

# Carbon Risk and Corporate Creditworthiness: Evidence from a Major Emerging Economy

Executive Summary

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## Abstract

This paper investigates how climate-related transition risks influence the creditworthiness of non-financial Indian firms by examining the relationship between carbon emissions and market-implied probability of default (PD) from 2005 to 2023. Using a comprehensive panel dataset of 647 firms, our analysis shows that higher carbon emissions significantly increase credit risks. The impact varies notably depending on firms' financial health, ESG practices, investment strategies, and physical climate risk exposure. The Paris Agreement intensified market penalties for carbon-intensive firms, highlighting investor sensitivity to global decarbonization goals. These findings enhance the understanding of how climate transition risks are priced into credit markets in emerging economies.

## Acknowledgement

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# Executive summary

## Introduction

**Addressing climate change requires a swift transition to a low-carbon economy.** Increasing CO<sub>2</sub> concentrations have pushed global temperatures 1.1 °C above pre-industrial baselines, contributing to an increase in extreme weather events and economic disruption. In response, the 2015 Paris Agreement committed all nations to limiting global warming to “well below 2 °C,” with efforts to cap it at 1.5 °C. Meeting these goals implies a large-scale shift to a low-carbon economy, requiring deep emission cuts and a structural reallocation of capital away from fossil-intensive sectors.

**Governments are introducing stringent climate policies to accelerate this transition.** While necessary to mitigate long-run climate damage, these interventions generate near-term financial risks—particularly for carbon-intensive firms. These firms may face higher compliance costs, regulatory penalties, demand shocks, or asset stranding, all of which can impair cash flows and weaken their credit profile. Accordingly, market participants are beginning to reassess the solvency and valuation of firms based on their carbon exposure and transition preparedness.

**Evidence suggests that financial markets penalize heavy emitters in developed countries.** Yet it remains unclear if it holds in emerging markets, where institutional contexts differ and development priorities may outweigh environmental concerns. This is critical given that emerging economies account for two-thirds of global GHG emissions, and their decarbonization is critical to meeting the Paris Agreement targets. High-emitting firms in these countries may face disproportionate transition risks due to carbon-intensive energy systems, weaker balance sheets, and limited access to capital. Understanding and managing these risks is essential to achieving global climate goals.

## This study

**This study examines the impact of climate-related transition risk on firm credit risk in India** – a major emerging economy at the forefront of the climate-development challenge. India is the world’s third-largest greenhouse gas emitter after China and the United States. Unlike advanced economies, however, India’s per capita emissions remain relatively low, reflecting the country’s still-developing status. Thus, India exemplifies a major emerging economy confronting the structural tensions between sustaining economic growth and advancing climate mitigation objectives.

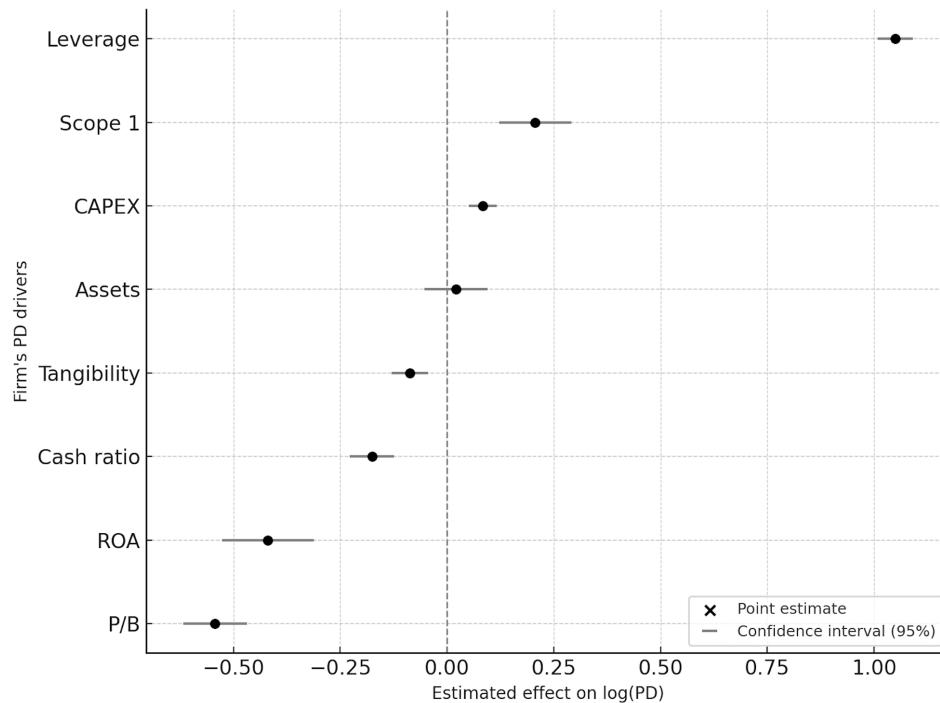
**India is increasingly exposed to transition risks as it engages with global climate efforts.** In recent years the Indian government has announced bold climate commitments – including a net-zero emissions goal by 2070 and plans for a national carbon market by 2026 – signalling that carbon-intensive firms will encounter growing regulatory and market forces to decarbonize. At the same time,

India’s economy remains heavily reliant on coal-based power generation and other high-emission industries, making its firms especially exposed to transition risk.

**This study examines how transition risk is priced into credit risk of Indian companies.** We build a panel dataset of Indian listed firms spanning 2005–2023, combining financial information, emissions data, ESG indicators, and measures of physical risk. We use firms’ annual Scope 1 carbon emissions as a proxy for their exposure to transition risk. As the outcome of interest, we consider firms’ market-implied probability of default (PD), a forward-looking measure of credit risk extracted from financial market data. We employ panel regression models to quantify the relationship between carbon emissions and default risk, whilst controlling for standard determinants of credit risk and including industry and time fixed effects to absorb unobserved sectoral and time-specific heterogeneity.

**This study also incorporates climate-economy scenarios to project how different climate policy pathways might impact firms’ default risk** through macroeconomic channels. Using climate stress-test scenarios developed by the NGFS tailored for India (spanning 2022–2050), we feed projected macroeconomic variables – GDP growth, inflation, and interest rate spreads – into a satellite credit risk model to simulate future PD trajectories.

## Key findings



**Figure 1.** The impact of risk factors on firms’ PD.<sup>1</sup>

<sup>1</sup> The numbers represent estimated coefficients multiplied by the standard deviation of the corresponding variable used in the regression analysis. Variables: Assets - natural logarithm of total assets; Tangibility -

**First, higher carbon emissions are associated with significantly elevated credit risk.** A one-standard-deviation increase in firms' (log of) Scope 1 emissions corresponds to a 20% increase in their PD, suggesting that financial markets are incorporating climate-related transition risk into the pricing of Indian firms' creditworthiness (see Figure 1).

**Second, the effect of transition risk on firms' credit risk is heterogeneous and varies with firm characteristics,** such as:

- **Weaker financial health:** Firms with weaker financial health experience a larger increase in PD for a given rise in emissions, consistent with the idea that limited financial buffers make it harder to cope with carbon transition costs.
- **Weaker ESG practices:** Firms exhibiting robust ESG practices see a markedly smaller emissions impact on PD, perhaps because such a firm is more transparent and proactive about managing climate risks.
- **Smaller capital expenditure:** High levels of capital investment reduce the effect of emissions on PD, suggesting that investors may view a firm's willingness and capacity to invest as a sign of adaptability or growth that offsets transition vulnerabilities.
- **Higher physical risk:** Firms' exposure to physical climate risk on its own has no significant impact on firms' PD, but increase in exposure to natural hazards strengthen the effect of emissions on PD.

Our estimates imply that, all else equal, firms with stronger financial buffers, better ESG practices, higher investment, and lower exposure to physical risk exhibit around 50% lower sensitivity to increases in transition risk, as proxied by Scope 1 emissions.

**Third, policy shift around the Paris Agreement has affected investor perceptions of credit risk.**

Using three complementary empirical strategies related to the Paris Agreement materially, we show that post-2015, the following firms show a higher impact on credit risk:

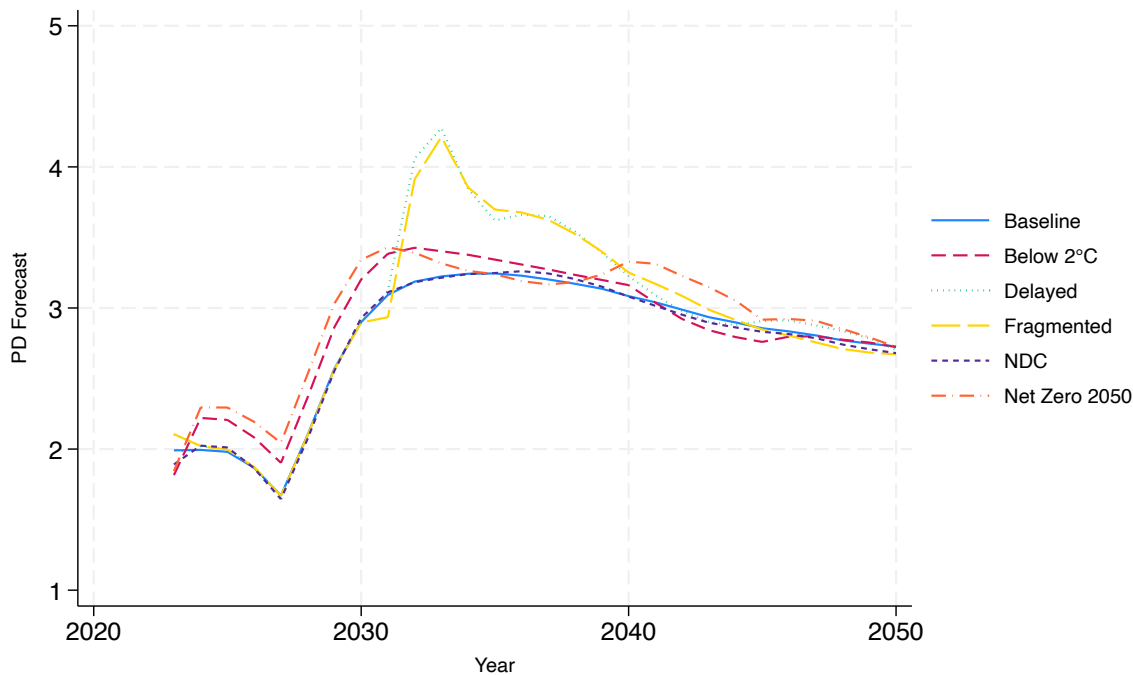
- **High emitting firms:** High-emitting firms experienced a significantly larger increase in their PDs relative to low emitters, consistent with rising sensitivity to transition risk. The credit risk advantage previously enjoyed by large high-emitting firms was reduced by more than 50%.
- **Paris misaligned firms:** Firms misaligned with Paris implied decarbonization pathways face significantly higher PD compared to firms that are on track. Firms emitting above their reduction targets have PDs approximately 12% higher than firms on track.
- **Unpriced carbon cost firms:** Firms with greater unpriced carbon cost are perceived as significantly riskier by markets, especially within carbon-intensive sectors, compared with firms with lower unpriced cost.

**Fourth, transition risk affects credit risk through two channels – reputation and cost of capital.**

tangible assets to total assets; CAPEX - capital expenditures to revenues; P/B- price-to-book value; ROA - net income to total assets; Leverage - debt to total assets.

- **Reputation risk:** Firms operating in high-emission industries face heightened exposure to environmental controversies that undermine reputation. Reputational damage from such incidents leads to a substantial increase in firms’ PD.
- **Cost of capital:** The cost of capital constitutes an important transmission channel through which costly transition risks affect credit risk, but the effects differ between debt and equity markets. We find no statistically significant relationship between firms’ Scope 1 emissions and the cost of debt, potentially reflecting banks’ preference for borrowers with stable cash flows and strong collateral. In contrast, equity investors appear more forward-looking, demanding higher returns from high emitters.

Both channels represent statistically significant and economically meaningful pathways through which emissions influence firms. A one-standard-deviation increase in emissions is associated with an indirect effect of approximately 4.2% via the reputational channel and 6.2% via the cost-of-equity channel.



**Figure 2:** Conditional forecast of firms’ PD under different climate scenarios

**Fifth, forward-looking scenario analysis further indicates deteriorating of credit risk.** A delayed or disorderly transition to a low-carbon economy could severely deteriorate corporate credit risk in India over the coming decades (Figure 2). The results reveal a pronounced divergence in credit risk after 2030: in the Delayed and Fragmented scenarios, PD peaks at around 4.3 and 4.2 respectively by 2033, compared to a peak of approximately 3.3 under the Baseline, whereas orderly transition pathways produce more stable credit risk trajectories.

## Conclusions

We examine how climate-related transition risks affect the creditworthiness of Indian non-financial firms, showing that higher carbon emissions significantly increase market-implied PDs. The effect is stronger post-Paris Agreement and is higher for firms with weaker financial strength, weaker ESG governance, lower capital investment, and higher exposure to physical risks.

We also find evidence of the impact via two channel – reputation risk and cost of capital. In particular, we find that higher transition risk results in a higher cost of equity but not higher cost of debt. This suggests that banks may insufficiently account for climate risk, potentially leading to an underestimation of borrowers' creditworthiness.

Our findings carry several policy implications. Regulators and central banks should incorporate climate risk into credit assessment frameworks to safeguard financial stability. The muted response in debt markets relative to equity markets suggests inefficiencies that may require targeted regulation and disclosure mandates.

For firms, the results underscore the value of ESG governance, financial resilience, and sustained investment in low-carbon technologies. Therefore, strengthening these areas may serve as an effective hedge against elevated credit risk stemming from the low-carbon transition.

Scenario analyses further highlight the financial risks of delayed or disorderly climate action, reinforcing the need for timely, coordinated policy responses and clear regulatory signals.



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