential concern with our empirical design is that control firms not covered by Refinitiv ESG ratings may differ systematically from treated firms—for example, they tend to be smaller—which could drive observed differences in corporate investment. We address this concern through several approaches. First, our baseline regressions control for time-varying firm characteristics and firm and year fixed effects, thereby mitigating both time-invariant and time-varying heterogeneity between treated and control firms. Second, we estimate a dynamic treatment model to test for pre-existing differences in investment trends between the two groups. Third, we employ Russell 1000 firms—already rated by Refinitiv ESG as of 2010—as an alternative control group. As noted by Rosenbaum (1987) and Roberts and Whited (2013), using an alternative control group that differs substantially from the primary one provides a stringent test for omitted variable bias: if unobserved heterogeneity drives our findings, estimates based on such a different control group should diverge. Fourth, we conduct falsification tests by artificially shifting the treatment event to earlier or later periods, or by assigning treatment status to Russell 1000 firms. Finally, we replicate our analysis using the largest 1,000 unrated firms as the control sample and by constructing a matched sample via propensity score matching. We present these analyses in Section 4, which reinforce the validity

[7]Specifically, we designate firms in the Russell 2000 index at the beginning of 2015 as treated firms, and those not included in the Russell 3000 index as control firms. Refinitiv provided ESG data for Russell 1000 firms before 2015 and expanded coverage to Russell 2000 firms thereafter. As a result, firms outside the Russell 3000 index were not covered by Refinitiv in 2015.

[8]MSCI expanded its ESG ratings coverage in 2012. To avoid potential confounding effects from this expansion, we begin our sample period two years later.

of our identification strategy.

3.2. Data and Variables

We use data from several sources for our analysis. The list of Russell 2000 index firms is obtained from Thomson Eikon, while firm-level financial data is from Compustat. In line with the investment literature (Fazzari, Hubbard, and Peterson, 1988; Kaplan and Zingales, 1997; Almeida and Campello, 2007; Chaney, Sraer, and Thesmar, 2012), we measure corporate investment, *Investment*, as the ratio of capital expenditure to lagged property, plant, and equipment. As discussed earlier, our primary variable of interest is the interaction term *Treated*×*Post*.

We also account for additional factors crucial to corporate investment decisions as identified in the literature. These include the market-to-book ratio (*MB*), firm size (*Size*), leverage ratio (*Leverage*), asset tangibility (*Tangibility*), cash flow ratio (*CashFlow*), and cash ratio (*CashHolding*). Specifically, *MB* reflects firms' growth opportunities and is calculated as the market value of equity divided by the book value of equity. *Size* is measured as the natural logarithm of book assets. *Leverage* represents book leverage, defined as the ratio of long-term debt to total assets. *Tangibility* is the ratio of property, plant, and equipment to book assets. *CashFlow* is the operating income before extraordinary items plus depreciation, divided by lagged book assets. *CashHolding* is the ratio of cash to lagged book assets.

Table 1 provides summary statistics for these variables. Panel (a) shows statistics for the entire sample, while Panel (b) details for the pre- and post-expansion periods. Our dataset includes 28,696 firm-year observations, with 23.6% classified as treated. The average investment ratio (*Investment*) is 0.307, with a standard deviation of 0.377, aligning with those reported in the literature (Almeida and Campello, 2007; Chaney et al., 2012). Other firm characteristics also align with prior findings. We observe a decline in the average investment ratio from 0.315 before the event to 0.301 afterward. However, simultaneous changes in other firm characteristics must be controlled to accurately assess the impact of the expansion of ESG ratings on corporate investment.

4. Empirical Analysis

In this section, we analyze the impact of ESG information on corporate investment using a difference-in-differences approach. Additionally, we conduct a range of endogeneity tests, including dynamic treatment effects tests, alternative control group assessments, and falsification tests, along with additional robustness checks.

4.1. Baseline Regressions

As discussed in Section 2, given the various potential channels through which ESG information affects corporate investment, whether ESG information has a positive or negative impact remains an empirical question. In this section, we use a difference-in-differences regression analysis to examine its effect on corporate investment, as outlined in Eq. (1).

The regression results are reported in Table 2. The t-statistics, shown in parentheses, are computed using standard errors clustered at the firm level. Column (1) presents the results with only firm and year fixed effects. The interaction term Treated×Post has an estimated coefficient of -0.034, with a t-statistic of -3.63.[9] Column (2) includes additional time-varying firm characteristics. The effect of ESG ratings expansion on investment remains similar and is significant at the 1% level. Notably, the coefficient is -0.041 after accounting for these controls.This translates to a reduction of 0.041 in the investment ratio for treated firms relative to control firms, which is roughly 11% of its standard deviation, highlighting a considerable economic effect.

We also conduct a back-of-the-envelope calculation to estimate the potential reduction in investment resulting from the expansion of Refinitiv ESG ratings to Russell 2000 firms. Based on the average estimation of our baseline regressions, the expansion of ESG ratings is associated with a change in the investment ratio of -0.0375 per firm-year for treated firms relative to controls. Using the average value for property, plant, and equipment (PPENT) of $967 million per firm in our sample, this implies a reduction in investment of approximately $36 million per firm-year (-0.0375×967). Extrapolating across Russell 2000 firms, the total decrease in investment for the entire treated cohort in one year is estimated to be around $72 billion ($36 \times 2,000$). Overall, our

[9]The model excluding time-varying controls helps mitigate potential concerns of endogenous control variables, as discussed by Angrist and Pischke (2009). The similarity of this result to that of the specification with such controls further reinforces the robustness of our findings.

analyses indicate a significant decrease in corporate investment when firms begin receiving ESG ratings information.

4.2. Dynamic Treatment Effects

Our baseline regressions reveal a decrease in capital investment when a firm begins receiving an ESG rating from Refinitiv. The key assumption underpinning this difference-in-differences analysis is the parallel trends assumption. This assumption posits that, in the absence of ESG ratings, the average change in investments would have followed the same trend for both the treatment and control groups. The decline in corporate investment is driven by the introduction of ESG ratings. Therefore, this assumption suggests that investment trends for the treatment and control groups should have been identical before the introduction of ESG ratings.

To verify this assumption, we follow Bertrand and Mullainathan (2003) and apply a dynamic treatment effect model to ensure that changes in investment for the treatment and control groups occur only after the ESG rating expansion event. Specifically, we replace the interaction term *Treated*×*Post* in the baseline regression (Eq. (1)) with interaction terms between *Treated* and year dummies as follows:

$$Y_{i,t} = \alpha + \sum_{j} \beta_j \text{Treated}_i \times \text{Year}_j + \Gamma' X_{i,t} + \delta_i + \sigma_t + \varepsilon, \tag{2}$$

where $Year_j$ is a dummy variable that equals one for observations in the jth year relative to the event, and zero otherwise, where $j = -3, -2, -1, 1, 2, 3$. The coefficient β_j captures the effect of ESG ratings expansion on corporate investment in the jth year relative to the event.[10]

The regression coefficients β_j are visually displayed along with their 90% confidence intervals in Figure 1. The figure shows that the coefficients of the interaction terms between the treatment and year dummies are statistically insignificant prior to the expansion of ESG ratings but become significantly negative afterward. Specifically, the coefficients display no discernible trend before the expansion event, followed by a sharp decline to significantly negative levels thereafter. This pattern is consistent with the parallel trends assumption underlying the difference-in-differences analysis.

[10] In this regression, we use 2015 as the benchmark year, where the ESG ratings were expanded and released to the public at the end of this year.

4.3. Analysis with an Alternative Control Sample

Our previous analysis reveals that investment trends for treated and control firms were similar before the ESG rating expansion, with declines in investment emerging only after the inclusion of the Russell 2000 in Refinitiv ESG ratings. This supports the parallel trends assumption. Nonetheless, potential concerns may still arise if the ESG rating expansion coincides with other time-varying factors that could influence investment. For example, control firms without ESG ratings might be smaller than treated firms. While firm fixed effects address some of these differences, time-varying unobservables might still affect investment outcomes.

To address these concerns, we use an alternative control sample to ensure that the observed reduction in investment is not driven by time-varying unobservable differences between treated (Russell 2000 index) firms and control (non-rated) firms. Specifically, we employ Russell 1000 index firms, which were already included in Refinitiv ESG ratings as of 2010. As discussed in Rosenbaum (1987) and Roberts and Whited (2013), an alternative control group that significantly differs from the primary control group along unobserved dimensions can serve as a test for the relevance of the omitted variables in determining the treatment effect. The underlying rationale is that if the outcome is influenced by time-varying unobservable differences between the treatment group and the control group, then an alternative control group with substantial differences from the first group should generate different outcomes. Therefore, using an alternative control group can help assess whether variations in time-varying unobservables are confounding the treatment effect.

In our setting, Russell 1000 firms and unrated firms are very different, with Russell 1000 firms being much larger and more valuable. The significant differences make Russell 1000 firms an ideal alternative control group for mitigating concerns that unobservable time-varying differences between the treated and control groups are driving the observed decline in investment. Table 3 presents the regression results with this alternative control group. Column (1) includes firm and year fixed effects, while Column (2) adds time-varying firm-specific controls. The results consistently show a significant decline in corporate investment of similar magnitude. The robustness of these findings indicates that the drop in investment is not due to time-varying unobservable differences between the treated and control groups. This strengthens the causal relationship between ESG

information and corporate investment.

4.4. Falsification Tests

If the decline in corporate investment is attributable to the introduction of ESG ratings for Russell 2000 firms, we do not anticipate similar effects in investments with falsified timings of the expansion event or for firms not in the Russell 2000 index. Therefore, to further address endogeneity concerns, we conduct several falsification tests in this section. First, we assume alternative timings for the inclusion of Russell 2000 firms in the Refinitiv ESG ratings by shifting the rating expansion to periods before and after the actual event. For the pre-expansion test, we use the years 2013-2014, with 2013 as the pre-event year and 2014 as the post-event year. For the post-expansion test, we use 2017-2018, with 2017 as the pre-event year and 2018 as the post-event year. Second, we assume a falsified treated sample by designating Russell 1000 firms as the treatment group, while the control group remains non-rated firms. In this case, the pre-event period is 2014-2015, and the post-event period is 2016-2018.

Table 4 displays the regression results for these falsification tests. Column (1) shows results for the pre-expansion years 2013-2014. Column (2) presents results for the post-expansion years 2017-2018. Column (3) reports results with Russell 1000 firms as the treated group. None of these tests reveal a significant reduction in corporate investment. These findings suggest that the reduction in corporate investment is specific to the treated Russell 2000 firms around the Refinitiv ESG rating expansion event, further reinforcing the causal link between ESG information and corporate investment.

4.5. Tests with Matched Control Samples

In our empirical framework, the treatment group consists of Russell 2000 firms, while the control group comprises unrated firms. While treated firms are systematically larger than control firms—potentially raising concerns about selection bias—our previous analysis using Russell 1000 firms as an alternative sample mitigates this concern. To further ensure robustness, we implement two additional approaches: (1) using the largest 1,000 unrated firms as an alternative control group, and (2) applying propensity score matching to construct a matched control sample.

Table 5 presents these robustness checks. Column (1) reports results using the largest 1,000

unrated firms as the control sample, while Column (2) presents estimates from propensity score matched control sample. Across both specifications, we continue to find significantly negative coefficients, reinforcing the robustness of our core finding regarding reduced corporate investments.

4.6. Robustness Tests

In this section, we perform additional robustness tests. First, we evaluate the robustness of our findings using two alternative measures of corporate investment: *FAGrowth* and *InvAdjusted*, following Durnev and Mangen (2009), Lara, Osma, and Penalva (2016), and Jacob, Michaely, and Müller (2019). *FAGrowth* is defined as the growth rate of property, plant, and equipment (PP&E) from the previous year to the current year. *InvAdjusted* is calculated as the sum of research and development (R&D) expenditure, capital expenditure, and acquisition expenditure, minus cash receipts from the sale of PP&E, scaled by lagged PP&E. The *FAGrowth* measure captures the growth rate of fixed assets, while *InvAdjusted* incorporates not only capital expenditure but also investments in R&D and acquisitions.

Table 6 displays the results of these robustness checks. Column (1) presents results using *FAGrowth* as the investment measure, while Column (2) uses *InvAdjusted* as an alternative measure. Our analyses demonstrate that the findings remain consistent with both measures, thereby reinforcing the robustness of our results. Additionally, this robustness check also addresses concerns that the observed decline in capital expenditure might be attributable to a shift towards intangible R&D investments (Falato, Kadyrzhanova, and Sim, 2013; Gutiérrez and Philippon, 2017). By incorporating R&D investment into our measure of corporate investment, we still find a consistent decline, further supporting the robustness of our conclusions.

Second, to improve the external validity of our results, we extend our analyses to a broader sample period, including additional firms as they are gradually incorporated into Refinitiv's ESG ratings. We examine whether the reduction in investment continues to hold for these firms that begin receiving coverage. Specifically, we use the variable *ESGDummy*, a binary indicator that equals one if a firm is covered by Refinitiv's ESG ratings in a year and zero otherwise. We analyze the impact of ESG rating initiation on corporate investment using data from 2002 to 2021. We apply a propensity score matching approach to identify the closest match for each firm covered by Refinitiv in a year.

Table 7 presents the regression results. Columns (1) and (2) show the results with and without time-varying firm controls. In both cases, we observe significantly negative coefficients, suggesting that firms covered by Refinitiv ESG ratings experience a reduction in corporate investment. The consistency of our main findings strengthens the external validity of our results.

4.7. Further Discussions

Our analysis identifies a significant decline in corporate investment following Refinitiv's expansion of ESG ratings. However, a potential concern is that some firms in the Russell 2000 index may have been covered by other ESG rating agencies, raising the possibility that the shock of Refinitiv's expansion may not be as significant as suggested. Specifically, during the period of Refinitiv's expansion, coverage by Sustainalytics and S&P was limited to fewer than 1,000 firms, indicating that their coverage did not overlap extensively with the broader universe of Russell 2000 firms. In contrast, MSCI's coverage expanded in 2012, from a few hundred to more than 2,000 firms (Pástor et al., 2021), potentially overlapping with Russell 2000 firms. This raises the concern that the expansion of MSCI ratings may have reduced the perceived significance of Refinitiv's ESG rating expansion in 2015.

We argue, however, that MSCI's expansion does not pose a threat to the robustness of our findings for two primary reasons: First, MSCI's ratings expansion occurred in 2012, three years before the event of interest—Refinitiv's expansion in 2015. Our dynamic treatment effect analysis shows that significant changes in corporate investment began only in 2016, indicating that the effects we observe cannot be attributed to MSCI's expansion. Second, even if MSCI's expansion overlapped with some Russell 2000 firms, this would likely result in an attenuation bias. In other words, any reduction in the significance of Refinitiv's shock due to this overlap would imply that our estimates may be conservative, and the true effect might be stronger than what we observe.

5. Potential Mechanisms

Our analyses thus far have demonstrated that the Refinitiv's expansion of ESG ratings leads to a reduction in corporate investment for treated firms relative to control ones. In this section, we conduct additional tests to explore potential explanations for the observed decline in investment.

Specifically, we examine this reduction through the lenses of both a capital budgeting and an agency perspective. Furthermore, we provide discussions on whether the substitution from ESG initiatives might drive the result.

5.1. A Capital Budgeting Perspective

From a capital budgeting perspective, ESG information may influence corporate investment decisions by shaping either the expected cash flows or the hurdle rate. Specifically, ESG information can affect the expected cash flows of investment projects or the cost of capital, thereby prompting managers to reassess their valuation and adjust investment decisions accordingly. In the following, we examine whether the reduction in investments is driven by a decrease in expected cash flows or by an increase in the hurdle rate.

5.1.1. Expected Cash Flow

In this section, we investigate whether the observed reduction in corporate investments is attributable to managers' expectation of deteriorating expected cash flows for projects. Firms receiving poor ESG ratings might face declines in expected cash flows due to negative customer reactions, whereas firms with strong ESG ratings may see an increase in expected cash flows. If the adverse effects prevail, we would expect a corresponding reduction in investment associated with the ESG ratings expansion.

If the reduced cash flows is the primary reason driving the decline in investment, we expect to observe a deterioration in firm performance. Thus, we examine the effect of ESG ratings expansion on firm performance. We assess firm performance using three proxies: return on assets (ROA), return on equity (ROE), and future cash flow ratio (FCF). Specifically, ROA is the ratio of income before extraordinary items to lagged total assets, ROE is net income divided by lagged total equity, and FCF is the operating income before extraordinary items plus depreciation, divided by lagged total assets, measured in the following year. Table 8 presents the regression results. Columns (1), (2), and (3) show the effects of ESG ratings on ROA, ROE and FCF, respectively. Across all three specifications, we observe significant negative effects on firm performance, which supports the explanation of reduced expected cash flows.

However, a concern may arise that managers may remain unaware of the decline in future cash

flows and make errors in their capital budgeting decisions. To address this concern, we conduct additional tests to assess whether managers also downgrade their expectations in response to the Refinitiv's expansion event, thereby reducing their valuation of investments and decreasing corporate investment. Specifically, we employ management earnings forecast data from I/B/E/S to examine how their annual forecasts change with Refinitiv's ESG ratings expansion. We use *EPS-Growth* to capture the growth rate of management's median earnings per share forecast from the prior year to the current year. Column (1) of Table 9 presents the effect of the ESG ratings expansion on management earnings forecasts. It shows significantly negative coefficient, indicating that managers indeed revise their forecasts downward with the expansion event. The consistent observation between management forecasts and future cash flows reinforces that the decline in expected cash flows is likely to be the main mechanism behind the reduction in corporate investments.

We further analyze whether this reduction in expected cash flows is driven by decreased sales. Firms with low ESG ratings are likely to experience lower sales if customers choose to avoid their products (Darendeli et al., 2022; Meier et al., 2023; Duan et al., 2024). Specifically, we measure sales using *SalesGrowth*, which represents the growth rate of sales from the previous year to the current year. Column (2) of Table 9 reports the effect of ESG rating expansion on sales growth. We find a significant negative effect, aligning with the reduction in sales and adverse customer reactions. This is consistent with the findings of Derrien et al. (2024), who document that the negative impact of adverse ESG news on analyst earnings forecasts is primarily driven by reduced sales.

As discussed earlier, we hypothesize that customers' responses to the ESG ratings expansion may vary between treated firms receiving high and low ESG ratings. Specifically, we expect treated firms with low ESG ratings to experience negative consequences, while those with high ESG ratings may see positive outcomes. The observed decline in corporate investment suggests that the negative effects outweigh the positive effects. To explore whether firms with high and low ESG ratings respond differently, we categorize our treated firms—those that begin to receive ESG scores—into two subsamples: one consisting of treated firms with low ESG ratings (below the median) and the other with high ESG ratings (above the median). We then empirically analyze the impact of the ESG ratings expansion on both subsamples.

Table 10 presents the effects of the ESG ratings expansion on management earnings forecast,

sales growth, and investment for both subsamples. Panel (a) shows the regression results for treated firms with low ESG ratings, while Panel (b) presents results for treated firms with high ESG ratings. Our analysis reveals asymmetric effects on these two groups. For firms with low ESG ratings, we observe a significant decline in management earnings forecast, sales growth, and investment. However, firms with high ESG ratings show no positive responses: there are no significant changes in management earnings forecast, sales growth, and investment. The results also remain robust using ASSET4 data prior to 2018, addressing concerns about possible score revisions (Berg, Fabisik, and Sautner, 2021). The observed asymmetry is likely driven by consumers' asymmetric responses to ESG information, whereby low ESG ratings elicit strong adverse reactions, while high ESG ratings generate no significant responses. This pattern aligns with Krüger (2015)'s findings that stock prices react strongly to negative ESG events but very weakly to positive ones.

This asymmetric investment response between high- and low-ESG-rated firms also sheds light on whether ESG information could generate positive social impact. The theory of Pástor et al. (2021) suggests that ESG information can shift capital from brown to green firms, boosting green investments and growth while reducing brown firms', thereby generating societal benefits. However, our findings suggest that while ESG information may increase the relative size of sustainable firms in the society, it does so at the expense of overall business growth. In addition, we identify the reduced expected cash flows is likely to be the channel driving this shift.

5.1.2. Hurdle Rate

In this section, we focus on whether the reduced corporate investment could be also driven by an elevated cost of capital. With the advent of corporate ESG ratings, investors are now better equipped to monitor and evaluate companies' environmental, social, and governance practices. Companies with poor ESG ratings may face negative investor sentiment or reduced investment interest, potentially resulting in a higher cost of capital, while those with strong ratings may benefit from a lower cost of capital (Pástor, Stambaugh, and Taylor, 2022; Hong and Kacperczyk, 2009; Luo and Balvers, 2017; Bolton and Kacperczyk, 2021). If the adverse effect dominates, we anticipate a decline in corporate investment following the expansion of the Refinitiv ESG ratings. To test this hypothesis, we first explore the relationship between the ESG ratings expansion and the cost of capital.

We apply two methodologies to estimate the implied cost of equity, drawing from Claus and Thomas (2001) and Lee, Ng, and Swaminathan (2009).[11] Specifically, *CostEquity* refers to the implied cost of equity as per Lee et al. (2009), while *CostEquity2* represents the cost of equity following Claus and Thomas (2001). Additionally, we calculate the cost of debt using loan-level data from DealScan, where *LoanSpread* represents the logarithm of the interest premium on firm loans—the difference between the loan's interest rate and the London Interbank Offered Rate (LIBOR), measured in basis points. Table 11 presents the impact of ESG ratings expansion on the cost of capital. Columns (1), (2), and (3) display the effects on *CostEquity*, *CostEquity2*, and *LoanSpread*, respectively. Our empirical results reveal no significant relationship between ESG ratings expansion and either the cost of debt or the cost of equity. These findings suggest that the decline in corporate investment is unlikely to be attributed to an increase in the hurdle rate.

To further address concerns about whether the observed decline in investments is driven by changes in the cost of capital, we examine the impact of ESG ratings expansion on the amount of external capital raised by firms. If the cost of capital were the primary factor, we would expect to see reduced external financing available for investments (Fazzari et al., 1988; Kaplan and Zingales, 1997; Almeida and Campello, 2007). Specifically, we would anticipate a decline in external capital following the expansion of the Refinitiv ESG ratings. We utilize several proxies for external financing: leverage ratio (*Leverage*), net debt issuance (*NetDebtIssue*), net equity issuance (*NetEquityIssue*), and total issuance (*TotalIssue*). *Leverage* represents book leverage, calculated as the ratio of long-term debt to total assets. *NetDebtIssue* measures long-term debt issuance minus long-term debt redemption and changes in short-term debt, scaled by lagged total assets. *NetEquityIssue* is equity issuance minus the purchase of common and preferred stock, divided by lagged total assets. *TotalIssue* combines net debt issuance and net equity issuance. Table 12 displays the impact of ESG ratings expansion on corporate external financing. Columns (1), (2), (3), and (4) report the effects on *Leverage*, *NetDebtIssue*, *NetEquityIssue*, and *TotalIssue*, respectively. Our results indicate no significant relationship between ESG ratings expansion and external financing. Overall, our empirical evidence suggests that the decline in corporate investment is unlikely to be attributed to an increase in the hurdle rate.

A potential concern is that the positive and negative effects of the ESG ratings expansion on

[11] A detailed description of both methodologies is provided in Appendix B.

the cost of capital for firms receiving high and low ratings may offset each other, resulting in no net effect at the average level. To address this, we conduct additional analyses of the impact of the ESG ratings expansion on the cost of capital for treated firms with both high and low ratings. Specifically, we divide the treated firms into two subsamples: one with low ratings (below the median) and the other with high ratings (above the median). We then empirically examine how the ESG ratings expansion affects the cost of capital for each subsample. Table 13 reports the effects on both the cost of equity and the cost of debt for these subsamples. Panel (a) presents results for treated firms with low ratings, while Panel (b) shows results for treated firms with high ratings. Our analysis reveals no significant changes in the cost of capital for either subsample. This result remains robust when using ASSET4 data prior to 2018, avoiding potential concerns about score revisions highlighted by Berg et al. (2021). This finding further supports our conclusion that the decline in investment is unlikely to be driven by changes in the cost of capital. Moreover, our results contribute to the ongoing debate on whether ESG information can promote economic decarbonization through their impact on the cost of capital (Bolton and Kacperczyk, 2021; Edmans, Levit, and Schneemeier, 2022; Pástor et al., 2022; Karolyi, Wu, and Xiong, 2023; Berk and Binsbergen, 2025). Our finding is in line with the recent work of Berk and Binsbergen (2025), who shows that ESG divestment has no detectable effect on the cost of capital of firms.

5.2. An Agency Perspective

As discussed in Section 2, ESG information may also shape corporate investment decisions by mitigating agency problems within firms. Specifically, ESG information may help address underinvestment issues by reducing information asymmetry between capital providers and firms. Additionally, they may alleviate overinvestment problems by enabling shareholders to more effectively monitor managerial decisions. The decline in investment following the expansion of Refinitiv ESG ratings contradicts the prediction of reduced underinvestment but aligns with the prediction of decreased overinvestment.

If the mitigation of the overinvestment agency problem were dominant, we would expect firms to reduce non-profitable investments, thereby enhancing firm performance and investment efficiency. However, our earlier analysis shows a decline in firm performance across various proxies, contradicting this prediction. Additionally, following the approach of Biddle et al. (2009) and Chen

et al. (2011), we measure investment efficiency through the sensitivity of investment to growth opportunities. This sensitivity indicates how quickly firm investments respond to changing growth opportunities, with higher efficiency reflecting a more responsive investment strategy. We use two proxies for growth opportunities: market-to-book ratio (MB) and sales growth rate ($SalesGrowth$). To analyze how ESG ratings expansion affects investment sensitivity to growth opportunities, we include additional interaction terms $Treated \times Post \times MB$ ($Treated \times Post \times SalesGrowth$), $Treated \times MB$ ($Treated \times SalesGrowth$), and $MB \times Post$ ($SalesGrowth \times Post$) in our baseline regressions. The coefficient of the triple interaction term reveals the effect of ESG ratings expansion on the sensitivity of investment to growth opportunities. Table 14 reports the regression results. Both coefficients for the tripple interaction terms are significantly negative, indicating a decrease in investment efficiency. Thus, our empirical evidence rules out the explanation that the decline in corporate investment is due to a reduction in overinvestment agency problem.

5.3. Discussions on Substitution Effects

So far, we have shown that the reduction in corporate investment is likely to be driven by the reduction in expected cash flows. In this section, we conduct additional analyses to investigate whether this observed reduction in corporate investment may be result from a substitution effect, wherein increased ESG-related activities may crowd out corporate capital investments. Under this hypothesis, the decline in corporate investment is not attributed to diminished expected cash flows or project profitability but rather to the reallocation of resources toward ESG initiatives. If this mechanism is dominant, we anticipate that companies would first curtail inefficient or marginal investment projects, as these are less costly to eliminate when shifting focus to ESG activities. Consequently, the remaining capital expenditure would be more efficient, leading to an improvement in investment efficiency. However, our prior empirical analyses indicate the opposite outcome: a decrease in capital investment efficiency following the expansion of ESG information.

In addition, if the substitution mechanism is predominant, we expect treated firms to show a significant increase in ESG activities relative to control firms. Moreover, as noted by Di Giuli and Kostovesky (2014), many ESG initiatives—such as charitable contributions and work-life benefits—are implemented through Selling, General, and Administrative (SG&A) expenses. If firms reallocate funds from capital investments to ESG activities, we would expect an increase in SG&A

expenses. To test this hypothesis, we use two proxies: Sga1 (the ratio of SG&A expenses to total sales) and Sga2 (the ratio of SG&A expenses to total assets). However, Table 15 shows no significant effects.

Lastly, if the substitution mechanism dominates, non-financially constrained firms should not experience a reduction in corporate investment because they have ample resources for both projects and ESG initiatives. In contrast, if the expected cash flow channel is dominant, even unconstrained firms would reduce investment due to diminished project profitability. Given the different predictions, we focus on the non-constrained sample. We capture financial constraints using three measures: the HP index from Hadlock and Pierce (2010) and the equity and debt constraints from Linn and Weagley (2024). The HP index is calculated based on firms' age and size characteristics. Linn and Weagley (2024) derived their measures by training a random forest on the textual analysis-based financial constraints of Hoberg and Maksimovic (2015).[12] High values on all three measures indicate more severe financial constraints, and we classify firms as non-financially constrained if they fall in the bottom quartile. Table 16 presents the impact of ESG rating expansion on investment for unconstrained firms. In Columns (1), (2), and (3), the non-constrained firms are selected based on the HP index, equity constraint, and debt constraint, respectively. The persistent reduction in investment suggests that the expected cash flow channel, rather than the substitution channel, is likely to the primary mechanism.

6. Heterogeneity Tests

Our analyses document a significant reduction in corporate investment with the Refinitiv' expansion shock of ESG ratings, and suggest that reduced expected cash flows are likely to be the primary reason driving this decline. In this section, we conduct additional heterogeneity tests to identify the factors that drive the sensitivity of investments to the introduction of ESG ratings, as well as to determine factors that may amplify the negative impact on investment.

First, we investigate how the decline in investments varies with the climate concerns. If firms reduce investments due to the increased external pressure from consumer responses, we would expect this effect to be more pronounced when climate concerns are higher. To measure climate

[12]Linn and Weagley (2024) develop both full-model and primitive-variable measures. We use the full-model measures; however, our results remain robust when using the primitive measures.

concerns, we use both year-level and state-level data. We utilize the Climate Change News Index (*ClimateNews*) from Engle, Giglio, Kelly, Lee, and Stroebel (2020). This is a time-series index, constructed through textual analysis of newspapers. Higher values of this index indicate greater climate concerns. We also examine state-level data from Howe, Mildenberger, Marlon, and Leiserowitz (2015), which estimates the percentage of respondants who somewhat or strongly oppose global warming. We use three proxies: *HappeningOppose*, *HarmOppose*, and *RenewablesOppose*, which represent the percentage of respondants opposing the belief that global warming is occurring, that it harms people in the U.S., and that renewables should be used for electricity production, respectively. These proxies are negatively related to climate pressure at the state level.

Table 17 displays how the reduction in investment correlates with climate concerns. We focus on the interactions between *Treated*×*Post* and each of *ClimateNews*, *HappeningOppose*, *HarmOppose*, and *RenewablesOppose*. Our results reveal a significantly negative coefficient for *Treated*×*Post*×*ClimateNews*, while the coefficients for the other three tripple interaction terms are significantly positive. This pattern supports the idea that the reduction in corporate investment is more pronounced when climate pressure is higher.

Second, we analyze the heterogeneity effects across firm size. We hypothesize that the negative effects of the ESG ratings expansion on corporate investment will be more pronounced for smaller firms, as they typically have fewer resources to address the negative consequences from external demands for improving ESG performance. To test this, we divide our sample into two subsamples based on firm size: one for firms above the median size and the other for those below it. Specifically, *LargeSize* is an indicator variable that equals one if the firm size is above the median and zero otherwise. We add the interaction terms *Treated*×*Post*×*LargeSize*, *Treated*×*LargeSize*, and *Post*×*LargeSize* to the baseline regression. Column (1) of Table 18 shows that the coefficient for *Treated*×*Post*×*LargeSize* is significantly positive, indicating that the reduction in investment resulting from the ESG ratings expansion is less severe for larger firms.

Lastly, we investigate how the effect of the ESG ratings expansion varies with industry competition. We hypothesize that customer reactions to low ESG firms are less severe in industries with fewer competitors, as customers have fewer alternative choices. We test this hypothesis by analyzing whether the reduction in investment is more evident for firms in industries with more competitors. Specifically, *LogNoCompetitors* represents the natural logarithm of the number of firms within an

industry. We run regressions including the interaction terms *Treated*×*Post*×*LogNoCompetitors*, *Treated*×*LogNoCompetitors*, and *Post*×*LogNoCompetitors*, along with baseline controls, and firm and year fixed effects. Column (2) of Table 18 shows a significantly negative coefficient for *Treated*×*Post*×*LogNoCompetitors*, suggesting that the reduction in investment due to the ESG ratings expansion is more pronounced in industries with more competitors.

7. Concluding Remarks

This paper utilizes a difference-in-differences methodology to analyze the impact of ESG information on corporate investment, employing a quasi-natural experiment stemming from the large-scale expansion of Refinitiv ESG ratings coverage to Russell 2000 firms. Our findings reveal a significant decline in corporate investment following this expansion. This decline remains robust across various measures and endogeneity tests, suggesting a likely causal relationship between ESG information and corporate investment. Further empirical analysis shows that this reduction in investment is not due to the resolution of overinvestment agency problems, an increase in the hurdle rate or a substitution effect from ESG activities. Instead, it is likely to result from reduced expected cash flows.

Our study contributes to the ongoing debate about the implications of the widespread usage of ESG information by various stakeholders over the past decade. As the ESG concept gains popularity among financial institutions, customers, and regulators, understanding the potential effects of ESG information on underlying companies is critical. While some literature suggests that ESG information induces corporate sustainability practices, others raise concerns. Previous research has largely focused on ESG information's impact on corporate social responsibility, leaving its influence on other crucial corporate decisions underexplored.

By investigating how the expansion event affects corporate investment—the primary determinant of firm value—our paper addresses this gap. We demonstrate that ESG information leads to reductions in both corporate investment and performance, highlighting an important negative aspect of ESG information. Our findings offer new insights into the broader consequences of ESG information, emphasizing the need for a nuanced understanding of its costs and benefits.

Appendix A: Variable Definitions

Variables	Descriptions
Dependent variable	
Investment	Capital expenditure divided by lagged property, plant, and equipment.
The main variables of interest	
Treated	A dummy variable that takes a value of one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating.
Post	An indicator variable that equals one for years after 2015 and zero otherwise.
Control variables	
MB	The market value of equity scaled by the book value of equity.
Size	The natural logarithm of book assets.
Leverage	Book leverage, defined as the ratio of long-term debt to total assets.
Tangibility	Ratio of property, plant, and equipment to book assets.
CashFlow	The operating income before extraordinary items plus depreciation, divided by lagged book assets.
CashHolding	The ratio of cash to lagged book assets.
Variables for robustness tests	
$Year_j$	A dummy variable that equals one for observations in year j, and zero otherwise.
FAGrowth	Growth rate of property, plant, and equipment from year t-1 to year t.
InvAdjusted	The sum of research and development (R&D) expenditure, capital expenditure, and acquisition expenditure, minus cash receipts from the sale of PP&E, scaled by lagged PP&E.
ESGDummy	A binary indicator that equals one if a firm was covered by Refinitiv ESG rating in a year and zero otherwise.
Variables for potential mechanisms	
ROA	The ratio of income before extraordinary items to lagged total assets.
ROE	The ratio of net income to lagged total equity.
CostEquity	The implied cost of equity as per Lee et al. (2009).
CostEquity2	The implied cost of equity following Claus and Thomas (2001).

Variables	**Descriptions**
Variables for potential mechanisms continued	
LoanSpread	The logarithm of the interest premium on firm loans—the difference between the loan's interest rate and the London Interbank Offered Rate (LIBOR), measured in basis points.
NetDebtIssue	The long-term debt issuance minus long-term debt redemption and the change in short-term debt, scaled by lagged total assets.
NetEquityIssue	The equity issuance minus the purchase of common and preferred stock, divided by lagged total assets.
TotalIssue	The sum of net debt issuance and net equity issuance.
EPSGrowth	The growth rate of management's median earnings per share forecast from the prior year to the current year.
SalesGrowth	The growth rate of sales from year t-1 to year t.
GrossMargin	The difference between sales and the cost of goods sold, scaled by sales.
CostofGoods	The cost of goods sold divided by sales.
ClimateNews	A time-series climate index, constructed through textual analysis of newspapers by Engle et al. (2020).
HappeningOppose	The percentage of individuals who oppose the idea that global warming is happening from Howe et al. (2015).
HarmOppose	The percentage of individuals who oppose the idea that global warming harms people in the U.S. from Howe et al. (2015).
RenewablesOppose	The percentage of individuals who oppose the idea that renewables should be used to produce electricity from Howe et al. (2015).
LargeSize	An indicator variable that equals one if the firm size is above the median and zero otherwise.
LogNoCompetitors	The natural logarithm of the number of firms within an industry.

Appendix B: Calculations of the cost of equity

1. The computation of *CostofEquity*: Following Lee et al. (2009), we utilize the free cash flow valuation model to calculate *CostofEquity*:

$$P_t = \sum_{k=1}^{T} \frac{FE_{t+k}(1 - b_{t+k})}{(1 + r_e)^k} + \frac{FE_{t+T+1}}{r_e(1 + r_e)^T}, \tag{3}$$

where P_t represents the firm's stock price at time t, FE_{t+k} denotes the forecasted earnings for year $t+k$, b_{t+k} is the plowback rate at year $t+k$, and r_e is the cost of equity. The term $FE_{t+k}(1-b_{t+k})$ captures the free cash flow to equity for the firm at year $t+k$. This equation implies that a firm's stock price is equal to the sum of the present value of free cash flows to equity over the next T years and the terminal value $\frac{FE_{t+T+1}}{r_e(1+r_e)^T}$.

Earnings forecasts for years $t+1$ and $t+2$ are based on analyst predictions. The forest for year $t+3$ is assumed to grow at the same rate observed between year $t+1$ and $t+2$. Earnings forecasts for subsequent years are computed by meaning reverting the earnings growth rate from year $t+3$ to its steady-state value by year $t+T+2$. The steady-state growth rate, g, is calculated as the sum of the world average real GDP growth rate over the past 10 years and the long-run average U.S. inflation rate. We apply an exponential rate of decline to mean-revert the growth rate from year $t+3$ to the steady-state growth rate g, using the following formula:

$$g_{t+k} = g_{t+k-1} \times \exp\left[log(g/t_{t+3})/(T-1)\right], \tag{4}$$

and the earnings forecasts from year $t+4$ to $t+T+1$ are

$$FE_{t+k} = FE_{t+k-1} \times (1 + g_{t+k}). \tag{5}$$

Plowback rates are determined in two stages: first, we forecast the plowback rates explicitly for years $t+1$ and $t+2$, with the plowback rate being one minus the firm's dividend payout ratio. The dividend payout ratio is calculated by dividing the actual dividends from the most recent fiscal year by earnings.[13] Second, we linearly mean-revert the plowback rates between years $t+2$ to $t+T+1$ to a steady-state value derived from the sustainable growth rate formula, where $g = ROI \times b$ and

[13]For firms with negative earnings, we use 6% of total assets as a proxy for earnings.

ROI is set to r_e. Therefoer, the steady-state plowback rate is $b = g/r_e$, and intermediate plowback rates from $t+3$ to $t+T$ $(k = 3, ..., T)$ are computed as:

$$b_{t+k} = b_{t+k-1} - \frac{b_{t+2} - b}{T-1}. \tag{6}$$

The terminal value at time $t+T$ is obtained by computing the present value of a perpetuity: $TV_{t+T} = \frac{FE_{t+T+1}}{r_e}$.

By obtaining earnings forecast and plowback rates and applying a 15-year horizon ($T = 15$), we solve equation 3 to obtain the implied cost of equity r_e.

2. The computation of *CostofEquity2*: Following Claus and Thomas (2001), we measure the the cost of equty, *CostofEquity2*, using the following model:

$$P_t = bv_t + \sum_{i=1}^{5} \frac{ae_{t+i}}{(1+k)^i} + \frac{ae_{t+5}(1+g)}{(k-g)(1+k)^{t+5}}, \tag{7}$$

where P_t is the stock price at time t, bv_t is the book value of equity at t, k is the implied cost of equity, g is the steady state growth rate, and ae_{t+i} represents expected abnormal earnings, calculated as:

$$ae_{t+i} = e_{t+i} - k(bv_{t+i-1}), \tag{8}$$

where e_t denotes the earnings forecast for year t. This model employs a 5-year horizon. Similarly, the long-run nominal GDP growth rate is used to estimate g. Earnings forecast for the first two years are obtained from analyst predictions, with abnormal earnings ae growing at a rate that converges to the long-run rate g in year $t+6$. The book value of equity is sourced from the company's financial statements. Therefore, by solving equation 7 , we derive the implied cost of equity k.

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Table 1: Summary Statistics

(a) Entire Sample

VARIABLES	N	Mean	SD	25p	Median	75p
Investment	28,696	0.307	0.377	0.068	0.169	0.372
Treated	28,696	0.236	0.425	0.000	0.000	0.000
Post	28,696	0.579	0.494	0.000	1.000	1.000
MB	28,696	2.292	3.452	0.773	1.533	3.153
Size	28,696	5.380	2.666	3.557	5.692	7.310
Leverage	28,696	0.159	0.201	0.000	0.060	0.273
Tangibility	28,696	0.271	0.300	0.024	0.127	0.475
CashFlow	28,696	-0.210	0.637	-0.178	0.013	0.086
CashHolding	28,696	0.256	0.349	0.034	0.105	0.321

(b) Samples before and after expansion

VARIABLES	Before Expansion				After Expansion			
	N	Mean	SD	Median	N	Mean	SD	Median
Investment	12,081	0.315	0.384	0.172	16,615	0.301	0.372	0.167
Treated	12,081	0.244	0.429	0.000	16,615	0.230	0.421	0.000
Post	12,081	0.000	0.000	0.000	16,615	1.000	0.000	1.000
MB	12,081	2.188	3.402	1.441	16,615	2.367	3.486	1.595
Size	12,081	5.235	2.688	5.550	16,615	5.486	2.645	5.779
Leverage	12,081	0.155	0.199	0.055	16,615	0.163	0.202	0.066
Tangibility	12,081	0.281	0.304	0.139	16,615	0.263	0.296	0.119
CashFlow	12,081	-0.221	0.649	0.012	16,615	-0.202	0.628	0.014
CashHolding	12,081	0.250	0.347	0.101	16,615	0.260	0.351	0.108

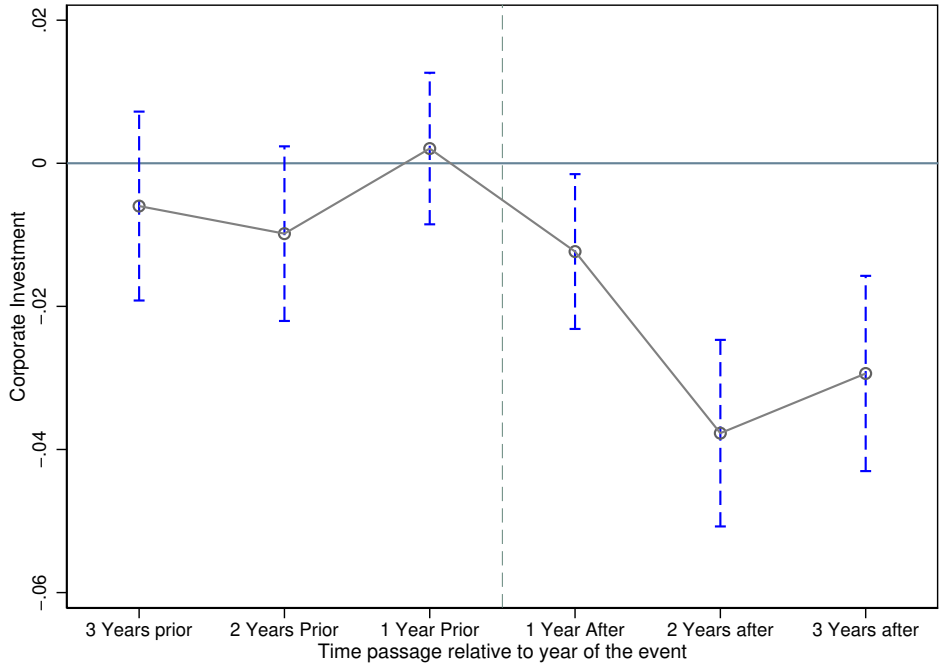
This table presents descriptive statistics for our main variables. Panel (a) covers the entire sample period from 2014 to 2018, while Panel (b) compares the pre-expansion period (2014-2015) with the post-expansion period (2016-2018). Investment is defined as capital expenditure divided by lagged property, plant, and equipment. Treated is a dummy variable that takes a value of one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB represents the market value of equity scaled by the book value of equity. Size is the natural logarithm of book assets. Leverage is book leverage, defined as the ratio of long-term debt to total assets. Tangibility is the ratio of property, plant, and equipment to book assets. CashFlow is operating income before extraordinary items plus depreciation, divided by lagged book assets. CashHolding is the ratio of cash to lagged book assets.

Table 2: Effects of ESG Ratings Expansion on Corporate Investment

	(1)	(2)
VARIABLES	Investment	Investment
Treated×Post	-0.034***	-0.041***
	(-3.63)	(-4.51)
MB		0.006***
		(4.74)
Size		0.070***
		(9.00)
Leverage		-0.026
		(-0.93)
Tangibility		0.179***
		(5.30)
CashFlow		-0.049***
		(-4.00)
CashHolding		0.193***
		(10.48)
Observations	28,696	28,696
R-squared	0.013	0.058
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the effects of ESG ratings expansion on corporate investment. The dependent variable, Investment, is defined as capital expenditure divided by lagged property, plant, and equipment. The primary independent variable of interest is Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Fig. 1. Dynamic Effects of ESG Ratings Expansion on Corporate Investment



Notes: The figure illustrates the 90 percent confidence interval (CI) for the estimated difference-in-differences (DID) coefficients for the interactions of the treatment with the year dummies, as outlined in Eq.(2). The figure presents the specification incorporating time-varying covariates as well as firm and year fixed effects. The confidence interval is constructed using robust standard errors adjusted for clustering at the firm level.

Table 3: Regressions with an Alternative Control Sample

	(1)	(2)
VARIABLES	Investment	Investment
Treated×Post	-0.031***	-0.035***
	(-4.56)	(-5.19)
MB		0.004***
		(3.35)
Size		0.062***
		(6.02)
Leverage		-0.110***
		(-3.00)
Tangibility		0.243***
		(3.60)
CashFlow		0.146***
		(3.67)
CashHolding		0.177***
		(5.30)
Observations	10,951	10,647
R-squared	0.034	0.065
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the effects of ESG ratings expansion on corporate investment using an alternative control sample, specifically employing Russell 1000 firms as the control group. The dependent variable, Investment, is defined as capital expenditure divided by lagged property, plant, and equipment. The main independent variable of interest is Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for Russell 1000 firms. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 4: Falsification Tests

	(1)	(2)	(3)
VARIABLES	Investment	Investment	Investment
Treated×Post	-0.003	0.034	0.009
	(-0.32)	(1.11)	(1.31)
MB	0.002	0.005*	0.005***
	(1.08)	(1.77)	(4.45)
Size	0.073***	0.125	
	(3.46)	(1.56)	
Leverage	0.136**	0.043	0.024
	(2.04)	(0.29)	(0.82)
Tangibility	0.502***	1.439***	0.222***
	(6.17)	(4.09)	(6.69)
CashFlow	-0.041	-0.013	-0.028**
	(-1.48)	(-0.49)	(-2.44)
CashHolding	0.193***	0.107	0.234***
	(4.37)	(1.34)	(12.41)
Observations	11,871	10,938	25,795
R-squared	0.053	0.023	0.045
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

This table presents the results of falsification tests. The dependent variable, Investment, is defined as capital expenditure divided by lagged property, plant, and equipment. The main independent variable of interest is Treated×Post. Columns (1) and (2) assume falsified timings for the inclusion of Russell 2000 firms in the Refinitiv ESG rating. In these columns, Treated is defined as in the baseline regression. Column (1) examines the pre-expansion years 2013-2014, with Post being an indicator variable that equals one for the year 2014 and zero otherwise. Column (2) examines the post-expansion years 2017-2018, with Post being an indicator variable that equals one for the year 2018 and zero otherwise. Column (3) assumes a falsified treated sample, specifically the Russell 1000. Here, Treated equals one for Russell 1000 firms and zero for firms without a Refinitiv ESG rating, with Post defined as in the baseline regression. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 5: Robustness Tests with Matched Control Sample

	(1)	(2)
VARIABLES	Investment	Investment
Treatment×Post	-0.053***	-0.038***
	(-5.73)	(-3.21)
MB	0.005***	0.005***
	(2.74)	(2.93)
Size	0.060***	0.067***
	(3.74)	(4.40)
Leverage	-0.152***	-0.099*
	(-2.99)	(-1.89)
Tangibility	0.243**	0.332***
	(2.34)	(3.24)
CashFlow	0.025	0.034
	(0.59)	(0.96)
CashHolding	0.252***	0.240***
	(6.61)	(6.85)
Observations	11,502	10,800
R-squared	0.634	0.577
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the robustness results with alternative matched control samples. Column (1) reports results using the largest 1,000 unrated firms as the control sample, while Column (2) presents estimates from propensity score matched control sample. The dependent variable, Investment, is defined as capital expenditure divided by lagged property, plant, and equipment. The main independent variable of interest is Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Specifications include firm, and year fixed effects. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 6: Robustness Tests with Alternative Measures

	(1)	(2)
VARIABLES	FAGrowth	InvAdjusted
Treated×Post	-0.066***	-7.662**
	(-5.42)	(-2.42)
MB	0.007***	0.710**
	(4.69)	(2.41)
Size	0.174***	6.544**
	(16.67)	(2.19)
Leverage	0.033	-2.962
	(0.89)	(-0.38)
Tangibility	0.856***	-33.302*
	(19.20)	(-1.83)
CashFlow	-0.065***	-24.458***
	(-4.13)	(-5.65)
CashHolding	0.352***	3.828
	(14.55)	(0.91)
Observations	28,696	11,949
R-squared	0.116	0.030
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the robustness results with alternative measures. The dependent variables are FAGrowth and InvAdjusted. FAGrowth represents the growth rate of property, plant, and equipment, while InvAdjusted is defined as the sum of research and development expenditure, capital expenditure, and acquisition expenditure, minus cash receipts from the sale of property, plant, and equipment, scaled by lagged property, plant, and equipment. The main independent variable of interest is Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Specifications include firm, and year fixed effects. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 7: Robustness Tests with Rating Initiation

	(1)	(2)
VARIABLES	Investment	Investment
ESGDummy	-0.047***	-0.029**
	(-3.80)	(-2.55)
MB		0.002***
		(4.11)
Size		-0.020*
		(-1.76)
Leverage		-0.125***
		(-4.31)
Tangibility		-0.048
		(-0.71)
CashFlow		-0.010
		(-0.26)
CashHolding		0.246***
		(7.44)
Observations	41,885	41,885
R-squared	0.444	0.468
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the robustness results with Refinitiv's rating initiation. The dependent variable, Investment, is defined as capital expenditure divided by lagged property, plant, and equipment. The main independent variable of interest is ESGDummy. ESGDummy is a binary indicator that equals one if a firm was covered by Refinitiv ESG rating in a year and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Specifications include firm, and year fixed effects. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 8: Effects of ESG Ratings Expansion on Corporate Performance

	(1)	(2)	(3)
VARIABLES	ROA	ROE	FCF
Treated×Post	-0.004**	-0.038***	-0.010**
	(-2.19)	(-2.76)	(-2.01)
MB	-0.000	0.003	-0.000
	(-0.91)	(1.19)	(-0.07)
Size	0.018***	-0.007	0.106***
	(6.43)	(-0.51)	(14.46)
Leverage	-0.019*	-0.076	-0.011
	(-1.71)	(-1.20)	(-0.47)
Tangibility	0.011	0.215***	0.095***
	(0.76)	(3.21)	(2.78)
CashFlow	0.642***	0.030	0.008
	(101.96)	(1.15)	(0.82)
CashHolding	0.015**	0.321***	0.102***
	(2.35)	(10.02)	(8.41)
Observations	28,696	28,642	26,482
R-squared	0.850	0.018	0.085
Number of gvkey	7,540	7,533	6,942
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

This table presents the effects of ESG ratings expansion on corporate performance. The dependent variables are ROA, ROE and FCF. ROA is defined as income before extraordinary items divided by lagged book assets. ROE is the ratio of net income to lagged book equity. FCF is the operating income before extraordinary items plus depreciation, divided by lagged book assets, measured in the following year. The main independent variable of interest is Treated×Post. Treated is a dummy variable that takes a value of one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 9: Effects of ESG Ratings Expansion on Management Earnings Forecast and Sales

	(1)	(2)
VARIABLES	EPSGrowth	SalesGrowth
Treated×Post	-0.269*	-0.030***
	(-1.94)	(-3.21)
MB	0.030	0.007***
	(1.28)	(4.27)
Size	0.205	0.105***
	(0.97)	(10.06)
Leverage	-0.416	0.105***
	(-0.69)	(3.01)
Tangibility	-2.709*	0.209***
	(-1.66)	(3.38)
Cashflow	0.017	0.090***
	(0.01)	(4.59)
CashHolding	0.040	0.237***
	(0.10)	(9.88)
Observations	2,273	24,860
R-squared	0.007	0.057
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the effects of ESG ratings expansion on management earnings forecast and sales. The dependent variable are EPSGrowth and SalesGrowth. EPSGrowth is the growth rate of the management earnings forecast from last year to current year. SalesGrowth measures the growth rate of sales from the previous year to the current year. The main independent variable of interest is the interaction term Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 10: Effects of ESG Ratings for Low and High ESG Treated Firms

(a) Low ESG Sample

VARIABLES	(1) EPSGrowth	(2) SalesGrowth	(3) Investment
Treated×Post	-0.453*	-0.027*	-0.042***
	(-1.88)	(-1.85)	(-3.05)
Observations	1,293	20,396	24,124
R-squared	0.014	0.054	0.054
Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

(b) High ESG Sample

VARIABLES	(1) EPSGrowth	(2) SalesGrowth	(3) Investment
Treated×Post	-0.100	-0.011	-0.003
	(-0.88)	(-0.97)	-0.003
Observations	1,384	20,427	24,131
R-squared	0.014	0.056	0.054
Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

This table reports how the effects of ESG ratings on firms' eps and sales growth vary between low and high ESG treated firms. The dependent variables are EPSGrowth, SalesGrowth, and Investment. EPSGrowth is the growth rate of the management earnings forecast from last year to current year. SalesGrowth measures the growth rate of sales from the previous year to the current year. Investment is capital expenditure divided by lagged property, plant, and equipment. The main independent variable of interest is the interaction term Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. Firm-fixed effects, year-fixed effects and baseline controls are included. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 11: Effects of ESG Ratings Expansion on the Cost of Capital

	(1)	(2)	(3)
VARIABLES	CostEquity	CostEquity2	LoanSpread
Treated×Post	-0.003	-0.001	-0.017
	(-0.83)	(-0.27)	(-0.47)
MB	-0.003***	-0.006***	-0.006
	(-5.95)	(-10.29)	(-1.21)
Size	-0.013***	-0.012***	-0.023
	(-3.08)	(-3.49)	(-0.52)
Leverage	0.002	0.037***	0.243
	(0.16)	(4.05)	(1.29)
Tangibility	-0.006	0.070***	-0.063
	(-0.23)	(3.42)	(-0.23)
CashFlow	-0.026	-0.048***	-0.355**
	(-1.63)	(-3.31)	(-2.16)
CashHolding	-0.017**	-0.003	0.130
	(-2.20)	(-0.49)	(1.51)
Observations	10,628	10,224	3,163
R-squared	0.019	0.041	0.018
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

This table presents the impact of ESG ratings expansion on the costs of capital. The dependent variables include CostEquity, CostEquity2, and LoanSpread. CostEquity represents the implied cost of equity based on the methodology of Lee et al. (2009), while CostEquity2 reflects the cost of equity calculated according to Claus and Thomas (2001). LoanSpread is the logarithm of the interest premium on firm loans, which is the difference between the loan's interest rate and the London Interbank Offered Rate, measured in basis points. The key independent variable is Treated×Post. Treated is a dummy variable equal to one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is a dummy variable equal to one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 12: Effects of ESG Rating Expansion on External Financing

	(1)	(2)	(3)	(4)
VARIABLES	Leverage	NetDebtIssue	NetEquityIssue	TotalIssue
Treated×Post	0.004	-0.001	-0.004	-0.003
	(1.15)	(-0.19)	(-0.82)	(-0.46)
MB	-0.003***	-0.000	0.001	0.000
	(-5.97)	(-0.07)	(0.66)	(0.42)
LagLeverage	0.190***	-0.397***	0.132***	-0.458***
	(13.59)	(-28.32)	(5.90)	(-13.06)
Size	0.009***	0.019***	0.007	0.032***
	(3.22)	(6.77)	(1.29)	(4.13)
Tangibility	0.065***	-0.011	0.080***	0.087**
	(4.85)	(-0.82)	(3.18)	(2.32)
CashFlow	-0.012***	-0.012***	-0.181***	-0.218***
	(-3.28)	(-2.66)	(-18.30)	(-15.09)
Observations	28,662	27,468	26,848	25,749
R-squared	0.054	0.126	0.442	0.388
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

This table presents the impact of ESG ratings expansion on external financing. The dependent variables are Leverage, NetDebtIssue, NetEquityIssue, and TotalIssue. Leverage represents book leverage, calculated as the ratio of long-term debt to total assets. NetDebtIssue is long-term debt issuance minus long-term debt redemption and the change in short-term debt, scaled by lagged total assets. NetEquityIssue is equity issuance minus the purchase of common and preferred stock, divided by lagged total assets. TotalIssue is the sum of net debt issuance and net equity issuance. The key independent variable is Treated×Post. Treated is a dummy variable equal to one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is a dummy variable equal to one for years 2016 to 2018, and zero otherwise. LagLeverage is the lagged leverage ratio. MB, Size, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 13: Effects of ESG Ratings Expansion on Cost of Capital for Low and High ESG Treated Firms

(a) Low ESG Sample

	(1)	(2)	(3)
VARIABLES	CostEquity	CostEquity2	LoanSpread
Treated×Post	-0.006	-0.004	-0.053
	(-1.47)	(-1.62)	(-1.24)
Observations	7,292	6,994	2,246
R-squared	0.019	0.039	0.026
Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

(b) High ESG Sample

	(1)	(2)	(3)
VARIABLES	CostEquity	CostEquity2	LoanSpread
Treated×Post	-0.004	-0.000	0.024
	(-1.31)	(-0.02)	(0.52)
Observations	7,297	7,002	2,271
R-squared	0.024	0.044	0.025
Controls	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

This table reports how the effects of ESG ratings expansion on firms' cost of capital vary between low and high ESG treated firms. The dependent variables include CostEquity, CostEquity2, and LoanSpread. CostEquity represents the implied cost of equity based on the methodology of Lee et al. (2009), while CostEquity2 reflects the cost of equity calculated according to Claus and Thomas (2001). LoanSpread is the logarithm of the interest premium on firm loans, which is the difference between the loan's interest rate and the London Interbank Offered Rate, measured in basis points. The main independent variable of interest is the interaction term Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. Firm-fixed effects, year-fixed effects and baseline controls are included. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 14: Effects of ESG Rating Expansion on Investment-Growth Opportunity Sensitivity

VARIABLES	(1) Investment	(2) Investment
Treated×Post×MB	-0.007**	
	(-1.97)	
Treated×Post×SalesGrowth		-0.095**
		(-2.34)
Treated×Post	-0.018	-0.012
	(-1.49)	(-1.45)
Treated×MB	0.005	
	(1.37)	
MB×Post	-0.003	
	(-1.27)	
Treated×SalesGrowth		0.029
		(0.95)
SalesGrowth×Post		-0.060***
		(-3.11)
MB	0.007***	
	(3.99)	
SalesGrowth		0.152***
		(10.09)
Size	0.072***	0.065***
	(9.18)	(7.28)
Leverage	-0.024	-0.069**
	(-0.85)	(-2.41)
Tangibility	0.177***	0.249***
	(5.24)	(5.19)
CashFlow	-0.049***	-0.020
	(-4.03)	(-1.19)
CashHolding	0.190***	0.145***
	(10.30)	(6.58)
Observations	28,696	24,860
R-squared	0.058	0.068
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the effects of ESG ratings expansion on investment-growth opportunity sensitivity. The dependent variable is Investment, defined as capital expenditure divided by lagged property, plant, and equipment. The main independent variables of interest are the interaction terms: Treated×Post×MB and Treated×Post×SalesGrowth. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1, and SalesGrowth is defined in Table 8. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 15: Effects of ESG Ratings Expansion on SG&A Expenses

	(1)	(2)
VARIABLES	Sga1	Sga2
Treatment×Post	-0.002	-0.001
	(-0.61)	(-0.12)
MB	0.002**	-0.001
	(2.18)	(-0.24)
Size	-0.046***	-0.003
	(-8.59)	(-0.18)
Leverage	0.031*	0.023
	(1.87)	(0.42)
Tangibility	0.087***	0.078
	(3.51)	(0.71)
Cashflow	-0.325***	-0.336***
	(-28.48)	(-9.24)
CashHolding	0.333***	0.167***
	(24.94)	(4.57)
Observations	24,062	20,544
R-squared	0.930	0.881
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table reports the effects of ESG ratings expansion on SG&A costs. The dependent variable, Sga1 and Sga2, is defined as the ratio of selling, general and administrative costs to the total sales or to total assets, respectively. The primary independent variable of interest is Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 16: Effects of ESG Ratings Expansion on Investment for Non-financially Constrained Companies

VARIABLES	(1) Investment	(2) Investment	(3) Investment
Treated	-0.014*	-0.025*	-0.093**
	(-1.67)	(-1.80)	(-2.48)
MB	0.002	0.004	0.006***
	(1.38)	(1.61)	(2.92)
Size	0.045***	0.127***	0.120***
	(3.11)	(6.02)	(8.20)
Leverage	0.035	0.043	0.027
	(0.62)	(0.66)	(0.42)
Tangibility	0.255***	0.368***	0.182***
	(3.00)	(3.02)	(3.27)
CashFlow	0.193***	-0.089	-0.068***
	(3.48)	(-1.54)	(-3.61)
Cash	0.137	0.117*	0.164***
	(1.41)	(1.80)	(5.11)
Observations	6,653	4,822	4,946
R-squared	0.608	0.532	0.467
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

This table reports the effects of ESG ratings expansion on corporate investment for non-financially constrained firms. The dependent variable, Investment, is defined as capital expenditure divided by lagged property, plant, and equipment. In Columns (1), (2), and (3), non-financially constrained firms are selected based on the HP index, equity constraint, and debt constraint, respectively. The primary independent variable of interest is Treated×Post. Treated is a dummy variable that equals one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. MB, Size, Leverage, Tangibility, CashFlow, and CashHolding are defined in Table 1. Firm-fixed effects and year-fixed effects are included in all model specifications. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 17: Cross-sectional Variations with Climate Concerns

VARIABLES	(1) Investment	(2) Investment	(3) Investment	(4) Investment
Treated×Post×ClimateNews	-1.894***			
	(-2.86)			
Treated×Post×HappeningOppose		0.009*		
		(1.95)		
Treated×Post×HarmOppose			0.007*	
			(1.83)	
Treated×Post×RenewablesOppose				0.008**
				(2.15)
Treated×Post	-0.016	-0.146*	-0.232	-0.338**
	(-0.35)	(-1.88)	(-1.63)	(-2.51)
Treated×ClimateNews	0.159			
	(0.37)			
HappeningOppose		0.028***		
		(3.25)		
Treated×HappeningOppose		-0.005		
		(-0.55)		
Post×HappeningOppose		-0.005		
		(-1.59)		
HarmOppose			-0.001	
			(-0.11)	
Treated×HarmOppose			0.000	
			(0.01)	
Post×HarmOppose			-0.004	
			(-1.56)	
RenewablesOppose				0.007
				(1.13)
Treated×RenewablesOppose				-0.013*
				(-1.67)
Post×RenewablesOppose				-0.006*
				(-1.93)
Observations	23,249	10,656	10,656	10,656
R-squared	0.060	0.078	0.076	0.077
Controls	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

This table shows how the effects of ESG rating expansion on corporate investment vary with climate concerns. The main independent variables of interest are the tripple interaction terms: Treated×Post×ClimateNews, Treated×Post×HappeningOppose, Treated×Post×HarmOppose, and Treated×Post×RenewablesOppose. Treated is a dummy variable equal to one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. ClimateNews is the climate change news index from Engle et al. (2020). HappeningOppose, HarmOppose, and RenewablesOppose represent the estimated percentage of individuals who somewhat or strongly oppose the ideas that global warming is happening, that it harms people in the U.S., and that renewables should be used to produce electricity, respectively, according to Howe et al. (2015). All models include firm-fixed effects, year-fixed effects, and baseline controls. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.

Table 18: Heterogeneous Effects of ESG Ratings Expansion

VARIABLES	(1) Investment	(2) Investment
Treated×Post×LargeSize	0.126***	
	(4.86)	
Treated×Post×LogNoCompetitors		-0.014**
		(-2.10)
Treated×Post	-0.139***	0.032
	(-5.70)	(0.85)
Largesize	0.011	
	(0.52)	
Treated×LargeSize	-0.087**	
	(-2.51)	
LargeSize×Post	0.006	
	(0.62)	
LogNoCompetitors		-0.229***
		(-4.34)
Treated×LogNoCompetitors		-0.141
		(-1.54)
LogNoCompetitors ×Post		0.007*
		(1.86)
Observations	28,696	28,696
R-squared	0.060	0.060
Controls	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

This table shows the heterogeneous effects of ESG ratings expansion on corporate investment. The dependent variable is Investment, defined as capital expenditure divided by lagged property, plant, and equipment. The main independent variables of interest are the triple interaction terms: Treated×Post×LargeSize and Treated×Post×LogNoCompetitors. Treated is a dummy variable equal to one for Russell 2000 firms and zero for firms without a Refinitiv ESG rating. Post is an indicator variable that equals one for years 2016 to 2018, and zero otherwise. LargeSize is a dummy variable that takes a value of one if the firm size is greater than the median, and zero otherwise. LogNoCompetitors is the natural logarithm of the number of companies within an industry. All models include firm-fixed effects, year-fixed effects, and baseline controls. T-statistics are presented in parentheses below the estimates, with standard errors clustered at the firm level. Statistical significance levels are indicated using asterisks (*, **, ***), representing 10%, 5%, and 1% confidence levels, respectively.