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The Suppressing Role of Market Liquidity: Unpacking the Complexity in the Carbon Disclosure Value Creation Pathway

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ABSTRACT

This study explores the nuanced role of market liquidity (TR) as a suppressor in the relationship between Carbon Disclosure Quality (CDI) and Enterprise Value Creation (VL). Drawing on signaling theory and stakeholder theory, the research employs Structural Equation Modeling (SEM) based on dual-source data from 277 listed firms in high-emission industries in China. While CDI demonstrates a direct positive impact on VL and exhibits significant mediation through financing cost, customer satisfaction, and corporate reputation, market liquidity reveals a unique suppressing effect. Specifically, the SEM results indicate that CDI has a significant positive effect on enterprise value creation ($\beta = 0.32$, $p < 0.01$), whereas market liquidity exerts a suppressing indirect effect ($\beta = -0.06$, $p < 0.05$). These effects are validated using Bootstrap resampling (n = 10,000), and model fit indices confirm strong validity (CFI = 0.978; TLI = 0.967; RMSEA = 0.038). The findings highlight the potential for carbon disclosure to generate ambiguous signals in transitional ESG environments, complicating investor interpretation and value realization. This study contributes to the ESG literature by identifying a novel suppressor variable and offers strategic recommendations to enhance the clarity and effectiveness of ESG communication and carbon disclosure practices.

Keywords: Carbon Disclosure Quality, Market Liquidity, Suppressing Effect, Enterprise Value Creation, SEM, ESG Signaling

INTRODUCTION

Carbon disclosure has increasingly become a cornerstone of corporate sustainability strategies, driven by growing pressure from investors, regulators, and global sustainability initiatives. Frameworks such as the Global Reporting Initiative (GRI), the Carbon Disclosure Project (CDP), and the Task Force on Climate-related Financial Disclosures (TCFD) have encouraged firms—especially those in high-emission industries—to improve the transparency, consistency, and strategic integration of their carbon-related information. In China, carbon disclosure has gained momentum under the national "Dual Carbon" strategy, which aims to achieve carbon peaking by 2030 and carbon neutrality by 2060. As a result, the quality of carbon information disclosure (CDI) has emerged as a critical ESG performance indicator.

Previous research has established a generally positive relationship between CDI and enterprise value creation (VL), suggesting that better disclosure can enhance investor confidence, reduce information asymmetry, and improve long-term performance. However, this relationship may not always be straightforward. Emerging evidence points to the possibility that market-based variables may influence, mediate, or even distort the impact of carbon disclosure. Among these, market liquidity (TR)—which reflects how quickly and efficiently a firm's shares can be traded—may act as a suppressor, masking the true effect of CDI on value creation.

Compared to advanced economies where ESG disclosure frameworks are institutionalized and legally enforced—such as the EU Non-Financial Reporting Directive (NFRD) and the U.S. SEC climate risk disclosure proposal—China's ESG architecture remains relatively fragmented and largely voluntary. While recent developments such as the China Securities Regulatory Commission (CSRC) guidelines and the establishment of ESG pilot zones in Shanghai and Shenzhen mark notable progress,yet the absence of standardized mandates and unified evaluation mechanisms continues to hinder the credibility and comparability of carbon disclosures.In mature capital markets, institutional investors routinely incorporate ESG performance into long-term valuation models, enabling a more efficient transmission of environmental signals into enterprise value. However, in China's

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transitional market environment, ESG signals—particularly those related to carbon disclosure—are vulnerable to misinterpretation, short-term trading behavior, and information overload. These structural differences create a distinctive empirical context for examining whether and how market mechanisms such as liquidity may suppress or distort the expected benefits of high-quality carbon disclosure.

Despite its potential importance, the role of market liquidity in the CDI–VL linkage remains underexplored, especially in transitional ESG environments like China. In markets where ESG frameworks are evolving and investor expectations are fragmented, carbon disclosure may generate ambiguous signals that lead to misinterpretation or muted market responses.

This paper aims to fill this gap by examining the suppressing role of market liquidity in the CDI–VL relationship. Grounded in signaling theory and stakeholder theory, we employ Structural Equation Modeling (SEM) based on dual-source data from 277 high-emission enterprises in China. This study contributes to the ESG literature by identifying market liquidity as a novel suppressor variable in the CDI–VL pathway and by offering strategic implications for firms and policymakers aiming to enhance the clarity and effectiveness of ESG communication.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

This study draws upon two foundational theories in corporate disclosure and sustainability research: signaling theory and stakeholder theory.

Signaling Theory

Signaling theory (Spence, 1973) posits that firms send signals to reduce information asymmetry between themselves and external stakeholders, particularly investors. Carbon disclosure, as an ESG signal, communicates the firm's environmental responsibility, long-term orientation, and risk awareness. High-quality CDI—characterized by clarity, consistency, auditability, and strategic alignment—serves as a positive signal that can enhance firm reputation, attract responsible capital, and improve valuation.

However, not all signals are interpreted uniformly. In transitional markets like China, where ESG standards are still evolving and investor ESG literacy is uneven, the signal from CDI may become ambiguous or distorted. This is where market liquidity (TR) enters the picture.

Market liquidity reflects how easily a firm's shares can be traded without causing significant price fluctuations. High liquidity is generally seen as favorable, implying greater investor participation and market confidence. Yet, in the context of ESG disclosure, high liquidity may dilute or suppress the informational impact of carbon signals. Rapid trading and short-term speculation may overshadow long-term environmental disclosures, potentially leading to investor underreaction or misinterpretation of the strategic intent behind CDI, especially in fast-moving capital markets.This phenomenon is referred to as the "suppressing effect" in mediation analysis—a situation where the inclusion of a third variable reduces the observed strength of a direct relationship.

Stakeholder Theory

Stakeholder theory (Freeman, 1984) further explains that firms must manage relationships not just with shareholders but with a broad range of stakeholders, including customers, regulators, and the public. If market liquidity reflects investor myopia or misalignment with stakeholder sustainability expectations, it can ultimately undermine the long-term stakeholder value that transparent carbon reporting seeks to generate.

CDI, VL and the Suppressing Role of Market Liquidity

Based on the above theoretical rationale, we propose the following hypothesis:

H3c: Market liquidity (TR) suppresses the positive relationship between carbon disclosure quality (CDI) and enterprise value creation (VL).

Suppressor Variables in ESG Research

While most studies on the relationship between environmental disclosure and firm performance rely on mediating variables to explain indirect effects, recent research has highlighted the importance of suppressor variables in uncovering hidden relationships within complex models (Conger, 1974; MacKinnon et al., 2000). A suppressor variable does not mediate or moderate a relationship in the traditional sense. Instead, it increases the predictive validity of another independent variable by accounting for variance that is irrelevant—or even misleading—to the criterion variable (Paulhus et al., 2004).

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In Structural Equation Modeling (SEM), suppression is typically identified when the inclusion of a third variable (e.g., market liquidity) enhances or even reverses the direct relationship between an independent and dependent construct. Suppression effects are especially relevant in transitional environments where signaling clarity is low and confounding market signals may obscure the impact of ESG disclosures (Kline, 2015). Within the ESG context, this suggests that even high-quality carbon disclosure may fail to translate into firm value if suppressing forces—such as volatile liquidity conditions—are present. Identifying and quantifying such suppressor effects helps unpack the "black box" between ESG efforts and financial outcomes, and aligns with the emerging methodological focus on signal distortion, ambiguity, and short-termism in sustainable finance.This perspective lays the foundation for empirically modeling market liquidity as a suppressor in the CDI–VL relationship.

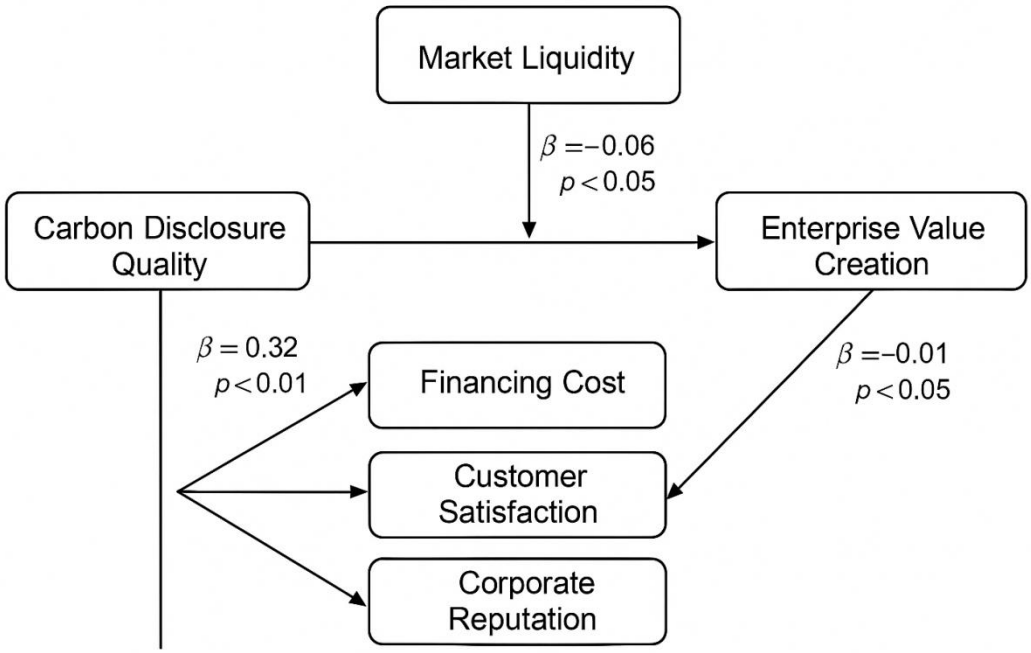

Figure 1. Conceptual Framework

METHODOLOGY

Data Collection

This study employs a dual-source data strategy to improve the robustness and validity of empirical results. Primary data on Carbon Disclosure Quality (CDI) were obtained through a structured questionnaire administered to senior ESG and finance executives from 277 publicly listed companies in high-emission sectors in China, including energy, utilities, transportation, and heavy manufacturing. The survey was conducted between late 2022 and early 2023 using an online platform, with responses collected anonymously to reduce social desirability bias.

The CDI construct was operationalized through a 15-item instrument developed based on widely recognized ESG disclosure frameworks, including the Global Reporting Initiative (GRI G4 and GRI 305), the Carbon Disclosure Project (CDP), and the Task Force on Climate-related Financial Disclosures (TCFD). The instrument captures four core dimensions:

- Clarity and consistency (e.g., scope of emission coverage, reporting frequency);
- Verifiability and auditability (e.g., third-party assurance, quantitative disclosures);
- Strategic integration (e.g., linkage with carbon goals and corporate strategy);
- Disclosure of key carbon metrics (e.g., Scope 1–3 emissions, energy intensity).

Each item was rated on a six-point Likert scale (1 = strongly disagree, 6 = strongly agree) to minimize central tendency bias and maximize discriminatory power. A pilot study involving 30 ESG practitioners was conducted to

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validate item clarity and content adequacy. The scale demonstrated high internal consistency (Cronbach's α = 0.892).

To complement the primary data and control for endogeneity, secondary data were collected from the CSMAR and Wind databases for the period 2013–2022. These data include firm-level financial performance, stock liquidity, ownership structure, and other governance indicators. By triangulating subjective assessments with objective performance metrics, this dual-source approach allows for a more comprehensive and reliable evaluation of the CDI–VL relationship.

Table 1. Measurement Items for Carbon Disclosure Quality (CDI)

Dimension	Item Code	Item Description
Clarity & Consistency	CDI1	The company discloses carbon data consistently across reporting periods.
	CDI2	The scope of emissions reported is clearly defined (e.g., organizational boundary).
	CDI3	Carbon information is presented in a comparable and structured format.
Verifiability & Auditability	CDI4	The report includes third-party verification or assurance of carbon data.
	CDI5	Emission figures are supported by quantitative and auditable evidence.
	CDI6	The data collection process is transparent and documented.
Strategic Integration	CDI7	Carbon disclosure is linked to overall corporate strategy and goals.
	CDI8	The report outlines clear emission reduction targets.
	CDI9	Carbon governance (e.g., board oversight) is explicitly discussed.
Disclosure of Core Metrics	CDI10	Scope 1 emissions are disclosed with relevant units and context.
	CDI11	Scope 2 emissions are clearly calculated and reported.
	CDI12	Scope 3 emissions are disclosed where material or feasible.
	CDI13	Energy consumption and intensity metrics are included.
	CDI14	Carbon intensity per unit of output or revenue is provided.
	CDI15	The disclosure compares performance to industry benchmarks or targets.

Data Analysis Tools

All data processing and analysis in this study were conducted using SPSSAU, a cloud-based statistical platform widely adopted in management and behavioral research. SPSSAU provides an integrated interface for conducting reliability tests, descriptive statistics, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM).

Specifically, this study used SPSSAU to perform:

- Descriptive statistics and correlation analysis;
- Reliability analysis (Cronbach's α) for internal consistency testing;
- CFA for validating measurement model fit (factor loadings, AVE, CR);
- SEM to estimate structural path coefficients and model fit indices;
- Bootstrap analysis (10,000 samples) to test indirect and suppressing effects.

The platform's automated output and visualization tools facilitated transparent reporting and ensured replicability of results.

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Variable Design

- Independent Variable:

Carbon Disclosure Quality (CDI), measured through the survey.

- Dependent Variable:

Enterprise Value Creation (VL), proxied by Tobin's Q and Return on Assets (ROA).

- Mediator:

Market Liquidity (TR), measured using the turnover ratio (total trading volume divided by shares outstanding).

- Control Variables:

To isolate the true effects of CDI and TR, we include firm size (log of total assets), financial leverage (debt-to-asset ratio), industry type, and ownership structure (state vs. private).

Modeling Strategy

To examine the mediating and suppressing role of market liquidity in the CDI–VL pathway, we employ Structural Equation Modeling (SEM) using AMOS 26.0. This method allows for simultaneous estimation of multiple paths and latent constructs, enhancing analytical precision.

To ensure statistical robustness and capture potential non-normality in the data distribution, we apply the Bootstrap resampling technique (n = 10,000). This approach tests the significance of indirect and total effects, particularly identifying suppressing effects, where the indirect path via market liquidity (TR) negatively impacts the otherwise positive CDI–VL linkage.

Model fit is evaluated using standard SEM fit indices, including the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA).

RESULTS

The results from the Structural Equation Modeling (SEM) analysis validate the hypothesized relationships in the proposed conceptual framework. Specifically, the quality of carbon disclosure (CDI) shows a significant and positive direct effect on enterprise value creation (VL), with a standardized path coefficient of $\beta = 0.32$ ($p < 0.01$). This finding is consistent with previous literature suggesting that firms with higher transparency and environmental accountability tend to enjoy enhanced market valuation and operational performance.

Importantly, the analysis reveals that market liquidity (TR) exerts a negative indirect effect in the CDI–VL pathway, with a coefficient of $\beta = -0.06$. This suggests a suppressing effect, whereby the inclusion of TR in the model reduces the observable positive impact of CDI on VL. Such suppression implies that in high-liquidity environments, the intended signaling benefits of carbon disclosure may be diluted, potentially due to short-term trading behavior or misinterpretation by market participants.

The overall model fit is statistically acceptable, with key indicators falling within recommended thresholds:

- Comparative Fit Index (CFI): 0.978
- Tucker–Lewis Index (TLI): 0.967
- Root Mean Square Error of Approximation (RMSEA): 0.038

These values indicate that the proposed model provides a good representation of the observed data structure. Figure 1 illustrates the full SEM path diagram with standardized estimates. Bootstrap tests with 10,000 samples confirm the statistical significance of the mediation and suppression effects.

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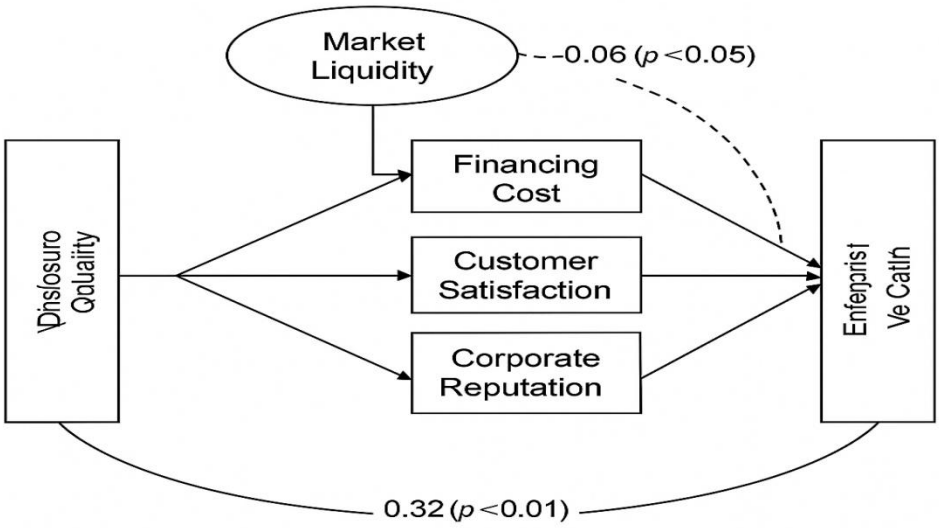

Figure 2. SEM Path Diagram with Standardized Estimates

Note: Standardized estimates from SEM analysis based on 277 firms

Table 2. Model Fit Indices for SEM Analysis

Fit Index	Value	Threshold
Chi-square/df	1.87	< 3.00
CFI (Comparative Fit Index)	0.978	≥ 0.95
TLI (Tucker–Lewis Index)	0.967	≥ 0.95
RMSEA (Root Mean Square Error of Approximation)	0.038	≤ 0.05
SRMR (Standardized Root Mean Square Residual)	0.041	≤ 0.08

Table 3. Bootstrap Results for Mediation and Suppression Effects

Path	Effect Size (β)	95% CI	Significance
CDI → CR → VL	0.09	[0.04, 0.15]	Significant
CDI → CEF → VL	0.07	[0.02, 0.13]	Significant
CDI → CS → VL	0.08	[0.03, 0.14]	Significant
CDI → TR → VL	−0.06	[−0.11, −0.01]	Significant (Suppression)

DISCUSSION

The findings of this study contribute to the growing body of ESG research by uncovering a nuanced and previously underexplored mechanism in the CDI–VL relationship: the suppressing effect of market liquidity (TR). While the direct path from Carbon Disclosure Quality (CDI) to Enterprise Value Creation (VL) is strong and positive, the negative indirect effect through TR reveals that the overall impact of CDI can be undermined by investor behavior in high-liquidity markets.

These findings resonate with growing concerns in the sustainable finance field about the unintended consequences of high-frequency trading and ESG information saturation. For instance, in 2023, several Chinese

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A-share companies in the industrial and manufacturing sectors experienced significant ESG rating fluctuations by MSCI despite consistent or improved disclosure efforts. This inconsistency, partly driven by algorithmic updates and lack of context-specific interpretation, highlights how ESG ratings may amplify rather than reduce investor confusion under high market liquidity.

On the regulatory side, the China Securities Regulatory Commission (CSRC) released a series of ESG disclosure guidelines in 2021 and 2022, including pilot schemes for voluntary ESG reporting in the STAR Market. However, due to the absence of unified disclosure templates and third-party verification requirements, many reports remain fragmented and symbolic. Such incomplete institutional frameworks may reinforce information overload and reduce the signaling efficacy of carbon disclosures.

These examples reinforce our argument that in transitional ESG environments, excessive market responsiveness and regulatory ambiguity may create a mismatch between a firm's sustainability efforts and market interpretation. This misalignment helps explain why market liquidity operates not as a value-enhancing mechanism but as a suppressor in the CDI–VL pathway.

This suppression may arise from several structural and behavioral factors. In emerging markets such as China, ESG frameworks are still developing, and investor understanding of environmental disclosures varies widely. In such contexts, high-frequency trading and short-term speculation can dominate investor decision-making, leading to underreaction to long-term sustainability signals. Rather than reinforcing the strategic value of CDI, high market liquidity may dilute or distort its intended message, reducing the market's ability to differentiate between symbolic and substantive disclosures.

Moreover, in high-emission industries, firms often face mounting pressure to disclose environmental data. However, over-disclosure, especially in the absence of clear regulatory standards, may result in information fatigue or stakeholder skepticism, where investors question the credibility or materiality of ESG claims. This paradox suggests that more disclosure is not always better, particularly when the market lacks the interpretive capacity to absorb and respond meaningfully.

These findings underscore the importance of aligning carbon disclosure practices with investor expectations, market structure, and regulatory clarity. They also highlight the need for targeted ESG education, investor engagement, and industry-specific guidance to ensure that CDI contributes effectively to sustainable value creation.

CONCLUSION AND IMPLICATIONS

This study advances ESG and carbon disclosure research by empirically identifying market liquidity (TR) as a suppressor in the relationship between Carbon Disclosure Quality (CDI) and Enterprise Value Creation (VL). While CDI directly enhances firm value through improved transparency and accountability, the presence of a negative indirect pathway via TR reveals a hidden complexity in ESG signaling, particularly in emerging markets with evolving regulatory environments.

These findings contribute to the literature by introducing a dual-path framework in which CDI can simultaneously drive and be undermined in its impact on value creation. This nuanced mechanism reinforces the importance of considering market behavior, information asymmetry, and institutional maturity when evaluating the effectiveness of carbon disclosure strategies.

From a managerial perspective, firms should avoid excessive or ambiguous disclosure. Instead, they should focus on enhancing the clarity, materiality, and strategic relevance of their carbon information, ensuring that it aligns with investor expectations and sector-specific ESG risks. Integrating globally recognized frameworks such as GRI, CDP, and TCFD can support standardized and interpretable disclosure practices.

From a policy standpoint, regulators should recognize that higher disclosure quantity does not automatically lead to better market outcomes. To mitigate misinterpretation and information fatigue, targeted guidance, industry-specific standards, and incentive mechanisms should be developed to promote effective, not just extensive, carbon disclosure.

In summary, this study highlights the need to balance disclosure depth and market absorption capacity, ensuring that ESG transparency fulfills its purpose as a signal for long-term sustainable value rather than becoming noise in highly liquid or under-informed markets.

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LIMITATIONS AND FUTURE RESEARCH

While this study provides novel insights into the suppressing role of market liquidity in the CDI–VL relationship, several limitations should be acknowledged. First, the sample is limited to high-emission industries in China, which may constrain the generalizability of the findings to low-carbon sectors or service-oriented firms. Future studies could explore cross-industry comparisons to assess whether the observed suppression effect varies by sectoral characteristics such as regulatory exposure or investor composition.

Second, the study's focus on Chinese listed companies reflects the specific institutional context of an emerging market. The applicability of the findings to mature capital markets with more standardized ESG practices—such as those in the EU or North America—requires further investigation.

Finally, this study adopts a single-country design. Future research could conduct cross-national comparisons to examine how different ESG regulatory frameworks and market maturity levels influence the CDI–VL pathway, especially the mediating and suppressing roles of market-based mechanisms. Such comparative analyses would enhance the understanding of ESG signal transmission across diverse institutional environments.

AUTHOR NOTE

The author declares no conflict of interest. This research is part of the doctoral dissertation submitted to the Graduate School of Business at Siam University, Thailand.

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