Institutional Investor Distraction and Corporate Green Innovation

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Abstract

Prior studies have largely examined how institutional ownership affects corporate innovation, yet limited attention has been paid to the role of institutional investor distraction. This study examines the impact of institutional investor distraction on corporate green innovation and explores the underlying mechanisms through earnings management and financial constraints. We further investigate the moderating roles of market competition, ESG performance, and analyst coverage. We exploit attention-grabbing shocks to institutional investors' other portfolio firms as plausibly exogenous variation in investor distraction. Using a sample of 7,144 U.S. firms from 2002 to 2024, covering nine industries, we find that institutional investor distraction significantly reduces corporate green innovation. Earnings management and financial constraints serve as important channels through which this effect operates, while market competition, ESG performance, and analysts' coverage significantly moderate the relationship. These findings highlight the importance of institutional attention in shaping firms' green innovation activities and underscore the need to allocate institutional attention and governance resources more effectively, while encouraging managers to strengthen internal governance and environmental commitment when external oversight weakens.

JEL classification: G23; G32; Q55; Q56; O30.

Keywords: Green innovation; Investor distraction; Institutional investors.

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1. Introduction

Given the widespread concerns about global warming and extreme weather risks, the United Nations formulated the Sustainable Development Goals (SDGs) to provide a seminal framework for addressing the climate change crisis (Wu et al., 2023). In practice, the introduction and implementation of low-carbon innovations designed to reduce the consumption of fossil fuels and carbon emissions are viewed as a critical measure to translate high-level SDGs into feasible climate actions (Jin et al., 2024). As low-carbon innovation requires large amounts of investment and may confront higher uncertainty (Xu et al, 2023), both public and private sectors endeavor to accelerate the pace of low-carbon innovation (Wu et al., 2022). In addition to government efforts in adopting various policy tools including tax and subsidy policies encouraging low-carbon innovation, private actors in capital markets, such as large institutional investors, are also putting increasing emphasis on environmental, social, and governance (ESG) investment and start to prompt their portfolio companies to reduce carbon emissions and thereby prepare for a low-carbon economy (Chen et al., 2024). For example, the United Nations Principles for Responsible Investment (UNPRI) has gathered more than 1,600 institutional investors (with around 62 trillion dollars in assets) committed to integrating ESG criteria into their investment practices (Wu et al., 2023).

Institutional investors (e.g., funds, pension funds, QFIIs, insurance, banks, trusts, securities) are professional organizations that specialize in investing in certain firms using their own funds or funds raised from clients to pursue more benefits. Institutional investors possess more funds, information, and expertise than retail investors (Chung et al., 2021) and can use such advantages to make suggestions but assert their voice with regard to firms' green innovation decision-making (Zhao et al., 2023). Hence, institutional investors, as firms' vital stakeholders, could play a crucial role in influencing firms' green innovation (García-Sánchez et al., 2020). Yet, the question of whether institutional investors actively exert effects on the promotion of firms' green innovation remains controversial. Indeed, institutional investors who have different

supervisory motivations and governance capabilities might form disparate preferences, horizons, and inclinations with regard to firms' major decision-making (Oehmichen et al., 2021; Zhao et al., 2023). In addition, institutional investor distraction could also have an impact on firms' green engagement (Ni et al., 2023).

Attention is a scarce cognitive resource and has been documented to influence the decisions of both individual and institutional investors (Pu et al., 2023). The monitoring capacity of institutional investors is also limited because of their scarce attention (Ballinari et al., 2022). When institutional investors allocate more attention to certain stocks in their portfolios, they must simultaneously pay less attention to other portfolio firms, thereby reducing their monitoring intensity over those firms. We borrow the example from Pu et al. (2023) to illustrate this idea more explicitly. Consider an institutional investor who holds two stocks: one in a focal firm and another in a firm from a different industry, such as banking. Suppose there is an attention-grabbing event in the banking industry, such as a banking crisis that causes bank stock prices to decline sharply. Given limited attention, the institutional investor rationally shifts attention toward bank stocks and away from the focal firm. As a result, the monitoring intensity over the focal firm decreases, giving its management more room to pursue private benefits. Since the focal firm does not belong to the banking industry, the reduction in monitoring intensity is plausibly exogenous to the focal firm.

Therefore, by observing how managers of firms adjust their green innovation decisions to respond to the exogenous variation of institutional investors' monitoring intensity, we can establish the causality between firms' institutional investors and their green innovation without the concern of endogeneity issues. This study aims to investigate how institutional investor distraction affects corporate green innovation. Specifically, a positive relationship between institutional investor inattention and green innovation indicates that managers invest more in green innovation when they are less monitored, supporting the notion that green innovation is beneficial to managers instead of shareholders. In contrast, a negative relationship between institutional investor

inattention and green innovation indicates that managers invest less in green innovation when they are less urged by institutional investors to do so, supporting the notion that green innovation is beneficial to shareholders, including institutional investors. To dig deeper potential channels of the interest relationship, we conduct a mechanism analysis, exploring whether earnings management and corporate investment-cash flow sensitivity are the main reasons that institutional investor distraction exposed to less green innovation. Moreover, we conduct heterogeneity analyses to explore how the effects of market competition, ESG performance, and analyst coverage differ in shaping the relationship between institutional investor distraction and green innovation.

We may make several contributions to literature. First, we contribute to the institutional ownership literature, different from the numerous studies that have examined the stability hypothesis, we consider the effects of the attention hypothesis to explore the effect of institutional investor distraction. Second, we are the first to investigate the relationship between institutional investor distraction and firms' green innovation. In addition, we delve deeper into the potential mechanisms through which institutional investors affect corporate green innovation, as well as the heterogeneity effects.

The paper proceeds as follows. Section 2 reviews the theoretical and the empirical literature. The research hypotheses are formulated in Section 3. Section 4 describes our data and the empirical methodology, then presents and discusses the empirical results and the policy and business implications. The robustness tests are conducted in Section 5. Section 6 presents and discusses the heterogeneity analyses. Section 7 concludes the paper.

2. Literature Review

2.1 Theoretical underpinnings

Institutional investors are vital stakeholders with different characteristics who can

influence firms' decision-making through active supervision and governance. Generally, institutional investors hold different rights in firms based on their ownership (Chava et al., 2009) and exhibit diverse attitudes and value pursuits in exerting their rights (Aggarwal et al., 2005; Gloßner, 2019; Erhemjamts & Huang, 2019; Oehmichen et al., 2021). Previous studies have indicated that some institutional investors might supervise firms' managers and participate in firm decision-making to pursue long-term benefits, whereas others might adopt speculative and free-riding approaches in pursuit of immediate returns (Alvarez et al., 2018; Brickley et al., 1988; Ferreira & Matos, 2008; Flammer et al., 2021; Gloßner, 2019). Fich et al. (2015) and Shi et al. (2020) showed that these different effects of institutional investors derive from their disparate supervisory motivations and governance abilities.

Previous studies classify institutional investors into dedicated institutional investors and transient institutional investors based on their shareholding characteristics (Alvarez et al., 2018; Brickley et al., 1988; Ferreira & Matos, 2008) and portfolio characteristics (Choi et al., 2017; Fich et al., 2015; Oehmichen et al., 2021; Ravid & Sekerci, 2020; Ward et al., 2018). Dedicated institutional investors have the characteristics of more shareholding independence and higher portfolio concentration. According to previous studies (Brickley et al., 1988; Choi et al., 2017; Ferreira & Matos, 2008; Fich et al., 2015; Kang et al., 2018), more shareholding independence and higher portfolio concentration are both crucial for institutional investors because these two characteristics produce active supervisory motivation and strong governance ability, respectively. Accordingly, institutional investors who possess these two characteristics are more likely to play a supervisory role. These institutional investors might tend to focus on firms' long-term returns and become active participants in firms' major decision-making (Oehmichen et al., 2021; Qian et al., 2019). On the other hand, transient institutional investors do not simultaneously possess more shareholding independence and higher portfolio concentration (i.e., they have less shareholding independence and/or lower portfolio concentration). Such characteristics could increase

the possibility of short-sighted and speculative behaviors by institutional investors owing to a lack of supervisory motivation and/or governance ability (Brickley et al., 1988; Choi et al., 2017; Ferreira & Matos, 2008; Fich et al., 2015; Qian et al., 2019), leading to an inability to impartially focus on firms' long-term development. Consequently, transient institutional investors are generally viewed as speculators who seek immediate returns from firms (Erhemjamts & Huang, 2019) and might become negative stakeholders in firms' decision-making (Oehmichen et al., 2021; Qian et al., 2019).

According to stakeholder theory, major decision-making, such as green innovation, needs to consider the interests of institutional investors (Erhemjamts & Huang, 2019; Kim et al., 2020; Lins et al., 2017). In turn, institutional investors aim to influence firms' green innovation to maximize benefits (Berrone et al., 2013; García-Sánchez et al., 2020; Jiang & Yuan, 2018). Given the diversity in terms of shareholding independence and portfolio concentration among different types of institutional investors, dedicated and transient institutional investors might have different supervisory motivations and governance abilities and therefore have distinct effects on firms' green innovation.

Stability hypothesis suggests that long-term institutional investors provide the stability needed for managers to pursue innovation (Aghion et al., 2013; Bushee, 1998; Cremers et al., 2020). Prior studies relating institutional ownership to innovation have focused on the access to finance channels by measuring overall levels of institutional holdings by firms dedicated to holding long term positions in the firm (Aghion et al., 2013; Bushee, 1998; Cremers et al., 2020). These studies have causally addressed this debate by examining quasi exogenous changes in membership in the Russell 2000 index or other major stock indexes affecting the levels of IO. The studies suggest that higher levels of overall institutional holdings or dedicated institutional holdings with longer-term positions provide the stability needed for managers to take a longer-term focus on innovation. The maintenance of constant levels of holdings provides secure equity financing for firms to make long-term investments and supports the financing channel

through which firms increase innovation.

However, it is important to note that stable levels of institutional holdings may also proxy for the other two innovation-impacting channels of (1) monitoring of the board and (2) information sharing. A high level of IO does not ensure these other two channels will be utilized, but it creates conditions in which they should be easier and more reliable.1 Stable level of holdings and institutions with longer-term positions should foster tighter relationships between institutional owners and board members. In other words, stable holdings should be highly correlated with the level of attention institutional owners give firms. Many of the prior studies examining levels of institutional holdings likely inadvertently pick up the effects of attention in their studies.

This suggests conclusions from prior studies using levels of institutional holdings may be biased, as attention from institutional holders is not guaranteed. Kempf et al. (2017) and Pu et al (2023) proposed attention hypothesis. Attention is well known to be a finite resource. It is a constraint for many market participants, as, for example, fund managers spend their time only on projects with the highest rates of return, retail investors pay more attention to popular news and even firms like to work with only the most popular YouTubers to advise their products. Attention has been shown to be an important constrained resource for institutional investors as well. For example, Kempf et al. (2017) examine the association between distracted shareholders and corporate actions. Their empirical results demonstrate that distracted institutional investors undermine firm performance due to a temporary loosening of monitoring. Similarly, Liu et al. (2020) investigate the relationship between distracted institutional investors and board governance. They apply the distracted institutional investor measure as an exogenous shock in institutional investors' portfolios and similarly conclude that distracted institutional investors lead to weak monitoring. These studies indirectly suggest that institutions giving their holdings higher attention could improve innovation by (i) providing better monitoring of the board to increase their advisory assistance to management, (ii) gaining enough knowledge to allow tolerance for managerial failures

where appropriate and (iii) allowing better sharing of information leading to potential collaboration with the institutional owner's other firm holdings through common ownership or with others in the industry. In other words, the attention effect should be distinct from and possibly even stronger than the stable funding effect.

2.2 Empirical Literature

In existing empirical literature, a larger number of studies have focused on examining the association between institutional investors and corporate sustainability. For example, historical literature has examined the relationship between different types of institutional investors, such as pension funds, mutual funds, hedge funds, banks, insurance companies, and other investment funds, and corporate sustainability. Additionally, there is a body of literature focusing on the characteristics of institutional investors and their relationship with corporate sustainability. Previous studies find that independent/active institutional investors (Xiang et al., 2021), long-term institutions (Chang et al., 2021), sustainable institutional investors (Kordsachia et al., 2021), and foreign institutional investors lead to increased ESG/CSR performance. Thirdly, some studies identify the moderating role of institutional ownership (IO) in the relationship between corporate sustainability and financial performance. For example, Flammer (2021) reported that the positive link between environment-related shareholder proposals and CDP reporting was moderated by long-term institutional ownership. Similarly, Erhemjamts and Huang (2019) found a moderating influence of long-term institutional ownership on the positive link between CSR/ESG performance and buy-and-hold returns.

Recent studies have increasingly focused on the role institutional investors play in promoting corporate green innovation. Institutional investors, including green investment funds and investors with explicit environmental preferences, significantly impact firms' green innovation activities through various mechanisms. Chi et al. (2023)

investigated how green investment funds (GIFs) contribute to corporate green innovation (CGI) in Chinese listed companies. Their findings indicated that GIFs significantly enhance CGI, particularly in state-owned enterprises and firms with long-term green investments. GIFs alleviate financing constraints faced by firms, mitigate stock risks, and enhance social valuation by reducing resource consumption and increasing resource efficiency. Such effects underscore the dual logic of GIFs - balancing commercial returns with substantial social value. Tang et al. (2024) further reinforced this perspective by demonstrating that green investors exert a notable influence on corporate green innovation, particularly through boosting institutional investment levels, enhancing executives' green perceptions, and attracting high-quality talent. The presence of green investors was particularly beneficial for non-high-polluting, large, and state-owned enterprises, enhancing not only green innovation at source control but also significantly improving companies' Environmental, Social, and Governance (ESG) ratings. Chen et al. (2024) echoed these findings, emphasizing institutional investors' role in enhancing corporate green innovation through mechanisms such as easing corporate financial constraints and incentivizing managerial performance. This positive relationship is strengthened by heightened political and public attention toward environmental issues. The authors argued that institutional investors' preferences significantly direct resources and managerial attention towards environmentally friendly innovations.

A series of studies focus on examining institutional investors' horizons or institutional investor short-termism. They support that long-term institutional investors positively influence corporate governance, environmental sustainability (Drobetz et al., 2024), earnings quality (Mian et al, 2023), creditworthiness (Driss et al., 2021), and market stability (Fu et al., 2024). Conversely, short-term institutional investors generally exert weaker governance effects, contributing less positively or even negatively to these corporate outcomes (Rahim et al., 2024; Dow et al., 2024). These insights highlight the critical importance of distinguishing investor horizons when

considering institutional investor impact.

Among them, there are some studies examining the relationship between institutional investors' horizons and corporate innovation. Zhang et al. (2023) examine the role of institutional investor contestability against controlling shareholders and its effect on firm innovation. The findings indicate that domestic mutual funds enhance corporate innovation through their strong contestability, provided they hold significant ownership. However, the study notes the impact is weaker among short-term mutual funds and quasi-index funds, which exhibit investor short-termism, preferring immediate returns rather than supporting long-term innovation strategies. Chen et al. (2024) investigate how institutional investors with environmental protection preferences impact corporate green innovation. Institutional investors with long-term horizons significantly promote green innovation by alleviating corporate financial constraints and incentivizing managerial efficiency. These investors counteract short-termism by focusing on sustainable, environmentally conscious investments, thereby influencing firms to invest in long-term innovative projects. The study emphasizes the importance of institutional investors who can effectively mitigate corporate myopic behaviors and promote long-term sustainable growth. Moreover, Zhao et al. (2023) highlighted the differentiated impact based on the characteristics of institutional investors. Dedicated institutional investors with greater shareholding independence and portfolio concentration were found to be proactive drivers of green innovation, especially in firms demonstrating strong financial and social performance. In contrast, transient institutional investors were either passive or obstructive, particularly when firms faced adverse financial conditions.

Regarding the institutional investor distraction, previous studies collectively highlight that institutional investor distraction significantly undermines various aspects of corporate governance, including managerial monitoring, financial reporting quality, audit quality, debt structure, and board effectiveness etc. For example, Ballinari et al. (2022) study the impact of investor attention on stock market volatility surrounding

news releases, they find that institutional attention has a stabilizing effect on stock market volatility. Garel et al. (2021) find that distracted institutional investors significantly increase both accrual-based and real earnings management due to reduced monitoring intensity. Chan et al. (2021) argue that increased institutional investor inattention negatively affects audit quality. The findings suggest that distracted institutional investors reduce the likelihood of auditors issuing going-concern opinions, reporting internal control weaknesses, and increase the likelihood of financial misstatements. Cheung et al. (2024) discuss the relationship between institutional investor distraction and corporate debt maturity decisions.

Only a limited number of studies explore how institutional investor distraction affects corporate innovation. Gao et al. (2023) analyze how institutional distractions affect firms' R&D activities in transition economies. They argue that institutional environments - such as government-imposed employment goals and political considerations - can distract management attention from profit-driven R&D search. The research highlights that institutional distraction significantly moderates firms' strategic responses to profitability shortfalls, ultimately limiting R&D investments. Pu et al. (2023) investigate how institutional investor distraction impacts corporate innovation. Their study highlights that institutional investor distraction significantly reduces innovative activities within firms, evidenced by decreases in R&D expenditures, patent filings, patent citations, and overall patent creativity. However, no research has investigated how institutional investor distraction influences green innovation. To fill this gap, we explore the relationship between institutional investor distraction and green innovation, as well as the potential mechanisms and heterogeneity underlying this relationship.

3. Hypotheses development

From the perspective of agency theory, institutional investors play a crucial role in

monitoring corporate managers and aligning managerial actions with shareholder interests. To monitor managers' green engagement, institutional investors should carefully pay attention to managers. Specifically, strong institutional oversight can encourage firms to pursue long-term value creation, including robust corporate social responsibility (CSR) practices. However, as a scarce cognitive resource, attention is not unlimited even for institutional investors (Ben-Rephael et al. 2017; Lu et al. 2016). They must allocate their limited attention across hundreds of stocks in their portfolios. When institutional investors are distracted by exogenous attention-grabbing events, they loosen their monitoring intensity on managers as a result of their limited attention (Kempf et al. 2017). For example, due to market shocks, competing investment opportunities, or attention diverted to other portfolio firms, their monitoring effectiveness declines. This weakened external governance exacerbates agency problems, providing managers with greater discretion to prioritize personal or short-term objectives over the long-term interests of shareholders. Given that eco-innovation initiatives often require sustained commitment and yield uncertain future benefits, they are particularly vulnerable to managerial cutbacks when external oversight diminishes. Therefore, institutional investor distraction can lead to a deterioration in firms' green innovation by weakening the governance mechanisms that typically restrain managerial opportunism. Thus, managers will engage less in green innovation when they are paid less attention and are thus less monitored by institutional investors. Our hypothesis *H1* is thus stated as follows:

H1. Institutional investor distraction is significantly and negatively related to firms' green innovation.

When institutional investors are distracted by exogenous attention-grabbing events, they loosen their monitoring intensity on managers as a result of their limited attention

(Pu et al. 2023). Aware of being less monitored, managers are more likely to maximize their private benefits than to create firm value for shareholders through green innovation. Earnings management can serve as a channel through which managers pursue private benefits and conceal their actions, thereby reducing the firm's engagement in eco-innovation activities. Garel et al. (2021) prove that managers exploit the loosening in monitoring intensity resulting from investor distraction by engaging in earnings management. This earnings management serves as a mechanism through which managers can pursue short-term financial objectives and conceal actions that undermine long-term investments, particularly in green initiatives. As resources are diverted away from sustainable practices to support managed earnings, the firm's genuine green performance deteriorates. Thus, earnings management acts as an important channel linking investor distraction to a decline in corporate environmental outcomes. Therefore, we establish our second hypothesis:

H2. Institutional investor distraction negatively affects firms' green innovation by increasing corporate earnings management.

Financial constraints may serve as an important channel through which institutional investor distraction affects corporate green innovation. Green innovation is typically long-term, risky, and resource intensive. However, financial constraints do not necessarily affect green innovation only through a resource-shortage mechanism. Recent research suggests that the relationship between financial constraints and green innovation can be more nuanced. In particular, firms facing stronger financing pressure may have incentives to use green innovation as a strategic signal to external capital providers. Nguyen et al. (2025) show that while debt financing constraints hinder green innovation, equity financing constraints are associated with increased green patenting, possibly because firms attempt to attract sustainability-oriented investors. Similarly,

Chen (2024) finds that green innovation is positively associated with equity financing, suggesting that green innovation can improve firms' external financing prospects. These studies imply that green innovation may function not only as a technological response to environmental challenges, but also as a visible signal of long-term viability and environmental commitment. This signalling logic is also consistent with evidence from the sustainable finance literature. Flammer (2021) shows that corporate green bond issuance is followed by positive market reactions, improved environmental performance, and increased ownership by long-term and green investors, supporting the view that green actions can credibly signal environmental commitment to capital markets. In addition, external sustainability-related pressures can induce firms to strengthen green innovation. For example, Ren et al. (2023) find that mandatory CSR disclosure promotes corporate green innovation. These studies suggest that firms facing external financing or legitimacy pressure may engage in green innovation to improve external evaluations and attract sustainability-oriented resources.

Institutional investors are important external governance actors and can influence firms' long-term innovation decisions. Zhao et al. (2023) show that dedicated institutional investors are positively associated with corporate green innovation. When institutional investors become distracted, however, their monitoring and engagement weaken. Garel et al. (2021) provide evidence that institutional investor distraction loosens monitoring constraints and increases managerial discretion. In this context, investor distraction may reduce firms' external financing pressure and weaken their incentives to use green innovation as a signal to investors and other stakeholders. As a result, corporate green innovation may decline.

H3. Institutional investor distraction negatively affects corporate green innovation by weakening financing-pressure-driven incentives for green innovation.

4. Data and Methodology

4.1 Data and Sample

The study employs a quantitative research design to analyze the impact of institutional investor distraction on green innovation. We focus on U.S. publicly traded companies across various industries that have a substantial portion of their ownership held by institutional investors. Industries that rely heavily on innovation, such as technology, pharmaceuticals, and manufacturing, will be given particular attention. Our study period spans from 2002 to 2024. The selection of 2002 as the starting point is based on data availability, as the earliest accessible data for Environmental Innovation Score from LSEG begins in that year. The end year, 2024, is chosen because it represents the most recent year for which Environmental Innovation Score data is currently available, thereby enhancing the timeliness and relevance of our research.

To construct the main sample, we begin by obtaining all US firms from both LSEG and Compustat. The data on institutional ownership is from the Thomson Financial Institutional Holdings (13f) database. The data on green innovation is from LSEG. The data on firm's general innovation is from LSEG and KPSS databases (Kogan et al., 2017). The board characteristics and governance data are obtained from the LSEG, Bloomberg databases.

The study uses regression analysis to test the relationship between institutional investor distraction and green innovation levels. Models also controls other variables that may affect corporate innovation, such as firm size, return on assets, and industry type.

4.2 Institutional investors' distraction measure

We obtain institutional investor shareholdings from the Thomson-Reuters Institutional Holdings (13F) database, which we use to construct our firm-level investor distraction

measure. We follow Kempf et al. (2017), Pu et al. (2023), El Ghoul et al., (2023), Cheung and Wang (2024), Chowdhury et al. (2025) to construct our key explanatory variable, DISTRACT, a firm-level exogenous shareholder distraction measure. $D_{f,q}$ is measured for each firm *f* and calendar quarter *q* as the weighted average of institutional investors that are distracted by exogenous shocks to an unrelated part of their portfolio, as follows:

$$D_{f,q} = \sum_{\epsilon F_{q-1}} \sum_{IND \neq IND_f} \omega_{i,f,q-1} \times \omega_{i,q-1}^{IND} \times IS_q^{IND} \quad (1)$$

where F_{q-1} denotes firm *f*'s institutional shareholders at the end of quarter *q-1*, *IND* denotes a Fama-French 12 industry, and IND_f denotes the industry to which firm *f* belongs. We first calculate investor-level distraction. IS_q^{IND} is an indicator variable that equals one if the industry return is the highest or the lowest across all the Fama-French 12 industries in a given quarter *q*. IS_q^{IND} captures the exogenous shock from another industry that is different from firm i's industry. ${w_{i,q-1}}^{IND}$ is the weight of industry *IND* in the portfolio of institutional shareholder *i*. ${w_{i,q-1}}^{IND}$ captures the importance of the industry in an institutional shareholder's portfolio. To obtain shareholder distraction at the firm-level for firm *f*, we next weight the investor-level distraction by $w_{i,f,q-1}$, which captures the importance of institutional shareholder i in firm f at the end of quarter *q-1*. Following Chowdhury et al. (2025), Pu et al. (2023), Bertomeu et al. (2023), $w_{i,f,q-1}$ is defined as follows:

$$\omega_{i,f,q-1} = \frac{QPFweight_{i,f,q-1} + QPercOwn_{i,f,q-1}}{\sum_{i \epsilon F_{Q-1}} (QPFweight_{i,f,q-1} + QPercOwn_{i,f,q-1})} \quad (2)$$

where $PercOwn_{i,f,q-1}$ is the percentage of firm *f* held by institutional shareholder *i* at

the end of quarter *q-1*. $PFweight_{i,f,q-1}$ is the market value weight of firm *f* in the institutional investor i's holdings. We sort all investors of firm f into quintiles by $PercOwn_{i,f,q-1}$ and all stocks held by investor i into quantiles by $PFweight_{i,f,q-1}$. Both $QPFweight_{i,f,q-1}$ and $QPercOwn_{i,f,q-1}$ are categorical variables with a value from 1 to 5. We finally scale the term by $\sum_{i \epsilon F_{Q-1}}(QPFweight_{i,f,q-1} + QPercOwn_{i,f,q-1})$ in the denominator so that the sum of $w_{i,f,q-1}$ in firm f equals one. As the measure is constructed for each quarter, we average the quarterly measure across four quarters in a given fiscal year to obtain the annual measure.

4.3 Green innovation measure

Prior studies have adopted Research and Development (R&D) to capture general innovation. However, we rely on Thomson Reuters Eikon eco-innovation score instead of R&D due to difficulty in obtaining environmental-related R&D expenses as it is not compulsory for a firm to disclose environmental processes improvement-related information. Eco-innovation score as documented in the Thomson Reuters database has been used in recent research (e.g., Zaman et al., 2021; Phung et al., 2022; Albitar et al., 2023; Uyar et al., 2023). Thomson Reuters Eikon eco-innovation score reflects a company's capacity to reduce environmental costs and burdens for its customers and thereby creating new market opportunities through new/improvement in existing environmental technologies and processes or eco-designed products or processes. Thomson Reuters Eikon eco-innovation score is a weighted average industry adjusted composite score on a scale of 0–100 and encompasses twenty variables related to the organisational eco-product and eco-processes, where 100 reflects a high level of eco-innovation commitment (Albitar et al., 2022; Uyar et al., 2023).

4.4 Regression design

To test the impact of shareholder distraction on corporate green innovation, we estimate the following models:

$$Eco\_innovation_{i,t} = \alpha + \beta \times Distraction_{i,t} + \delta \times Control_{i,t} + YearDummies + IndustryDummies + \varepsilon_{i,t} \quad (3)$$

where $Eco\_innovation_{i,t}$ is green innovation. We follow Kempf et al. (2017), Cheung and Wang (2024), Chowdhury et al. (2025) to construct the variable $Distraction_{i,t}$ which is a firm-level proxy for the degree of the distraction of an institutional owner in firm *i* at time *t*. To differentiate the impact of institutional investor inattention on corporate green innovation, a set of control variables are included in the regression model. These variables are selected based on prior studies (e.g., Zaman et al., 2023; Phung et al., 2022; Pu et al., 2023). First, we control for institutional ownership (*IO*), which is importantly and closely relevant to our research design, to relieve the confounding effects of institutional ownership per se (Chan et al., 2021), and to disentangle any impact derived from the stability hypothesis (Pu et al., 2023). We also control the shareholding ratio of major shareholder (Top1), which is measured by the shareholding ratio of the largest shareholder. In addition, we control overall environmental performance (*EnScore*) because companies with higher environmental score may undertake more environmentally innovative projects (Zaman et al., 2022). We also control for firm-specific financial variables (Zaman et al., 2023): firm size (*SIZE*) is measured as the natural logarithm of total assets; financial performance (*ROA*) is measured as income before extraordinary items divided by total assets; market performance − market value divided by book value; leverage (*Leverage*) is total debt to total equity ratio; the logarithm of net property, plant, and equipment (PPE) is scaled by the number of employees (*Ln_PPE_employees*) to account for capital intensity; research and development (*R&D_TA*) is total research and development expense

divided by total assets. To capture the effect of a firm's life cycle on its innovation ability, we use the natural logarithm of firm age (*Age*), which is estimated as the number of years elapsed since a firm entered the LSEG database. Moreover, we control for board of directors' variables (Phung et al., 2022), including board size (*BOARDSIZE*), measured by the total number of directors serving on the board; board independence (*BODIND*), measured by the proportion of independent directors to the total number of directors on the board. To the extent that our shareholder distraction measure is exogenous to the firm, we estimate our regressions in an OLS framework. To control for unobservable time-invariant firm-characteristics across time and time-variant characteristics across firms, we include industry and year fixed effects in our regressions. We cluster the standard errors at the firm level.

4.5 Descriptive statistics

Table 1 reports the industry and year distribution of the sample. Panel A shows that the sample is mainly concentrated in the manufacturing sector, which accounts for 44.48% of total observations. Services represent the second largest industry group at 17.81%, followed by Transportation, Communications, and Electric at 14.70%. Other industries account for relatively smaller proportions of the sample. Panel B presents the distribution of observations by year. The sample covers the period from 2002 to 2024, with the number of observations generally increasing over time, especially after 2013. The largest share of observations appears in 2022, accounting for 9.41% of the total sample, followed closely by 2023 and 2024.

Table 1 Industry and year distribution

Panel A: Industry Distribution		
SIC Industry	Freq.	Percent
Agriculture, Forestry, and Fishing	268	0.49
Mining	4,252	7.84

Construction	2,096	3.86
Manufacturing	24,124	44.48
Transportation, Communications, Elect	7,974	14.7
Wholesale Trade	1,863	3.44
Retail Trade	3,986	7.35
Services	9,660	17.81
Public Administration / Nonclassifiab	10	0.02
Total	54,233	100

Panel B: Year Distribution		
year	Freq.	Percent
2002	176	0.32
2003	191	0.35
2004	327	0.6
2005	449	0.83
2006	317	0.58
2007	487	0.9
2008	648	1.19
2009	953	1.76
2010	1,291	2.38
2011	1,310	2.42
2012	1,519	2.8
2013	2,264	4.17
2014	2,349	4.33
2015	2,817	5.19
2016	3,257	6.01
2017	3,594	6.63
2018	4,018	7.41
2019	4,355	8.03
2020	4,597	8.48
2021	4,797	8.85
2022	5,101	9.41
2023	5,011	9.24
2024	4,405	8.12
Total	54,233	100

Note: This table presents the observation distribution by industry and year in Panels A and B, respectively. The overall sample includes 7144 firms, covering 9 industries in the US, with total 54,233 observations. The industry classification refers to the SIC industry classification.

Table 2 shows the descriptive statistical results of the main variables. The mean level

of green innovation is 21.852, suggesting that US firms' adoption of environmentally innovative processes and practices is relatively limited. The standard deviation is 30.127, the maximum is 99.91, and the minimum is 0, which indicates a significant difference in the level of green innovation among enterprises. Some enterprises have not undergone green innovation. The average log of patents per firm is about 2.8/year. The average log of citations is about 3. The mean value of the investor distraction measure is 0.12 in line with Cheung et al. (2024). Average IO is about 57%, which is similar to that from other IO-related papers (e.g., Garel et al, 2021). The summary statistics of all the financial characteristic controls, board-level controls, and institutional investor level controls are generally consistent with the literature (e.g., Miller et al, 2022; Zaman et al., 2023; Tang et al., 2024). The details of all variable measurements are provided in Appendix A.

Table 2 Descriptive statistics of variables

Variable	N	Mean	SD	Min	p25	p50	p75	Max
EIS	54233	26.012	31.538	0.000	0.000	0.000	50.000	99.910
EIS_indadj	54233	1.669	25.330	-74.759	-13.460	-2.251	17.756	89.459
RD_TA	54233	0.030	0.079	0.000	0.000	0.000	0.026	1.814
RD_Sales	54233	0.052	0.192	0.000	0.000	0.000	0.032	2.994
LnPat	7041	2.736	1.772	0.693	1.099	2.398	3.932	9.175
LnCite	7041	2.305	2.022	0.000	0.000	2.054	3.765	8.826
lnAverage_citation	7041	0.980	1.001	0.000	0.000	0.693	1.609	5.663
lnNominal_Value_innovation	7041	5.751	2.508	0.007	3.900	5.815	7.526	13.504
lnReal_Value_innovation	7041	4.798	2.449	0.003	2.905	4.812	6.542	12.342
IID	54233	0.124	0.036	0.024	0.097	0.127	0.146	0.321
SIZE	54233	15.120	1.728	7.404	14.001	15.130	16.275	20.497
LEV	54233	0.533	0.207	0.023	0.391	0.543	0.682	1.865
CASH_HOLD	54233	0.263	0.177	0.000	0.132	0.225	0.353	1.000
MTB	54233	3.626	4.920	0.250	1.275	2.186	3.878	35.616
ROA	54233	0.092	0.159	-1.422	0.062	0.106	0.156	0.469
SalesGrowth	54233	0.103	0.449	-0.782	-0.048	0.046	0.158	4.853
Ln_PPE_Employees	54233	4.725	1.651	0.677	3.657	4.478	5.583	9.504
AGE	54233	2.361	0.947	0.000	1.792	2.398	3.091	4.094
BoardSize	54233	9.718	3.121	1.000	8.000	9.000	11.000	98.000
Duality	54233	0.399	0.490	0.000	0.000	0.000	1.000	1.000

CSRCommittee	54233	0.602	0.489	0.000	0.000	1.000	1.000	1.000
InBoardM	54233	64.634	24.328	0.000	46.670	71.430	85.710	100.000
EnScore	54233	40.226	28.975	0.000	12.730	40.330	65.050	99.410
IO	54233	55.546	31.990	0.000	27.325	54.805	84.209	100.000
TOP1	54057	9.489	8.633	0.004	4.856	8.006	11.575	98.816

Note: This table reports univariate statistics (number of observations, mean, median, standard deviation, minimum, and maximum). The sample consists of 54,233 firm-year observations, the time range is 2002–2024. *EIS* and *EIS_indadj* represent environmental innovation score and industry adjusted eco-innovation score. Research and development intensity measured by total assets (*RD_TA*), research and development intensity measured by sales (*RD_Sales*), natural logarithm of patent counts (*LnPat*), natural logarithm of patent citations (*LnCite*), natural logarithm of average patent citations (*lnAverage_citation*), natural logarithm of nominal value of innovation outputs (*lnNominal_Value_innovation*), natural logarithm of real value of innovation outputs (*lnReal_Value_innovation*), are all measures of firms' general innovation. *IID* represents institutional investors' distraction measure. *SIZE* denotes firm size, measured as the natural logarithm of total assets; *LEV* denotes leverage; *CASH_HOLD* denotes cash holdings; *MTB* denotes the market-to-book ratio; *ROA* denotes return on assets; *SalesGrowth* denotes sales growth; *Ln_PPE_Employees* denotes the natural logarithm of property, plant, and equipment per employee; *AGE* denotes firm age; *BoardSize* denotes the number of board members; *Duality* denotes CEO-chairman duality; *CSRCommittee* denotes the existence of a CSR committee; *InBoardM* denotes board independence; *EnScore* denotes the environmental score; *IO* denotes institutional ownership; and *TOP1* denotes the ownership of the largest shareholder. The detailed definitions of variables are presented in Appendix A.

Table 3 presents the Pearson correlation matrix for the variables used in the baseline model. The results show that some high correlations mainly arise between different measures of the same construct. For example, the correlation coefficient between EIS and its alternative measure, industry adjusted eco-innovation score (*EIS_indadj*), is 0.805. Apart from such cases, most pairwise correlation coefficients are below 0.7. In addition, we calculate the variance inflation factors (VIFs) for the main variables, and all VIF values are below 10 (Table 4). These results suggest that multicollinearity is unlikely to be a serious concern in the baseline model.

Table 3 Correlation analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13
1.EIS	1												
2.EIS_indadj	0.805***	1											
3.RD_Sales	-0.200***	-0.083***	1										
4.RD_TA	-0.152***	-0.055***	0.686***	1									
5.LnPat	0.269***	0.193***	-0.127***	-0.061***	1								
6.LnCite	0.178***	0.131***	-0.089***	-0.025**	0.913***	1							
7.lnAverage_citation	-0.093***	-0.045***	-0.043***	-0.009	0.333***	0.557***	1						
8.lnNominalV_Innov	0.255***	0.229***	-0.146***	-0.136***	0.806***	0.740***	0.319***	1					
9.lnRealV_Innov	0.251***	0.225***	-0.148***	-0.136***	0.816***	0.758***	0.348***	0.998***	1				
10.IID	0.030***	0.007	-0.117***	-0.118***	0.101***	0.140***	0.366***	0.080***	0.103***	1			
11.SIZE	0.420***	0.335***	-0.295***	-0.354***	0.467***	0.389***	0.141***	0.623***	0.623***	0.167***	1		
12.LEV	0.189***	0.122***	-0.125***	-0.144***	0.062***	0.029**	-0.063***	0.139***	0.136***	0.094***	0.326***	1	
13.CASH HOLD	-0.057***	-0.055***	0.128***	0.225***	-0.080***	-0.062***	-0.041***	-0.122***	-0.124***	-0.128***	-0.289***	-0.122***	1
14.MTB	-0.088***	-0.017***	0.164***	0.243***	-0.002	-0.007	-0.049***	0.150***	0.143***	-0.082***	-0.139***	0.259***	0.146***
15.Ln_PPE_Employees	0.067***	0.059***	-0.050***	-0.152***	0.038***	0.015	-0.046***	0.141***	0.139***	0.048***	0.305***	0.044***	-0.392***
16.ROA	0.146***	0.082***	-0.499***	-0.572***	0.236***	0.202***	0.128***	0.335***	0.336***	0.100***	0.316***	0.011**	-0.044***
17.SalesGrowth	-0.110***	-0.052***	0.304***	0.150***	-0.080***	-0.058***	0.001	-0.049***	-0.051***	-0.066***	-0.115***	-0.070***	0.145***
18.AGE	0.058***	0.038***	-0.058***	-0.065***	0.113***	0.067***	-0.012	0.184***	0.181***	-0.024***	0.124***	0.051***	-0.116***
19.BoardSize	0.272***	0.218***	-0.140***	-0.154***	0.251***	0.208***	0.079***	0.327***	0.328***	0.146***	0.555***	0.226***	-0.154***
20.CCSDuality	-0.047***	-0.042***	-0.001	-0.007	0.125***	0.129***	0.128***	0.195***	0.198***	0.054***	0.051***	0.031***	-0.007
21.CSRCommittee	0.377***	0.291***	-0.179***	-0.195***	0.182***	0.083***	-0.164***	0.264***	0.255***	-0.023***	0.424***	0.155***	-0.153***
22.InBoardM	-0.113***	-0.053***	0.130***	0.124***	0.021*	0.007	-0.035***	0.118***	0.111***	-0.043***	-0.118***	0.040***	-0.085***
23.EnScore	0.698***	0.592***	-0.254***	-0.234***	0.325***	0.214***	-0.122***	0.399***	0.392***	0.019***	0.620***	0.212***	-0.164***

24.IO	-0.124***	-0.091***	0.098***	0.094***	-0.038***	-0.005	0.053***	0.089***	0.076***	-0.015***	-0.101***	0.020***	-0.019***
25.TOP1	-0.129***	-0.103***	0.098***	0.058***	-0.162***	-0.143***	-0.100***	-0.177***	-0.184***	-0.069***	-0.197***	0.005	-0.026***

	13	14	15	16	17	18	19	20	21	22	23	24
13.CASH HOLD	1											
14.MTB	0.146***	1										
15.Ln_PPE_Employees	-0.392***	-0.147***	1									
16.ROA	-0.044***	-0.010*	0.028***	1								
17.SalesGrowth	0.145***	0.099***	-0.007	-0.088***	1							
18.AGE	-0.116***	-0.001	0.004	0.112***	-0.058***	1						
19.BoardSize	-0.154***	-0.068***	0.137***	0.126***	-0.073***	0.033***	1					
20.Duality	-0.007	0.061***	-0.054***	0.030***	0.003	0.228***	0.025***	1				
21.CSRCommittee	-0.153***	-0.075***	0.200***	0.158***	-0.107***	0.027***	0.259***	-0.098***	1			
22.InBoardM	-0.085***	0.142***	-0.040***	-0.064***	0.054***	0.371***	-0.199***	0.127***	-0.079***	1		
23.EnScore	-0.164***	-0.093***	0.195***	0.238***	-0.141***	0.055***	0.390***	-0.082***	0.642***	-0.147***	1	
24.IO	-0.019***	0.154***	-0.170***	0.012**	0.037***	0.334***	-0.112***	0.176***	-0.163***	0.536***	-0.223***	1
25.TOP1	-0.026***	0.032***	-0.071***	-0.092***	0.029***	0.032***	-0.129***	-0.021***	-0.105***	0.206***	-0.190***	0.459***

Note: This table shows Pearson correlations matrix between proxies of environmental innovation score (*EIS*), industry-level adjusted EIS (*EIS_indadj*), corporate general innovation variables (*RD_Sales, RD_TA, LnPat, LnCite, lnAverage_citation, lnNominalV_Innov, lnRealV_Innov*), institutional investor distraction (*IID*), firms size (*SIZE*), leverage (*LEV*), cash holding (*CASH_HOLD*), market to book ratio (*MTB*), Natural Logarithm of Property, Plant, and Equipment per Employee (*Ln_PPE_Employees*), return on assets (*ROA*), sales growth (*SalesGrowth*), firm age (*AGE*), board size (*BoardSize*), CEO-Chairman duality (*CCSDuality*), CSR committee (*CSRCommittee*), board independence (*InBoardM*), environmental score (*EnScore*), institutional ownership (*IO*), largest shareholder ownership (*TOP1*). The detailed definitions of variables are presented in Appendix A. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively (* p <0.10, ** p<0.05, *** p <0.01).

Table 4 *Variance inflation factor (VIF) test*

Variables	VIF
IID	1.08
SIZE	2.6
ROA	1.72
MTB	1.32
LEV	1.36
CASH_HOLD	1.34
AGE	1.33
SalesGrowth	1.07
EnScore	2.4
RD_TA	1.84
CSRCommittee	1.74
BoardSize	1.52
InBoardM	1.61
TOP1	1.36
IO	1.95
Ln_PPE_Employees	1.32
Duality	1.1
Mean VIF	1.57

Notes: This table reports the variance inflation factors (VIFs) for the variables included in the baseline regression analysis. VIF denotes the variance inflation factor. *IID* represents institutional investors' distraction measure; *SIZE* denotes firm size, measured as the natural logarithm of total assets; *LEV* denotes leverage; *CASH_HOLD* denotes cash holdings; *MTB* denotes the market-to-book ratio; *ROA* denotes return on assets; *SalesGrowth* denotes sales growth; *Ln_PPE_Employees* denotes the natural logarithm of property, plant, and equipment per employee; *AGE* denotes firm age; *BoardSize* denotes the number of board members; *Duality* denotes CEO-chairman duality; *CSRCommittee* denotes the existence of a CSR committee; *InBoardM* denotes board independence; *EnScore* denotes the environmental score; *IO* denotes institutional ownership; and *TOP1* denotes the ownership of the largest shareholder; *RD_TA* represents research and development intensity measured by total assets. The detailed definitions of variables are presented in Appendix A.

4.6 Regression results

Table 5 reports the fixed effects estimation results of Equation (3) using green

innovation and general innovation as the dependent variable. According to our main hypothesis *H1*, we expect a negative relation between institutional investors' distraction (proxied by IID) and firms' green innovation. In Column (1), we control for year and industry fixed effects, while in Column (2), we control for year and industry fixed effects. The regression results in Columns (1) show that the estimated coefficients on distraction are negative and statistically significant at the 1% level. Specifically, the coefficient estimates on distraction are -24.8369 for EIS in Columns (1). This result suggests that firms with more distracted shareholders are associated with a lower green innovation score. To gauge economic significance, we calculate the effect of a one-standard-deviation increase in IID on EIS. Based on the descriptive statistics, the standard deviation of IID is 0.036 and the mean value of EIS is 26.012. In Column (1), the coefficient on IID is -24.8369, indicating that a one-standard-deviation increase in IID is associated with a decrease in EIS of 0.894 points, equivalent to 3.44% of the sample mean of EIS ((24.8369 × 0.036) / 26.012). These results suggest that the negative association between IID and EIS is also economically meaningful. Therefore, these results lend support to hypothesis *H1*. That is to say, when institutional investors are distracted, their ability to monitor portfolio firms is weakened, which may intensify agency conflicts and provide managers with greater discretion to pursue opportunistic or short-term-oriented decisions (Cheung et al., 2024). In our context, green innovation often requires long-term commitment, substantial resources, and uncertain future payoffs. When external monitoring from institutional shareholders declines, managers may have less pressure to engage in environmentally innovative processes and practices. As a result, they may reduce their commitment to green innovation, leading to a lower level of EIS. This interpretation is consistent with our finding that IID is negatively associated with EIS.

In Table 5, we further examine the relationship between IID and firms' general innovation. A common challenge in measuring general innovation is that innovation-related data are often sparsely reported and contain a large number of missing

observations, as not all firms disclose or generate observable innovation outputs in a given period. Following prior literature on firm innovation (Miller et al., 2022; Wang et al., 2024), we replace missing values of general innovation with zero in the main regression analysis. This treatment is consistent with the interpretation that firms without reported innovation records have no observable general innovation output during the corresponding period. It also allows us to retain a broader sample and reduce concerns that the results are driven by sample attrition caused by missing innovation data.

Column (3) shows the relationship between IID and input innovation, measured as *RD_TA*, Columns (4) and (5) show the relationship between IID and output innovation, measured as *LnPat* and *LnCite*. The coefficients of all the three variables are negatively significant at 1% significance level, indicating that IID is negatively related to corporate general innovation. This result is consistent with prior literature (e.g., Pu et al., 2023).

Table 5 *Regression results for H1*

	(1)	(2)	(3)	(4)
	EIS	*RD_TA*	*LnPat*	*LnCite*
IID	-24.8369***	-0.3199***	-3.5404***	-3.3810***
	(7.8055)	(0.0268)	(0.5543)	(0.5302)
SIZE	-0.5982***	-0.0048***	0.1057***	0.0958***
	(0.2306)	(0.0005)	(0.0143)	(0.0131)
LEV	6.8073***	-0.0588***	-0.3280***	-0.3042***
	(1.1838)	(0.0032)	(0.0701)	(0.0656)
CASH_HOLD	8.8163***	0.0513***	0.1496**	0.1202**
	(1.2750)	(0.0036)	(0.0646)	(0.0608)
MTB	-0.2825***	0.0034***	0.0159***	0.0126***
	(0.0412)	(0.0002)	(0.0029)	(0.0026)
ROA	-4.5743***	-0.2504***	0.3809***	0.3868***
	(1.2032)	(0.0114)	(0.0816)	(0.0781)
SalesGrowth	-0.158	0.0088***	-0.0196**	-0.0130
	(0.1866)	(0.0014)	(0.0098)	(0.0094)
Ln_PPE_Employees	0.4861**	0.0019***	-0.0131	-0.0111
	(0.1962)	(0.0004)	(0.0091)	(0.0082)
AGE	0.9503***	0.0018***	0.0820***	0.0667***

	(0.2642)	(0.0007)	(0.0152)	(0.0139)
BoardSize	-0.103	0.0008***	-0.0105**	-0.0110***
	(0.0932)	(0.0002)	(0.0045)	(0.0042)
Duality	0.392	-0.0024**	0.0882***	0.0841***
	(0.4579)	(0.0011)	(0.0259)	(0.0241)
CSRCommittee	-7.4191***	-0.0050***	-0.0451*	-0.0413*
	(0.5160)	(0.0011)	(0.0261)	(0.0247)
InBoardM	-0.0109	0.0002***	0.0045***	0.0039***
	(0.0122)	(0.0000)	(0.0006)	(0.0005)
EnScore	0.8148***	0.0002***	0	0.000100
	(0.0129)	(0.0000)	(0.0006)	(0.0006)
IO	0.0318***	0.0001***	0.0036***	0.0029***
	(0.0097)	(0.0000)	(0.0005)	(0.0005)
TOP1	-0.0234	-0.0004***	-0.0018*	-0.00130
	(0.0296)	(0.0001)	(0.0009)	(0.0009)
RD_TA	-3.050		2.6483***	2.4689***
	(2.6641)		(0.2737)	(0.2622)
Constant	0.896	0.1329***	-1.3522***	-1.1643***
	(3.2084)	(0.0087)	(0.2025)	(0.1835)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	54233	54233	54233	54233
R-square	0.530	0.437	0.163	0.153
Adj. R-square	0.530	0.437	0.162	0.152
Hausman Test P-Value	0.000	0.000	0.000	0.000

Note: Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent p<0.1, p<0.05 and p<0.01, respectively. The Hausman test is employed to determine whether to use a fixed effects model or a random effects model to estimate the impact of IID. After conducting the Hausman test, the p-values of all the regressions are at 0.000, indicating that, at the 1% significance level, we reject the random effects model in favour of the fixed effects model. All the regressions are controlled for industry-, year-fixed effects. The detailed definitions of variables can be found in Appendix A.

Table 6 reports the results related to *H2* and presents the mechanism test for the role of earnings management in the relationship between institutional investor distraction and corporate green innovation. Column (1) shows that the coefficient of IID is significantly negative, suggesting that distracted institutional investors reduce corporate green innovation. Column (2) shows that IID has a significantly positive effect on earnings management (*EM*), indicating that institutional investor distraction

increases firms' earnings management, which is consistent with Garel et al. (2021). This suggests that when institutional monitoring becomes weaker, managers face fewer external constraints and have greater discretion to engage in earnings management. Column (3) further includes both *IID* and *EM* in the model. The coefficient of *EM* is significantly positive, while the coefficient of *IID* remains significantly negative. This result indicates that institutional investor distraction continues to directly reduce corporate green innovation, but earnings management also generates a significant positive indirect effect in this relationship.

These findings suggest that earnings management does not operate as a traditional mediation mechanism that reinforces the negative effect of institutional investor distraction. Instead, it generates an indirect effect in the opposite direction to the direct effect. Specifically, institutional investor distraction directly reduces green innovation by weakening external monitoring. At the same time, it increases earnings management, and firms with higher earnings management may face greater information asymmetry and stronger pressure to maintain external evaluations. As a result, such firms may be more likely to engage in externally visible strategic activities, such as green innovation, to signal long-term development potential and social responsibility (Ren et al., 2023; Reitmaier et al., 2025). Therefore, the earnings management channel partially offsets the negative direct effect of institutional investor distraction on green innovation. Overall, these results indicate that the effect of institutional investor distraction on corporate green innovation is complex: it operates not only through the direct weakening of external monitoring, but also through indirect changes in managerial behaviour.

Table 6 *Regression results for H2: earnings management mechanism*

	(1)	(2)	(3)
	EIS	*EM*	*EIS*
IID	-24.8369***	0.8198***	-25.6355***
	(7.8055)	(0.0815)	(7.8766)

EM			1.8967***
			(0.5632)
SIZE	-0.5982***	-0.0096***	-0.5808**
	(0.2306)	(0.0013)	(0.2332)
LEV	6.8073***	-0.0263***	6.9727***
	(1.1838)	(0.0088)	(1.2047)
CASH_HOLD	8.8163***	0.1038***	8.5519***
	(1.2750)	(0.0122)	(1.3010)
MTB	-0.2825***	0.000400	-0.2897***
	(0.0412)	(0.0004)	(0.0418)
ROA	-4.5743***	-0.1357***	-4.2193***
	(1.2032)	(0.0141)	(1.2467)
SalesGrowth	-0.158	0.0297***	-0.200
	(0.1866)	(0.0053)	(0.1933)
Ln_PPE_Employees	0.4861**	0.0034**	0.4478**
	(0.1962)	(0.0015)	(0.2006)
AGE	0.9503***	-0.00260	0.9006***
	(0.2642)	(0.0019)	(0.2683)
BoardSize	-0.103	-0.000400	-0.118
	(0.0932)	(0.0005)	(0.0941)
Duality	0.392	0.00150	0.387
	(0.4579)	(0.0032)	(0.4644)
CSRCommittee	-7.4191***	0.0093**	-7.4657***
	(0.5160)	(0.0039)	(0.5236)
InBoardM	-0.0109	0.0002**	-0.00960
	(0.0122)	(0.0001)	(0.0123)
EnScore	0.8148***	0.0002**	0.8171***
	(0.0129)	(0.0001)	(0.0130)
IO	0.0318***	-0.000100	0.0316***
	(0.0097)	(0.0001)	(0.0098)
TOP1 a	-0.0234	0.000200	-0.0246
	(0.0296)	(0.0002)	(0.0303)
RD_TA	-3.050	0.1793***	-3.164
	(2.6641)	(0.0402)	(2.7647)
Constant	0.896	0.1031***	0.898
	(3.2084)	(0.0211)	(3.2566)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	54233	52888	52888
R-square	0.530	0.137	0.530
Adj. R-square	0.530	0.136	0.529

Note: This table presents regression results of whether earnings management (*EM*) is the underlying channel through which institutional investor distraction (*IID*) negatively affects corporate environmental

innovation (*EIS*). Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent p<0.1, p<0.05 and p<0.01, respectively. All the regressions are controlled for industry-, year-fixed effects.

Table 7 reports the mechanism test for the role of financial constraints in the relationship between institutional investor distraction and corporate green innovation. Column (1) shows that the coefficient of IID is significantly negative, indicating that institutional investor distraction reduces corporate green innovation. Column (2) shows that IID has a significantly negative effect on *KZ_Index*, suggesting that distracted institutional investors are associated with lower financial constraints. Column (3) further includes both IID and *KZ_Index* in the model. The coefficient of *KZ_Index* is significantly positive, while the coefficient of IID remains significantly negative. These results indicate that financial constraints play a partial mediating role in the relationship between institutional investor distraction and green innovation.

Table 7 shows that institutional investor distraction significantly reduces financial constraints, while financial constraints are positively associated with corporate green innovation. This result suggests that the financial-constraint channel should not be interpreted merely as a resource-availability mechanism. Instead, it is more consistent with a pressure- and signalling-based mechanism. Firms facing stronger financial constraints are under greater pressure to obtain external resources and maintain capital-market confidence. Under such conditions, green innovation may serve as a visible signal of long-term orientation, environmental commitment and sustainable growth potential. Recent evidence supports this interpretation. Nguyen et al. (2025) show that while debt constraints hinder green innovation, equity constraints are associated with increased green patenting, possibly because firms attempt to attract sustainability-oriented investors. Similarly, Li et al. (2025) find that green bond issuance promotes green technological innovation through environmental-commitment signalling, financing-constraint alleviation and improved environmental disclosure. Ren et al.

(2023) also show that external disclosure pressure can stimulate corporate green innovation. Therefore, the positive coefficient of *KZ_Index* may indicate that financially constrained firms have stronger incentives to use green innovation as a signalling device to improve external evaluations and access external resources. When institutional investors become distracted and firms' financing pressure declines, this signalling incentive weakens, thereby reducing green innovation. Therefore, the results provide support for *H3*.

Table 7 *Regression results for H3: financial constraints mechanism*

	(1)	(2)	(3)
	EIS	*KZ*	*EIS*
IID	-24.8369***	-2.9392***	-23.6871***
	(7.8055)	(0.4505)	(7.8104)
KZ_Index			0.4788***
			(0.1792)
SIZE	-0.5982***	0.0604***	-0.6253***
	(0.2306)	(0.0117)	(0.2308)
LEV	6.8073***	2.4556***	5.6274***
	(1.1838)	(0.0659)	(1.2496)
CASH_HOLD	8.8163***	-1.0437***	9.2817***
	(1.2750)	(0.0756)	(1.2947)
MTB	-0.2825***	-0.0151***	-0.2765***
	(0.0412)	(0.0051)	(0.0410)
ROA	-4.5743***	-2.9236***	-3.1578***
	(1.2032)	(0.1188)	(1.1834)
SalesGrowth	-0.158	0.1194***	-0.212
	(0.1866)	(0.0156)	(0.1871)
Ln_PPE_Employees	0.4861**	0.0345***	0.4702**
	(0.1962)	(0.0091)	(0.1967)
AGE	0.9503***	-0.0502***	0.9703***
	(0.2642)	(0.0129)	(0.2647)
BoardSize	-0.103	0.00240	-0.105
	(0.0932)	(0.0039)	(0.0934)
Duality	0.392	0.0594***	0.366
	(0.4579)	(0.0223)	(0.4591)
CSRCommittee	-7.4191***	-0.0296	-7.4073***
	(0.5160)	(0.0248)	(0.5173)

InBoardM	-0.0109	-0.0016***	-0.0104
	(0.0122)	(0.0006)	(0.0122)
EnScore	0.8148***	-0.0063***	0.8175***
	(0.0129)	(0.0006)	(0.0129)
IO	0.0318***	0.0072***	0.0286***
	(0.0097)	(0.0005)	(0.0097)
TOP1	-0.0234	-0.0028*	-0.0217
	(0.0296)	(0.0015)	(0.0298)
RD_TA	-3.050	-0.8914***	-2.579
	(2.6641)	(0.2046)	(2.7018)
Constant	0.896	-1.1338***	1.468
	(3.2084)	(0.1756)	(3.2190)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations	54233	54041	54041
R-square	0.530	0.305	0.530
Adj. R-square	0.530	0.304	0.529

Note: This table presents regression results of whether financial constraints (*KZ_Index*) is the underlying channel through which institutional investor distraction (*IID*) negatively affects corporate environmental innovation (*EIS*). Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent p<0.1, p<0.05 and p<0.01, respectively. All the regressions are controlled for industry-, year-fixed effects.

5. Robustness Tests

In the robustness tests, we retest our hypothesis and provide supporting evidence on the relationship between institutional investor distractions and firms' green innovation. To investigate robustness and alleviate the potential endogeneity and omitted variables concerns, we perform tests using several alternative dependent variables. As for environmental innovation, we construct an industry adjusted eco-innovation score, which captures the relative eco-innovation activities of a firm relative to industry peers. Specifically, for each industry and year, calculate the average eco-innovation score and deduct this average score from the firm-level eco-innovation score for a particular year (Zaman et al., 2023). To examine the robustness of our baseline findings, we further employ firms' process innovation level (*PRC_EIN*) as an alternative measure of corporate innovation, in addition to the overall score of corporate green innovation.

Whereas the overall green innovation score captures firms' comprehensive green innovation performance, process innovation reflects improvements in production processes, resource allocation, pollution control, and operational efficiency. This alternative specification allows us to assess whether our results are robust to different measurements of corporate innovation. The detailed definition of *PRC_EIN* is presented in Appendix B.

We use research and development expenses scaled by net sales or revenues and multiplied by 100 (*RD_Sales*) as an alternative measure of innovation input (Huang et al., 2024). Following Wang et al. (2024), we use *lnNominal_Value_innovation*, *lnReal_Value_innovation*, and *lnAverage_citation* as alternative measures of innovation output. *lnNominal_Value_innovation* is defined as the natural logarithm of one plus the firm's market value of innovation outputs, measured in millions of nominal dollars, for firm *i* in year *t*, and is set to zero if missing. *lnReal_Value_innovation* is defined as the natural logarithm of one plus the firm's nominal market value of innovation outputs deflated to 1982 million dollars using the CPI. Specifically, $Real\_Value\_innovation_{i,t} = Nominal\_Value\_innovation_{i,t} / CPI \times 100$, and the variable is set to zero if missing. *lnAverage_citation* is defined as the natural logarithm of the average number of lifetime citations received by patents applied for by firm *i* in year *t*, and is set to zero if missing. The results in Table 8 reveal that our results stay unchanged when we use the alternative measures for green innovation and corporate general innovation.

Table 8 *Robustness tests: alternative dependent measures*

	(1)	(2)	(3)	(4)	(5)	(6)
	EIS_indadj	*PRC_EIN*	*RD Sale*	*lnAverage_citation*	*lnNominalV_Innov*	*lnRealV_Innov*
IID	-34.3478***	-0.2119*	-0.6177***	-1.4275***	-6.2250***	-5.4729***
	(7.3030)	(0.1140)	(0.0623)	(0.2188)	(0.9843)	(0.8618)
SIZE	-0.5513***	0.00320	-0.0041***	0.0224***	0.2237***	0.2026***
	(0.2054)	(0.0022)	(0.0011)	(0.0040)	(0.0251)	(0.0223)
LEV	-1.381	0.0705***	-0.1054***	-0.1330***	-0.7356***	-0.6414***

	(1.0914)	(0.0144)	(0.0076)	(0.0262)	(0.1250)	(0.1092)
CASH_HOLD	4.1498***	-0.0566***	0.0648***	0.0500*	0.3535***	0.2890***
	(1.1437)	(0.0169)	(0.0093)	(0.0264)	(0.1254)	(0.1086)
MTB	0.00990	-0.0016***	0.0048***	0.0035***	0.0486***	0.0428***
	(0.0357)	(0.0005)	(0.0004)	(0.0009)	(0.0063)	(0.0055)
ROA	-5.0672***	0.1536***	-0.3597***	0.1038***	0.6533***	0.6075***
	(1.0728)	(0.0199)	(0.0197)	(0.0309)	(0.1491)	(0.1312)
SalesGrowth	0.7615***	-0.0293***	0.0645***	0.00800	0.00730	0.00420
	(0.1606)	(0.0042)	(0.0058)	(0.0051)	(0.0199)	(0.0166)
Ln_PPE_Employees	-0.135	-0.0052**	0.0058***	-0.00210	-0.00600	-0.00550
	(0.1777)	(0.0022)	(0.0010)	(0.0031)	(0.0178)	(0.0155)
AGE	0.7577***	-0.0104***	-0.00190	0.0286***	0.1710***	0.1445***
	(0.2381)	(0.0031)	(0.0015)	(0.0052)	(0.0275)	(0.0239)
BoardSize	0.0227	-0.0027***	0.0018***	-0.0033**	-0.0173**	-0.0167**
	(0.0813)	(0.0009)	(0.0003)	(0.0014)	(0.0074)	(0.0065)
Duality	0.195	-0.0286***	-0.00150	0.0310***	0.1932***	0.1729***
	(0.4124)	(0.0052)	(0.0026)	(0.0094)	(0.0482)	(0.0420)
CSRCommittee	-6.6019***	0.1343***	-0.0051**	-0.0224**	-0.0747	-0.0568
	(0.4636)	(0.0067)	(0.0026)	(0.0098)	(0.0469)	(0.0407)
InBoardM	0.00800	-0.0003**	0.0003***	0.0014***	0.0091***	0.0078***
	(0.0105)	(0.0001)	(0.0001)	(0.0002)	(0.0010)	(0.0009)
EnScore	0.6470***	0.0054***	0	-0.0004*	-0.00100	-0.000700
	(0.0115)	(0.0001)	(0.0000)	(0.0002)	(0.0011)	(0.0010)
IO	0.0178**	0.0004***	0.0003***	0.0015***	0.0091***	0.0074***
	(0.0088)	(0.0001)	(0.0001)	(0.0002)	(0.0009)	(0.0008)
TOP1	-0.0127	-0.0014***	-0.0004***	-0.0012***	-0.0061***	-0.0049***
	(0.0270)	(0.0004)	(0.0002)	(0.0004)	(0.0018)	(0.0015)
RD_TA	14.7568***	-0.2047***		0.9096***	4.7546***	3.9925***
	(2.3939)	(0.0472)		(0.0975)	(0.4833)	(0.4200)
Constant	-11.0738***	0.5816***	0.1746***	-0.1987***	-3.1834***	-2.8571***
	(2.8346)	(0.0342)	(0.0175)	(0.0556)	(0.3714)	(0.3286)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54233	50736	54249	54249	54249	54249
R-square	0.370	0.390	0.206	0.170	0.185	0.183
Adj. R-square	0.370	0.389	0.205	0.170	0.185	0.182

Note: To investigate robustness and alleviate the potential endogeneity and omitted variables concerns, we perform tests using several alternative dependent variables, including industry adjusted eco-innovation score (*EIS_indadj*), process green innovation (*PRC_EIN*), research and development intensity measured by sales (*RD_Sale*), natural logarithm of average patent citations (*lnAverage_citation*), natural logarithm of nominal value of innovation outputs (*lnNominalV_Innov*), natural logarithm of real value

of innovation outputs (*lnRealV_Innov*). Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent p<0.1, p<0.05 and p<0.01, respectively. All the regressions are controlled for industry-, year-fixed effects. The detailed definitions of variables can be found in Appendix A.

We incorporate several additional control variables in our regression models to mitigate the possibility of omitted variables bias. Following prior literature, we control for tangibility (*Tangibility*) (Pu et al., 2023), net sales scaled by the number of employees (*Ln_Sales_Employees*) (Miller et al., 2022). From the perspective of board characteristics variables, we control for number of board meetings (*BoardMeeting*) (Liu et al., 2020), board tenure (*BoardTenure*) (Deng et al., 2025), total executives compensations (*LnExcuCom*) (Deng et al., 2025), percent of independent directors (*PCT_IND*) (Wu et al., 2023), and governance committees (*GovCommittee*) (Nadeem et al., 2020), the number of employees (*Employ*) (Tang et al., 2024). We also control for controlling for the industry-level factor, Herfindahl index (*HHI*) (Kałdoński and Jewartowski, 2026). The relevant results are presented in Table 9, which are consistent with those obtained in our main regression analysis.

Table 9 *Robustness tests: additional controls*

	(1)	(2)	(3)	(4)	(5)
	EIS	*EIS*	*RD_TA*	*LnPat*	*LnCite*
IID	-28.5550***	-8.1027*	-0.3097***	-3.5444***	-3.3258***
	(8.9786)	(4.4674)	(0.0283)	(0.5975)	(0.5632)
SIZE	-1.6902***	-1.1611*	0.0094***	0.1378***	0.1254***
	(0.4370)	(0.6590)	(0.0014)	(0.0252)	(0.0232)
LEV	6.2875***	-2.7986**	-0.0379***	-0.2775***	-0.2684***
	(1.3687)	(1.3323)	(0.0035)	(0.0798)	(0.0744)
CASH_HOLD	7.1524***	1.524	-0.0094*	0.1545*	0.124
	(1.6636)	(1.1349)	(0.0054)	(0.0841)	(0.0806)
MTB	-0.2796***	0.0131	0.0025***	0.0136***	0.0102***
	(0.0440)	(0.0365)	(0.0002)	(0.0032)	(0.0028)

ROA	-6.5492***	-0.327	-0.1950***	0.5565***	0.5504***
	(1.5955)	(0.9782)	(0.0109)	(0.1070)	(0.1017)
SalesGrowth	0.0993	0.8663***	0.0085***	-0.0368***	-0.0292**
	(0.2446)	(0.1962)	(0.0014)	(0.0119)	(0.0115)
Ln_PPE_Employees	0.390	-0.377	-0.0091***	-0.0349**	-0.0317**
	(0.2978)	(0.4239)	(0.0009)	(0.0153)	(0.0145)
AGE	0.449	0.784	0.000600	0.0699***	0.0573***
	(0.3338)	(0.5328)	(0.0007)	(0.0179)	(0.0162)
BoardSize	-0.1884*	-0.0704	0.0006***	-0.0194***	-0.0188***
	(0.1070)	(0.0805)	(0.0002)	(0.0059)	(0.0055)
Duality	0.783	0.120	-0.0036***	0.0500	0.0535*
	(0.5169)	(0.4296)	(0.0012)	(0.0310)	(0.0289)
CSRCommittee	-7.8884***	-4.8019***	-0.0051***	-0.0308	-0.0287
	(0.5753)	(0.4451)	(0.0011)	(0.0292)	(0.0279)
InBoardM	0.0239	0.00770	0.0001*	0.000800	0.000400
	(0.0191)	(0.0129)	(0.0000)	(0.0008)	(0.0007)
EnScore	0.8217***	0.7701***	0.0002***	0.00100	0.000900
	(0.0146)	(0.0177)	(0.0000)	(0.0008)	(0.0007)
IO	0.0235**	-0.00520	0	0.0023***	0.0018***
	(0.0119)	(0.0153)	(0.0000)	(0.0006)	(0.0006)
TOP1	-0.00200	0.00910	-0.0002***	0	0.000300
	(0.0337)	(0.0267)	(0.0001)	(0.0011)	(0.0010)
RD_TA	-0.684	-0.836		3.1875***	2.9603***
	(3.6498)	(2.9997)		(0.3348)	(0.3212)
BoardMeeting	0.0719	-0.00590	-0.000100	-0.000400	0.000200
	(0.0439)	(0.0268)	(0.0001)	(0.0018)	(0.0017)
BoardTenure	0.2118***	-0.1802**	-0.000100	0.0070*	0.00490
	(0.0753)	(0.0812)	(0.0002)	(0.0038)	(0.0035)
LnExcuCom	0.0578	0.0422	0.0056***	0.0339***	0.0283***
	(0.2403)	(0.1421)	(0.0005)	(0.0103)	(0.0091)
HHI	-0.673	-1.337	-0.0256***	-0.0158	-0.00580
	(2.4454)	(4.7406)	(0.0050)	(0.1386)	(0.1192)
Tangibility	-0.458	-1.039	0.1223***	0.134	0.139
	(1.9577)	(1.8182)	(0.0061)	(0.1090)	(0.1025)
PCT_IND	0.0101	-0.0297*	0.0001*	0.0022**	0.0019**
	(0.0218)	(0.0158)	(0.0000)	(0.0009)	(0.0008)
Ln_Sales_Employees	1.6544***	-1.8240***	0	0.0318	0.0304
	(0.4785)	(0.4537)	(0.0013)	(0.0223)	(0.0199)
Employ	1.3316***	-1.012	-0.0086***	0.00210	-0.000400
	(0.4510)	(0.6569)	(0.0014)	(0.0230)	(0.0204)
GovCommittee	0.0930	-1.053	0.0039***	0.1962***	0.1695***
	(0.7258)	(0.9405)	(0.0012)	(0.0280)	(0.0250)
Constant	-6.149	41.5007***	-0.0443***	-2.2768***	-1.9722***

	(5.8342)	(7.6460)	(0.0126)	(0.3391)	(0.3079)
Year	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Observations	42686	42177	42686	42686	42686
R-square	0.525	0.864	0.496	0.181	0.168
Adj. R-square	0.524	0.843	0.495	0.180	0.167

Note: To avoid important factors that could affect the examined causal relationship from being omitted in the model regression analysis, we include several additional control variables in the basic model to conduct further robustness tests and to mitigate the issue on omitted variable bias. Some firm-level control variables are added, including the number of board meeting (*BoardMeeting*), board tenure (*BoardTenure*), total compensation of executives (*LnExcuCom*), Herfindahl index (*HHI*), tangibility (*Tangibility*), independent director ratio (*PCT_IND*), net sales scaled by the number of employees (*Ln_Sales_Employees*), the number of employees (*Employ*), corporate governance committees (*GovCommittee*). Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent $p<0.1$, $p<0.05$ and $p<0.01$, respectively. All the regressions are controlled for industry-, year-fixed effects. The detailed definitions of variables can be found in Appendix A.

To address concerns regarding the treatment of missing values in innovation variables, we further conduct a robustness test by keeping missing values unchanged and estimating the regressions using only observations with non-missing general innovation measures. In the baseline analysis, missing values of general innovation variables are replaced with zero following prior studies, because innovation databases often do not record innovation outcomes for all firm-year observations and directly dropping such observations would substantially reduce the sample size. Nevertheless, missing values may also reflect data unavailability rather than true zero innovation. Therefore, this robustness test examines whether the baseline results are driven by the zero-imputation procedure.

The results in Table 10 show that the coefficients of IID remain negative and statistically significant across all innovation measures after excluding observations with missing innovation values. In particular, IID is negatively associated with R&D intensity, patent output, citation-based measures, and innovation value measures. These findings are consistent with the baseline results, suggesting that the documented

relationship between IID and firm innovation is not sensitive to the treatment of missing innovation observations. Thus, the main conclusion remains robust.

Table 10 *Robustness test: excluding observations with missing general innovation measures*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	RD_TA	*RD_Sale*	*LnPat*	*LnCite*	*lnAverage_citation*	*lnNominalV_Innov*	*lnRealV_Innov*
IID	-0.3244***	-0.2339**	-7.4217***	-8.1752***	-2.0602***	-10.2383***	-10.0147***
	(0.0326)	(0.1038)	(1.5042)	(1.6520)	(0.6223)	(1.7476)	(1.7029)
SIZE	-0.0059***	-0.0122***	0.5663***	0.5582***	0.0680***	1.0538***	1.0154***
	(0.0007)	(0.0020)	(0.0492)	(0.0544)	(0.0166)	(0.0573)	(0.0564)
LEV	-0.0658***	-0.1820***	-0.7721***	-0.9410***	-0.3199***	-1.8834***	-1.8358***
	(0.0041)	(0.0135)	(0.2231)	(0.2428)	(0.0968)	(0.2545)	(0.2484)
CASH_HOLD	0.0558***	0.0605***	0.3956*	0.374	0.0694	0.6622***	0.6422***
	(0.0047)	(0.0166)	(0.2020)	(0.2272)	(0.0853)	(0.2430)	(0.2366)
MTB	0.0038***	0.0065***	0.00700	0.0106*	0.0064***	0.0762***	0.0740***
	(0.0002)	(0.0006)	(0.0055)	(0.0064)	(0.0023)	(0.0069)	(0.0067)
ROA	-0.2797***	-0.7837***	0.8065***	0.7957***	0.1659*	1.3329***	1.2658***
	(0.0126)	(0.0377)	(0.2247)	(0.2436)	(0.1001)	(0.3002)	(0.2928)
SalesGrowth	0.0083***	0.1116***	-0.0975***	-0.0689**	0.0381**	0.00650	0.00640
	(0.0017)	(0.0094)	(0.0264)	(0.0338)	(0.0175)	(0.0380)	(0.0356)
Ln_PPE_Employees	0.0022***	0.0238***	-0.1712***	-0.1428**	-0.00830	-0.0980*	-0.0914
	(0.0007)	(0.0027)	(0.0541)	(0.0567)	(0.0168)	(0.0595)	(0.0582)
AGE	0.00100	0.000700	-0.1029*	-0.1353**	-0.0337	-0.0835	-0.0774
	(0.0009)	(0.0027)	(0.0601)	(0.0641)	(0.0222)	(0.0729)	(0.0710)
BoardSize	0.0011***	0.0032***	-0.0219	-0.0213	0.00160	-0.0327	-0.0332
	(0.0002)	(0.0006)	(0.0218)	(0.0232)	(0.0062)	(0.0279)	(0.0276)
Duality	-0.0036**	-0.0113**	0.2042**	0.2635***	0.0991***	0.4097***	0.4072***
	(0.0014)	(0.0045)	(0.0824)	(0.0913)	(0.0327)	(0.0971)	(0.0951)
CSRCommittee	-0.0068***	-0.0089*	0.0156	0.0292	-0.0115	0.126	0.131
	(0.0015)	(0.0048)	(0.0911)	(0.0975)	(0.0365)	(0.1172)	(0.1147)
InBoardM	0.0002***	0.0006***	0.000100	0.00100	0.00140	0.0080*	0.0080*
	(0.0000)	(0.0001)	(0.0030)	(0.0032)	(0.0011)	(0.0044)	(0.0043)
EnScore	0.0002***	0.000100	0.0067***	0.0050**	-0.0032***	0.00220	0.00220
	(0.0000)	(0.0001)	(0.0023)	(0.0024)	(0.0009)	(0.0024)	(0.0023)
IO	0.0001***	0.0002*	-0.0036*	-0.00170	0.0024***	0.0069**	0.00550
	(0.0000)	(0.0001)	(0.0022)	(0.0023)	(0.0007)	(0.0035)	(0.0034)
TOP1	-0.0004***	-0.000500	0.00260	0.00300	-0.00250	-0.00510	-0.00440
	(0.0001)	(0.0004)	(0.0054)	(0.0055)	(0.0020)	(0.0071)	(0.0068)
RD_TA			3.6990***	4.2166***	0.9006***	4.2993***	4.2058***
			(0.4775)	(0.5124)	(0.1686)	(0.5711)	(0.5543)

Constant	0.1540***	0.2431***	-3.7079***	-4.1490***	0.144	-9.3437***	-9.6824***
	(0.0109)	(0.0307)	(0.7004)	(0.7483)	(0.2061)	(0.9267)	(0.9008)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38531	27449	6393	6393	6393	6393	6393
R-square	0.480	0.380	0.418	0.425	0.567	0.548	0.556
Adj. R-square	0.480	0.379	0.413	0.421	0.564	0.545	0.553

Notes: This table reports the robustness test in which missing values of general innovation measures are retained as missing rather than being replaced with zero. Observations with missing values for the corresponding dependent variable are excluded from each regression. The dependent variables in Columns (1)–(7) are *RD_TA, RD_Sale, LnPat, LnCite, lnAverage_citation, lnNominalV_Innov*, and *lnRealV_Innov*, respectively. Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent p<0.1, p<0.05 and p<0.01, respectively. All the regressions are controlled for industry-, year-fixed effects. The detailed definitions of variables can be found in Appendix A.

6. Further analysis: heterogeneity effects

Table 11 reports the moderating effects of product market competition, ESG performance, and analyst coverage on the relationship between institutional investor distraction and corporate green innovation. Overall, the results suggest that the negative effect of institutional investor distraction is not uniform across firms. Instead, it is more pronounced when firms face stronger external pressure or higher stakeholder expectations.

First, the results show that institutional investor distraction significantly reduces corporate green innovation in the low-HHI group. The coefficient of IID is -41.9042 and is significant at the 1% level, whereas the coefficient in the high-HHI group is positive but statistically insignificant. The Wald test p-value is 0.0860, indicating that the difference between the two groups is statistically significant at the 10% level. Since a lower HHI reflects a more fragmented market structure and stronger product market competition, this finding suggests that competitive pressure amplifies the negative governance effect of institutional investor distraction. In highly competitive industries, firms are more likely to face short-term pressure related to profitability, cost control,

and market share. Green innovation, however, usually requires long-term investment, involves high uncertainty, and may not generate immediate financial returns. Under such conditions, effective monitoring by institutional investors becomes especially important in preventing managerial short-termism. When institutional investors are distracted, their monitoring role weakens, allowing managers to cut back on long-term green innovation projects in order to respond to immediate competitive pressures. By contrast, firms in high-HHI industries face relatively weaker product market competition and may have more stable market positions and resource buffers. Therefore, institutional investor distraction has a less pronounced effect on their green innovation decisions.

Second, the negative effect of institutional investor distraction is concentrated among firms with high ESG scores. In the low-ESGScore group, the coefficient of IID is positive but insignificant. In contrast, in the high-ESGScore group, the coefficient is -66.4069 and significant at the 1% level. The Wald test p-value is 0.0176, confirming that the coefficient difference between the low- and high-ESGScore groups is statistically significant. This result indicates that firms with stronger ESG performance are more sensitive to institutional investors' attention.

In addition, the coefficient of IID is significantly negative only in the high-ESGScore group, while it is insignificant in the low-ESGScore group. This finding indicates that the effect of IID on EIS is stronger among firms with better ESG performance. Firms with higher ESG scores are generally subject to greater external scrutiny and stronger expectations regarding transparency and long-term strategic responsibility. As a result, IID may play a more salient role in shaping their environmental innovation.

Finally, the results based on analyst coverage show that IID has a significantly negative effect on EIS only in the high-analyst-coverage group. Analyst coverage reflects the external information environment and the intensity of capital market monitoring. Firms followed by more analysts are more closely observed by external

market participants, and their operating performance, governance structure, strategic adjustments, and future prospects are more likely to be evaluated and communicated to investors. As a result, these firms face stronger information disclosure pressure and market expectation pressure. This may explain why the negative effect of IID on EIS is more evident among firms with high analyst coverage. When firms are under greater external monitoring, managers and boards may pay more attention to short-term observable performance and market reactions. Since EIS-related activities are usually long-term, uncertain, and difficult to evaluate in the short run, firms with high analyst coverage may become more cautious in making such strategic commitments. Therefore, IID's negative influence on EIS is more likely to be amplified in firms with stronger analyst attention.

Table 11 *Heterogeneity analyses: HHI, ESG score, and analysts' coverage effects*

	EIS	*EIS*	*EIS*	*EIS*	*EIS*	*EIS*
	Low HHI	High HHI	Low ESGScore	High ESGScore	Low Analysts	High Analysts
	(1)	(2)	(3)	(4)	(5)	(6)
IID	-41.9042***	0.470	10.43	-66.4069***	3.762	-54.0039***
	11.3046)	(14.1110)	(6.5734)	(16.8768)	(11.0637)	(14.8685)
SIZE	-0.157	-0.8399**	-1.0154***	0.326	-0.9349***	0.548
	(0.3509)	(0.3668)	(0.2037)	(0.4261)	(0.3499)	(0.4544)
LEV	7.7943***	6.1874***	2.1807**	14.6607***	5.6900***	5.7709**
	(1.7422)	(2.0833)	(0.9841)	(2.4892)	(1.6008)	(2.3405)
CASH_HOLD	11.2458***	8.3300***	1.9908**	18.8959***	5.7838***	13.5277***
	(1.8812)	(2.2285)	(0.9271)	(3.1742)	(1.6081)	(2.6746)
MTB	-0.3141***	-0.2587***	-0.0806***	-0.4461***	-0.2123***	-0.2384***
	(0.0519)	(0.0737)	(0.0272)	(0.0965)	(0.0514)	(0.0737)
ROA	-6.6416***	-5.1248**	-1.5977*	1.274	-3.1301**	-2.572
	(1.6372)	(2.2093)	(0.8790)	(4.4678)	(1.3875)	(3.2867)
SalesGrowth	0.0480	0.0435	0.0715	-3.9852***	-0.0660	-0.860
	(0.2322)	(0.5132)	(0.1247)	(0.8412)	(0.2221)	(0.5588)
Ln_PPE_Employees	-0.293	1.0516***	0.3039**	-0.459	0.8977***	0.339
	(0.3111)	(0.3277)	(0.1435)	(0.4094)	(0.2517)	(0.3789)
AGE	0.9159**	1.3824***	0.4705**	0.226	0.7343**	0.418
	(0.4235)	(0.4371)	(0.2071)	(0.5768)	(0.3425)	(0.5731)
BoardSize	-0.0113	-0.0131	-0.0141	-0.143	-0.139	-0.150

	(0.1473)	(0.1531)	(0.0981)	(0.1480)	(0.1490)	(0.1433)
Duality	-1.2766*	1.3011*	0.6218*	-1.073	-0.0218	1.325
	(0.7117)	(0.7639)	(0.3634)	(0.9151)	(0.6223)	(0.8455)
CSRCommittee	-8.7147***	-6.5130***	-4.3133***	-7.7874***	-6.0973***	-10.3364***
	(0.8140)	(0.8026)	(0.5346)	(1.3394)	(0.7232)	(0.9800)
InBoardM	-0.00280	-0.0226	0.00510	-0.0199	-0.0105	-0.0178
	(0.0208)	(0.0196)	(0.0111)	(0.0226)	(0.0173)	(0.0236)
EnScore	0.8019***	0.7953***	0.8770***	1.2218***	0.7667***	0.8900***
	(0.0189)	(0.0210)	(0.0257)	(0.0296)	(0.0202)	(0.0218)
IO	0.00280	0.0419***	0.00840	0.0857***	0.0381***	0.0434**
	(0.0159)	(0.0149)	(0.0075)	(0.0215)	(0.0137)	(0.0208)
TOP1	0.0294	-0.0295	0.0230	-0.0998	-0.0879**	0.0480
	(0.0442)	(0.0422)	(0.0199)	(0.0635)	(0.0371)	(0.0607)
RD_TA	-7.3063**	19.7909**	-1.819	-12.86	-5.8884**	3.559
	(3.1431)	(8.9800)	(1.6369)	(12.9599)	(2.8563)	(8.4308)
Constant	0.641	-2.948	7.2707***	-38.5328***	3.675	-16.2213**
	(4.7863)	(5.3624)	(2.6585)	(6.4513)	(4.5408)	(6.7914)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17606	18136	17960	18063	15189	17681
R-square	0.557	0.547	0.396	0.450	0.485	0.525
Adj. R-square	0.556	0.546	0.394	0.449	0.483	0.524
Wald test p-value	0.0860		0.0176		0.0328	

Notes: This table reports the heterogeneity analyses based on industry concentration, ESG performance, and analysts' coverage. The sample is divided into low and high groups according to the median values of *HHI*, *ESGScore*, and *Analysts*, respectively. Heteroskedasticity-consistent standard errors are reported in parentheses. *, ** and *** represent p<0.1, p<0.05 and p<0.01, respectively. All the regressions are controlled for industry-, year-fixed effects. The detailed definitions of variables can be found in Appendix A.

7. Conclusions

Despite substantial stakeholder pressure on firms to undertake environmentally friendly activities, such as eco-innovation, progress in putting such practices in place remains astonishingly low. This is due to the inherent qualities of eco-innovation, which necessitate substitutional expenditures with a delayed return on investment, hence impeding or changing management financial aims (Zaman et al., 2023). As a result, managers, despite knowing that eco-innovation provides a competitive advantage by

lowering a company's environmental footprint and risk profile, either avoid engaging in expensive eco-innovation initiatives (eco-innovation) or do so only to advance their own agenda (i.e., reputation building or “Public Relations”-related kudos), resulting in lower eco-innovation diffusion in a company. Institutional investors are among the key monitors and motivators of corporate engagement in green activities. Although prior studies have tried to understand the importance of IO to firms' environmental engagement/green innovation, few studies have examined the effect of institutional investor distraction on firms' green innovation.

This study contributes to the existing literature to examine how institutional distraction affect firms' green innovation in the US in the period of 2002 to 2024. Different from the numerous studies that have examined the stability hypothesis, we consider the effects of the attention hypothesis to explore the effect of institutional investor distraction. We find that institutional investor distraction has a significantly negative effect on firms' green innovation. In addition, we investigate the mechanisms underlying this nexus. We find that institutional investor distraction inhibits green innovation via the channel of financial constraints. Furthermore, we explore the moderating effects of market competition, ESG performance, and analyst coverage on the relationship of interest, and the results show that higher market competition, higher ESG performance, and higher analyst coverage strongly strengthen the negative relationship between institutional investor distraction and firms’ green innovation.

Our findings carry significant implications for practical applications and policy development. From the practice perspective, our findings help institutional investors recognize that their own distraction may weaken monitoring effectiveness and undermine firms’ long-term value. Encourage better allocation of attention and governance resources across portfolio firms. We also signal to managers the need to strengthen internal governance and long-term strategic commitment, especially when external oversight is weakened. Regarding the policy implications, this research may inform policymakers about the broader implications of institutional investor behavior

on innovation and sustainability economic growth. Regulators may consider strengthening stewardship responsibilities for institutional investors, particularly to discourage excessive short-termism and ensure continuous oversight. Second, improving transparency regarding institutional attention - such as through enhanced portfolio disclosure - can mitigate the risks associated with investor distraction. Moreover, incentive-based policies may be developed to promote sustained engagement in ESG governance.

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Appendix A. Variable definition

Variables	Abbreviations	Definition
Dependent Variable		
Green Innovation		
		Environmental innovation category score reflects a company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.
Environmental Innovation Score	*EIS*	Thomson Reuters Eikon eco-innovation score reflects a company's capacity to reduce environmental costs and burdens for its customers, and thereby creating new market opportunities through new/improvement in existing environmental technologies and processes or eco-designed products or processes (Thomson Reuters Eikon). Thomson Reuters Eikon eco-innovation score is a weighted average industry adjusted composite score on a scale of 0–100 and encompasses twenty variables related to the organisational eco-product and eco-processes, where 100 reflects a high level of eco-innovation commitment (see supplementary file for details).
Industry adjusted eco-innovation score	*EIS_indadj*	Construct an industry adjusted eco-innovation score, which captures the relative eco-innovation activities of a firm relative to industry peers. Specifically, for each industry and year, calculate the average eco-innovation score and deduct this average score from the firm-level eco-innovation score for a particular year (Industry adj. Eco-Innovation).
Process eco-innovation	*PRC_EIN*	Consists of six indicators reflecting improvements in environmental processes: energy efficiency targets, water efficiency targets eco-designed products, emission-reduction processes, natural resource reduction policies / supply-chain environmental policies, waste-reduction initiatives. The *PRC_EIN* score ranges from 0 to 6, depending on the number of disclosed indicators.
General Innovation		
Input Innovation		
Research & Development	*RD_Sales*	Research and Development Expense / Net Sales or Revenues * 100
	RD_TA	The natural logarithm of one plus annual R&D spending measured at the end of fiscal year t scaled by total assets.
Output Innovation		

Innovation Output	*LnPat*	The natural logarithm of one plus the number of patent applications a firm files (and is eventually granted)
Innovation Quality	*LnCite*	The number of citations a patent receives divided by the average number of citations received by patents in its cohort (i.e., patents applied in the same year and in the same technology class)
lnNominal_Value_innovation	*lnNominal_Value_innovation*	Natural logarithm of one plus firm's market value of innovation outputs in millions of nominal dollars for firm i in a given year t, set to zero if missing.
lnReal_Value_innovation	*lnReal_Value_innovation*	Natural logarithm of one plus firm's nominal market value of innovation outputs is deflated to 1982 (million) dollars using the CPI for firm i in a given year t. Real_Value_innovation i,t = Nominal_Value_ innovation i,t /CPI∗100, set to zero if missing.
lnAverage_citation	*lnAverage_citation*	Natural logarithm of the average number of lifetime citations received by the patents applied for firm i in a given year t, set to zero if missing.
Independent Variable		
Institutional Investor Distraction	*IID*	The shareholder distraction measure obtained from Kempf et al. (2017).
Control Variables		
Firm Characteristics Controls		
Firm Size	*SIZE*	Logarithm of total book assets as of the prior fiscal year end.
Leverage	*LEV*	Liabilities-Total/Total Assets
Cash holding	*CASH_HOLD*	Cash plus receivables, normalized by lagged total assets.
Market to book value	*MTB*	MTB is the market value divided by book value
Return on Assets	*ROA*	Earnings before interest, taxes, and depreciation and amortization (EBITDA)/Assets
Saled Growth	*SalesGrowth*	The growth rate of sales from year t-1 to year t.
Log PPE/#employees	*Ln_PPE_Employees*	The natural logarithm of net property, plant, and equipment divided by the number of employees.
AGE	*AGE*	Logarithm of one plus the number of years since the firm appears on LSEG.
Executives Compensation	*LnExcuCom*	The total compensation of executives.
Tangibility	*Tangibility*	Defined following Berger, Ofek, and Swary (1996) as: 0.715 × receivables + 0.547 × inventory + 0.535 × capital + cash, normalized by total assets.
Board Characteristics Controls		
Board Size	*BoardSize*	Board size is the number of people on the corporate board.
Duality	*Duality*	Duality is a dummy variable that indicates whether the chairman concurrently also holds the position of general manager.
CSR Committee	*CSRCommittee*	Takes the value of 1 when the company has a corporate social responsibility committee or team, 0 otherwise.
Independent Board Member	*InBoardM*	Percentage of independent board members.
Environmental Score	*EnScore*	Environmental performance score from LSEG

Number of Board Meetings	*BoardMeeting*	The number of board meetings during the year.
Board Tenure	*BoardTenure*	Average number of years each board member has been on the board.
Independent director ratio	*PCT_IND*	PCT_IND is measured by the ratio of the number of independent directors to the number of directors on the board
the number of employees	*Employ*	Calculated as the natural logarithm of the total number of employees
CG committees	*CG_COMM*	Takes the value of 1 when the company has a corporate governance committee, 0 otherwise.
Institutional Investor Controls		
Institutional Ownership	*IO*	Fraction of the firm's stock owned by institutional investors as reported in the Thomson Reuters 13f database, measured at the quarter-end before the event period.
Largest shareholder ownership	*TOP1*	The shareholding ratio of major shareholder (Top1) is measured by the shareholding ratio of the largest shareholder.
Industry-level Control		
Herfindahl index	*HHI*	Herfindahl-Hirschman Index calculated as the sum of the squared market shares using firm sales, based on 4-digit SIC industry classification.
Mechanisms and Moderators		
Earnings management	*EM*	To measure the level of earnings management in a company, employ the manipulated accrual profit index based on the modified Jones model.
Financial constraints	*KZ_Index*	The Kaplan-Zingales index, which measures the degree of financial constraints faced by a firm. A higher value indicates that the firm faces more severe financial constraints.
ESG performance	*ESGSCORE*	Corporate ESG score
Analyst Coverage	*Analysts*	Earnings per Share Total Number of Estimates in the Mean FY1

Appendix B. Measurement of process green innovation (*PRC_EIN*)

The process green innovation typically include the following indicators available in ASSET4:

i) Resource efficiency objectives/energy efficiency: Has the company set targets or objectives to be achieved on energy efficiency?

ii) Resource efficiency objectives/water efficiency: Has the company set targets or objectives to be achieved on water efficiency?

iii) Eco-design products: Does the company report on specific products which are

designed for reuse, recycling or the reduction of environmental impacts?

iv) Emission reduction processes/emissions: Does the company describe, claim to have or mention processes in place to improve emission reduction?

v) Resource reduction/policy: Does the company have a policy for reducing the use of natural resources? Does the company have a policy to lessen the environmental impact of its supply chain?

vi) Waste reduction total: Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out total waste?

In ASSET4, each of the above indicators is assigned a value of 1 if the focal firm has made relevant disclosure, and 0 otherwise. We follow Nadeem et al. (2020) and assign equal weights to each of the abovementioned indicators. Thus, our *PRC_EIN* is the sum of all six (6) indicators (i–vi) and the total scores for a focal firm would range from 0 (no disclosure made on any indicator) to a maximum of 6 (disclosure made on all indicators).