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Government Subsidies and Environmental Disclosure Quality: Evidence from Chinese Listed Firms

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Abstract

This study examines the association between government subsidy intensity and a proprietary Wind-based proxy for environmental disclosure quality in Chinese listed firms. Using 20 713 firm-year observations from 2020 to 2024, the analysis employs firm and year fixed effects with province-clustered inference. Government subsidy intensity is positively associated with the Wind environmental score (coefficient = 0.0218; wild-cluster p = .0014). The association remains positive after zero scores are excluded, but subsidies do not predict whether a positive score is observed. A lagged specification is not statistically significant, whereas future subsidy intensity predicts current scores, indicating that subsidy allocation may partly respond to firms' existing disclosure characteristics. Subsidies are not associated with reported carbon-emission intensity or total emissions among positive reporters. Supplementary evidence shows a small analyst-attention component and a stronger association among non-state-owned firms. The results establish an economically modest association, not a causal effect.

Keywords: government subsidies, environmental disclosure quality, Wind ESG, carbon disclosure, analyst attention, state ownership, China

1. Introduction

Environmental disclosure is part of the information system through which firms report environmental risks, policies, and resource use to investors and other stakeholders. Credible nonfinancial disclosure can reduce information asymmetry and support monitoring, whereas selective disclosure can be used to manage legitimacy without equivalent changes in underlying performance (Cho & Patten, 2007; Clarkson, Li, Richardson, & Vasvari, 2008; Healy & Palepu, 2001). Government subsidies may alter these reporting incentives. Public funding supplies resources, creates a visible relationship with the allocating authority, and can attract scrutiny from outsiders (Huang, 2022). The relation between subsidies and environmental disclosure is therefore an accounting question about information production and accountability as well as a policy question about resource allocation.

Prior research links subsidies to voluntary disclosure in the United States (Huang, 2022), voluntary CSR disclosure in China (Lee, Walker, & Zeng, 2017), and environmental disclosure among Chinese heavy polluters (Wang, 2020). Related studies associate public support with green innovation and aggregate ESG performance (Bai, Song, Jiao, & Yang, 2019; Na, Ni, Shu, & Zhang, 2024; Peng & Sun, 2024). Zhu and Zhao (2025) further show that subsidy dependence strengthens Chinese firms' environmental-disclosure response to political turnover, while much of that response is symbolic. The present study is therefore an incremental extension rather than a first test. It focuses on within-firm variation in a continuous, disclosure-oriented environmental score, uses a later 2020–2024 estimation period, and supplements province-clustered inference with a small-cluster correction.

The dependent variable is the environmental-dimension score from Wind ESG. Wind aggregates standardized indicators drawn from corporate reports, announcements, and other public information, while also incorporating management practices, performance information, and controversies (Wind ESG Rating Team, 2026). The score is thus disclosure-intensive but is not a simple count of disclosed items or a direct measure of physical environmental performance. Because ESG ratings differ across providers in scope, measurement, and weighting (Berg, Kölbel, & Rigobon, 2022; Christensen, Serafeim, & Sikochi, 2022), the analysis interprets the Wind score as a provider-specific

proxy for environmental disclosure quality. Throughout the paper, environmental disclosure quality refers to this proxy rather than to an error-free universal construct.

The initial panel contains 27 630 observations for 5297 Chinese listed firms during 2019–2024. The baseline fixed-effects model uses 20 713 observations from 2020 to 2024. The specification compares each firm's Wind environmental score with the same firm's score in other years, controlling for common year shocks and time-varying firm characteristics. The coefficient on ln(1 + government subsidy) is 0.0218, with a province-clustered t-statistic of 4.40 and a 9999-replication wild-cluster p-value of .0014. The association is statistically clear but economically modest.

The study contributes to the accounting literature by connecting a public-finance decision to the production of environmental information. It distinguishes a disclosure-oriented environmental score from both rating coverage and real environmental performance, documents a significant positive-score subsample result but no extensive-margin scoring effect, and pairs the disclosure score with annual-report carbon measures. It also presents analyst attention and state ownership as descriptive supplementary analyses. Methodologically, it applies inference procedures appropriate for 31 policy-relevant province clusters and reports temporal diagnostics that temper causal interpretation.

The remainder of the paper is organized as follows. Section 2 reviews the literature and develops the single hypothesis. Section 3 introduces the institutional setting, sample, and variables. Section 4 presents the methodology. Section 5 reports the baseline, robustness, measurement, and temporal results. Section 6 presents supplementary analyst, ownership, and physical-performance analyses. Section 7 discusses the findings, and Section 8 concludes.

2. Literature Review and Hypothesis Development

2.1 Government Subsidies and Corporate Disclosure

Corporate disclosure reduces information asymmetry when it supplies decision-useful information that outsiders cannot otherwise obtain at reasonable cost (Healy & Palepu, 2001). Environmental disclosure extends this accounting function beyond conventional financial statements by communicating environmental policies, risks, systems, and quantified outcomes. Hasnan et al. (2023) review the organizational, governance, and external factors that shape ESG reporting. Interpretation requires care, however: Clarkson et al. (2008) link discretionary disclosure to environmental performance, whereas Cho and Patten (2007) show that firms can also use disclosure for legitimacy. Disclosure quality and real environmental performance are therefore related but not interchangeable.

Government support can influence disclosure incentives because it affects both resources and accountability. Huang (2022) finds that U.S. subsidy recipients release more voluntary information, especially under stronger public scrutiny. In China, subsidies are linked to voluntary CSR disclosure (Lee et al., 2017) and environmental disclosure among heavy polluters (Wang, 2020). Zhu and Zhao (2025) find that impending political turnover increases environmental information disclosure and that government subsidies strengthen this response, consistent with firms' dependence on government resources and pressure; they also distinguish symbolic from substantive disclosure. Adjacent research connects subsidies to green innovation and aggregate ESG performance (Bai et al., 2019; Na et al., 2024; Peng & Sun, 2024). These studies inform the setting, but their dependent variables are not equivalent measures.

The dependent variable used here occupies a specific position between a hand-collected disclosure index and a broad ESG rating. Wind builds its environmental score from granular indicators and information sources, including corporate reports and announcements, management practices, performance information, and controversies (Wind ESG Rating Team, 2026). Provider-specific design choices can produce rating divergence (Berg et al., 2022), and greater disclosure can even increase disagreement among raters when new information is interpreted differently (Christensen et al., 2022). Accordingly, the paper tests the relation between subsidy intensity and a disclosure-intensive Wind environmental score while explicitly separating that score from physical performance and aggregate ESG.

2.2 Government Subsidies and Environmental Disclosure Quality

Producing credible environmental information is costly because firms must collect operational data, maintain internal controls over nonfinancial information, document environmental systems, and coordinate reporting across departments (Dhaliwal, Li, Tsang, & Yang, 2011; Healy & Palepu, 2001). Subsidies can relax resource constraints and help fund both the underlying environmental activities and the information systems needed to report them. Even general subsidies can release internal funds for data collection, monitoring, and disclosure. Evidence that grants affect real investment and green innovation supports this capacity channel (Bai et al., 2019; Howell, 2017).

Subsidies may also change the demand for information. Government screening can serve as a third-party signal of policy alignment or project quality (Connelly, Certo, Ireland, & Reutzel, 2011; Kleer, 2010), attracting investors and

analysts who seek further information. At the same time, recipients of public funds face an accountability relationship with allocating authorities and taxpayers. Public scrutiny strengthens subsidy-related disclosure responses (Huang, 2022), and governmental dependence influences Chinese firms' CSR reporting choices (Marquis & Qian, 2014). Resource support, certification, and monitoring can therefore jointly raise the expected benefit of producing verifiable environmental information.

The prediction is not mechanical. Political control can make firm decisions serve objectives other than shareholder value (Shleifer & Vishny, 1994), and subsidies can be politically allocated, diverted, or accompanied by weak enforcement. Chinese subsidy recipients display adverse compensation-allocation patterns in some settings (Bu, Shalchian, Huang, & Hu, 2019), while firms receiving targeted subsidies in the United States subsequently engage in more corporate misconduct (Raghunandan, 2024). Moreover, the subsidy measure is not limited to environmental grants. These countervailing forces may attenuate the average relation. At the same time, Zhu and Zhao (2025) show that subsidy dependence can intensify firms' environmental-disclosure response to political pressure. Together with the disclosure evidence in Huang (2022), Lee et al. (2017), and Wang (2020), this supports a positive net expectation.

Even for firms subject to legal disclosure duties, managers retain discretion over the scope and granularity of environmental reporting; the Wind environmental score captures variation on this margin (Ministry of Ecology and Environment of the People's Republic of China, 2021; Wind ESG Rating Team, 2026). The resource, certification, and accountability channels therefore imply a positive average association, although political allocation and weak enforcement may attenuate it. Because the observational fixed-effects design cannot remove all time-varying selection into subsidies, the prediction is associational rather than causal. Accordingly, these arguments lead to the following hypothesis:

H1: Government subsidy intensity is positively associated with the Wind-based environmental disclosure-quality score.

3. Institutional Setting and Data

3.1 Institutional Setting

Government subsidies are embedded in China's fiscal, industrial, and local-development policies. Prior evidence on Chinese listed firms treats non-tax subsidies as instruments used to pursue policy objectives and incorporates provincial-government information, illustrating the subnational role in subsidy allocation (Lim, Wang, & Zeng, 2018). Chinese Accounting Standard for Business Enterprises No. 16 defines a government grant as a monetary or nonmonetary asset received from government without consideration and distinguishes asset-related from income-related grants. It also requires firms to disclose the types and amounts of grants, their presentation in the financial statements, amounts recognized in current profit or loss, and any returned grants (Ministry of Finance of the People's Republic of China, 2017). The subsidy variable used here is therefore an accounting amount covering public support from multiple programs and levels of government; it is not limited to environmental grants. This partly decentralized institutional setting also motivates clustering standard errors by province because subsidy implementation and policy shocks may be correlated within provinces.

Environmental reporting during 2020–2024 is best understood as a mixed mandatory-voluntary regime rather than a uniformly voluntary period. Mandatory duties were concentrated among environmentally sensitive firms, while many other listed firms retained discretion over the scope and granularity of their reporting. The Ministry of Ecology and Environment's Order No. 24, effective February 8, 2022, standardized legal disclosure for key pollutant-discharging entities, firms subject to mandatory cleaner-production audits, and listed or bond-issuing firms meeting specified environmental-violation conditions. Local environmental authorities publish annual lists of covered enterprises. The full A-share population was therefore not subject to one universal disclosure mandate: designated firms faced legal obligations, whereas firms outside the covered categories continued to operate under broader market, exchange, and stakeholder expectations. The analysis accordingly does not label every observation as voluntary or treat 2022 as an exogenous policy shock. Year fixed effects absorb common changes in regulation, reporting infrastructure, and public attention (Ministry of Ecology and Environment of the People's Republic of China, 2021).

3.2 Sample and Data

The analysis uses two datasets. The main financial and governance panel combines CSMAR firm characteristics (provided by GTA/Guotai'an) with Escore from Wind ESG; the subsidy dataset contains government-subsidy data from CSMAR. The two datasets are merged one-to-one by stock code and year. The initial panel contains 27 630 observations for 5297 listed firms from 2019 through 2024.

Table 1 summarizes the fixed sample-construction sequence. Continuous variables are winsorized at the 1st and 99th percentiles using the full 27 630-observation panel before any sample exclusions. Negative subsidy values are set to zero before transformation, Growth is computed from the preceding observed revenue record within each firm, and zero environmental scores are retained for direct measurement checks in Section 5.4. The subsequent exclusions remove 738 financial-industry observations classified under CSRC section J (China Securities Regulatory Commission, 2012), 862 Special Treatment (ST) observations, and 5045 observations with incomplete baseline controls, yielding a filtered sample of 20 985 observations. Small firms and firms with calendar gaps are not excluded. The fixed-effects estimator uses 20 713 observations after absorbing 272 singleton observations. Because Growth requires a preceding observed revenue record, the estimation sample begins in 2020 even though the full panel begins in 2019; the panel remains unbalanced and calendar gaps are retained.

Table 1. Sample selection and attrition comparison

Panel A. Sample selection process		Observations
Initial firm-year panel		27 630
Less: financial-industry observations		738
Less: ST observations		862
Less: incomplete baseline controls		5045
Filtered sample		20 985
Less: absorbed singleton observations		272
Baseline estimation sample		20 713
Panel B. Attrition comparison, 2020–2024		
Variable	Retained sample	Dropped sample
N	20 713	3161
Escore	2.1307	1.3537
lnGovSub	16.2120	15.2730
Size	22.4121	22.4246
SOE	0.2982	0.2433

Note. Panel A reports the complete sample-construction sequence. Panel B reports means for observations in the 2020–2024 analysis window retained in the baseline estimation sample and those not retained. The comparison is descriptive; no statistical test of between-group differences is reported.

3.3 Variables

Environmental disclosure quality is proxied by Escore, the environmental-dimension score from Wind ESG, a domestic commercial rating system that converts granular public information into standardized environmental, social, and governance scores. Escore ranges from 0 to 10 in the panel; higher values indicate a higher provider-assigned environmental score derived from public environmental information, management practices, performance evidence, and controversies. Wind's methodology describes a bottom-up, data-driven framework in which standardized indicators are aggregated into E, S, and G dimension scores and the inputs draw on corporate reports and announcements as well as regulatory, media, nonprofit, performance, and controversy information. Because public environmental information is a central input, the score is treated as a provider-specific proxy for environmental disclosure quality, not as a direct measure of physical emissions. The dataset was extracted in February 2026 and records annual firm-year scores for the relevant fiscal years. Wind's 2026 methodology states that its underlying data and scores are stored under a Point-in-Time mechanism, in which original information is not overwritten by later restatements and historical states can be reconstructed (Wind ESG Rating Team, 2026). Section 5.4 separately examines the interpretation of zero scores.

The independent variable is lnGovSub, defined as ln(1 + government subsidy). Negative reported amounts are recoded to zero before taking logarithms. The logarithm is appropriate because subsidies are strongly right-skewed and many observations are zero. An alternative specification scales the nonnegative subsidy amount by total assets (GovSubR). The annual subsidy series records aggregate government support reported in the financial statements and does not preserve grant-level descriptions; reliable separation into environmental and non-environmental components is therefore not possible. The baseline controls are firm size (Size), leverage (Lev), return on assets (ROA), revenue growth (Growth), largest-shareholder ownership (Top1), Tobin's Q (TobinQ), and institutional ownership (InstOwn); Table 2 provides definitions. Analyst attention is ln(1 + number of analysts following the firm). CarbonIntensity and CarbonTotal are numeric environmental-performance fields extracted from annual reports and are used only for positive reporters in Section 6.3.

Table 2. Variable definitions

Variable	Definition
Escore	Wind ESG environmental-dimension score, 0–10; used as a provider-specific proxy for environmental disclosure quality.
lnGovSub	ln(1 + government subsidy), after setting negative subsidy values to zero.
GovSubR	Nonnegative government subsidy divided by total assets.
Size	Natural logarithm of total assets.
Lev	Total liabilities divided by total assets.
ROA	Net income divided by total assets.
Growth	Revenue change divided by the preceding observed revenue within the firm.
Top1	Ownership percentage of the largest shareholder.
TobinQ	Tobin's Q.
InstOwn	Institutional ownership relative to total shares.
Analyst	ln(1 + number of analysts following the firm).
SOE	Indicator equal to one for state-owned enterprises and zero otherwise.
Carbon outcomes	CarbonIntensity is ln(1 + reported carbon-emission intensity); CarbonTotal is ln(1 + reported total carbon emissions). Both are estimated among positive annual-report values.

Note. Data sources are CSMAR (GTA/Guotai'an), Wind ESG, and numeric carbon fields extracted from annual reports. Continuous variables are winsorized at the 1st and 99th percentiles on the full 27 630-observation panel before exclusions.

4. Methodology

4.1 Empirical Model

The baseline model regresses Escore on lnGovSub, the control vector, firm fixed effects, and year fixed effects. Firm fixed effects absorb time-invariant characteristics such as organizational culture, historical location, and persistent industry affiliation. Year fixed effects absorb national trends in environmental regulation, investor attention, and scoring practices. Industry fixed effects are not added separately because time-invariant industry membership is already absorbed by firm fixed effects. A robustness specification adds industry-by-year fixed effects while retaining firm fixed effects.

$$\mathrm{Escore}_{it} = \beta_0 + \beta_1 \mathrm{lnGovSub}_{it} + \gamma' \mathrm{Controls}_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where i indexes firms and t indexes years; μ_i and λ_t denote firm and year fixed effects, respectively, and ε_{it} is the error term.

4.2 Inference

Standard errors are clustered by province because subsidy implementation and environmental administration are partly local, making within-province disturbances potentially correlated. The sample contains 31 province clusters. Since conventional cluster-robust t-tests can over-reject when the number of clusters is small, inference is supplemented by a wild cluster bootstrap with 9999 replications (Cameron, Gelbach, & Miller, 2008; MacKinnon, Nielsen, & Webb, 2023; Roodman, Nielsen, MacKinnon, & Webb, 2019). Recent simulation evidence shows that wild-cluster procedures can materially improve reliability when clusters are few or uneven in size (MacKinnon et al., 2023). The coefficient on lnGovSub captures a conditional within-firm relation. The design does not rule out time-varying omitted variables or reverse allocation, so the estimates are interpreted as associations rather than causal effects.

5. Empirical Results

5.1 Descriptive Statistics

Table 3 reports descriptive statistics for the 20 713-observation baseline estimation sample. Escore has a mean of 2.1307, a median of 1.5400, and a standard deviation of 2.2334. The mean of lnGovSub is 16.2120 with a standard deviation of 2.3241. GovSubR averages 0.0042, and state-owned firms account for 29.82% of the estimation sample. Reporting all descriptives on the estimation sample avoids mixing the 20 985-observation filtered sample with the sample used in the regressions.

Table 4, Panel A reports the baseline estimation sample by year. Mean Escore rises from 1.640 in 2020 to 2.612 in 2024, while the zero-score share declines from 37.0% to 9.3%. By contrast, mean lnGovSub falls from 16.280 to 15.965 after peaking at 16.373 in 2022. The opposing aggregate movements do not generate the positive estimate: identification comes from year-to-year within-firm variation in subsidy intensity, while year fixed effects absorb common temporal changes in disclosure and subsidy conditions. Subsidy receipt is nearly universal, so the coefficient reflects the intensive margin rather than a recipient-versus-nonrecipient comparison. Panel B presents raw Pearson correlations. The largest reported correlation among the selected regressors is 0.427, and the full-model mean and maximum variance-inflation factors are 1.47 and 2.08, respectively; multicollinearity is not a material concern.

Table 3. Descriptive statistics

Variable	N	Mean	SD	Min	Median	Max
Escore	20 713	2.1307	2.2334	0	1.5400	10.0000
lnGovSub	20 713	16.2120	2.3241	0	16.3785	22.8756
GovSubR	20 713	0.0042	0.0048	0	0.0029	0.0961
Size	20 713	22.4121	1.3365	18.1225	22.1867	28.7908
Lev	20 713	0.4214	0.2052	0.0540	0.4127	0.9707
ROA	20 713	0.0236	0.0743	−0.3717	0.0304	0.2018
Growth	20 713	0.0942	0.3362	−0.6512	0.0577	1.9028
Top1	20 713	0.3200	0.1461	0.0782	0.2970	0.7355
TobinQ	20 713	1.8390	1.6451	0.0509	1.3787	9.9840
InstOwn	20 713	0.3840	0.2313	0.0014	0.3822	0.8778
Analyst	20 713	1.1212	1.1834	0	0.6931	4.3307
SOE	20 713	0.2982	0.4575	0	0	1

Note. Descriptive statistics use the 20 713-observation baseline estimation sample after singleton absorption.

Table 4. Sample distribution and pairwise correlations

Panel A. Distribution by year

Year	N	Mean Escore	Zero share	Subsidy share	Mean lnGovSub
2020	3375	1.640	37.0%	97.4%	16.280
2021	3818	1.714	34.6%	98.9%	16.323
2022	4299	1.944	21.0%	99.3%	16.373
2023	4648	2.528	13.2%	99.3%	16.166
2024	4573	2.612	9.3%	99.3%	15.965

Panel B. Pairwise correlations

Variable	Escore	lnGovSub	Size	Lev	ROA	Growth
Escore	1.000					
lnGovSub	0.205	1.000				
Size	0.342	0.427	1.000			
Lev	0.057	0.124	0.422	1.000		
ROA	0.086	0.139	0.117	−0.344	1.000	
Growth	−0.016	0.021	0.036	0.018	0.291	1.000

Note. Both panels use the 20 713-observation baseline estimation sample. Subsidy share is the percentage with positive government subsidies. Panel B reports raw Pearson correlations; fixed-effects estimates appear in Table 5.

5.2 Baseline Results

Government subsidy intensity is positively associated with the Wind-based environmental disclosure-quality score, supporting H1. In the fully controlled specification reported in Table 5, lnGovSub has a coefficient of 0.0218 (t = 4.40). Column (1), which includes firm and year fixed effects but no time-varying controls, reports gives a coefficient of 0.0297 (t = 5.62). Adding the controls reduces the coefficient by approximately 26.6%, indicating that observable changes in scale, financing, profitability, growth, ownership, and valuation explain part, but not all, of the within-firm relation.

The wild cluster bootstrap confirms that the result does not rely on conventional small-cluster asymptotics. With 9999 replications and province-level clustering, the bootstrap p-value is .0014. Using the standard deviation of lnGovSub (2.3241), a one-standard-deviation increase corresponds to 0.0506 Escore points, or 2.38% of the 2.1307 sample mean. For scale, mean Escore rose by 0.972 points between 2020 and 2024; the estimate is about 5.2% of that change. The magnitude is therefore modest but not negligible.

The direction is consistent with prior evidence linking subsidies to voluntary corporate disclosure (Huang, 2022), Chinese CSR disclosure (Lee et al., 2017), and environmental disclosure (Wang, 2020), as well as evidence that subsidy dependence strengthens firms' environmental-disclosure response to political pressure (Zhu & Zhao, 2025). The present coefficient should not be compared mechanically with those estimates because the outcomes, samples, and functional forms differ. Here it represents the change in a continuous Wind score accompanying within-firm variation in subsidy intensity after national year shocks are removed.

Several controls are statistically significant. Larger firms and firms with more concentrated largest-shareholder ownership have higher environmental scores. Leverage, revenue growth, and Tobin's Q have negative coefficients. ROA and institutional ownership are not statistically different from zero.

Table 5. Government subsidies and environmental disclosure quality

Variable	(1)	(2)
lnGovSub	0.0297***(5.62)	0.0218***(4.40)
Size		0.4357***(6.36)
Lev		−0.5777**(−2.55)
ROA		−0.0600(−0.29)
Growth		−0.1402***(−4.28)
Top1		1.1981***(2.81)
TobinQ		−0.1053***(−5.49)
InstOwn		0.1588(1.05)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	20 713	20 713
Within R^2	0.0011	0.0148
Province clusters	31	31

Note. The dependent variable is Escore. Province-clustered t-statistics are in parentheses. * p < .10, ** p < .05, *** p < .01. For column (2), a 9999-replication wild cluster bootstrap gives p = .0014 for lnGovSub.

5.3 Robustness Checks

The subsidy coefficient remains positive across the four province-clustered sensitivity checks in Table 6. Results are similar when subsidies are scaled by total assets, when the four provincial-level municipalities are excluded, within manufacturing firms, and with industry-by-year fixed effects. Every row reports a 9999-replication wild-cluster p-value. A separate firm-clustered specification, for which the small-cluster concern is not relevant because there are 4747 firm clusters, gives the same coefficient of 0.0218 (t = 3.01). These results support coefficient stability, but they do not resolve endogenous subsidy allocation.

Table 6. Sensitivity checks

Specification	Coefficient	t	Wild p	N	Clusters
Subsidy / total assets	11.6060	3.77	.0019	20 713	31
Exclude municipalities	0.0197	3.44	.0110	16 581	27
Manufacturing firms	0.0249	3.26	.0153	13 939	31
Firm and industry ×year FE	0.0229	3.99	.0021	20 700	31

Note. Each row is a separate regression including the baseline controls and relevant fixed effects. The first row uses GovSubR; the remaining rows use lnGovSub, so coefficient magnitudes are not directly comparable. Province-clustered t-statistics and 9999-replication wild-cluster p-values are reported.

5.4 Measurement and Temporal Diagnostics

Table 7 reports the measurement and temporal diagnostics. Zero scores are retained in the baseline because zero lies within Wind's standardized 0–10 scoring scale (Wind ESG Rating Team, 2026), but their interpretation is examined directly. The baseline sample contains 4513 zero environmental scores (21.79%). All 4513 observations nevertheless have an overall Wind ESG rating, making complete firm-level rating absence an unlikely explanation. Among the 16 200 positive Escore observations before singleton absorption, the mean, median, and standard deviation are 2.724,

2.120, and 2.182, respectively. Excluding zeros leaves a positive coefficient of 0.0198 (wild p = .0030). By contrast, a linear-probability model for Escore > 0 yields a near-zero coefficient and wild p = .9708. The baseline association therefore appears on the intensive score margin rather than the extensive margin of observing a positive environmental score.

The temporal diagnostics materially limit causal interpretation. Lagged subsidy intensity has a smaller coefficient of 0.0143 and is not statistically significant under the wild-cluster bootstrap (p = .1119). More importantly, future subsidy intensity predicts current Escore (coefficient = 0.0235; wild p = .0042), while current subsidy intensity does not significantly predict next year's Escore (wild p = .1082). This pattern is consistent with reverse allocation or anticipation: governments may allocate subsidies partly in response to firms' existing disclosure characteristics. The contemporaneous relation remains informative as an association, but the temporal ordering does not support a one-way causal claim.

Table 7. Measurement and temporal diagnostics

Specification	Coefficient	t	Wild p	N
Exclude Escore = 0	0.0198	3.29	.0030	15 966
Dependent variable: Escore > 0	0.0001	0.04	.9708	20 713
Lagged lnGovSub	0.0143	1.73	.1119	15 440
Future lnGovSub	0.0235	3.76	.0042	15 440
Future Escore	0.0137	1.75	.1082	15 440

Note. All specifications include the baseline controls and firm and year fixed effects, with province-clustered t-statistics and 9999-replication wild-cluster p-values. The future-lnGovSub row regresses Escore at t on lnGovSub at t + 1; the future-Escore row regresses Escore at t + 1 on lnGovSub at t.

6. Supplementary Analyses

6.1 Descriptive Evidence on Analyst Attention

Analysts act as information intermediaries whose coverage can reduce information opacity and strengthen external monitoring (Nie, Zeng, & Du, 2018; Yu, 2008). Voluntary nonfinancial disclosure can improve the information environment (Dhaliwal et al., 2011), and CSR information can affect analysts' investment recommendations (Ioannou & Serafeim, 2015). Recent Chinese evidence likewise links analyst coverage to CSR through information and monitoring functions (Y. Liu & Du, 2024) and treats analyst coverage as an information-intermediary channel in an ESG setting (Tang, Guo, & Li, 2025). In the present setting, a subsidy award may draw attention because it conveys information about resources, policy alignment, or future projects (Kleer, 2010). Once analysts cover the firm, requests for explanations and forecasts may increase pressure to maintain observable environmental systems and reporting practices (Ioannou & Serafeim, 2015; Y. Liu & Du, 2024).

Table 8 reports a descriptive product-of-coefficients analysis. In column (1), the coefficient on lnGovSub in the Analyst model is 0.0122 (t = 5.29). In column (2), the coefficient on Analyst in the Escore model is 0.0698 (t = 3.23), while the subsidy coefficient remains positive at 0.0209. A 1000-replication province-cluster bootstrap gives an indirect component of 0.00085 (p = .014), with a bias-corrected 95% interval of [0.00036, 0.00165] (Hayes & Rockwood, 2020). The component is about 3.91% of the total association.

These results are consistent with analyst attention accompanying part of the subsidy-score relation, but they are not a causal mediation test. Subsidies, analyst following, and environmental scores may respond to common time-varying firm developments. The small indirect share also shows that analyst attention is not the principal mechanism.

Table 8. Descriptive evidence on analyst attention

Variable	(1) Analyst	(2) Escore
lnGovSub	0.0122***(5.29)	0.0209***(4.33)
Analyst		0.0698***(3.23)
Controls	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	20 713	20 713
Within R^2	0.1256	0.0154

Note. Province-clustered t-statistics are in parentheses. The 1000-replication province-cluster bootstrap produces an indirect component of 0.00085 (p = .014), with a bias-corrected 95% confidence interval of [0.00036, 0.00165]. *** p < .01.

6.2 State Ownership

The ownership analysis is exploratory and does not introduce a second hypothesis. State-owned enterprises already operate through administrative affiliation and may have more direct channels for obtaining legitimacy, policy information, and resources. Non-state-owned enterprises may therefore depend more heavily on observable environmental disclosure quality to validate policy alignment and preserve access to government support. Recent Chinese evidence supports treating political and ownership ties as boundary conditions: Na et al. (2024) report a stronger subsidy–ESG relation among firms with fewer political connections, while Peng and Sun (2024) explicitly distinguish state-owned and non-state-owned enterprises. Prior evidence does not imply that ownership has a uniform direction across outcomes. Bu et al. (2019) find a stronger subsidy-pay-gap relation among state-owned firms, whereas Lee et al. (2017) and Wu (2017) report stronger subsidy-related disclosure or signaling effects among non-state-owned firms. Because the present outcome is disclosure quality rather than compensation allocation, the direction observed here need not generalize to other subsidy-related outcomes.

Table 9 reports the state-ownership estimates. The interaction between lnGovSub and SOE is −0.0381 (t = −3.45), with a wild-cluster p-value of .0102. The non-state-owned slope is positive at 0.0347 (t = 5.09), whereas the implied state-owned slope is −0.0034 (t = −0.42; p = .6761). Figure 1 reports the slopes and 95% confidence intervals. State-owned firms have a higher mean Escore (2.587 versus 1.937) and a higher positive-score share (83.7% versus 75.9%), so less headroom may contribute to the weaker slope. Ownership status does not switch for any of the 4747 firms in the estimation sample; the SOE main effect is therefore absorbed by firm fixed effects. The interaction captures differences in subsidy slopes across time-invariant ownership groups and remains descriptive.

Table 9. State-ownership heterogeneity

Term	Coefficient	t
lnGovSub (non-SOE slope)	0.0347***	5.09
lnGovSub × SOE	−0.0381**	−3.45
Implied SOE slope	−0.0034	−0.42
Controls	Yes	
Firm and year fixed effects	Yes	
Observations	20 713	
Within R^2	0.0152	

Note. Province-clustered t-statistics are reported. SOE is time invariant in the estimation sample and its main effect is absorbed by firm fixed effects. The wild-cluster p-value for the interaction is .0102; its significance marker reflects that bootstrap result. ** p < .05, *** p < .01.

Figure 1. Implied subsidy slopes by state ownership

6.3 Environmental Performance Check

Table 10 reports whether the subsidy-score association is accompanied by movement in physical outcomes, using numeric carbon-emission fields extracted from annual reports rather than Wind ESG. Among positive reporters, lnGovSub is unrelated to reported carbon-emission intensity (coefficient = 0.00025; wild p = .5360) and reported total carbon emissions (coefficient = 0.00048; wild p = .8068). These null estimates do not prove greenwashing because reporting selection, measurement error, and the short panel remain important. They do show that the higher disclosure-oriented score is not accompanied by detectable movement in the two reported physical quantities, consistent with the conceptual distinction between environmental disclosure and environmental performance (Clarkson et al., 2008; G. Liu et al., 2025).

Table 10. Government subsidies and reported carbon outcomes

Dependent variable	Coefficient	t	Wild p	N
Carbon-emission intensity	0.00025	0.64	.5360	14 943
Total carbon emissions	0.00048	0.25	.8068	14 945

Note. The reported coefficient is on lnGovSub. Outcomes are ln(1 + the stated annual-report carbon measure), estimated only among observations with positive reported values. All models include the baseline controls and firm and year fixed effects. Province-clustered t-statistics and 9999-replication wild-cluster p-values are reported.

7. Discussion

7.1 Relation to Prior Evidence

The baseline finding is closest in spirit to Huang (2022), who shows that U.S. government subsidies are associated with more voluntary corporate disclosure, particularly when public scrutiny is stronger. The present study is not a replication of that result. Huang examines a different institutional setting and a broad set of voluntary corporate disclosures, whereas this paper studies a later Chinese panel and a disclosure-intensive environmental score. The common element is the accountability logic: public resources can increase both the capacity to produce information and outsiders' demand for it. The Chinese mixed disclosure regime and province-level implementation add an institutional dimension that is absent from a purely national subsidy-disclosure comparison (Lim et al., 2018; Ministry of Ecology and Environment of the People's Republic of China, 2021).

The result also complements the Chinese studies discussed in Section 2.1, but the distinctions among their dependent variables matter. Lee et al. (2017) study voluntary corporate social responsibility disclosure, a broader construct that combines environmental and social information. Wang (2020) focuses on environmental disclosure by firms in heavy-pollution industries, whereas the present study examines a broader sample of nonfinancial A-share firms. Zhu and Zhao (2025) distinguish symbolic and substantive environmental information disclosure under political turnover and show that subsidies strengthen the disclosure response. This paper instead uses a continuous Wind score that

aggregates granular public evidence together with management, performance, and controversy information. The positive directions are comparable, but coefficient magnitudes are not because the samples, measures, and functional forms differ. The contribution is therefore a measurement- and inference-focused extension: a recent broad panel, a continuous disclosure-oriented proxy, firm and year fixed effects, and inference adjusted for a limited number of policy-relevant province clusters.

Recent evidence cautions against equating subsidy-linked environmental disclosure with improved physical performance. G. Liu et al. (2025) find that environmental subsidies can increase ESG-report greenwashing among Chinese listed firms, particularly among state-owned enterprises. Their environmental-subsidy measure and greenwashing outcome differ from this study's broad subsidy measure and Wind score. The present carbon tests nevertheless provide a related caution: the subsidy-score association is not accompanied by detectable changes in reported carbon intensity or total emissions. The stronger non-SOE score slope also does not contradict G. Liu et al.; it describes where the provider score moves with broad subsidy intensity, not which ownership group has the largest disclosure-performance gap.

7.2 Economic Magnitude and Supplementary Evidence

The estimated economic magnitude is modest. Three features make a small coefficient unsurprising. First, subsidy receipt is nearly universal, so the estimate captures marginal changes in intensity rather than the contrast between recipients and nonrecipients. Second, firm fixed effects use only within-firm variation, while year fixed effects remove the sharp nationwide rise in disclosure and ratings. Third, the subsidy amount includes many forms of public support that are unrelated to environmental investment. Even so, 0.051 points equal about 5.2% of the 0.972-point increase in mean Escore from 2020 to 2024. Relative to movement on this provider-specific scale, the association is limited but not economically negligible. It is more consistent with an incremental reporting response than with a transformation of environmental performance.

The analyst results accompany only a small part of the association. Both component paths are statistically supported, but the indirect component is 0.00085, or 3.91% of the total relation. Analyst attention is therefore not the dominant mechanism. Other possibilities include investment in environmental data systems, reporting intended to satisfy regulators and taxpayers, certification effects, and attention from local media or financial institutions (Huang, 2022; Kleer, 2010; Marquis & Qian, 2014). These remain interpretations rather than identified mechanisms.

Ownership heterogeneity is consistent with an incremental disclosure-incentive account, but the higher baseline Escore and positive-score share among state-owned firms also leave less room for score increases. The absence of ownership switchers means that the comparison is across time-invariant ownership groups. Administrative affiliation, ceiling effects, and other persistent group differences may all contribute, so the interaction should not be read as a causal ownership mechanism.

8. Conclusions and Implications

This study documents a positive contemporaneous within-firm association between government subsidy intensity and Wind environmental-dimension scores in 20 713 observations from 2020 to 2024. The result survives province-clustered and wild-cluster inference, rules out an extensive-margin explanation, and remains positive after zero scores are removed. However, the lag and lead tests indicate that subsidy allocation may partly respond to existing disclosure characteristics, and the annual-report carbon tests reveal no corresponding movement in reported physical outcomes. The evidence supports H1 as an association, not a causal effect.

The findings suggest practical measures for several parties. Listed firms can strengthen internal controls over environmental data, document links from disclosed indicators to underlying evidence, standardize metric definitions across years, and obtain external assurance for material measures. Governments can publish clearer subsidy purposes and expected reporting outcomes, require proportionate post-award disclosure, and monitor whether reported environmental claims correspond to physical indicators. Regulators can promote comparable environmental metrics and cross-check provider scores against emissions and other operating data. Analysts and investors should combine disclosure-oriented scores with physical-performance measures rather than treating a higher score as evidence of improved environmental outcomes.

Several limitations remain. Firm and year fixed effects do not eliminate time-varying omitted variables or reverse allocation, and the temporal diagnostics are consistent with governments responding to firms' existing disclosure characteristics. The Wind score is provider specific and includes management, performance, and controversy information in addition to disclosure. The February 2026 extraction records annual firm-year scores, and Wind's methodology describes Point-in-Time storage and historical traceability (Wind ESG Rating Team, 2026); however, the

proprietary construction prevents independent reconstruction of each historical score. The aggregate subsidy data lack item-level descriptions, so environmental and non-environmental grants cannot be separated. Carbon measures are self-reported by positive reporters, the 2020–2024 window is short, and the analyst test is descriptive. Future research could use grant-level descriptions, legal designation lists under Order No. 24, externally verified emissions, or a credible allocation threshold.

Subject to these qualifications, public financial support is associated with the accounting production of environmental information, but neither the temporal evidence nor the physical-performance tests justify interpreting the coefficient as an environmental-performance effect.

9. Data Availability Statement

CSMAR and Wind ESG are proprietary subscription databases and cannot be redistributed by the author. Replication code and variable-construction instructions are available from the author on reasonable request, subject to the providers' licensing restrictions.

10. Software Statement

All reported regressions were estimated in Stata/MP 18.0. High-dimensional fixed effects were absorbed using reghdfe, which builds on the iterative fixed-effect approach described by Guimarães and Portugal (2010), and 9999-replication wild-cluster inference was implemented with boottest (Roodman et al., 2019). The province-cluster bootstrap seeds and complete estimation sequence are recorded in the replication code.

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