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Abstract

This study investigates supply chain transparency's (SCT) impact on corporate greenwashing. Analyzing Chinese data reveals a notable negative effect, suggesting that enhanced SCT contributes to reducing greenwashing. This relationship is primarily driven by easier financing constraints and increased investor vigilance. Environmental regulation rigor, digital finance adoption, the degree of market competition, and industry-specific characteristics emerge as key moderating factors of this relationship. Crucially, we demonstrate SCT's integral role in promoting genuine corporate environmental practices and emphasize non-financial disclosures' importance in diminishing information asymmetry and strengthening corporate governance.

Keywords: Supply chain, Transparency, Corporate greenwashing
JEL Classification: G34; M14; M41; Q56; R11

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1 Introduction

Supply chain transparency (SCT) refers to disclosing information to the public about counterparties' names, upstream operations, and purchasing and selling practices, reflecting the degree to which market participants can access and understand supply chain information. SCT increases consumer trust, ensures regulatory compliance, promotes sustainable and ethical practices, and improves operational efficiency (Egels-Zandén et al., 2015; Sodhi and Tang, 2019). Therefore, many governments now require companies to provide appropriate disclosures about their supply chains.[1] Specific information such as suppliers' identities and transaction amounts, which often entail business confidentiality, are typically encouraged rather than enforced. Still, some corporations, such as Nike, Apple, Tesla, Marks, Spencer, and Patagonia, are beginning to disclose more comprehensive information on their supply chains, such as suppliers' names and locations (Sodhi and Tang, 2019).

China offers an intriguing case for examining this issue. The Chinese government has continuously augmented listed companies' requirements to disclose supply chain information to increase transparency, and thus, reduce the transaction costs resulting from information asymmetry.[2] However, contrary to this policy, listed companies' willingness to disclose this information has declined. As illustrated in Figure 1, the proportion of listed companies that chose to disclose the names of their suppliers (or clients) exhibits a noticeable trend of an initial phase of growth followed by a subsequent decline.[3] Clearly, listed corporations are becoming more reticent in revealing details about their upstream and downstream operations.

[FIGURE 1 about here.]

SCT falls within the scope of voluntary disclosures for listed Chinese companies. As a form of non-financial information, it is instrumental in influencing corporate earnings management, guiding

[1] Examples are Section 1502 of the Dodd-Frank Act in the United States (Dalla Via and Perego, 2018) and the Supply Chain Due Diligence Act implemented in Germany at the beginning of 2023 (Dai and Tang, 2022).

[2] In 2001, the China Securities Regulatory Commission (CSRC) first mandated that listed companies disclose total sales to the top five customers, their proportions, and total purchases from the top five suppliers in the annual report. In 2012, in its disclosure rules, the CSRC *"encouraged"* listed companies to disclose the names of the top five customers and suppliers along with their respective transaction amounts. The tone of the *"encouragement"* has remained consistent in subsequent rule revisions and has been emphasized many times. Table A.1 in the Appendix lists the relevant documents.

[3] According to regulations, disclosing the names of the Top-5 suppliers and customers is not mandatory. Firms often use terms such as "Customer 1", "Customer 2", "Supplier 1", and "Supplier 2" instead (Figure A.1, Appendix).

board oversight, and informing CEO turnover decisions (De George et al., 2016). These roles are intricately linked to curbing opportunistic corporate behaviors (Lakhal and Dedaj, 2020). That is, the risks of opportunistic corporate behavior and information asymmetry may escalate with a non-transparent supply chain. Hence, a decrease in SCT suggests potential opportunistic actions, such as "greenwashing," which is the deceptive practice of presenting a company or product as more environmentally friendly than it truly is.[4] Chinese data indicate that 46.6% of firms are categorized in the Low SCT & High Greenwashing, 37.4% in Low SCT & Low Greenwashing, 9.3% in High SCT & Low Greenwashing, and 6.9% in High SCT & High Greenwashing groups.[5] Therefore, when a company's SCT is low (high), greenwashing is more likely to be higher (lower). Inevitably, one may ask: Can we leverage the SCT level to detect and possibly prevent corporate greenwashing practices?

Despite this seemingly inherent link, scholars have not explored the role of a firm's SCT in identifying and preventing corporate greenwashing. Because of its intrinsic high traceability, SCT acts as a credible voluntary disclosure. Disclosed information, especially details about suppliers and customers, increases stakeholder scrutiny of corporations. This can foster sustainable production and deter companies from deflecting greenwashing accusations onto their suppliers, as they can no longer operate in obscurity (Kalkanci and Plambeck, 2020; Pizzetti et al., 2021). Echoing this sentiment, Kovács (2008) argued that consumer-driven environmental demands push companies towards a deeper understanding and accountability of their supply chains. Drawing on the theory of social

[4]Some notable examples include the $1.5 million fine imposed on BNY Mellon Investment Adviser, Inc. by the US Securities and Exchange Commission (SEC) for false statements related to environmental, social, and governance (ESG) considerations in its investment decisions, such as implying that all fund investments had undergone an ESG review (SEC, 2022). DWS, a global asset management company, has also been investigated by both the SEC and the German financial watchdog BaFin after a whistleblower alleged that DWS marketed its funds as being more environmentally friendly ("greener") than they were (Reuters, 2023b). As highlighted by Jahdi and Acikdilli (2009), Shell made a bold claim in 2000 that it would invest US $1 billion in renewable energy in the subsequent years. However, no relevant figures have been produced to demonstrate that is walking the talk. Shell has repeatedly faced similar allegations. According to Reuters (2023a), in a complaint to the SEC at the beginning of 2023, Shell was accused by the activist group Global Witness of inflating its commitment to renewable energy sources. McDonald's paper straws (BBCNEWS, 2019), Keurig's misleading environmental claims (CBCNEWS, 2022), and Ryanair's fake low-CO2 claims (Reuters, 2020) are additional examples of greenwashing. Southern Weekend, a highly influential independent Chinese newspaper, has been publishing a Greenwashing List since 2009, with more than 150 companies (more than 70 listed companies) in China identified as practicing greenwashing, for example, Harbin Pharmaceutical Group (in 2011), China Communications Construction Company Limited (in 2012), and Fufeng Group Limited (in 2016). Notably, this list continues to grow (Du, 2015; Li et al., 2023b).

[5]See Section 3 for further details about the data.

identity (Abrams and Hogg, 1988), ethically driven managers' behavior reflects a larger societal trend. When these managers prioritize transparent practices, such as openly disclosing supply chain information, they inherently reduce the company's inclination towards greenwashing. They aim to align their organization's actions with social values, fostering public trust (Pearce, 2013; Harjoto, 2017). This act of disclosure improves trust, and appeals to the discerning and skeptical nature of younger generations, and thus, makes greenwashing less appealing (Carter and Rogers, 2008; Francis and Hoefel, 2018). Moreover, as Lee et al. (2018) posited, the profitability of a greenwashing strategy is contingent on an uninformed market. By its nature, SCT contributes to a well-informed market ecosystem, thereby reducing corporate incentives to resort to greenwashing. Lastly, preserving proprietary data becomes a herculean task in today's digital era. Although firms might initially resist SCT fearing that trade secrets may be leaked, the Internet's information dissemination capabilities already challenge such notions (Sodhi and Tang, 2019). Consequently, a firm's active decision to withhold supply chain information may imply its greenwashing tendencies. Therefore, we advance research on supply chain management (Saberi et al., 2019), information disclosure (Cheynel, 2013; De George et al., 2016), and environmental protection (De Freitas Netto et al., 2020) by exploring the relationship between SCT and corporate greenwashing practices.

The remainder of this article is organized as follows. Section 2 summarizes the relevant literature and develops the hypotheses. The data sources and construction of the variables are elaborated in Section 3. Section 4 shows model specification, empirical discoveries with economic explanations, and robustness tests. Extensive analyses are conducted in Section 5 to discuss the moderating effects and heterogeneity. Finally, we draw conclusions and provide policy implications in Section 6.

2 Literature Review and Hypotheses Development

"Greenwashing" is the deceptive tactic adopted by companies and investment institutions to project an exaggerated or false image of environmental responsibility. Despite the lack of a formal definition, Delmas and Burbano (2011) discussed that greenwashing at the firm level is predominantly characterized by a disparity between a firm's *"poor environmental performance"* and

"positive communication about its environmental performance". Similarly, Walker and Wan (2012) and Bowen (2014) highlighted that greenwashing is a strategy whereby firms engage in *symbolic communications* without *substantially* solving environmental problems through their actions. Essentially, despite potential short-term gains, greenwashing practices can lead to distrust and reduced social support for companies (Kim and Lyon, 2015), discourage managerial engagements (Ferrón-Vílchez et al., 2021), and do not improve product quality (Zhang, 2022a). Moreover, from a societal perspective, these practices can decrease overall welfare due to misjudgments of genuine corporate commitment to social responsibility (Wu et al., 2020).

With increasing vigilance of governments and public awareness of environmental issues, straightforward non-compliant behaviors, such as concealing pollutants or falsely reporting carbon emissions, are diminishing. However, some space still exists for corporate greenwashing. This is largely due to the lack of auditing and specific regulatory guidelines that ensure the precision of the ESG-related reported data relevant (Friede, 2019; Yu et al., 2020). For publicly traded firms, greenwashing, beyond corporate disinformation, manifests in ambiguous, superficial, and misleading discourse that does not align with substantive actions. To obtain benefits equivalent to those from genuine environmental conduct, but at a much lower cost, companies often adopt tactics such as disseminating narratives about environmental performance in annual reports, company websites, and investor communication which are divergent from their actual environmental practices (Bowen and Aragon-Correa, 2014; Ruiz-Blanco et al., 2021; Mateo-Márquez et al., 2022; Hu et al., 2023). Recent research empirically revealed the factors behind corporate greenwashing, such as industry competition (Arouri et al., 2021), consumer demand (Zhang et al., 2018), economic growth pressures (Zhang, 2023b), external scrutiny (Zhang, 2022b, 2023a), stakeholder legitimacy (Lee and Raschke, 2023), agency problem (Hu et al., 2023), and lack of standardized environmental disclosure guidelines (Friede, 2019; Yu et al., 2020).

The relationship between SCT and greenwashing is complicated and may be unclear. Egels-Zandén et al. (2015) delineated the trade-offs between the benefits and costs of SCT. For example, firms and their suppliers have a reciprocal relationship, whereby firms may conceal supplier information as a negotiation strategy to obtain trade credits. This implicitly allows suppliers to exploit

labor and natural resources for financial gain without improving working conditions (Wang et al., 2023). The theory of corporate collusion supports this phenomenon, suggesting that by hiding supply chain information, listed companies can form a complicit relationship with upstream and downstream companies. This improves their position as a market monopoly, and weakens the inherent motivation and external pressure for ESG investments (Ying et al., 2023), resulting in an unclear relationship between SCT and greenwashing.

However, SCT is also about revealing the truth and conveying a specific perspective that serves different supply chain participants' interests (Madsen, 2009). Thus, the more realistic scenario may be a situation where companies with high SCT dominate the supply chain (Egels-Zandén et al., 2015). Investors can determine a company's stability and competitiveness from its supply chain disclosure, such as its resilience in the face of supply chain risks and its bargaining power in the market (Saberi et al., 2019). This information can influence business decisions. Companies with high stability and bargaining power typically have a comparative advantage (Vachon and Mao, 2008), and therefore, may not need to highlight their green practices to excessively enhance their corporate value. Thus, we propose the first hypothesis as follows:

Hypothesis 1. *Corporate SCT and greenwashing practices are negatively related.*

At the same time, many studies (Delmas and Burbano, 2011; Zhang, 2022b; Hu et al., 2023; Zhang, 2023b) find that financially constrained firms are tempted to exaggerate their environmentally-friendly efforts for several strategic reasons. First, in public relations and branding, green initiatives garner considerable positive media attention. Consequently, greenwashing is a cost-effective tool. Second, greenwashing can be a tactical move to qualify for certain preferences offered by governments and banks. Third, financial limitations may deter firms from investing in high-risk, albeit genuine, environmentally friendly technologies or products.

Moreover, considering the connection between SCT and financing constraints, Cheynel (2013) showed that when the disclosure is discretionary, firms opting for information disclosure benefit from a reduced cost of capital compared to their non-disclosing counterparts. Further exploring the value of transparency, Cheng et al. (2014) demonstrated that the clarity surrounding corporate social responsibility (CSR) plays a pivotal role in alleviating capital constraints. Accordingly, we propose

our second hypothesis as follows:

Hypothesis 2. *Enhanced SCT reduces corporate greenwashing by easing financial constraints.*

Finally, researchers (Chen, 2017; He et al., 2022) content that heightened investor attention, which refers to investors' focus on specific stocks or markets, reduces information asymmetry and curtails managers' opportunistic tendencies. This is due to the faster processing and dissemination of company information, and managers' knowledge that they are being closely watched. Clearly, greater investor attention reduces corporate greenwashing.

However, investor attention is limited and tends to gravitate towards stocks that conspicuously capture their focus (Barber and Odean, 2008). Hirshleifer and Teoh (2003) highlighted that according to the theory of limited attention and information processing, investors are more likely to focus on assets with high information transparency and ease of understanding. Blankespoor et al. (2014) underscored the value of disseminating disclosures to gain investor attention through social media. Similarly, Madsen (2017) observed a positive relationship between proactive advertising efforts and a spike in short-term prices. Dambra et al. (2023) found that voluntary disclosures attract the attention of prospective investors and information intermediaries; in turn, this enhances IPO valuation. Cheng et al. (2014) added another dimension by suggesting that increased disclosures, particularly those related to CSR, tend to attract a niche segment of investors with pronounced social responsibility tendencies. Accordingly, we posit that enhanced SCT can attract more investors because: 1) greater transparency simplifies investor understanding, and 2) voluntary disclosure reflects a firm's commitment to social responsibility, appealing to discerning investors. Therefore, we present the following hypothesis:

Hypothesis 3. *Enhanced SCT reduces corporate greenwashing by increasing investor attention.*

3 Data

In addition to the local government work reports used in the construction of the corporate greenwashing indicator, all other data are obtained from the China Stock Market & Accounting Research

(CSMAR) database, Chinese Research Data Services (CNRDS) database, and city statistical yearbooks as listed in Table 1.[6] We delete 1) ST and *ST firms, 2) financial sector firms, and 3) firms with missing values. To further control for the impact of extreme values, a 1% tail truncation is implemented on all variables. Our sample includes 24,776 observations from 2008 to 2021, with 3,240 unique Chinese A-listed firms, and starts in 2008 as very few companies issued social responsibility reports before this year.[7]

[TABLE 1 about here.]

More specifically, we compile several corporate greenwashing measures. First, referring to Gu et al. (2023), we first construct a measure for the environmental disclosure index (DIS_{it}) using the following three steps:

1. Terminology dictionary construction: We construct our own dictionary based on policy semantic systems, given the absence of an established environmental protection-specific terminology dictionary. This involves downloading and analyzing local government work reports from 2008 to 2021 retrieved from various local government websites. Using Python for initial word segmentation and subsequent manual identification, we extract 183 terms that appeared at least five times and are directly related to corporate environmental protection. These terms, along with frequency, constitute our dictionary.

2. Textual analysis: We incorporate the 183 identified terms into the *jieba* Chinese word segmentation library in Python. Using machine learning methods, we perform a textual analysis of

[6]CNRDS database: https://ngdc.cncb.ac.cn/databasecommons/database/id/4333. CSMAR database: https://cn.gtadata.com/.

[7]The Shenzhen Stock Exchange took a pioneering role in advocating CSR by issuing the "Social Responsibility Guidelines for Listed Companies on the Shenzhen Stock Exchange" in 2006. This initiative clarified the meaning of social responsibility, encouraging listed companies to assume these responsibilities and voluntarily disclose related information actively. In December 2007, the State-owned Assets Supervision and Administration Commission of the State Council issued the "Guidelines on Central Enterprises Fulfilling Social Responsibilities", requiring conditioned enterprises to publish social responsibility or sustainability reports regularly. Further enhancing the regulatory landscape, the Shanghai Stock Exchange published the "Environmental Information Disclosure Guidelines for Listed Companies on the Shanghai Stock Exchange" in 2008 (Noronha et al., 2013). The introduction of these guidelines marked a significant phase in CSR awareness in China and provided a robust platform for listed firms to actively conduct and disclose their sustainability activities (Shahab and Ye, 2018). This is the rationale for our decision to designate the sample period from 2008 to 2021 for our study. We have compiled 1,487 independently disclosed CSR reports, which are used to evaluate the level of initiative listed firms show in communicating their environmental protection activities to stakeholders.

social responsibility reports of publicly listed companies. Specifically, we calculate the frequency of occurrence of these terms in the reports.

3. Indicator construction: We then develop corporate environmental disclosure indicators. Recognizing the potential for word frequency variations between industries and different annual report lengths, we use the approach proposed by Loughran and McDonald (2011) to calculate the weights $w_{c,ist}$ for different word frequencies. Then, we calculate the weighted sum DIS_{it} Equation (1), which is indicative of a firm's proactive environmental information disclosure; a higher value of DIS_{it} implies a more proactive stance.

$$
\begin{aligned}
w_{c,ist} &= \begin{cases} \frac{(1+\log(tf_{c,ist}))}{(1+\log(l_{st}))} \log \frac{N_{st}}{df_{c,st}} & \text{if } tf_{c,ist} \geq 1 \\ 0 & \text{otherwise} \end{cases} \\
DIS_{it} &= \sum_{c=1}^{183} w_{c,ist} tf_{c,ist}
\end{aligned}
\tag{1}
$$

where N_{st} represents the total number of annual reports belonging to sector s in the year t, $df_{c,st}$ is the number of annual reports containing at least one occurrence of the word c, $tf_{c,ist}$ is the raw count of the word c in firm i's annual report in the year t, and l_{st} is the word count in the annual reports.

Similarly, based on Zhang et al. (2019), Zhu et al. (2022), Li et al. (2023a), Gu et al. (2023), Chen et al. (2023), and Zhang (2023b), a firm's environmental performance index (ACT_{it}) is evaluated using the following three dimensions: 1) environmental input and output (each item equals 1 point), 2) third party certification (each item equals 1 point), and 3) pollution treatment (qualitative descriptions receive 1 point while quantitative descriptions receive 2 points). Therefore, the range of the environmental performance score ACT_{it} is $[0, 15]$; further details are in Table 2.

[TABLE 2 about here.]

Finally, referring to the definition proposed by Delmas and Burbano (2011), Walker and Wan (2012), and Bowen (2014), greenwashing is identified as the gap between what firms disclose DIS_{it} and what they execute ACT_{it} with respect to environmental activities. We normalize the DIS_{it}

and ACT_{it} values as they vary substantially. Subsequently, we calculate the greenwashing scores ($GreenWash_{it}$), as defined in Equation (2), using the methodologies presented by Zhang (2022b) and Hu et al. (2023):

$$GreenWash_{it} = \left(\frac{DIS_{it} - \overline{DIS_{it}}}{\sigma_{DIS}}\right) - \left(\frac{ACT_{it} - \overline{ACT_{it}}}{\sigma_{ACT}}\right) \tag{2}$$

where $\overline{DIS_{it}}$ and $\overline{ACT_{it}}$ signify the industry-year average value of environmental disclosure and performance, respectively. Likewise, σ_{DIS} and σ_{ACT} represent the standard deviations of environmental disclosure and performance, respectively.

The other key variable in our analysis is supply chain transparency ($SCTScore_{it}$). Following previous studies (Sodhi and Tang, 2019; Chen et al., 2019; Kalkanci and Plambeck, 2020; Wang et al., 2023), SCT is measured by the extent to which firms disclose the names of their main suppliers and consumers. Stakeholders can only retrieve relevant information about the enterprise's supply chain and supervise their activities by disclosing specific names. In contrast, the non-disclosure of specific names includes instances without mention or anonymity. Additionally, SCT encompasses the frequency of interaction between a company, and upstream and downstream supply chain enterprises. Thus, we also use the number of times supply chain-related words appear in annual reports to measure SCT. Specifically, the SCT indicator includes five aspects: the number of suppliers (*SupNum*) and consumers (*CltNum*) whose specific names are disclosed; proportion of purchases from suppliers with disclosed names (*SupRatio*) and proportion of sales to consumers with disclosed names (*CltRatio*); and finally, the frequency of the term "supply chain" appearing in annual reports (*SCTWord*). Then, the principal component analysis (PCA) method is used to calculate the comprehensive factor score, denoted $SCTScore_{it}$, which measures the firm's SCT (see Figure A.2, Appendix).

The right panel of Figure 2 shows a discernible negative relationship between $SCTScore_{it}$ and $GreenWash_{it}$, suggesting that increased transparency is concomitant with reduced levels of greenwashing. This observation is supported by the left panel of Figure 2, where, at lower levels of *SCT*, *DIS* exceeds *ACT*. Conversely, at higher *SCT* levels, *ACT* predominates. In particular, as *SCT* increases, the growth rate of *ACT* significantly exceeds that of *DIS*.

[FIGURE 2 about here.]

We also control for financial and governance indicators that impact the green behaviors of firms, following Zhang (2022b), Zhang (2023b), and Hu et al. (2023). Among financial aspects, we consider firm profitability (*ROA*), growth potential (*Growth*), leverage ratio (*Lev*), income concentration (*HHI*), and firm size (*Asset*). Among governance factors, we consider firm maturity (*Age*), whether the CEO also serves as a board member (*Dual*), ownership concentration ($Top1$), board size (*Board*), proportion of independent directors (*IndDir*), employment of Big Four accounting firms ($Big4$), institutional investor holdings (*Inveratio*), and state-ownership (*SOE*). These variables are summarized in Table 1. By incorporating these control variables, we aim to isolate the impact of our main independent variables on firms' greenwashing behavior. Table 3 represents the descriptive statistics of the variables. Table 4 is the correlation coefficients table. *SCTScore* and *GreenWash* exhibit a significantly negative correlation at the 5% level, suggesting that an increase in a firm's SCT is associated with a rise in its greenwashing activities. The positive and significant correlation between *SCTScore* and its instrumental variable (IV) *SSIV* indicates that the instrument can adequately represent the variations in *SCTScore*. Further, although the control variables show significant correlations with *GreenWash*, their values are all below 0.2. Thus, the multicollinearity issue is minimal.

[TABLE 3 about here.]

[TABLE 4 about here.]

4 Model and Results

4.1 Identification based on the shift-share instrumental variable

To test the validity of Hypothesis 1, we propose the following regression equation:

$$GreenWash_{it} = \alpha_1 + \beta_{1,1} SCTScore_{i,t} + \sigma_1 X_{i,t-1} + \lambda_t + \rho_i + \varepsilon_{1,it} \tag{3}$$

where i refers to firm, t to year, and ε to the error term. X_{it} encompasses a vector of control variables. λ_t and ρ_i correspond to fixed effects for year and firm, respectively. We consider potential endogeneity issues in estimation, where explanatory variables in the model might be correlated with the error term. This may arise from omitted variables, such as where a firm's operational decisions dictate its green practices and supply chain disclosures. It may also come from spurious regressions, where firms may reduce SCT to better engage in greenwashing. Hence, we use lagged values of these control variables.[8]

In addition, following Adelino et al. (2017), Goldsmith-Pinkham et al. (2020), and Borusyak et al. (2022), we construct a shift-share (or "Bartik") IV (SSIV) for $SCTScore$. Specifically, we first calculate the growth rates of each industry s at the national level for $SupNum$, $CltNum$, $SupRatio$, $CltRatio$, and $SCTWord$. This involves aggregating these indicators of each industry at the national level excluding province p where firm i is located. Next, we use the factor weights estimated from the PCA (Section 3) to aggregate these growth rates, thereby obtaining the common shocks required for the SSIV method, denoted as $g_{st,-p}$. Additionally, we use 2007 as the base year to calculate the share of different industries s in province p based on the proportion of sales revenue, denoted as $w_{sp,t=2007}$. After obtaining the inner product of $g_{st,-p}$ and $w_{sp,t=2007}$, we can calculate the predicted growth rate in SCT in province p: $g_{p,t} = \sum_s w_{sp,t=2007} \times g_{st,-p}$.

Considering that a firm's information disclosure behavior is influenced by competition within the same industry (Seo, 2021) and actions of other firms in the same market (Cao et al., 2019), we adopt a special method is adopted to derive the firm-level IV. Specifically, we multiply the firm's sales revenue share by the reciprocal of the sum of the distance to other firms and use the standardized value of this product as the weight $w_{ip,t=2007}$. This weight is multiplied by $g_{p,t}$ to construct the firm-level IV, denoted as $SSIV_{ipt}$. This IV is computed as follows:

$$SSIV_{ipt} = \sum_s w_{ip,t=2007} w_{sp,t=2007} \times g_{st,-p} \tag{4}$$

The rationale is that at a specific time, industry concentration varies across different regions due to the accumulation of long-term economic activities that are difficult to adjust in the short term.

[8] Our conclusions remain unaffected even without using lagged control variables.

When national policy changes occur, such as requiring businesses to enhance SCT, industries more sensitive to this policy will respond swiftly. This can create differences in the pre-existing shares of different industries within provinces, causing some places to be more affected. The variable construction described in Equation (4) is precisely based on this logic. It is achieved by combining a province's industry composition with the national changes in SCT of that industry (excluding the impact of that particular province). Meanwhile, the firm weight, $w_{ip,t=2007}$, is composed of the sales share in 2007 and distance between firms. Its exogeneity comes from the fact that significantly increasing industry ranking in a short period is difficult, especially for mature listed companies. Additionally, the distance between firms can generally be considered as an exogenous variable. Therefore, after standardization, the product of these two can be regarded as an exogenous variable.

Additionally, following the quasi-experimental framework of Borusyak and Hull (2020), we verify the exogeneity of the shocks $g_{st,-p}$ and instrument $SSIV_{ipt}$ as outlined in Equation (4). We design two types of falsification tests: regressing industry- and firm-level relevant variables on the shock and SSIV, respectively. Initially, we conduct a regression analysis of potential proxies for unobserved residuals (i.e., any unobserved factors influencing industry greenwashing behaviors) on the instrument $g_{st,-p}$ (normalized to have unit variance). The dependent variables are the number of firms in each industry disclosing CSR in 2007; industry average of real activities manipulation measured by real earnings management (REM), following Roychowdhury (2006); sustainable development index, and inventory turnover rate in 2007.[9] [10] Subsequently, we conduct a pre-trends

[9]We choose these four variables because: first, the number of industry social responsibility reports can reflect the industry's attention to social responsibility and environmental issues. Second, real earnings management level can reveal the industry's tendency to manipulate profits in financial reports. Widespread earnings management may indicate the industry's conceaent of actual environmental behaviors, thus representing hidden factors influencing greenwashing. Third, average performance in sustainable development can serve as a measure of the industry's overall approach to future business directions, reflecting its potential operational decisions. Lastly, the inventory turnover rate, typically seen as an operational efficiency measure, can also indirectly reflect a company's behavior in resource use and environmental practices. A low inventory turnover rate may suggest resource wastage or insufficient environmental measures. Therefore, these variables can act as appropriate proxies, reflecting those difficult-to-directly-observe factors influencing greenwashing behavior.

[10]Following Roychowdhury (2006), REM is calculated as follows:

$$REM_{it} = -\frac{ABCFO_{it}}{Asset_{i,t-1}} + \frac{ABPROD_{it}}{Asset_{i,t-1}} - \frac{ABDISEXP_{it}}{A_{i,t-1}}$$

where $ABCFO$ is the abnormal cash flow from operations, $ABPROD$ is the abnormal production costs as the sum of the cost of sales and change in inventory, and $ABDISEXP$ is the abnormal discretionary expenses. The "normal" cash flow

analysis at the firm level. We regress the pre-trend variables (for the years 2005, 2006, and 2007) on the $SSIV_{ipt}$ (normalized to have unit variance) controlling for period indicators interacted with the exposure share $w_{ip,t=2007}w_{sp,t=2007}$.

[TABLE 5 about here.]

Panel A of Table 5 lists the results of the industry-level balance tests. These variables reflect the unobserved residuals that can potentially influence firms' greenwashing activities. If shocks $g_{st,-p}$ are as-good-as-randomly assigned to industries within periods, they should not predict these predetermined variables. Panel A shows that no statistically significant correlation, which satisfies the assumptions proposed by Borusyak and Hull (2020). Panel B of Table 5 shows the results of our firm-level balance tests. A set of control variables, reflecting various firm characteristics, in the previous years (2006-2007) are regressed on SSIV. At 5% level, no statistically significant relationships is observed between these variables and the SSIV within periods (though some estimators are statistically significant at the 10% level). Overall, we fail to reject the imbalance of the potential confounders at the 5% level of statistical significance, implying the homogeneity and validity of our instruments $SSIV_{ipt}$.

Furthermore, considering that high SCT within firms can mitigate corporate greenwashing motivations by easing financing constraints (Hypothesis 2) and increase the difficulty of greenwashing by enhancing investor attention (Hypothesis 3), we analyze the underlying mechanisms between SCT and greenwashing. Equations (5) and (6) need to be validated.

$$KZ_{it} = \alpha_2 + \beta_{2,1} SCTScore_{it} + \sigma_2 X_{i,t-1} + \lambda_t + \rho_i + \varepsilon_{2,it} \tag{5}$$

from operation (CFO), production costs ($PROD$), and discretionary expenses ($EISEXP$) can be estimated as follows:

$$\frac{CFO_{i,t}}{Asset_{i,t-1}} = \alpha_0^1 + \alpha_1^1 \left[\frac{1}{Asset_{i,t-1}}\right] + \alpha_2^1 \left[\frac{S_{i,t}}{Asset_{i,t-1}}\right] + \alpha_3^1 \left[\frac{\Delta S_{i,t}}{Asset_{i,t-1}}\right] + \varepsilon_{i,t}^1$$

$$\frac{PROD_{i,t}}{Asset_{i,t-1}} = \alpha_0^2 + \alpha_1^2 \left[\frac{1}{Asset_{i,t-1}}\right] + \alpha_2^2 \left[\frac{S_{i,t}}{Asset_{i,t-1}}\right] + \alpha_3^2 \left[\frac{\Delta S_{i,t}}{Asset_{i,t-1}}\right] + \alpha_4^2 \left[\frac{\Delta S_{i,t-1}}{Asset_{i,t-1}}\right] + \varepsilon_{i,t}^2$$

$$\frac{DISEXP_{i,t}}{Asset_{i,t-1}} = \alpha_0^3 + \alpha_1^3 \left[\frac{1}{Asset_{i,t-1}}\right] + \alpha_2^3 \left[\frac{S_{i,t-1}}{Asset_{i,t-1}}\right] + \varepsilon_{i,t}^3$$

where $\Delta S_t = S_t - S_{t-1}$, S is the sales; hence, $ABCFO$, $ABPROD$, and $ABDISEXP$ can be measured by $\varepsilon_{i,t}^1$, $\varepsilon_{i,t}^2$ and $\varepsilon_{i,t}^3$, respectively.

$$ASVI_{it} = \alpha_3 + \beta_{3,1} SCTScore_{it} + \sigma_3 X_{i,t-1} + \lambda_t + \rho_i + \varepsilon_{3,it} \tag{6}$$

KZ_{it} is a measure of financial constraints from Kaplan and Zingales (1997). Firms with higher index values of KZ_{it} are considered more financially constrained, which means they have less access to external capital. Similar to Yang et al. (2021), we construct the abnormal Baidu search volume index, $ASVI_{it}$, which measures the deviation of a specific search volume index from the average search volume index for a given industry, year, and province. This measure captures the unusual or unexpected level of attention towards a certain firm, as indicated by the volume of search queries about it on Baidu, a major search engine in China. The firm has received more attention than average if the resulting value is positive. Conversely, if the value is negative, the firm has received less attention than average. Equations (5) and (6) are estimated using a two-stage least squares (2SLS) regression.

4.2 SCT and greenwashing

Table 6 reports the main results estimated by the 2SLS regression according to Equation (3). The first three columns report the reduced-form results. In addition to fixed effects, which are controlled in all regressions, we add financial, governance, and all control variables in columns (1), (2), and (3), respectively. The reduced-form estimates are significantly negative, implying that firms in markets with higher SCT exhibit fewer greenwashing behaviors.

The estimates in columns (4), (5), and (6) reveal that the first-stage IV estimates are statistically significant at the 5% level. The F-statistic of more than 60 shows that our IV is by no means a weak instrument. Importantly, the second-stage IV estimates are also significant at the 5% level. The estimated coefficient $\hat{\beta}_{1,1}$ on $SCTScore_{it}$ is of interest. We observe statistically significant negative estimates of approximately -0.88. These findings align with Hypothesis 1, suggesting that an increase in corporate SCT restrains the firm's greenwashing activities. The instrumented result indicates that a one standard deviation increase (0.75 units) in SCT significantly predicts an approximately 0.66 units ($0.88 \times 0.75 = 0.66$) decrease in the propensity for corporate greenwashing.

[TABLE 6 about here.]

Table 6 reveals that in terms of financial variables, firms with higher profitability ($ROA_{i,t-1}$), more leverage ($Lev_{i,t-1}$), operating in a concentrated market ($HHI_{i,t-1}$), and a slower growth rate ($Growth_{i,t}$) are associated with lower greenwashing practices. Possible reasons might be that firms with higher profitability tend to be genuinely committed to sustainable practices, given that they have the resources to do so, resulting in less greenwashing. Heavily leveraged firms, perhaps wary of any additional scrutiny that could jeopardize their financial position, also seem to shy away from deceptive green practices. Next, firms with a more focused market have a better grip on their production processes, ensuring more genuine sustainability practices. Conversely, rapidly growing firms, perhaps in their bid to appeal to a wider or more conscious audience, or due to challenges in instilling genuinely sustainable practices amidst rapid expansion, show a propensity for greenwashing.

From a governance perspective, we show the positive role of good corporate governance practices in curbing greenwashing. More independent directors ($IndDir_{i,t-1}$) can provide greater oversight and a broader perspective on the firm's strategies, making deceptive sustainability claims less likely. Similarly, affiliating with one of the Big Four accounting firms ($Big4_{i,t-1}$), known for their rigorous audit processes, may deter firms from misrepresenting their sustainable initiatives. An increase in institutional investors ($Inveratio_{i,t-1}$), who often have long-term investment horizons and prioritize genuinely sustainable practices, can further diminish greenwashing tendencies. However, when equity ownership is highly concentrated, a few dominant shareholders can drive the firm's strategies, potentially leading to increased greenwashing if these shareholders prioritize short-term gains over genuine sustainability.

4.3 Financial constraints and investor attention

To examine the mechanisms behind SCT and greenwashing activities, we run regressions in Equations (5) and (6). Table 7 demonstrates the corresponding 2SLS results. Columns (1), (2), and (3) use financing constraints as the dependent variable, while columns (4), (5), and (6) use investor attention as the dependent variable.

[TABLE 7 about here.]

Using the IV, the coefficients for *SCTScore* on financing constraints are negative (approximately -1.14 after controlling all covariables and fixed effects, column (3)). Thus, an increase in SCT significantly reduces a firm's financing constraints. That is, disclosing more supply chain information sends a positive signal to the market, highlighting the firm's competitive advantages and increasing the opportunities for external financing. The increased external financing, in turn, can reduce the firm's incentives for speculative behavior, such as corporate greenwashing. Furthermore, the literature (Delmas and Burbano, 2011; Zhang, 2022b; Hu et al., 2023; Zhang, 2023b) reveals that the corporate financing constraint is a determinant of greenwashing. Therefore, we can validate Hypothesis 2 that increased SCT can reduce corporate greenwashing by easing financial constraints.

The coefficients for *SCTScore* on investor attention are statistically positive at approximately 0.10 in columns (4), (5), and (6) after controlling all covariables and fixed effects. Instrumented results suggest that for each standard deviation increase in SCT, the firm's abnormal investor attention increases by approximately 0.075 units ($0.10 \times 0.75 = 0.075$). An increase in investor attention can more easily differentiate a firm's greenwashing behavior from true green practices, as implied by Chen (2017) and He et al. (2022). Therefore, firms will be more cautious about greenwashing practices to protect their reputation. Thus, Hypothesis 3 is supported.

Following Dippel et al. (2019) and Dippel et al. (2020), we estimate the mediation effect with IVs. Figure 3 displays the total, direct, and indirect effects with different mediators. Both the total and indirect effects are statistically significant. The direct effect measures, ceteris paribus, the impact of changes in SCT on corporate greenwashing. This effect represents the intrinsic relationship between SCT and greenwashing without considering any potential mediators. Meanwhile, the indirect effect measures the impact of changes in SCT on greenwashing through its influence on financing constraints or investor attention. According to Figure 3, the indirect effect is -0.28 for financing constraints, accounting for approximately 30% of the total effect. The indirect effect is -0.18 for investor attention, accounting for approximately 20% of the total effect.

[FIGURE 3 about here.]

These findings underline the importance of SCT in influencing a firm's financing options and the

level of investor attention it receives. These insights contribute to our understanding of the mechanisms through which non-financial disclosure affects corporate behavior. In particular, firms face reduced financing constraints as SCT increases, making them less likely to resort to greenwashing. Additionally, enhanced SCT can alter investors' perceptions, as the increased attention can induce firms to reduce greenwashing strategies to meet investors' environmentally conscious expectations. Among these two effects, the mediating effect of the financing constraints is more important.

4.4 Robustness tests

To check the robustness of our results to different settings, we conduct robustness tests using alternative variables, narrowing the sample, and using additional fixed effects.

Alternative variables: Yu et al. (2020) and Hu et al. (2023) argued that the Bloomberg environmental rating can be regarded as an appropriate environmental disclosure score *DIS* as it reflects the disclosure quality; however, it does not measure the environmental performance. Meanwhile, the Thomson Reuters ASSET4 performance scores and Wind practical environmental rating can proxy the actual green performance of the firm *ACT*. Hence, based on Equation (2), we calculate an alternative proxy for corporate greenwashing, which is indicated as $GreenWashR1$ (using the Wind rating) after Hu et al. (2023) and $GreenWashR2$ (using Asset4) after Yu et al. (2020).

Table 8 summarizes the results. The coefficients on *SCTScore* consistently show a significantly negative relationship and are close to the estimates in Table 6. Thus, our support for the main assumption is not sensitive to the choice of the greenwashing measure.

[TABLE 8 about here.]

Narrowing the sample: Considering that a firm's decision to disclose information can be associated with its needs, our conclusions may be influenced by self-selection bias. To address this, we narrow our sample by eliminating those firms that do not disclose any supply chain information. Columns (1) and (2) in Table 9 illustrate our deletion process, where our criteria are based on *SupNum*, *CltNum*, *SupRatio*, *CltRatio*, and *SCTWord*. If all these indicators are zero, we argue that firms are not disclosing any SCT. Meanwhile, columns (3) and (4) demonstrate a more stringent

selection process, relying solely on the first four of the aforementioned indicators.

First, after narrowing the sample, the 2SLS estimate of *SCTscore* still significantly and negatively affects the greenwashing behavior of firms. Second, the absolute coefficient estimate value for the limited sample is slightly smaller than that of the full sample. This is consistent with the diminishing marginal effect. That is, the firm's decision on whether to disclose their supply chain can have a stronger impact on greenwashing behavior. However, adding additional supply chain information can slightly weaken its inhibitory effect on greenwashing once disclosed.

[TABLE 9 about here.]

Additional fixed effects: In the main regression, we have incorporated company fixed effects to account for time-invariant and firm-specific characteristics, such as corporate culture or management style. Year-fixed effects have also been included to capture any time-specific effects, such as macroeconomic fluctuations or nationwide policy changes. In Table 10, we further incorporate year-province pair fixed effects to control spatially specific, time-varying factors within different provinces across time, as well as year-industry pair fixed effects within different industries in a particular year. The impact of SCT on corporate greenwashing is consistently significantly negative at the level 1% and close to the estimates in Table 6, suggesting the robustness of the main results.

[TABLE 10 about here.]

5 Further Analyses

5.1 Moderating effects

Environmental regulations often vary significantly in their strictness and enforcement across regions. Similarly, the inhibitory effect of SCT on corporate greenwashing can differ under varying regulatory environments. Regions with high digital financial inclusion typically imply that the public has easier access to Internet devices, thereby increasing the likelihood of exposing corporate greenwashing activities. Understanding the moderating effects of environmental regulations and digital

financial inclusion can provide invaluable insights to policymakers in crafting more effective policies and regulations to promote environmental protection and sustainable development.

Table 11 summarizes the results considering the moderating effects with the instrument variables *SSIV* and its interaction terms $SSIV \times EnvInt$ (or $SSIV \times Digit$). Following Chen et al. (2018), environmental regulation intensity (*EnvInt*) is measured from the proportion of environment-related vocabulary within the total vocabulary of the local government's work reports. This serves as an appropriate measure because these reports often reflect government priorities and commitment. The more frequently such terms appear, the greater the emphasis on environmental regulation.

Columns (1) and (2) in Table 11 report the results for varying environmental regulatory intensities. The two columns differ in their inclusion of control variables. The coefficient for interaction term $SCTScore \times EnvInt$ is significant at the 1% level and approximately -2.05 in column (2). Thus, SCT is more effective in curtailing corporate greenwashing in regions with stricter environmental regulations. The finding is consistent with previous studies (Yu et al., 2020; Mateo-Márquez et al., 2022). Thus, firms' disclosure behavior is significantly influenced by the legal and regulatory environments in which they operate; greenwashing is more likely in countries with less regulation.

Columns (3) and (4) report the results for digital financial inclusion. The Peking University Digital Financial Inclusion Index of China (PKU_DFIIC) is used as a proxy for the degree of digital financial inclusion. A higher level of digital financial inclusion indicates that users can easily access corporate-related information anytime and anywhere using mobile devices and computers. The coefficient of $SCTScore \times Digit$ is -0.003 and significant at the 5% level. Thus, as information becomes more readily disseminated and accessible, the more comprehensive the supply chain information and the more challenging it becomes for firms to engage in greenwashing. The literature (Liu and Zhang, 2023) underscores the importance of digitalizing internal financial data in the disclosure, release, and dissemination processes. In contrast, this study shifts its lens externally and, from a different perspective, corroborates the beneficial role of digital finance in strengthening the relationship between SCT and corporate greenwashing activities.

[TABLE 11 about here.]

5.2 Heterogeneity analysis

Columns (1) and (2) in Table 12 display the findings for sub-samples of firms distinguished by levels of market competition. Market competition is gauged by market share. If a firm's market competition exceeds the two-thirds percentile, it is classified into the $High(>67\%)$ competition group ($Competition_{it} = 1$); conversely, if it falls below the one-third percentile, it is placed in the $Low(<33\%)$ competition group ($Competition_{it} = 0$). SCT dampens, albeit not statistically significantly, greenwashing among firms in the low-competition category. Meanwhile, the impact is more pronounced and greater in the high-competition category, with a coefficient of -1.22 for instrumented $SCTscore$ significant at the 1% level. The difference between the two groups is statistically significant at the 5% significance level.

[TABLE 12 about here.]

Columns (3) and (4) present the findings for sub-samples of firms characterized by low and high levels of pollution, respectively.[11] SCT significantly influences all firms. However, its effect is more pronounced in heavily polluting firms. Specifically, a one-unit increase in SCT corresponds to a 1.19 unit decrease for heavily polluting firms, which is approximately 0.6 units greater than the effect observed for low polluting firms. This difference is statistically significant with a p-value of 0.088.

Our findings are consistent with legitimacy theory. This theory posts that organizations continually want to ensure that they operate within the norms and bounds of their respective societies; if corporate scandals directly threaten organizational legitimacy, companies will respond by adopting more ethical behavior (Dorfleitner et al., 2022). Given the heterogeneity in market competition, companies that face intense competition may be more impacted by SCT. For these high-competition firms, greater transparency exerts a more pronounced dampening effect on greenwashing. Specif-

[11] A firm is defined as "highly polluting" ($Pollution_{it} = 1$) based on the criteria established in the "*Industry Classification Guide for Listed Companies*", revised by the CSRC in 2012, and the "*Industry Classification Management Catalog for Environmental Inspections of Listed Companies*" issued by the Ministry of Environmental Protection in 2008 ([2008] No. 373). Furthermore, the "*Guideline for Environmental Information Disclosure by Listed Companies*" ([2010] No. 78) is also used as a determining factor. These guidelines cover 16 major industries: thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, chemical, petrochemical, building materials, papermaking, brewing, pharmaceuticals, fermentation, textiles, tanning, and mining.

ically, the added scrutiny from heightened competition combined with the risks associated with greenwashing makes transparency not just a virtue but a necessity. The drive to maintain legitimacy under such scrutiny encourages these firms to be even more cautious. They leverage the transparency to avert further criticism and potential negative consequences. Marquis et al. (2016) believed that environmental damage can be perceived as a form of visibility, making firms more susceptible to public attention and scrutiny. Among the different industries, companies within polluting industries face increased supervision and criticism from various stakeholders, including governments, non-governmental organizations, consumers, and investors (Fan et al., 2020). As such, enhancing SCT increases the dampening effect on greenwashing practices, encouraging firms to be more cautious to avoid further criticism and negative consequences.

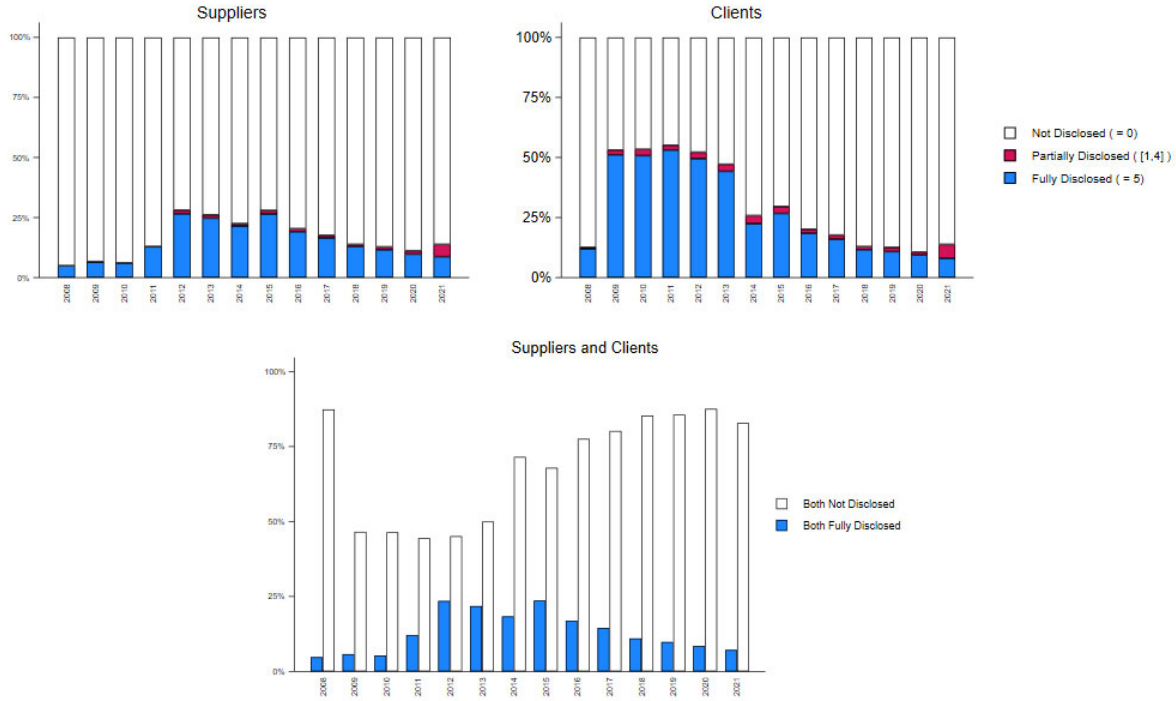
6 Conclusions

Despite the conventional belief that the government and firms are becoming more aware of the importance of environmental issues and firms' transparency, we observe an increasing reluctance among Chinese firms to disclose supply chain information. Data from Chinese publicly listed firms from 2008 to 2021 reveals that decreasing SCT increases the likelihood of opportunistic corporate behaviors such as greenwashing, characterized by a discrepancy between proactive environmental communications and poor environmental practices.

Specifically, we show a negative relationship between corporate SCT and greenwashing practices. This inhibiting effect is primarily realized by reducing corporate financing constraints and amplifying investor attention. Importantly, our findings resonate with research that emphasizes the importance of non-financial information disclosure (De George et al., 2016), champions the merits of voluntary information dissemination (Cheynel, 2013), and advocates for the broader application of supply chain technologies (Saberi et al., 2019). Furthermore, we find that SCT's mitigating influence on greenwashing is moderated by factors such as environmental regulation intensity, digital finance, market competition, and industry-specific characteristics. Our hypotheses hold under even after several robustness checks, including using alternative variables, narrowing the samples, and

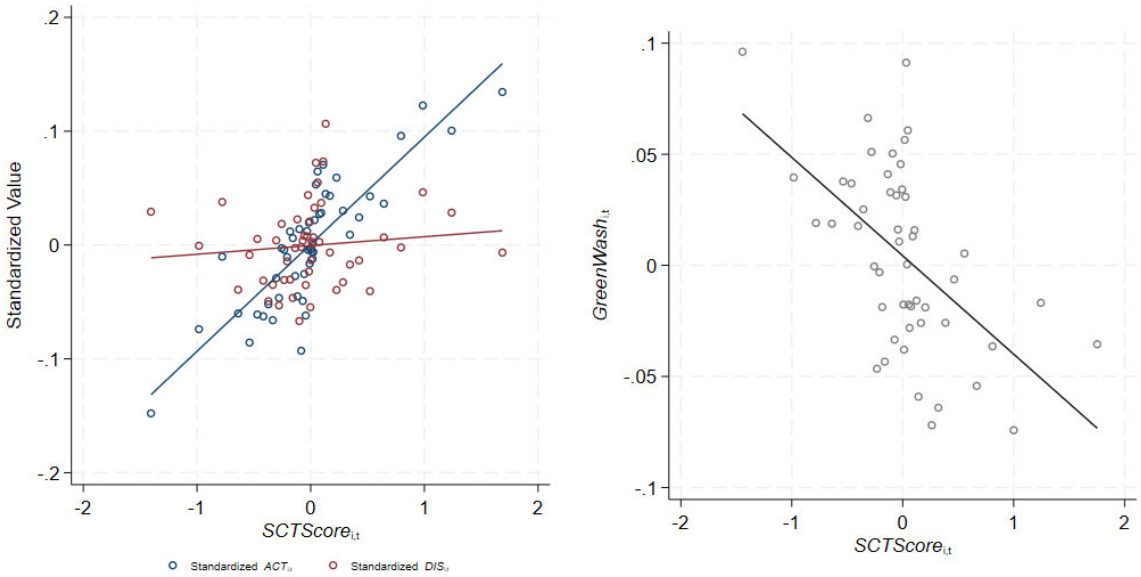
incorporating additional fixed effects.

Therefore, we argue that SCT can serve as a distinguishing metric for separating genuine green firms from those which may not be as green as they claim to be. Our insights provide empirical evidence for policymakers, underscoring the imperative of fortifying corporate supply chain disclosure mandates, thus fostering an ecosystem where genuine sustainability thrives.



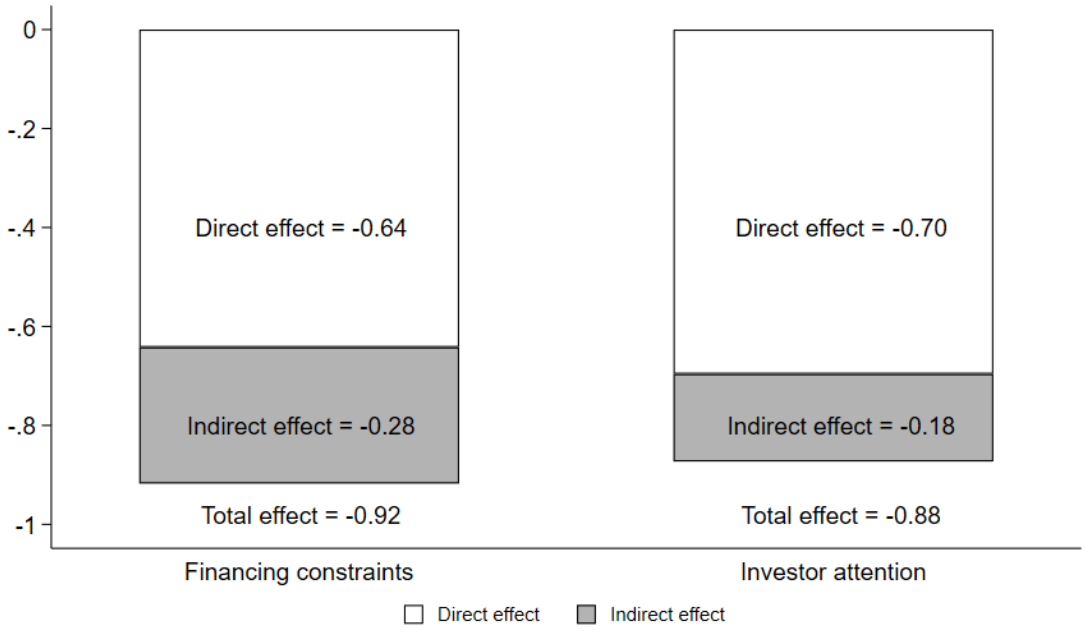
Note: This figure displays the proportion of listed companies disclosing their suppliers (in the left-hand graph), clients (in the right-hand graph), and both suppliers and clients (in the graph at the bottom). The x-axis represents the years, and the y-axis represents the proportion of companies. In the legend, *"Not Disclosed"* represents companies that have not revealed the names of their trading partners; *"Partially Disclosed"* indicates companies that have revealed the names of some but not all of their Top-5 trading partners. *"Fully Disclosed"* denotes companies that have revealed the names of all their Top-5 trading partners.

FIGURE 1. PROPORTION OF LISTED COMPANIES DISCLOSING THE NAMES OF SUPPLIERS AND CLIENTS



Note: This plot is a binned scatterplot. The x-axis represents the lagged measure of supply chain transparency ($SCTScore_{i,t-1}$), while the y-axis represents standardized environmental disclosure DIS_{it} (left), performance score ACT_{it} (left), and the degree of corporate greenwashing $GreenWash_{it}$ (right), as defined in Section 3. The plot divides the x-axis variable into 50 bins, and for each bin, it computes and plots the average value of the y-axis variable.

FIGURE 2. RELATIONSHIP BETWEEN SUPPLY CHAIN TRANSPARENCY AND CORPORATE GREENWASHING



Note: This figure displays the value of estimated direct (write part) and indirect (dark part) effects based on column (3) in Table 7 (the left bar) and column (6) in Table 7 (the right bar). The x-axis represents the mediator, and the y-axis represents the value. The total effect is calculated by adding direct effect and indirect effect.

FIGURE 3. DIRECT AND INDIRECT EFFECTS OF INSTRUMENTED SCT

TABLE 1. VARIABLE DEFINITION

Variable	Explanation	Source
Dependent Variables		
$GreenWash_{it}$	Greenwashing measure according by Equation (2)	Calculate by authors
Key Variables		
$SCTScore_{it}$	Comprehensive score for supply chain transparency by PCA	Calculate by authors
$SSIV_{ipt}$	Shift-share instrument variable for $SCTScore_{it}$	Calculate by authors
Mediating Variables		
KZ_{it}	Financing constraints, KZ index	CSMAR
$ASVI_{it}$	Investor attention, Abnormal Baidu search volume index	CNRDS
Control Variables		
ROA_{it}	Return on asset	CSMAR
$Growth_{it}$	Revenue growth Rate	CSMAR
Lev_{it}	Leverage ratio	CSMAR
HHI_{it}	Herfindahl-Hirschman Index	CSMAR
Age_{it}	The natural logarithm of years since IPO	CSMAR
$Asset_{it}$	The natural logarithm of asset size	CSMAR
$Dual_{it}$	Whether CEO also serves as the chairman of board	CSMAR
$Top1_{it}$	Share held the largest shareholder	CSMAR
$Board_{it}$	The natural logarithm of number of board members	CSMAR
$IndDir_{it}$	The ratio of independent directors	CSMAR
$Big4_{it}$	Whether the firm is audited by the Big Four	CSMAR
$Inveratio_{it}$	Share held by institutional investors	CSMAR
SOE_{it}	Whether the firm is state-owned	CSMAR

Note: i is firm, t is year and c refers to the city where the firm is situated.

TABLE 2. THE EVALUATION CRITERIA FOR THE ENVIRONMENTAL PERFORMANCE SCORE ACT_{it}

Dimensions	Items	Value
Environment input and output	Environmental investment Environmental expenses Environmental innovation	Larger than industry average: 1, otherwise 0
	Pollutant discharge	Meet the established standards: 1, otherwise 0
Third party verification	Certification of ISO14001 Certification of ISO9001 Auditing from the third-party	1 if a firms possesses, 0 if not
Pollution treatment	Exhaust gas Wastewater Dust and soot Solid waste	2 for qualitative descriptions, 1 for quantitative descriptions, otherwise 0

Note: Following the methodology outlined by Zhang et al. (2019) and Li et al. (2023a), we calculate firm's environmental investment and green expenses. In detail, we examine the "construction in progress" line items in a firm's annual report, aggregating all expenditures related to environmental protection to establish a data point for the firm's yearly environmental investment. When a firm's environmental investment in a given year exceeds the industry average, we increase ACT_{it} by one point. In addition, we dive into the breakdown of the firm's administrative expenses to gauge its commitment to environmental protection. Total expenditures classified as green costs are another crucial measure of the firm's environmental commitment. When these green expenses exceed the industry average for the year, ACT_{it} is again incremented by one point. Taking inspiration from Gu et al. (2023), we use the number of patent applications for green inventions to measure the firm's environmental innovation, which is a powerful testament to its environmental actions. When a firm's environmental innovation outperforms the industry average in a particular year, ACT_{it} receives an additional point. As highlighted by Zhu et al. (2022) and Zhang (2023b), ISO14001 and ISO9001 serve as international benchmarks to ensure environmentally friendly and consistently high-quality production, respectively. These standards can act as concrete indicators of a firm's real commitment to environmental stewardship. Thus, if a firm is certified under these standards, we award additional points to the environmental performance score ACT_{it}. According to the argument of Zhang (2023b), a firm's compliance with pollution emission standards and transparency in disclosing pollution treatment measures are considered hard disclosure items that are difficult to manipulate for greenwashing purposes. Chen et al. (2023) further emphasized that a firm's reporting on specific numerical data regarding its pollution control measures can more accurately reflect its true environmental performance. Therefore, we grant an additional 2 points to the environmental performance score ACT_{it} for firms that quantitatively report their pollution treatment efforts and successfully reduce pollution emissions and an additional point for those that offer qualitative descriptions of these efforts.

TABLE 3. DESCRIPTIVE STATISTICS

	Observation	Mean	Std. Dev.	Min	25%	50%	75%	Max
GreenWash	24,776	-0.0088	1.1608	-2.9728	-0.7140	0.1034	0.6938	3.1057
SCTScore	24,776	-0.0004	0.7548	-0.4242	-0.4242	-0.4013	0.1263	2.4510
SSIV	24,776	-0.1017	0.3520	-1.7195	-0.2436	-0.0822	0.0843	0.6422
KZ	24,776	0.8638	1.9722	-4.1282	-0.3164	0.9739	2.1203	5.4577
ASVI	24,776	0.0148	0.2959	-0.7346	-0.1304	-0.0167	0.0969	1.5803
ROA	24,776	0.0338	0.0666	-0.2898	0.0127	0.0351	0.0633	0.2041
Growth	24,776	0.1816	0.4183	-0.4278	0.0377	0.0820	0.3566	2.6813
Lev	24,776	1.4201	1.0057	0.4898	1.0022	1.1575	1.4308	7.9721
HHI	24,776	0.2319	0.1651	0.0395	0.1352	0.1998	0.2683	1.0000
Age	24,776	2.9180	0.3196	1.9429	2.7145	2.9513	3.1419	3.4908
Asset	24,776	22.3009	1.2969	19.7541	21.3819	22.1335	23.0714	26.0975
*Top*1	24,776	0.3434	0.1433	0.0924	0.2337	0.3366	0.4312	0.7335
Board	24,776	2.1276	0.1991	1.6094	1.9459	2.1972	2.1972	2.7081
IndDir	24,776	0.3762	0.0537	0.3188	0.3334	0.3583	0.4246	0.5696
Inveratio	24,776	0.4390	0.2350	0.0107	0.2549	0.4526	0.6245	0.8896
*Big*4	24,776	0	0.2352	0	0	0	0	1
SOE	24,776	0	0.4905	0	0	0	1	1
Dual	24,776	0	0.4374	0	0	0	1	1

Note: Variables are winsorized by 1% and 99%.

TABLE 4. CORRELATIONS OF VARIABLES

	GreenWash	*SCTScore*	*SSIV*	*KZ*	*ASVI*	*ROA*	*Growth*	*Lev*	*HHI*	*Age*	*Asset*	*Top*1	*Board*	*IndDir*	*Inveratio*	*Big*4	*SOE*	*Dual*
GreenWash	1.0000																	
SCTScore	-0.5079*	1.0000																
SSIV	-0.0604*	0.1091*	1.0000															
KZ	0.0864*	-0.1322*	-0.0433*	1.0000														
ASVI	0.0114	-0.0282*	-0.0278*	-0.0225*	1.0000													
ROA	0.0200*	-0.0550*	-0.0136*	-0.1969*	0.0649*	1.0000												
Growth	0.0090	0.0109	-0.0142*	0.0489*	-0.0412*	0.0111	1.0000											
Lev	0.0150*	0.0508*	-0.0018	0.1877*	0.0060	-0.2065*	-0.0396*	1.0000										
HHI	-0.2491*	0.0493*	-0.0347*	-0.0295*	0.0335*	-0.0368*	0.1391*	0.0011	1.0000									
Age	-0.0373*	0.0044	0.0283*	-0.0163*	0.0038	-0.0675*	0.0493*	0.0204*	0.0575*	1.0000								
Asset	-0.0146*	-0.0262*	-0.0423*	-0.1157*	0.2824*	0.0597*	0.0331*	0.1025*	0.1186*	0.1530*	1.0000							
*Top*1	-0.0324*	0.0171*	-0.0285*	-0.0592*	0.0690*	0.1146*	0.0174*	-0.0310*	0.0568*	-0.1065*	0.2159*	1.0000						
Board	-0.0662*	0.0635*	-0.0244*	-0.0003	0.1065*	0.0387*	-0.0227*	0.0544*	0.0221*	-0.0073	0.2436*	0.0444*	1.0000					
IndDir	-0.0307*	-0.0512*	-0.0011	-0.0016	0.0181*	-0.0278*	0.0122	-0.0023	0.0026	0.0066	0.0073	0.0339*	-0.5231*	1.0000				
Inveratio	-0.0925*	0.0454*	-0.0306*	-0.0019	0.2421*	0.1140*	0.0128*	0.0050	0.0811*	0.0271*	0.4112*	0.5277*	0.2309*	-0.0604*	1.0000			
*Big*4	-0.0292*	-0.0314*	-0.0300*	-0.1359*	0.1963*	0.0484*	-0.0245*	-0.0118	0.0475*	0.0085	0.3365*	0.1390*	0.0826*	0.0297*	0.2193*	1.0000		
SOE	-0.0579*	0.0927*	-0.0291*	0.1943*	0.1565*	-0.0561*	0.0259*	0.1041*	0.0455*	0.1184*	0.3094*	0.2279*	0.2722*	-0.0561*	0.4220*	0.1331*	1.0000	
Dual	0.0615*	-0.0595*	0.0114	-0.0521*	-0.0518*	0.0091	-0.0024	-0.0347*	-0.0235*	-0.0636*	-0.1376*	-0.0691*	-0.1768*	0.0986*	-0.1984*	-0.0546*	-0.2865*	1.0000

Note: This table presents the correlation coefficients between the variables. Coefficients marked with an asterisk (*) indicate significance at the 5% level.

TABLE 5. PRE-TRENDS ANALYSIS

Balance Variables	Coef.		SE
Panel A: Industry-level balance			
# of firms disclosing CSR, 2007	0.712		(0.439)
Real earnings management, 2007	-0.001		(0.001)
Sustainable development index, 2007	-0.0001		(0.001)
Inventory turnover rate, 2007	-0.749		(0.466)
Observations		28,738	
Panel B: Firm-level balance			
HHI, 2007	-0.033		(0.027)
Age, 2007	0.018		(0.038)
IndDir, 2007	0.001		(0.029)
Board, 2007	0.031		(0.023)
Asset, 2007	0.015*		(0.009)
Big4, 2007	0.081		(0.050)
Inveratio, 2007	0.074		(0.058)
SOE, 2007	-0.116		(0.095)
Top1, 2007	0.017		(0.029)
Dual, 2007	0.089		(0.092)
Growth, 2007	-0.677		(0.687)
Lev, 2007	-0.513		(0.433)
Observations		15,568	
HHI, 2006	-0.018		(0.021)
Age, 2006	0.042		(0.030)
IndDir, 2006	-0.009		(0.026)
Board, 2006	0.031		(0.023)
Asset, 2006	0.017*		(0.009)
Big4, 2006	0.065		(0.056)
Inveratio, 2006	0.084		(0.057)
SOE, 2006	-0.004		(0.101)
Top1, 2006	0.024		(0.032)
Dual, 2006	0.033		(0.079)
Growth, 2006	-1.169		(1.252)
Lev, 2006	-0.189		(0.284)
Observations		14,171	
HHI, 2005	-0.018		(0.025)
Age, 2005	0.058		(0.043)
IndDir, 2005	0.013		(0.042)
Board, 2005	0.050*		(0.030)
Asset, 2005	0.014		(0.011)
Big4, 2005	0.041		(0.053)
Inveratio, 2005	0.100*		(0.060)
SOE, 2005	-0.041		(0.122)
Top1, 2005	0.023		(0.039)
Dual, 2005	-0.012		(0.076)
Growth, 2005	-0.385		(0.270)
Lev, 2005	-0.532		(0.405)
Observations		13,484	

Note: Panel A of this table reports coefficients from regressions of the industry-level co-variates on shock $g_{st,-p}$. The regressions are controlled by period indicators and weighted by industry exposure shares $w_{sp,t=2007}$. Panel B reports coefficients of pre-trend regressions on SSIV. Period indicators control the regressions interacted with exposure share $w_{ip,t=2007}w_{sp,t=2007}$. Table 1 defines variables of Panel B. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 6. THE INFLUENCE OF SUPPLY CHAIN TRANSPARENCY ON CORPORATE GREENWASHING

	Reduced-form			2SLS, IV: BKIV		
	(1)	(2)	(3)	(4)	(5)	(6)
	$GreenWash_{it}$	$GreenWash_{it}$	$GreenWash_{it}$	$GreenWash_{it}$	$GreenWash_{it}$	$GreenWash_{it}$
$SCTScore_{i,t}$				-0.884***	-0.814***	-0.873***
				(0.167)	(0.164)	(0.166)
$ROA_{i,t-1}$	-0.882***		-0.847***	-0.741***		-0.716***
	(0.110)		(0.111)	(0.103)		(0.103)
$Growth_{i,t-1}$	0.038**		0.037**	0.040**		0.038**
	(0.018)		(0.018)	(0.016)		(0.016)
$Lev_{i,t-1}$	-0.010		-0.012*	-0.008		-0.011*
	(0.007)		(0.007)	(0.006)		(0.006)
$HHI_{i,t-1}$	-0.486***		-0.474***	-0.472***		-0.464***
	(0.071)		(0.071)	(0.072)		(0.072)
$Asset_{i,t-1}$	-0.055***		-0.044***	-0.098***		-0.084***
	(0.015)		(0.016)	(0.019)		(0.019)
$Age_{i,t-1}$		0.301**	0.273**		0.220	0.218
		(0.118)	(0.118)		(0.143)	(0.142)
$Dual_{i,t-1}$		0.028	0.029		0.025	0.026
		(0.022)	(0.022)		(0.024)	(0.023)
$Top1_{i,t-1}$		0.117	0.146		0.383**	0.419***
		(0.122)	(0.121)		(0.150)	(0.148)
$Board_{i,t-1}$		-0.117	-0.091		-0.135	-0.088
		(0.075)	(0.075)		(0.086)	(0.086)
$IndDir_{i,t-1}$		-0.927***	-0.902***		-0.982***	-0.929***
		(0.221)	(0.221)		(0.228)	(0.226)
$Big4_{i,t-1}$		-0.160**	-0.147**		-0.164**	-0.142**
		(0.067)	(0.066)		(0.072)	(0.071)
$Inveratio_{i,t-1}$		-0.319***	-0.223***		-0.421***	-0.300***
		(0.077)	(0.078)		(0.085)	(0.085)
$SOE_{i,t-1}$		-0.034	-0.042		0.016	0.017
		(0.046)	(0.046)		(0.043)	(0.043)
Constant	1.342***	-0.165	0.914*			
	(0.340)	(0.416)	(0.512)			
				First stage		
$SSIV_{ipt}$	-0.099***	-0.092***	-0.098***	0.112***	0.113***	0.112***
	(0.020)	(0.021)	(0.020)	(0.014)	(0.014)	(0.014)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	0.432	0.430	0.433	0.206	0.207	0.210
Kleibergen-Paap rk Wald F-stat				60.709	62.516	61.068
Obs.	24,776	24,776	24,776	24,776	24,776	24,776

Note: This table represents the main results according to Equation (3). The dependent variable is *GreeWash*, the instrumented variable is *SCTScore*, and the instrument variable is *SSIV*. Table 1 defines variables and Table 3 reports correspondingly descriptive statistics. Firm-fixed and year-fixed effects are controlled in all specifications. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 7. MECHANISM ANALYSES

	Financing constraints			Investor attention		
	(1)	(2)	(3)	(4)	(5)	(6)
	KZ_it	KZ_it	KZ_it	$ASVI\_it$	$ASVI\_it$	$ASVI\_it$
$SCTScore\_i,t$	-1.163***	-1.065***	-1.142***	0.102***	0.108***	0.103***
	(0.261)	(0.256)	(0.257)	(0.037)	(0.037)	(0.037)
$ROA\_i,t-1$	-2.264***		-2.054***	0.016		0.013
	(0.253)		(0.248)	(0.025)		(0.025)
$Growth\_i,t-1$	-0.252***		-0.260***	0.033***		0.033***
	(0.035)		(0.034)	(0.004)		(0.004)
$Lev\_i,t-1$	0.085***		0.077***	0.001		0.001
	(0.011)		(0.011)	(0.001)		(0.001)
$HHI\_i,t-1$	-0.254**		-0.230**	0.011		0.014
	(0.117)		(0.116)	(0.017)		(0.017)
$Asset\_i,t-1$	-0.130***		-0.127***	-0.008		-0.011**
	(0.039)		(0.038)	(0.005)		(0.005)
$Age\_i,t-1$		1.301***	1.293***		0.088**	0.092***
		(0.253)	(0.249)		(0.036)	(0.036)
$Dual\_i,t-1$		-0.001	0.003		0.005	0.004
		(0.041)	(0.041)		(0.005)	(0.005)
$Top1\_i,t-1$		-0.562**	-0.419		-0.076**	-0.082***
		(0.273)	(0.266)		(0.032)	(0.032)
$Board\_i,t-1$		-0.324**	-0.271*		-0.015	-0.009
		(0.141)	(0.139)		(0.020)	(0.020)
$IndDir\_i,t-1$		-0.524	-0.459		-0.018	-0.009
		(0.393)	(0.388)		(0.062)	(0.061)
$Big4\_i,t-1$		-0.768***	-0.736***		0.009	0.013
		(0.129)	(0.130)		(0.018)	(0.018)
$Inveratio\_i,t-1$		-0.330**	0.010		0.049**	0.056***
		(0.156)	(0.153)		(0.021)	(0.021)
$SOE\_i,t-1$		0.703***	0.660***		-0.041***	-0.041***
		(0.095)	(0.098)		(0.011)	(0.011)
			First stage			
$SSIV\_ipt$	0.112***	0.113***	0.112***	0.112***	0.113***	0.112***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	0.003	0.014	0.018	0.003	0.021	0.019
Kleibergen-Paap rk Wald F-stat	60.709	62.516	61.068	60.709	62.516	61.068
Obs.	24,776	24,776	24,776	24,776	24,776	24,776

Note: This table represents the results of the mechanism behind the influence of supply chain transparency on corporate greenwashing. Columns (1) - (3) use the dependent variable of financing constraints, *KZ* index. Columns (4) - (6) use investor attention, which is measured by abnormal Baidu search volume index (ASVI) following Yang et al. (2021), as the dependent variable. The instrumented variable is *SCTScore*, and the instrument variable is *SSIV*. Firm-fixed and year-fixed effects are controlled in all specifications. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 8. ROBUSTNESS ANALYSES, ALTERNATIVE MEASUREMENTS FOR THE DEPENDENT VARIABLE, 2SLS

	Wind rating		Asset4 score	
	(1)	(2)	(3)	(4)
	GreenWashR1_it	*GreenWashR1_it*	*GreenWashR2_it*	*GreenWashR2_it*
SCTScore_i,t	-0.596**	-0.576*	-0.798*	-0.808*
	(0.297)	(0.295)	(0.478)	(0.464)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables	No	Yes	No	Yes
Adj R-squared	0.060	0.074	0.088	0.087
Kleibergen-Paap rk Wald F-stat	19.331	19.200	12.219	12.911
Obs.	4,010	4,010	9,657	9,657

Note: This table represents the robust results by altering the dependent variable. Columns (1) and (2) reconstruct corporate greenwashing referring to Hu et al. (2023), and columns (3) and (4) follow Yu et al. (2020). All regressions are controlled for firm and year fixed effects, while columns (2) and (4) additionally include a vector of control variables: *ROA*, *Growth*, *Lev*, *HHI*, *Asset*, *Age*, *Dual*, *Top*1, *Board*, *IndDir*, *Big*4, *Inveratio*, and *SOE*. The instrumented variable is *SCTScore*, and the instrument variable is *SSIV*. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 9. ROBUSTNESS ANALYSES, NARROWED SAMPLE, 2SLS

	Based on five indicators		Based on four indicators	
	(1)	(2)	(3)	(4)
	GreenWash_it	*GreenWash_it*	*GreenWash_it*	*GreenWash_it*
SCTScore_it	-0.619***	-0.653***	-0.585*	-0.618**
	(0.155)	(0.157)	(0.305)	(0.301)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables	No	Yes	No	Yes
Adj R-squared	0.188	0.202	0.182	0.192
Kleibergen-Paap rk Wald F-stat	87.460	84.268	21.790	22.202
Obs.	15,539	15,539	6,238	6,238

Note: This table represents the robust results by limiting observations. Columns (1) and (2) delete samples based on five indicators, while columns (3) and (4) use four indicators. All regressions are controlled for firm and year fixed effects, while columns (2) and (4) additionally include a vector of control variables: *ROA*, *Growth*, *Lev*, *HHI*, *Asset*, *Age*, *Dual*, *Top*1, *Board*, *IndDir*, *Big*4, *Inveratio*, and *SOE*. The instrumented variable is *SCTScore*, and the instrument variable is *SSIV*. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 10. ROBUSTNESS ANALYSES, INCORPORATING MORE FIXED EFFECTS, 2SLS

	(1)	(2)	(3)	(4)	(5)
	GreenWash_it	*GreenWash_it*	*GreenWash_it*	*GreenWash_it*	*GreenWash_it*
SCTScore_it	-0.921***	-0.920***	-1.000***	-0.904***	-0.976***
	(0.167)	(0.169)	(0.184)	(0.162)	(0.178)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects		Yes	Yes	Yes	Yes
Year × Province				Yes	Yes
Year × Industry			Yes		Yes
Adj R-squared	0.203	0.202	0.181	0.187	0.167
Kleibergen-Paap rk Wald F-stat	60.898	59.539	54.412	67.374	60.306
Obs.	24,776	24,776	24,766	24,776	24,766

Note: This table represents the robust results by incorporating additional fixed effects. Year × Industry stands for the Year-industry fixed effects, and Year × Province stands for the Year-province fixed effects. All regressions are controlled a vector of control variables: *ROA*, *Growth*, *Lev*, *HHI*, *Asset*, *Age*, *Dual*, *Top*1, *Board*, *IndDir*, *Big*4, *Inveratio* and *SOE*. The instrumented variable is *SCTScore*, and the instrument variable is *SSIV*. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 11. FURTHER ANALYSES, MODERATOR EFFECTS FROM ENVIRONMENTAL REGULATION INTENSITY AND DIGITAL FINANCE, 2SLS

	Environmental regulation intensity		Digital financial inclusion index	
	(1)	(2)	(3)	(4)
	GreenWash_it	*GreenWash_it*	*GreenWash_it*	*GreenWash_it*
SCTScore_i,t	-0.336	-0.429	-0.464	-0.526*
	(0.283)	(0.288)	(0.285)	(0.288)
SCTScore_i,t × *EnvInt_it*	-2.245***	-2.046***		
	(0.645)	(0.654)		
SCTScore_i,t × *Digit_it*			-0.003***	-0.002***
			(0.001)	(0.001)
		First stage		
SSIV_ipt	0.102***	0.100***	0.101***	0.101***
	(0.014)	(0.014)	(0.014)	(0.014)
SSIV_ipt × *EnvInt_it*	0.261***	0.263***		
	(0.031)	(0.031)		
SSIV_ipt × *Digit_it*			0.0003***	0.0003***
			(0.000)	(0.000)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables	No	Yes	No	Yes
Adj R-squared	0.242	0.241	0.218	0.216
Kleibergen-Paap rk Wald F-stat	55.275	53.887	56.231	55.454
Obs.	24,776	24,776	22,933	22,933

Note: This table represents the results considering moderator effects. Columns (1) and (2) set environmental regulation intensity (*EnvInt*) as the moderator factor, which is measured by the proportion of environment-related vocabularies of local government's work reports. Columns (3) and (4) use the digital financial inclusion index as the moderator factor (*Digit*), which Peking University compiles. Control variables used are *ROA*, *Growth*, *Lev*, *HHI*, *Asset*, *Age*, *Dual*, *Top*1, *Board*, *IndDir*, *Big*4, *Inveratio* and *SOE*. The instrumented variables are *SCTScore* and *SCTScore* × *EnvInt* (or *SCTScore* × *Digit*), and the instrument variables are *SSIV* and *SSIV* × *EnvInt* (or *SSIV* × *Digit*). The figures in parentheses are standard errors and are clustered at individual levels. ∗, ∗∗, and ∗ ∗ ∗ denote significance at the 10%, 5%, and 1% levels, respectively.

TABLE 12. FURTHER ANALYSES, HETEROGENEITY FROM MARKET COMPETITION AND INDUSTRIAL POLLUTION, 2SLS

	Market competition	Industrial pollution
	(1)	(2)
	Low ($< 33\%$) vs. High ($> 67\%$)	Lowly-polluted vs. Heavily-polluted
Competition=0 × SCTScore	-0.311	
	(0.293)	
Competition=1 × SCTScore	-1.219***	
	(0.238)	
Pollution=0 × SCTScore		-0.590**
		(0.244)
Pollution=1 × SCTScore		-1.192***
		(0.226)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Control variables	Yes	Yes
Adj R-squared	0.021	0.068
Kleibergen-Paap rk Wald F-stat	24.139	28.779
Linear combinations p-value	*0.025***	*0.088**
Obs.	16,150	24,776

Note: This table represents the results considering heterogeneity. The dependent variable is $GreenWash_{it}$. Column (1) is the results grouped by whether firms have a competitive market (*Competition*). Column (2) divides firms by pollution (*Pollution*). All regressions are controlled for firm and year fixed effects, as well as a vector of control variables: *ROA*, *Growth*, *Lev*, *HHI*, *Asset*, *Age*, *Dual*, *Top*1, *Board*, *IndDir*, *Big*4, *Inveratio*, and *SOE*. The *p*-values of linear combinations are obtained by comparing the differential interaction effect of $Competition \times SCTScore$ (column (1)) and $Pollution \times SCTScore$ (column (2)). The null hypothesis is that there is no difference. The instrumented variable is *SCTScore*, and the instrument variable is *SSIV*. The figures in parentheses are standard errors and are clustered at individual levels. $*$, $**$, and $***$ denote significance at the 10%, 5%, and 1% levels, respectively.

A Appendix

TABLE A.1. DOCUMENTS REGARDING SUPPLY CHAIN DISCLOSURE OF LISTED COMPANIES IN CHINA

Year	Relevant Documents and Explanations
Dec. 2001	**Annual Report Disclosure Guidelines (Revised 2001) (CSRC Announcement [2001] No.153)** **Compilation Rules (Revised 2001) (CSRC Announcement [2001] No.160)** For the first time, the CSRC *required* listed companies to disclose in the main text of their annual report the proportion of total purchase amount from the top five suppliers in the annual total purchase amount, and the proportion of sales revenue from the top five customers in the company's total sales revenue. The companies are also *required* to disclose once again in the notes to their financial statements, the total sales and their percentage from the top five customers.
Sept. 2012	**Annual Report Disclosure Guidelines (Revised 2012) (CSRC Announcement [2012] No.22)** For the first time in its disclosure rules, CSRC *encouraged* listed companies to disclose the names of their top five customers and suppliers, as well as their respective transaction amounts, in the annual reports.
Dec. 2014	**Annual Report Disclosure Guidelines (Revised 2014) (CSRC Announcement [2014] No.21)** **Compilation Rules (Revised 2014) (CSRC Announcement [2014] No.54)** CSRC added disclosure requirements concerning the relationship with the Top-5 customers and suppliers, as well as disclosure requirements for customers and suppliers who account for over 50% of transactions. It also required the disclosure of newly added customers and suppliers. However, starting from 2014, the only reduction in disclosure is that the CSRC has *canceled* the requirement to disclose information about the Top-5 customers in the notes to financial statements.
May 2021	**Annual Report Disclosure Guidelines (Draft for Comment)** In the draft for comment, CSRC changed the "encouraged disclosure" of the names of Top-5 suppliers and customers to *"required disclosure"*, signaling a shift from "voluntary disclosure" to "mandatory disclosure". http://www.csrc.gov.cn/csrc/c101950/c2ccff0d96f7e42e88b24edbc16bf7980/content.shtml (In Chinese)
June 2021	**Annual Report Disclosure Guidelines (Revised 2021) (CSRC Announcement [2021] No.15)** The Annual Report Disclosure Guidelines, which came into effect at the end of June, still *maintained* the original "encouraged disclosure". CSRC added that if the sales proportion to a single customer exceeds 50% of the total, there are new customers among Top-5, or if the company is heavily reliant on a few customers, the names and sales volume should be disclosed.

Note: Annual Report Disclosure Guidelines is the abbreviation of *Standards for the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No.2–Contents and Formats of Annual Reports*. *Compilation Rules* is the abbreviation of *Compilation Rules No.15 for Information Disclosure by Companies Issuing Public Securities - General Provisions for Financial Reports*.


公司主要销售客户情况公司前5大客户资料

序号	客户名称	销售额（元）	占年度销售总额比例
1	珠海市年丰水产养殖有限公司（顾春宫）	73, 960, 663. 57	1. 50%
2	惠州小金应陈光	36, 839, 008. 90	0. 75%
3	深圳南山区王伟国	31, 689, 372. 70	0. 64%
4	南海镇南饲料店区叔安	29, 735, 059. 80	0. 60%
前五名客户合计销售金额（元）		199, 981, 276. 97	
前五名客户合计销售金额占年度销售总额比例		4. 07%	
前五名客户销售额中关联方销售额占年度销售总额比例		0. 00%	
5	汕头澄海林得先	27, 757, 172. 00	0. 56%
合计	--	199, 981, 276. 97	4. 07%

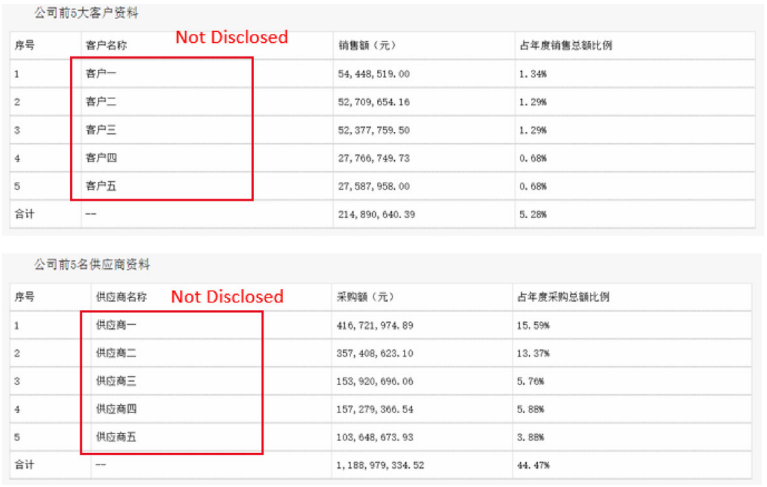
Fully Disclosed

公司前5名供应商资料

序号	供应商名称	采购额（元）	占年度采购总额比例
1	广西建工集团第四建筑工程有限公司	284, 359, 999. 98	10. 91%
2	深圳洲际建筑装饰集团有限公司	145, 545, 034. 40	5. 59%
3	深圳新美装饰建设集团有限公司	141, 048, 841. 39	5. 41%
4	深圳市协鹏工程勘察有限公司	104, 714, 490. 56	4. 02%
5	邯郸市邯一建筑工程有限公司深圳分公司	84, 904, 855. 58	3. 26%
合计	--	760, 573, 221. 91	29. 19%

Fully Disclosed

(a) 2019 ANNUAL REPORT


公司前5大客户资料

序号	客户名称	销售额（元）	占年度销售总额比例
1	客户一	54, 448, 519. 00	1. 34%
2	客户二	52, 709, 654. 16	1. 29%
3	客户三	52, 377, 759. 50	1. 29%
4	客户四	27, 766, 749. 73	0. 68%
5	客户五	27, 587, 958. 00	0. 68%
合计	--	214, 890, 640. 39	5. 28%

Not Disclosed

公司前5名供应商资料

序号	供应商名称	采购额（元）	占年度采购总额比例
1	供应商一	416, 721, 974. 89	15. 59%
2	供应商二	357, 408, 623. 10	13. 37%
3	供应商三	153, 920, 696. 06	5. 76%
4	供应商四	157, 279, 366. 54	5. 88%
5	供应商五	103, 648, 673. 93	3. 88%
合计	--	1, 188, 979, 334. 52	44. 47%

Not Disclosed

(b) 2020 ANNUAL REPORT


公司前5大客户资料

序号	客户名称	销售额（元）	占年度销售总额比例
1	客户一	89, 562, 278. 26	2. 78%
2	客户二	67, 132, 178. 60	2. 08%
3	客户三	46, 189, 877. 50	1. 43%
4	客户四	35, 504, 238. 41	1. 10%
5	客户五	27, 797, 402. 75	0. 86%
合计	--	266, 185, 975. 52	8. 26%

Not Disclosed

公司前5名供应商资料

序号	供应商名称	采购额（元）	占年度采购总额比例
1	广东吴川建筑安装工程有限公司	1, 438, 944, 764. 88	54. 40%
2	供应商二	455, 381, 119. 55	17. 22%
3	供应商三	183, 705, 388. 80	6. 95%
4	供应商四	170, 409, 681. 35	6. 44%
5	供应商五	92, 359, 848. 15	3. 49%
合计	--	2, 340, 800, 802. 73	88. 50%

Partially Disclosed

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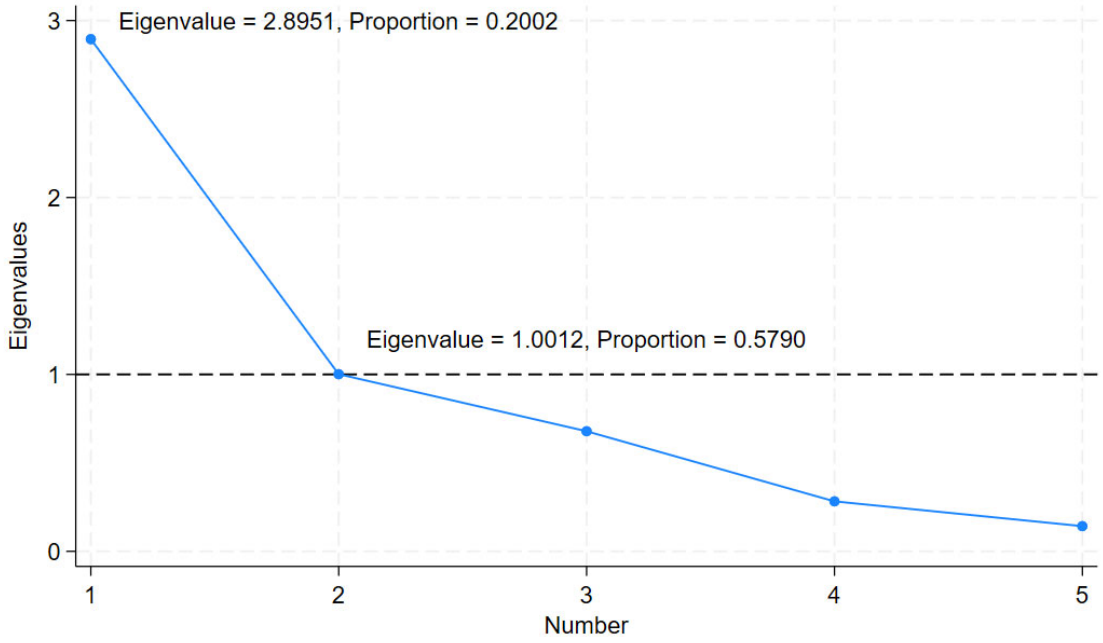
FIGURE A.1. EXAMPLE OF LISTED COMPANIES' SUPPLY CHAIN DISCLOSURE (SZ:000048)



Note: This plot is the scree plot of our factor analysis, two factors stand out with eigenvalues exceeding the commonly used threshold of 1. These two factors collectively account for 78% of the total variance of SCT, as shown by a cumulative value of 0.78. This suggests that these two factors capture the majority of the underlying structure of a matrix of SCT measures.

FIGURE A.2. SCREE PLOT OF SUPPLY CHAIN TRANSPARENCY

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