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Climate Risk and Finance: A Literature Review of Asset Pricing, Disclosure, and Climate-Policy Effects

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Abstract. Research conducted over the past five years from financial, accounting and economic perspectives has offered a clearer view of financial markets' treatment of climate risk. Today, transition and physical risks are being priced in equity, corporate bond, and option markets, and the differences in firm-level emissions are larger than the differences between countries. The U.S. carbon premium is in part an artifact of vendor-estimated emissions and is reduced when firm-disclosed emissions and environmental-concern shocks are considered. Mandatory climate disclosure cuts facility-level emissions through peer benchmarking, with the active channel running through public visibility rather than internal measurement. Institutional investors shape disclosure quality and subsequent emission paths, while ESG rating disagreement carries a separately priced uncertainty premium. Carbon pricing reduces firm emissions at an elasticity close to two, with sharp heterogeneity by financial constraint. Climate shocks propagate through global supplier-customer networks: customers terminate supplier relationships seven percentage points more often when realized exposure exceeds prior expectations. Private adaptation investment remains systematically below the social optimum because spillovers are unpriced. Three open questions concentrate on mandatory disclosure in emerging markets, anticipation effects from large-scale emissions-trading expansion, and the identification of adaptation distinct from mitigation in firm-level data.

Keywords: climate risk, carbon premium, ESG disclosure, emissions trading scheme, climate adaptation

1. Introduction

Climate risk has moved from a peripheral concern to a first-order pricing factor in empirical finance. But the most ambitious tests of whether markets price physical and transition risk have emerged only in the past five years. Three forces catalyzed this acceleration: proliferation of firm-level climate exposure measures, rollout of mandatory disclosure regimes (EU, UK, China, U.S.), and deployment of large policy instruments (ETS, PBoC refinancing tools). Together, they have transformed climate finance from a conceptual field into one producing credible causal estimates.

This review pursues three objectives. The research topic is post-2021 evidence on how markets price, disclose, and respond to climate risk, with attention to transportability to China. The purpose is to (i) synthesize credible identification strategies on climate risk premia, disclosure effects, and

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firm-level responses to carbon pricing; and (ii) convert this synthesis into a research agenda for emerging-market scholars. We focus on 2021–2025 contributions from 17 top journals, extracting 20 papers with novel identification or shaping frameworks. The significance is bridging a literature matured in advanced economies with the Chinese research community facing sharper policy shocks but lacking a consolidated design map.

2. Asset pricing of climate risk

The main issue of climate asset pricing is whether equity, debt or option markets impose a risk premium on carbon-intensive companies. The basic evidence is given by Bolton and Kacperczyk [1] for U.S. equities for the period of 2005–2017. The higher the Scope-1 emissions and the growth in emissions, the higher the stock returns, even after adjusting for standard risk factors, in what they read as a compensation for a type of transition risk that investors cannot diversify away. Bolton and Kacperczyk [2] expand the sample to include 14, 400 companies in 77 countries worldwide and find that the variation in how the carbon-transition factor is priced at the firm level is much larger than the variation at the country level.

However, there is disagreement about the interpretation. Pástor et al. [3] develop an equilibrium model with utility from green investments. In the steady state, the price of green stocks is below their fundamental value while the price of brown stocks is higher than their fundamental value, which reflects the taste based discount rates and not the systematic risk. Pástor et al. [4] test the model using realized German green-bond and U. S. green-stock returns and find that the recent green outperformance has resulted from unexpected positive shocks to environmental concern, not from higher expected returns. Zhang [5] gives the debate a boost: she demonstrates that the estimated carbon returns are positive in jurisdictions with strong climate policy, but are compressed or negative in markets that have had strong pro-climate concern shocks and that the U.S. carbon premium is mainly a measurement artifact of vendor-estimated emissions rather than firm-disclosed ones.

Beyond the level effect, climate risk shows up in tail and news pricing. Ilhan et al. [6] use option-implied tails to demonstrate that carbon-intense firms face higher downside risk pricing, with the premium widening when local climate policy uncertainty rises. Huynh and Xia [7] construct a climate news index and show that corporate bonds whose returns covary positively with adverse climate news earn lower expected returns, consistent with investors paying a premium for climate-hedging cash flows. Hsu et al. [8] push the cross-section to local environmental risks and document a pollution premium of 4.4% per year on within-industry portfolios sorted by toxic-emission intensity, with the spread driven by environmental-regulation regime risk.

Physical climate risk has been progressively integrated into asset-pricing tests. Goldsmith-Pinkham et al. [9] use the U.S. municipal bond market to show that issuers most exposed to sea-level rise pay higher long-maturity spreads even after controlling for default risk, indicating that bond investors discount climate-vulnerable cash flows. Three strong conclusions can be drawn from this collection of research: the cross-section of returns shows both the transition risk and physical risk; the size of the pricing is systematically related to the institutional and policy setting; and the measure used for emissions and exposure matters when it comes to detecting the presence of premia. These three facts also summarize the next section: each suggests one of the three forces outlined in the introduction, and the next three subsections describe how the literature has, in turn, clarified each of the three channels of measurement, disclosure and policy.

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3. Empirical evidence across exposure, disclosure, and policy channels

Each of the three forces highlighted in the introduction has generated its own research frontier. We review them in the same order, mapping force one (firm-level exposure measurement) onto Section 3.1, force two (mandatory disclosure and investor stewardship) onto Section 3.2, and force three (large policy instruments) onto Section 3.3. The unifying thread is that the credibility of climate-finance evidence now rests jointly on how exposure is measured, what firms are required to disclose, and which policy instruments are activated.

3.1. Firm-level climate exposure and ESG measurement

Asset-pricing tests are only as good as their exposure measures. Sautner et al. [10] construct the most widely used firm-level climate exposure index by extracting climate-related bigrams from quarterly earnings-call transcripts of over 10,000 firms. They separate physical, regulatory, and opportunity subindices, and show that each correlates with stock-return betas to climate news, capital-expenditure responses, and patenting in green technologies. This measurement has since become the industry standard and has spawned dozens of cross-country replications [10].

Yet alternative measures, particularly third-party ESG and carbon ratings, introduce substantial noise. Berg et al. [11] compare six major ESG raters and decompose the divergence into measurement (56%), scope (38%), and weighting (6%) components. Average pairwise correlations across raters of only 0.38 to 0.71 imply that empirical estimates of ESG-return relations can flip sign depending on which provider is used. Avramov et al. [12] translate this insight into pricing implications. In an equilibrium model with ESG-rating uncertainty, investors require a higher equity premium for stocks whose ESG profile is uncertain, ESG market betas rise mechanically with uncertainty, and the empirical relation between ESG and alpha attenuates. Their empirics, using the cross-rater standard deviation as a proxy for uncertainty, confirm both predictions.

Lessons are very focused. Firstly, estimates of emissions made by vendors are noisy, and the choice of vendor can influence headline results, including ESG scores. Second, if uncertainty about the fundamental ESG profile is part of the state, then traditional regressions of returns on ESG scores are misspecified. Third, measures based on text that are directly derived from corporate disclosures give a more precise, story-level signal which can be replicated by researchers. All of these innovations point to a sequencing of empirical research: use firm-reported exposure from primary data sources if possible, use commercial ESG scores if feasible, report exposure using multiple ESG providers and across uncertainty bins, and view the discrepancy between firm disclosure and vendor estimates as information, not nuisance variation.

3.2. Disclosure, investor stewardship, and real effects

The most policy relevant testing ground in the climate-finance literature is mandatory climate disclosure. Tomar [13] examines the U.S. Greenhouse Gas Reporting Program and determines that this mandatory disclosure plus peer benchmarking leads to a 7.9% reduction in emissions at the facility level. He demonstrates that facilities that were already conducting internal emission measurements prior to the program changed only because they were publicly disclosed and made public in the program, thereby exposing peer comparisons. Disclosure is about making what the managers don't know known to the shareholders and competitors.

Cohen et al. [14] pose the question of does the institutional investor exert influence upon disclosure decisions? With CDP responses, they demonstrate that companies with institutional

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investors that are also climate active are more likely to disclose their carbon emissions and, once they disclose, to have lower emissions going forward. So institutional stewardship is intended to complement, not supplant, compulsory regimes. The third leg of the triangle is described by Ilhan et al. [15] – institutional investors actually demand climate-risk disclosure from firms in their portfolios, especially, and with more intensity, if firms are large, long-horizon, and ESG-oriented, and depending on the salience of climate in public events.

Financing decisions are influenced by real effects from disclosure. The benchmark test for corporate green bonds is done by Flammer [16]. Cumulative abnormal returns are around 0.5% at an event that announces a corporate green-bond issue, and there are stronger reactions for first-time issuers and for bonds that are third-party certified. Issuers show measurable improvements in environmental performance after green bonds are issued and are able to attract long-term, green investors, suggesting that green bonds have commitment value and not just a "green label". Investors' expectations are also a state variable. Stroebel and Wurgler [17] survey 861 finance academics, regulators, and practitioners, and elicit that regulatory risk is the primary concern in the near term while physical risk is the primary concern in the long term; all respondents agree that equity prices understate the climate risk.

These three messages can be gleaned from the disclosure and stewardship literature as a whole, and are pertinent for researchers of emerging markets. When mandatory disclosure rules impose real effects, they do more than simply increase the information set; they have measurable real effects through the process of peer comparison. Marginal investor in disclosure-treated firms is different from the marginal investor in the market and thus heterogeneity is important both for pricing and stewardship. The disclosure quality and institutional ownership is endogenous and must be modeled simultaneously in regimes like China where the disclosure intensity as well as the ownership structure changes at the same time.

3.3. Policy shocks, real effects, and climate adaptation

Carbon pricing has progressed from theory to identification frontier. Martinsson et al. [18] use a long panel of firm-level emissions to estimate the price elasticity of CO2 emissions to be around 2, while they find significant heterogeneity between subsectors and between firm-level financial conditions and the elasticity of the emissions. That is because they estimate that 2015 manufacturing emissions in Sweden would have been about 30% higher without the carbon tax. The paper is remarkable in several respects: it demonstrates a very precise policy-rate change, using differential exposure between emitting firms, and it is the first to document abatements by emitting firms in the context of an increase in prices.

Pankratz and Schiller [19] are the first to study the transmission of climate shocks at scale by matching supplier-customer linkages to heat and flood exposure at supplier locations. They demonstrate that ex post exposure greater than the ex ante exposure increases the likelihood of a customer leaving a supplier by 7%, while replacement suppliers have lower expected exposure. The effect strengthens with signal repetition and weakens with country-level adaptation infrastructure. Climate risk therefore propagates through the production network, not just through direct firm-level damage.

The macro side of adaptation has received less attention but is developing quickly. Fried [20] builds a quantitative spatial macro model of coastal adaptation, comparing the welfare effects of seawalls (collective, durable, capital-intensive defenses) and stilts (private, marginal, fragmented investments). She shows that decentralized adaptation choices are systematically too low because coastal property owners do not internalize spillovers, and that the welfare cost of inaction rises

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super-linearly with sea-level rise expectations. Private adaptation investments observed in micro data are therefore likely under-provided and should be analyzed jointly with public adaptation infrastructure.

Taken together, these three papers deliver a stylized adaptation calculus. Carbon prices reduce emissions when they bind and are properly designed. Supply chains amplify and propagate climate shocks. Private adaptation responses are insufficient absent coordination. The remaining empirical gap, even in advanced economies, is to quantify which firms actually invest in adaptation rather than merely disclose intent. Recent industry reviews show that fewer than half of large global firms reference adaptation actions in disclosures, and adaptation capital expenditure is dwarfed by mitigation capex. Whether this reflects a measurement problem (adaptation is hidden inside maintenance budgets), a real underinvestment problem (consistent with the Fried [20] externality story), or a disclosure problem (firms hide adaptation to avoid drawing attention to exposure) remains open.

4. Open questions and implications for Chinese-context research

Three gaps motivate the empirical agenda we pursue. First, although Sautner et al. [10] and others have established firm-level exposure as a central variable, no published paper has used the post-2024 Chinese mandatory sustainability-disclosure rollout as a setting to test the cost-of-capital implications of disclosure. Given the regulation's sharp index-based threshold (SSE 180, SZSE 100, dual-listed firms) and its 2026 financial year, mandatory implementation, the Chinese setting offers a regression-discontinuity opportunity unavailable in the U.S. or EU disclosure rollouts [13-15]. Second, the November 2025 expansion of the Chinese national emissions trading system to cement, steel, and aluminum, covering an additional 1,500 firms, provides a setting in which to study anticipation and announcement effects analogous to those documented by Martinsson et al. [18] but at a scale and pace unparalleled in advanced-economy carbon pricing. The phased entry generates staggered difference-in-differences opportunities and continuous-treatment intensity from firm-level shadow prices. Third, supply-chain transmission of climate shocks [19] and adaptation provision [20] have been studied almost exclusively in U.S. and European settings. The Chinese listed-firm landscape offers an exceptionally rich combination of granular supplier-customer disclosure, satellite-level climate data, and centrally coordinated adaptation policy. It is an institutional setting in which the rigorous identification strategies pioneered in this literature can be transported with potentially cleaner inference.

5. Conclusion

This review set out to do three things: identify the post-2021 empirical and theoretical frontier in climate finance; consolidate what is now credibly known across the asset-pricing,disclosure, and policy channels; and convert that synthesis into a concrete research agenda for emerging-market scholars, with particular focus on China.

The three objectives are largely met. On the asset-pricing side, we conclude that transition and physical risks are priced across equities, corporate bonds, options, and municipal debt, but that the magnitude of the premium is jointly determined by jurisdictional policy stringency and by the measurement choice between vendor-estimated and firm-disclosed emissions. From a disclosure perspective, the main avenue of actual emission reductions from mandatory regimes is peer benchmarking and public visibility, with institutional investors complementing rather than replacing mandatory regimes. On the policy side, carbon pricing works with a firm elasticity of close to two,

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supply chains spread climate shocks across borders, and decentralized adaptation is systematically under-provided compared to the social optimum. Together with the findings of this study, these conclusions directly address the questions raised in the introduction and support the idea of considering climate risk as a first order pricing factor and not a fringe issue.

There are three restrictions that should be expressed in particular. First, the analytical perspective taken is one-sided: we look at the empirical-finance understanding of climate risks and do not delve into the parallel literatures on environmental economics, integrated-assessment macro modelling, or sustainable corporate finance from the management-science perspective. Second, the authors are careful to limit the breadth of the citation base to a select 20 papers from 17 journals over five years here, even within the confines of "empirical finance," coverage is illustrative rather than exhaustive, and sub-themes like biodiversity finance, transition planning, and climate-related credit risk are only sparsely referenced. Third, because the review is qualitative and selective, it cannot deliver meta-analytic point estimates or formal heterogeneity tests.

These limitations point directly to what we plan to do next. First, we intend to operationalize China's mandatory-disclosure regression-discontinuity design, which includes a pre-specified cost-of-capital test and a clean comparison to other studies. Second, we plan to track the staggered cement, steel, and aluminum sectors into China's national ETS as a continuous-treatment event study while adjusting for anticipated effects. Third, we aim to construct a firm-level Chinese adaptation index by combining supplier-customer disclosure data with satellite-derived physical-exposure measures, in order to address the identification of adaptation distinct from mitigation that remains open even in advanced-economy data.

References

[1] Bolton, P. and Kacperczyk, M. (2021) Do investors care about carbon risk? Journal of Financial Economics 142(2): 517–549.
[2] Bolton, P. and Kacperczyk, M. (2023) Global pricing of carbon-transition risk. Journal of Finance, 78(6): 3677–3754.
[3] Pástor, L., Stambaugh, R.F. and Taylor, L.A. (2021) Sustainable investing in equilibrium. Journal of Financial Economics, 142(2): 550–571.
[4] Pástor, L., Stambaugh, R.F. and Taylor, L.A. (2022) Dissecting green returns. Journal of Financial Economics, 146(2): 403–424.
[5] Zhang, S.J. (2025) Carbon returns across the globe. Journal of Finance, 80(1): 615–645.
[6] Ilhan, E., Sautner, Z. and Vilkov, G. (2021) Carbon tail risk. Review of Financial Studies, 34(3): 1540–1571.
[7] Huynh, T.D. and Ying X. (2021) Climate change news risk and corporate bond returns. Journal of Financial and Quantitative Analysis, 56(6): 1985–2009.
[8] Hsu, P.H., Li, K. and Tsou, C.Y. (2023) The pollution premium. Journal of Finance, 78(3): 1343–1392.
[9] Goldsmith-Pinkham, P., Gustafson, M.T., Lewis, R.C. and Schwert, M. (2023). Sea-level rise exposure and municipal bond yields. Review of Financial Studies, 36(11): 4588–4635.
[10] Sautner, Z., van Lent, L., Vilkov, G. and Zhang, R.S. (2023) Firm-level climate change exposure. Journal of Finance, 78(3): 1449–1498.
[11] Berg, F., Kölbel, J.F. and Rigobon, R. (2022) Aggregate confusion: The divergence of esg ratings. Review of Finance, 26(6): 1315–1344.
[12] Avramov, D., Cheng, S., Lioui, A. and Tarelli, A. (2022) Sustainable investing with esg rating uncertainty. Journal of Financial Economics, 145(2): 642–664.
[13] Tomar, S. (2023). Greenhouse gas disclosure and emissions benchmarking. Journal of Accounting Research, 61(2): 451–492, 2023.
[14] Cohen, S., Kadach, I. and Ormazabal, G. (2023) Institutional investors, climate disclosure, and carbon emissions. Journal of Accounting and Economics, 76(2): 101640.
[15] Ilhan, E., Krueger, P., Sautner, Z. and Starks, L.T. (2023) Climate risk disclosure and institutional investors. Review of Financial Studies, 36(7): 2617–2650, 2023.

DOI: 10.54254/2754-1169/2026.GT34764

[16] Flammer, C. (2021) Corporate green bonds. Journal of Financial Economics, 142(2): 499–516, 2021.
[17] Stroebel J. and Wurgler, J. (2021) What do you think about climate finance? Journal of Financial Economics 142(2): 487–498, 2021.
[18] Martinsson, G., Sajtos, L., Strömberg, P. and Thomann, C. (2024) The effect of carbon pricing on firm emissions: Evidence from the swedish co2 tax. Review of Financial Studies, 37(6): 1848–1886.
[19] Pankratz, N.M.C. and Schiller, C.M. (2024) Climate change and adaptation in global supply-chain networks. Review of Financial Studies, 37(6): 1729–1777.
[20] Fried, S. (2022) Seawalls and stilts: A quantitative macro study of climate adaptation. Review of Economic Studies, 89(6): 3303–3344.