

From Disclosure to Resilience: Climate-Risk Transmission Frictions in China's Corporate Bond Market

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Abstract

The paper examines why climate-related information does not consistently become a traceable signal in corporate bond prices, contracts, and secondary-market resilience. It defines transmission adequacy as the ability to connect a material exposure to the correct legal obligor, align it with the information date and financial horizon, document its treatment by credit intermediaries, and observe it in financing and stress-state indicators. A structured critical review of 49 verified academic and institutional sources, updated through 13 October 2026, organizes evidence around five links: disclosure, exposure measurement, pricing and contract design, credit intermediation, and market resilience. The synthesis identifies five corresponding frictions—legal-entity and asset-location mismatch, information-date and horizon misalignment, measurement non-comparability, absorption by ratings, guarantees and ownership, and limited price discovery in thinly traded bonds. For China, the article proposes Module 1, an issuer–emitter–bond map; Module 2, bond-relevant climate disclosure; Module 3, transparent intermediary treatment; Module 4, a climate-credit stress dashboard; and Module 5, pre-specified pilots and proportional scaling. These modules target traceability rather than an administratively imposed premium and are paired with burden safeguards, implementation metrics and failure interpretations.

Keywords: climate risk; corporate bonds; information disclosure; credit intermediation; market liquidity; China

JEL classifications: G12; G18; G32; Q54; Q58

1. Introduction

Climate risk can enter debt markets through expected cash flows, default probability, collateral values, refinancing capacity, risk appetite and market liquidity. Yet the empirical record does not deliver one stable climate premium (Giglio et al., 2021). Physical exposure is associated with municipal and corporate borrowing costs in several settings, but its magnitude depends on geography, maturity and adaptation capacity (Painter, 2020; Goldsmith-Pinkham et al., 2023; He et al., 2025). Carbon and transition measures are priced in some equity and bond samples, while other studies find that governance commitments or disclosure quality matter more than measured carbon exposure itself (Bolton & Kacperczyk, 2021, 2023; Lemma et al., 2021; Dong et al., 2026). Contract outcomes can move in a different direction from prices, and recent evidence shows that emissions can be associated with secondary spreads but not primary spreads (Ginglinger & Moreau, 2023; Goodell et al., 2025; Kim & Pouget, 2026).

A common response is to search for a better proxy or a more favorable specification. That approach mistakes an institutional question for a coefficient-selection problem. A risk can be economically material and still fail to appear as a uniform average premium when the legal obligor is not the measured entity, the disclosed information was unavailable at the decision date, the horizon of the exposure is longer than the bond, guarantees or implicit support absorb the signal, or trading is too sparse to reveal stress through transactions. Conversely, a significant association can reflect disclosure salience, regional conditions, issuer selection or liquidity rather than a structural default premium. The relevant policy question is therefore not simply whether climate risk is priced. It is whether the market's transmission chain is adequate for investors, intermediaries and supervisors to trace material climate information into credit decisions and stress monitoring.

The paper develops the concept of transmission adequacy. A climate-risk governance system is adequate when information can be traced from an operating exposure to the correct legal obligor, aligned to the information date and financial horizon, translated into a documented credit judgment, and observed in both financing terms and stress-state market indicators. This definition avoids two symmetric errors. It does not equate an insignificant mean coefficient with policy failure or economic irrelevance. It also does not treat any positive climate coefficient as proof of efficient risk pricing. Instead, it asks which link generated, transformed, absorbed or obscured the signal.

A concrete information-timing error illustrates the framework. China's 2025 national carbon-market expansion notice was dated 20 March but publicly released on 26 March. Treating bonds priced during the intervening days as already exposed violates the market's information set. Similar errors arise when a listed parent is substituted for a bond obligor or a registered office for operating assets. Transmission adequacy makes these lineage choices observable rather than burying them inside a risk score.

The contribution is threefold. First, the paper reorganizes a fragmented literature around a five-stage chain—disclosure, measurement, pricing and contract design, credit intermediation, and market resilience—rather than around isolated risk proxies. Second, it uses this chain to diagnose China-specific frictions, including listed-company versus bond-obligor mismatches, changing emissions-trading scope, concentrated bond ownership, and the distinction between timely disclosure and decision-useful disclosure. Third, it converts the diagnosis into a sequenced policy architecture with measurable implementation indicators, burden safeguards and failure interpretations. The objective is not to direct prices. It is to improve the informational and institutional conditions under which market participants can form defensible prices and contracts.

The remainder proceeds as follows. Section 2 explains the structured review method. Section 3 distinguishes risk measurement from risk transmission. Sections 4 and 5 synthesize the evidence and diagnose the five frictions. Section 6 develops the China-specific institutional assessment. Section 7 proposes a staged policy architecture and evaluation design. Section 8 presents a research agenda, and Section 9 concludes.

2. Review method and scope

The article uses a structured critical review rather than a meta-analysis. The empirical literature combines different risk constructs, markets, horizons, outcomes and identification strategies; pooling coefficients would give a false impression that each study estimates the same object. The review instead codes what information enters each study, how it is aligned to the issuer and decision date, which market margin is observed, and which institutional condition mediates the result.

Unlike broad climate-finance reviews such as Giglio et al. (2021), this article does not attempt to survey every climate-related financial market. It narrows the unit of synthesis to the operational links and frictions through which climate information can reach corporate bond prices, contracts, credit intermediation and stress-state resilience.

The core literature searches covered January 2000 through 4 September 2026; targeted literature and official-policy updates were completed on 13 October 2026. Core searches combined climate, physical risk, transition risk, carbon exposure, emissions trading and climate disclosure with corporate bonds, credit spreads, issuance, maturity, liquidity, volatility, tail risk, ratings, guarantees and China. Platform families were publisher sites and DOI/Crossref-style discovery, broad scholarly search, SSRN and NBER working-paper discovery, official Chinese regulatory and market-infrastructure sites, and official IFRS, BIS, European Commission and U.S. SEC sites. Backward checking began from major reviews and highly relevant bond studies. English- and Chinese-language items were eligible.

Academic studies were included when they examined corporate or municipal debt directly, or when a capital-market, disclosure, measurement or intermediary mechanism was portable to bond markets. Institutional items were included only when issued by the responsible authority or standard setter and material to disclosure, ETS scope, bond reporting, liquidity or supervisory design. Items were excluded when they were commentary without an identifiable method or rule, duplicates, unverifiable bibliographic records, purely technical climate-science papers without a finance channel, or studies whose only connection was a generic ESG label. Each included item was coded for market, period, risk dimension, transmission link, method, main finding, friction and policy relevance.

The initial evidence freeze on 12 August contained 26 items. A targeted update and full citation cross-check on 13 August added eleven items. A standards update on 4 September incorporated China's climate-specific disclosure standard issued in December 2025 and the ISSB's targeted IFRS S2 amendments issued in December 2025, producing 40 verified sources: 28 academic and 12 institutional. A targeted refresh on 13 October added three academic studies directly relevant to Chinese bond pricing and disclosure, alongside three authoritative institutional documents covering the Climate Standard application-guide consultation, the 2026 national carbon-market progress report and the 2026 ETS work notice. The coded evidence set therefore contains 49 sources (34 academic and 15 institutional). Three directly relevant studies by the authors are coded under the same inclusion rules: one published article on rating sorting and two SSRN working papers on measurement transport and transaction continuity. The working-paper status is identified in the references; their results are treated as provisional research evidence, not as peer-reviewed findings. The refresh was targeted rather than an exhaustive search of all research published after 4 September. The exploratory first-stage search did not preserve search-result hit counts, so the review does not reconstruct a retrospective PRISMA funnel. This is a structured, non-exhaustive critical review rather than a systematic review claiming complete retrieval. That boundary limits conclusions about literature prevalence but does not prevent transparent mechanism coding. Table 1 summarizes the coding dimensions, and Appendix A reports the review update trail and source-count changes.

The synthesis follows three rules. First, positive and null estimates are not counted as votes. Second, causal language is retained only when the design supports it; otherwise findings are described as associations. Third, official dates are coded according to the information set available to market participants. For example, the 2025 national carbon-market expansion is dated to its public release on 26 March rather than the document's internal signature date. The same discipline applies to annual-report announcement dates, ETS control years and compliance deadlines.

Verified means that the DOI or official URL resolves, the title and authors or issuing body match the authoritative record, the outlet and date match, and the coded finding has been checked against the abstract or official text. Recent 2024–2026 items received the same checks. Verification is bibliographic and interpretive quality control; it is not an endorsement of every empirical design or result.

Table 1. Evidence-coding framework

Review dimension	Coding question	Reason
Entity	Is exposure measured for the legal obligor, parent, subsidiary or operating asset?	Creditors hold a claim on a legal entity; group-level exposure is not automatically the obligor's exposure.
Time	Was the information public before pricing, rating or trading?	Using subsequently released information creates look-ahead bias.
Horizon	Does the exposure horizon match the bond and financial-planning horizon?	Long-horizon hazards need not affect short-dated debt in the same way.
Outcome	Is the study measuring price, access, size, maturity, covenant, liquidity or tail loss?	Climate risk can move different financing margins in different directions.
Intermediation	Do ratings, guarantees, ownership or underwriters transmit or absorb the signal?	Observed bond terms are reduced-form outcomes of multiple institutions.
Market state	Is the effect estimated in ordinary conditions or stress states?	Liquidity and credit interactions can strengthen during market stress.

3. From risk measurement to transmission adequacy

3.1 Three risk dimensions are not interchangeable

Physical, transition and perceived climate risk describe different objects. Physical metrics estimate exposure to hazards such as heat, precipitation, flooding or sea-level rise. Transition metrics capture policy, technology, carbon cost and demand shifts. Perception measures use disclosure or news to capture what managers and investors discuss. A headquarters weather index, an ETS coverage indicator and a climate-risk text count are therefore not alternative measurements of one latent variable. They can move independently and can enter credit decisions through different horizons and channels.

Granular establishment geocoding shows why geography must be tested rather than assumed: Addoum et al. (2020) combine daily temperature with establishment locations but find no significant average effect on establishment sales or productivity. The study therefore supports measurement at operating locations while also warning against presuming a nonzero average response. Municipal-bond research likewise shows that geographic exposure interacts with maturity and local capacity (Painter, 2020; Goldsmith-Pinkham et al., 2023). Text measures can add firm-level, time-varying information, but they require human and outcome validation and should distinguish physical, regulatory and opportunity exposure (Sautner et al., 2023). Direct legal coverage by an emissions-trading system is narrower than a high-carbon industry label, while a carbon-gap measure can capture broad forward transition pressure beyond current compliance obligations (Dong et al., 2026). More climate language can reveal risk, signal governance, or constitute imprecise ‘cheap talk’; these interpretations cannot be separated by word counts alone (Bingler et al., 2024).

3.2 Pricing is only one transmission margin

Corporate debt adjusts along multiple margins: whether firms issue, how much they raise, the maturity and covenant structure, the choice between bonds and loans, ratings and guarantees, and secondary-market liquidity. Ginglinger and Moreau (2023) connect physical risk to leverage through both borrower demand and lender supply. Lemma et al. (2021) find that climate commitment is associated with longer maturity even when carbon exposure does not have a robust debt-policy association. Goodell et al. (2025) report nonlinear maturity

responses that vary across firms and legal settings. These results caution against reading a stable price coefficient as necessary or sufficient evidence of risk transmission.

The same logic applies within bond markets. Coupon-minus-curve measures, secondary-market spreads and transaction returns are different reduced-form outcomes. Primary pricing reflects bookbuilding, underwriting competition, allocation and cross-subsidization as well as expected loss. Secondary spreads mix credit, liquidity and benchmark components. Kim and Pouget (2026) directly show why the distinction matters: carbon emissions are associated with secondary-market spreads in their setting but not primary spreads, with underwriting reputation conditioning the gap. Contract design can also absorb a risk through shorter maturity, lower volume or stronger protection before a large spread appears. A complete assessment therefore requires a vector of price, quantity, contract and resilience outcomes.

3.3 Transmission adequacy

Transmission adequacy is a process property. It does not require climate risk to increase every yield. Adaptation, credible transition plans, insurance, guarantees or policy support can reduce expected loss. Adequacy instead requires four forms of traceability: the measured exposure belongs to the obligor or is transparently attributed; the information predates the decision; the risk horizon and uncertainty are explicit; and intermediaries document how the information affects residual credit risk. A fifth requirement is observability during stress, when liquidity and refinancing constraints can amplify otherwise modest average effects.

Table 2. Five-stage climate-risk transmission framework

Link	Required function	Core friction	Observable diagnostic	Policy objective
Disclosure	Timely, comparable and financially connected information	Narrative volume is disconnected from exposure and financial effects	Timeliness; financial linkage; comparability	Make information decision-useful, not merely longer
Measurement	Map exposure to the legal obligor and material operating assets	Parent–subsidiary mismatch, registered-address proxies and broad sector labels	Entity, asset and scope coverage	Distinguish direct obligations from value-chain exposure
Pricing and contract	Reflect material risk across price and non-price terms	Selection, benchmark noise and contract substitution	Price, access and contract margins	Use consistent outcome and benchmark definitions
Credit intermediation	Translate information into documented credit judgment	Stale ratings, guarantees and implicit support can mask obligor exposure	Documented credit channel	Explain judgments without mechanical rating penalties
Resilience	Reveal liquidity and loss absorption in stress states	Thin trading and concentrated holders weaken transaction discovery	Liquidity and tail observability	Monitor state-contingent fragility and refinancing stress

4. What the evidence says—and does not say

4.1 Physical risk: exposure precision and financial capacity

Physical-risk evidence is strongest when geography and cash-flow channels are well aligned. Painter (2020) and Goldsmith-Pinkham et al. (2023) show that sea-level exposure can enter municipal yields, but the

effect varies with maturity and local conditions. He et al. (2025), using 30,087 Chinese bond-month observations, associate physical climate risk with wider corporate bond spreads through weaker internal cash flow and tighter external financing. These findings are economically coherent, but they do not validate every geographic proxy. A registered-address measure can combine hazard exposure with regional development, fiscal conditions and credit quality. The policy implication is not to discard physical metrics; it is to record asset coverage, mapping uncertainty and adaptation capacity.

4.2 Transition risk: legal scope, expectations and policy timing

Transition risk can enter markets before a direct carbon cash cost is material. Carbon pricing, technology, demand and future regulation alter expectations about cash flow and default risk. Global equity evidence documents carbon-transition premia (Bolton & Kacperczyk, 2021, 2023), while recent Chinese bond evidence associates carbon-gap and firm-level climate-policy-uncertainty measures with spreads, liquidity and non-price terms (Dong et al., 2026; Zhao et al., 2026). Yet broad transition exposure and direct ETS obligations remain distinct. The latter requires legal-entity matching, covered activity and event-time accuracy. Treating every power producer as fossil generation or using a document signature date before public release creates classification error precisely where the identification is supposed to be strongest. A recent China green-bond study further reports that greater climate-policy uncertainty is associated with lower corporate green-bond issuance costs, alongside stronger enforcement and investor attention (Lai et al., 2026). Because this result concerns labelled green-bond issuance, it should not be generalized to conventional corporate bonds or interpreted as a uniform climate-risk discount.

China's national carbon market illustrates why one policy date is insufficient. Public identification of a covered sector, formal release, the first control year, allowance allocation rules and compliance deadlines convey different information. The 2025 expansion notice for steel, cement and aluminium was publicly released on 26 March, although the document was dated 20 March (Ministry of Ecology and Environment, 2025). A credible bond-market analysis must preserve that difference and must distinguish formal inclusion from quantified stringency. Environmental-violation evidence further shows that concrete compliance events can affect corporate bond costs through refinancing risk (Ma et al., 2022). For governance, the same data lineage should be available to investors rather than reconstructed separately by each researcher or institution.

4.3 Disclosure: salience, comparability and financial connection

Disclosure can reduce uncertainty, reveal bad news, signal governance or amplify risk salience. Liu et al. (2026) find that climate information disclosure strengthens the association between climate risk and Chinese issuance spreads, while high-reputation underwriters mitigate the effect. In contrast, Xiang and Gong (2026) report that a TCFD-based disclosure measure is associated with lower Chinese corporate bond spreads, which they attribute to reduced information asymmetry and credit risk. Ke and Xu (2026), using Chinese listed-company bonds, find a positive association between climate-risk disclosure and spreads, with stronger effects in several investor- and issuer-level conditions. These results are not direct replications: the disclosure constructs, sample periods, bond universes and outcomes differ. Together they indicate that disclosure can make latent risk more salient or make issuer quality more legible; its price effect depends on what is disclosed, how the signal is interpreted and which financing margin is measured. Ben-Amar et al. (2024) show that analyst benefits are concentrated where disclosed physical risks are financially material. Bingler et al. (2024) demonstrate the opposite concern: climate narratives can be imprecise and disconnected from actions and emissions. Corporate green-bond evidence similarly indicates that labels are more credible when external certification and issuer behavior align (Flammer, 2021). These studies reject the simple assumption that more disclosure automatically lowers financing costs.

Chinese evidence using annual-report text also associates firm-level climate-risk exposure with wider corporate bond spreads, illustrating the importance of reproducible text definitions and issuer matching (Cang & Li, 2024). The IFRS S2 architecture offers a useful benchmark (IFRS Foundation, 2023). It separates physical risks, transition risks, opportunities, emissions, capital deployment, internal carbon prices and governance-linked remuneration, and it asks for current and anticipated effects on financial position, performance and cash flows. Subsequent ISSB educational material explains proportionality relief when quantitative effects are not separately identifiable or cannot be estimated without undue cost or effort (IFRS Foundation, 2025). The design lesson is to improve financial connectivity and comparability while retaining a transparent uncertainty channel—not to require spurious precision.

4.4 Liquidity and stress: why average pricing may be incomplete

Corporate bond liquidity is an independent transmission channel. Chen and Jiang (2021) find low liquidity in China but a relatively small estimated liquidity share of spreads in a pre-screened issuer market. Other Chinese evidence finds that multidimensional liquidity and credit-risk interactions are priced and strengthen during crisis conditions (Wu et al., 2022). The apparent tension is informative: low trading frequency, evaluated prices and institutional screening can weaken the relationship between transaction-based liquidity and average spread levels even while liquidity-credit amplification emerges under stress.

Climate-news innovations can also be priced as hedging states rather than as a uniform average spread premium (Huynh & Xia, 2021). Official market statistics reinforce the broader resilience diagnosis. For nonfinancial-enterprise debt-financing instruments in the interbank market at the end of November 2023—not the full universe of exchange and interbank credit bonds—the median number of holders per instrument was 12; 88% of instruments had no more than 20 holders. The top 50 investors held 50.2% of the volume and accounted for 63.8% of trading (People’s Bank of China, 2023). These aggregate statistics are not a ready-made instrument-level dashboard and do not map one-for-one to every proposed field. They establish the relevance of holder concentration and sparse trading, which a dashboard would combine with evaluated yields, valuation-provider dispersion, zero-trading days, turnover, refinancing and collateral indicators.

5. Five transmission frictions

5.1 Legal-entity and asset-location friction

The first friction arises because climate exposure follows physical assets and regulated activities, whereas creditors hold claims on legal entities. Listed-company data are often assigned to bonds issued by parents, subsidiaries or finance vehicles. Group affiliation is economically relevant but does not erase legal priority, guarantees or ring-fencing. A defensible system must preserve the legal obligor, map controlled operating assets and record how guarantees transfer risk. For physical hazards, it should report what share of material assets is geographically covered. For transition risk, it should distinguish direct regulated installations from value-chain and sector exposure. A recent China-bond measurement audit shows why parent or city proxies need an explicit bridge to the legal issuer and observed bond outcome (Yang, 2026a).

5.2 Information-date and horizon friction

A report can be accurate and still be unusable for a prior financing decision. Bond analysis requires the announcement date, reporting period and availability of the exact document used. Policy analysis additionally requires public-release dates, control years and compliance deadlines. Horizon alignment is equally important. A five-year note may not respond to a distant hazard in the same way as a 20-year obligation, and a near-term compliance cost differs from a long-run technology transition. Disclosures should therefore distinguish short-, medium- and long-term financial effects and state the assumptions linking scenarios to cash flows.

5.3 Measurement comparability and uncertainty friction

Climate indicators combine observed quantities, modeled hazards, text, ratings and policy classifications. Comparability fails when units, boundaries, normalization and missing-data treatment are opaque. A practical taxonomy should record metric owner, methodology version, legal scope, asset coverage, reporting date, estimation uncertainty and whether a value is measured, estimated or imputed. Multiple metrics can be appropriate—as recognized by the Basel Committee’s disclosure framework (Basel Committee on Banking Supervision, 2025)—but users need to know their strengths and limitations. Model disagreement should be retained as information rather than averaged into a falsely precise score.

5.4 Credit-intermediation friction

Ratings, guarantees, ownership and underwriting determine how an exposure reaches bond terms. A strong guarantor can absorb obligor-specific climate risk; state ownership can alter expected support; a rating can lag new information; and underwriters can validate or discount disclosures. Institutional investors themselves report that climate risks are financially relevant but often prefer engagement and risk management to immediate divestment (Krueger et al., 2020). These mechanisms are not nuisance controls. They are transmission institutions. Policy should require a documented explanation when climate information is financially material, including the horizon, mitigants and residual uncertainty. It should not prescribe a rating downgrade or a spread direction, which would replace credit judgment with administrative pricing. Related evidence from China documents issuer-grade compression and debt-grade sorting, indicating that rating categories can preserve public-signal differentiation even when issuer grades cluster near the top (Yang, 2026c).

5.5 Thin-trading and tail-observability friction

When holder bases are concentrated and trades are sparse, an average observed yield may change slowly even as the market becomes fragile. A recent matched-event study of China’s exchange-traded corporate bonds finds no common deterioration in transaction continuity after localized extreme-heat and extreme-rain events in its selected sample, while showing that zero-trading days, price age and resumption time capture different aspects of market function (Yang, 2026b). Climate-news, abnormal-weather and disaster evidence shows that salience and local experience can shift attention and portfolios, making unconditional averages incomplete (Alok et al., 2020; Choi et al., 2020; Engle et al., 2020). Risk can appear as valuation disagreement, lower turnover, a jump in evaluated yields, withdrawal of bids, shorter refinancing horizons or increased reliance on guarantees. Tail monitoring therefore needs a state-contingent design. Normal-period regressions should be complemented by event windows, local projections, quantile models or scenario exercises when adequate data exist. When coverage is inadequate, the correct conclusion is that the effect is not measurable with the current infrastructure—not that the risk is absent.

6. Institutional diagnosis for China

China-specific empirical evidence has expanded but remains thinner than the global evidence base. The diagnosis in this section therefore combines a limited set of China-focused bond studies with official disclosure, ETS and market-structure records. It should be read as an evidence-informed institutional assessment, not as a claim that every proposed friction has already been separately identified in Chinese bond data.

6.1 Disclosure coverage is advancing faster than cross-market linkage

China has substantially strengthened listed-company sustainability reporting. The Shanghai Stock Exchange issued trial sustainability-report guidelines in April 2024 and implementation guidance in January

2025 (Shanghai Stock Exchange, 2024, 2025). Debt-market periodic reporting is also highly timely: NAFMII reported 99.80% on-time annual-report disclosure and 99.65% on-time first-quarter disclosure among covered entities for the relevant 2025 cycle (National Association of Financial Market Institutional Investors, 2025). These are important compliance achievements. Yet timeliness and volume do not guarantee that climate metrics are linked to the bond's legal obligor, financial effects, guarantee structure or maturity horizon.

The national framework has now moved beyond a generic ESG architecture. China issued Sustainability Disclosure Standards for Business Enterprises No. 1—Climate (Trial) in December 2025, following the 2024 Basic Standard (Ministry of Finance et al., 2025). The new standard creates a common climate-reporting reference, but it does not by itself solve bond-level legal-entity linkage or establish universal instrument-level disclosure. The equity and debt disclosure systems still begin from different regulatory objects. A listed parent may issue some debt directly while subsidiaries or affiliated entities issue other instruments. A climate report at the listed-group level can be valuable, but a bond investor also needs the obligor's position, upstream support and guarantee. Cross-market identifiers and consolidation bridges are therefore as important as another narrative section.

6.2 ETS expansion raises the value of legal-scope and event-time infrastructure

The national ETS expanded from fossil-fuel power generation to steel, cement and aluminium management in 2025. The reform creates a natural demand for issuer–emitter–bond linkage, but simplistic classifications are hazardous. Non-fossil generators should not be treated as covered fossil-power entities solely because their industry code says power. Conglomerates can have covered and uncovered activities. Policy documents also distinguish public release, control year, allocation and compliance. A common, versioned scope table would reduce duplicated manual classification and make both investment and policy evaluation more credible.

6.3 Market concentration makes resilience data a first-order issue

The interbank market is large, but size does not imply continuous instrument-level trading. The holder statistics cited above show that many nonfinancial debt instruments are owned by a small number of institutions. This structure can support relationship-based monitoring and stable holdings, yet it can also delay public price discovery and concentrate liquidity pressure. A climate-credit monitoring framework should therefore combine market prices with valuation and ownership diagnostics rather than importing a transaction-only template from a more liquid market.

7. Policy architecture and sequencing

The policy architecture rests on a simple rule: build traceability before attempting to infer or influence prices. This is now an implementation problem rather than a purely prospective disclosure proposal: China has a national climate standard, while the bond market still lacks a consistently observable bridge from that standard to the obligor, guarantee structure, maturity and secondary-market state. Each phase has a burden safeguard, an implementation indicator, a market outcome and a failure interpretation. This converts policy support from a list of desirable measures into an evaluable sequence.

Table 3. Policy sequence and evaluation design

Phase	Action	Burden safeguard	Implementation indicator	Outcome to evaluate
0. Baseline	Publish definitions, entity maps, public event dates and current coverage gaps	Use existing identifiers and filings before requesting new data	Share of live bonds with validated obligor and issuer–emitter linkage	Reduction in unmatched and ambiguous observations

Phase	Action	Burden safeguard	Implementation indicator	Outcome to evaluate
1. Disclosure	Add a bond-relevant climate schedule to covered reports	Phased thresholds and qualitative relief when quantitative effects are not supportable	Timeliness, metric completeness, assurance and financial-effect coverage	Analyst disagreement, issuance dispersion and extraction cost
2. Intermediation	Require ratings, guarantors and underwriters to explain material climate inputs	Explain judgments; do not mandate rating changes or a pricing direction	Reports documenting horizon, mitigants and residual uncertainty	Rating outlook, guarantee reliance and underwriting allocation
3. Stress monitoring	Construct a liquidity and climate-credit dashboard	Aggregate or anonymize sensitive holder data	Coverage of trades, evaluated yields, zero-trade days, valuation dispersion and concentration	Jump risk, tail spread widening and refinancing stress
4. Pilot evaluation	Pilot in exposed sectors with transparent comparison groups	Pre-register outcomes and review dates	Completeness, pre-trend balance and treatment support	Price, contract, access and stress-state outcomes
5. Scale	Scale modules that improve traceability or resilience	Proportionality by issuer size and measurement capability	Cost per usable field, error and restatement rates, market use	Lower information friction without impaired financing access

Note: A failure to observe a price response is not by itself a failed policy outcome. Each phase is evaluated first on whether it improves traceability, comparability or stress observability.

7.1 Module 1: issuer–emitter–bond linkage

The foundational module is a versioned crosswalk connecting bond code, legal obligor, listed parent, guarantor, controlled operating entities and regulated emissions installations. The crosswalk should record effective dates and confidence levels and should preserve rejected matches. For physical risk, an asset-location coverage field should state the proportion of material operations represented. For transition risk, direct legal coverage, broader value-chain exposure and scenario sensitivity should be separate fields. This infrastructure supports investors, rating agencies, researchers and supervisors without prescribing any valuation.

7.2 Module 2: financially connected climate disclosure

A bond-relevant climate schedule should focus on information that can enter credit analysis: material assets and locations; direct and indirect emissions boundaries; current obligations; short-, medium- and long-term risks; capital expenditure and adaptation; insurance and contractual protection; and current or anticipated effects on cash flow, assets, liabilities and financing. China's Climate Standard now provides a domestic implementation reference alongside IFRS S2 (International Sustainability Standards Board, 2025). The two standards make financial effects, scenario assumptions, governance, metrics and targets more central, but they also preserve the practical problem of measurement uncertainty and scope. IFRS S2's 2025 targeted amendments further illustrate that comparability must be balanced with implementation relief. Domestic bond-market implementation should therefore translate the Climate Standard into legal-obligor, maturity and refinancing fields rather than simply reproduce a longer sustainability narrative.

7.3 Module 3: transparent credit intermediation

Rating, guarantee and underwriting institutions should disclose how material climate information enters their process, not disclose proprietary model weights. A concise explanation can identify the horizon

considered, the exposure or scenario, mitigants, the role of a guarantor and the residual uncertainty. For a guaranteed bond, the analysis should distinguish obligor exposure from guarantor capacity and correlation. For state-owned issuers, analysts should separate operating risk from assumptions about support. Supervisory review should test consistency, not require a predetermined climate penalty.

7.4 Module 4: climate-credit stress dashboard

The dashboard should combine daily or monthly evaluated yields, transaction yields, zero-trading indicators, turnover, valuation-provider dispersion, holder concentration, rating outlooks, guarantee dependence, refinancing calendars and climate-policy or hazard events. The People's Bank of China statistics above provide an aggregate motivation for holder and trading indicators, not an instrument-level substitute for the dashboard. Aggregate views can be published while granular holder data remain protected. The objective is to detect when an exposure that is quiet in average pricing becomes material through valuation disagreement, liquidity withdrawal or refinancing concentration. Scenario exercises can compare ordinary conditions with policy-stringency, hazard and forced-sale states.

7.5 Module 5: pre-specified pilots and proportional scaling

Policy pilots should freeze exposure definitions, information dates, outcomes and minimum sample-support thresholds before analysis. The registration record should be publicly time-stamped and administered by a debt-market self-regulatory body or an independent academic repository that is institutionally separate from the evaluation outcome. Price, contract, access and stress outcomes should all be reported; null and adverse results should not trigger post hoc redesign. Scaling decisions should consider the cost per usable field, error rates, restatements, market use and financing-access effects. If a field produces compliance volume but little comparability, it should be redesigned. If a pilot lacks adequate treated entities or market observations, the correct response is to improve data or change the evaluation horizon, not to broaden treatment after seeing results.

7.6 Implementation cost, infrastructure reuse and international lessons

The architecture is not costless, and this article does not claim a numeric budget without an audited implementation study. Its sequencing nevertheless separates cost types. Module 1 requires the largest upfront coordination effort because legal entities, installations, bonds and effective dates must be reconciled, but it should impose little recurrent issuer burden when existing identifiers and official filings are reused. Module 2 creates incremental reporting and assurance costs and therefore needs phased thresholds and proportionality. Modules 3 and 4 mainly require standardized explanations and secure linkage of data already held by market participants or infrastructures; sensitive holder information should remain protected and only aggregates should be published. Pilot budgets should report staff time, vendor expense, usable fields, match errors, restatements and extraction-cost savings before scale-up.

International experience cautions against treating maximal disclosure as synonymous with durable implementation. The EU's CSRD and ESRS architecture advances connected risk-and-impact reporting, while the stop-the-clock directive, the December 2025 political agreement on simplification, and July 2026 delegated acts illustrate burden, timing and value-chain constraints (European Commission, 2026). The U.S. SEC's 2024 climate rule connected material risks to strategy, operations and financial condition. The Commission stayed the rule in April 2024 and voted in March 2025 to end its defense in the consolidated litigation, underscoring legal durability and implementation uncertainty (U.S. Securities and Exchange Commission, 2024, 2025). IFRS S2 offers a more interoperable baseline with proportionality relief. For China, the lesson is to preserve comparability and financial connectivity while phasing scope, reusing infrastructure, documenting cost and embedding review points.

8. Research and evaluation agenda

The framework generates testable questions rather than a single prediction. First, does legal-entity matching change estimated climate coefficients relative to parent-level or sector-level assignment? Second, do report-date and public-release-date alignment reduce apparent anticipation? Third, does financially connected disclosure reduce analyst or valuation disagreement even when mean spreads do not fall? Fourth, do guarantees and ratings absorb climate signals in normal periods but transmit them through outlooks, covenants or refinancing terms under stress? Fifth, does a combined transaction-and-valuation dashboard predict liquidity withdrawal better than turnover alone?

Empirical work should impose feasibility gates. A secondary-market tail study, for example, needs sufficient issuers with usable daily histories, enough genuine exposure changes, high coverage and nondegenerate outcomes. If these conditions are not met, sophisticated tail models cannot repair the design. Researchers should publish coverage tables, legal-entity quality controls, event-date lineage and minimum detectable effects. Where causal identification is weak, descriptive stress mapping can still be useful if its limits are explicit.

Evaluation should also distinguish process success from market outcomes. An identifier map can succeed by reducing ambiguous matches even before yields change. A disclosure module can succeed by increasing financial-effect coverage and reducing extraction costs without lowering borrowing costs. An intermediation module can succeed by producing consistent, auditable credit narratives. A stress dashboard can succeed by detecting valuation disagreement and refinancing concentrations. Only after these process links are operating should policymakers interpret the direction and magnitude of market-price responses.

9. Conclusion

The climate-bond debate is often framed too narrowly: either markets price climate risk or they do not. The evidence supports a more useful question. Climate signals pass through a chain of disclosure, measurement, financing choices, credit intermediaries and market liquidity. Each link can transmit, transform, absorb or obscure the signal. Conflicting estimates are therefore not merely an econometric inconvenience; they can reveal where information and institutions are misaligned.

For China, the next step is not to administratively manufacture a climate premium. It is to make material climate risk traceable to the correct obligor and assets, align information with decision dates and horizons, connect disclosure to financial effects, require transparent intermediary judgment, and observe liquidity and refinancing stress in a concentrated market. A sequenced architecture—identifier infrastructure, bond-relevant implementation of the Climate Standard, credit-intermediation transparency, stress monitoring and pre-specified pilots—can improve resilience while preserving proportionality and market judgment.

This approach also changes how policy evidence is read. A weak average price response need not mean that governance is unnecessary; it may indicate missing linkage, measurement or observability. A significant coefficient need not mean that the market is efficient; it may reflect salience, selection or stress. Transmission adequacy provides a stricter and more constructive standard: material risks should be traceable, comparable, documented in credit decisions and visible when they threaten financing capacity or market resilience.

9.1. Policy and evidence update through 13 October 2026

The policy environment has developed since the SSRN version posted in September. On 30 September 2026, the Ministry of Finance published a consultation draft of the application guide for China's Climate Standard No. 1 and nine industry guides covering electricity, steel, coal, oil, fertilizer, aluminium, hydrogen, cement and automobiles. The consultation deadline is 26 October 2026 (Ministry of Finance, 2026). These materials

provide more operational guidance for connecting climate matters to business activities and financial effects, and make sector-specific exposure mapping more feasible. They remain consultation drafts: they do not themselves establish a new mandatory reporting perimeter or effective date. The article's recommendations should therefore be read as a design proposal consistent with emerging guidance, not as a description of binding implementation requirements.

The Ministry of Ecology and Environment published the Progress Report of China's National Carbon Market (2026) on 20 September, following its release at the 15 September China Carbon Market Conference. The report is a current official source for the development of both the national emissions trading system and the voluntary emissions-reduction market. The 2026 ETS work notice also specifies 2025 compliance and allocation steps for power, steel, cement and aluminium-smelting entities, including a 31 December 2026 deadline for surrender of 2025 allowances. These developments strengthen the case for dated, legal-entity and installation-level exposure measures. They do not retroactively change the paper's literature synthesis or establish bond-pricing effects. (Ministry of Ecology and Environment, 2026a, 2026b). For any future bond-level study, the relevant treatment date must be the public release or applicable compliance date, and a sector label should not be treated as proof that a specific issuer or facility is covered.

9.2. Literature update through 13 October 2026

The targeted literature refresh adds three external studies that sharpen the review's central point about heterogeneous transmission. The review also codes three directly relevant studies by the authors, using the same source and relevance checks as for other work. Xiang and Gong (2026) link TCFD-based climate disclosure to lower corporate bond spreads through reduced information asymmetry and credit risk; Ke and Xu (2026) report higher spreads associated with climate-risk disclosure in a Chinese listed-bond sample; and Lai et al. (2026) find lower issuance costs under greater climate-policy uncertainty for Chinese corporate green bonds. The latter is a labelled-bond result, not evidence about the full conventional bond market. The authors' studies add evidence on measurement transport (Yang, 2026a), transaction continuity (Yang, 2026b), and rating compression and sorting (Yang, 2026c). These studies reinforce a conditional account: transparency can improve the quality of issuer information while also increasing the salience of downside exposure, and policy uncertainty can affect labelled issuance through enforcement and investor attention. They do not support a single direction of climate pricing. Their distinct samples, measures and outcomes are why this article synthesizes mechanisms instead of treating estimates as votes.

Yang (2026c) is coded as a companion empirical study in the evidence base, not as evidence generated by this review. The two SSRN papers are identified as working papers in both the text and references. This distinction matters: the updated rules and the companion studies improve context and traceability, but this manuscript remains a structured critical review rather than an original empirical paper.

Appendix A. Review protocol and update trail

Appendix A records the review update trail and the limits of the retrieval protocol. The exploratory first-stage search did not preserve hit counts, so no retrospective PRISMA funnel is reconstructed.

Table A1. Evidence-base update record

Stage	Date	Coverage and action	Included evidence
Initial freeze	12 Aug 2026	Mechanism-led searches, official-source retrieval and backward checking; source identity and coded findings verified	26 items: 18 academic, 8 institutional

Stage	Date	Coverage and action	Included evidence
Revision update	13 Aug 2026	Targeted searches for major reviews, measurement, investor behavior, primary-secondary differences and international implementation	11 added: 9 academic, 2 institutional
Final coded set	13 Aug 2026	Duplicates and unverifiable records excluded; every item assigned review stage, date added and verification basis	37 items: 27 academic, 10 institutional
Final standards update	4 Sep 2026	China Climate Standard No. 1 and ISSB IFRS S2 amendments added; text and policy implications rechecked	2 institutional items added; final coded set: 40 items (28 academic, 12 institutional)
Policy refresh	13 Oct 2026	Targeted verification of China's draft Climate Standard application guide and sector guides, 2026 national carbon-market progress report, and ETS work notice	3 institutional documents added; updated coded set: 43 items (28 academic, 15 institutional)
Literature and policy refresh	13 Oct 2026	Targeted update: three bond studies, three official updates and three related author studies coded	49 sources: 34 academic, 15 institutional

Note: The review is structured and non-exhaustive. It does not claim PRISMA-complete retrieval or estimate literature-wide effect prevalence.

Declarations

Author contributions (CRediT): Fuli Yang: Conceptualization, Methodology, Writing—original draft, and Project administration. Shiyu Lin: Investigation, Validation, and Writing—review and editing. Both authors reviewed and approved the final manuscript and accept responsibility for the work.

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Ethics approval: Not applicable. This structured review uses publicly available academic and institutional sources and involves no human participants, personal data, interventions or identifiable private information.

Data availability: This review generated no new dataset. The source list, screening criteria and review update trail are provided in the article.

Generative AI disclosure: OpenAI ChatGPT (GPT-5 and GPT-6) was used to assist with literature organization, drafting, language revision, consistency checks and document formatting. The authors selected and verified sources, determined the argument and policy recommendations, reviewed and revised all generated material, and assume full responsibility for the article. The October 2026 update added a targeted check of Chinese climate-disclosure implementation guidance and national carbon-market materials.

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