Extreme Weather Events and Local Credit Market Dynamics: The Italian Case

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1. Introduction

Climate change is increasingly recognized as a systemic source of macro-financial risk. While transition risks have received considerable attention in financial economics, physical risks – stemming from extreme weather events and rising temperatures – are emerging as a critical dimension of financial stability. A growing body of research documents the adverse macroeconomic consequences of temperature shocks and climate extremes. Extreme heat and weather disruptions have been shown to reduce aggregate output (Dell, Jones and Olken, 2012; Burke, Hsiang and Miguel, 2015), impair labor productivity (Graff-Zivin and Neidell, 2014; Somanathan et al., 2021), damage agricultural yields (Schlenker and Roberts, 2009), and depress firm-level performance (Addoum, Ng and Ortiz-Bobea, 2023). These effects suggest that climate shocks weaken local economies through multiple real channels.

More recently, the financial implications of physical climate risk have attracted increasing attention. Natural disasters have been shown to affect bank capital allocation and lending behavior (Cortés and Strahan, 2017; Do et al., 2023), while climate exposure influences mortgage pricing and credit conditions (Nguyen et al., 2022). At the level of credit quality, emerging evidence indicates that heat stress and extreme temperatures increase non-performing loans and borrower distress, particularly for territorially concentrated institutions (Vollmar and Wening, 2024; Aguilar-Gomez et al., 2024). Theoretical contributions emphasize that physical risks may propagate through credit risk

channels, collateral impairment, and precautionary tightening of lending standards (Pagliari, 2021; Bandt et al., 2023).

However, most existing evidence is based on bank-level data in single-country settings – predominantly the United States – and often abstracts from within-country territorial heterogeneity. Yet climate exposure is inherently spatial, and regional economies differ substantially in sectoral composition, vulnerability, and adaptive capacity. In bank-based systems characterized by strong local intermediation, climate shocks may therefore generate territorially differentiated financial effects.

This paper investigates how extreme weather events affect local credit market dynamics across Italian provinces over the period 2002–2022. The central premise is that climate-related shocks, although exogenous to local financial systems, may deteriorate credit quality and alter lending conditions through spatially heterogeneous transmission channels. Italy provides a particularly suitable context: the country combines high exposure to hydrogeological and climate risks with marked territorial disparities in economic structure, income levels, and financial development. Local credit markets remain crucial for the financing of households and small and medium-sized enterprises (SMEs), especially in peripheral and Southern regions, making the Italian case an ideal laboratory to examine the interaction between climate exposure, regional heterogeneity, and financial stability.

The paper addresses two main research questions: (i) Do extreme weather events lead to a deterioration in local credit quality? and (ii) Through which financial and contractual channels do climate shocks propagate at the local level? By combining provincial-level climate exposure measures with disaggregated indicators of credit risk, pricing, guarantee intensity, and loan dynamics, this study contributes to both the climate finance and regional science literatures, highlighting the spatial dimension of physical climate risk within a European bank-based economy.

2. Conceptual Framework

The analysis builds on a territorial credit risk framework in which climate shocks affect local credit markets through three interrelated channels.

First, the real economy channel: extreme weather events disrupt production, reduce firm revenues, and increase operating costs. Empirical evidence shows that temperature shocks reduce productivity and profitability (Addoum et al., 2023), implying lower debt-servicing capacity.

Second, the collateral channel: floods and other extreme events damage physical assets, potentially reducing collateral values and increasing expected loss given default. This mechanism has been highlighted in research on flood risk and mortgage markets (Nguyen et al., 2022).

Third, the precautionary financial channel: heightened uncertainty may induce banks to tighten lending standards, reduce credit supply, or increase reliance on public guarantees. Evidence from natural disasters suggests that banks adjust capital allocation and lending behavior in response to localized shocks (Cortés and Strahan, 2017; Meisenzahl, 2023).

Territorial heterogeneity arises because exposure and vulnerability differ across provinces. Regions with higher shares of climate-sensitive sectors (e.g., agriculture, tourism, construction) or higher population density may experience stronger transmission effects. Financial structure, such as branch density and market concentration, may further modulate local resilience.

3. Data and Variable

The analysis uses an annual provincial panel for Italy (2002–2022) combining climate exposure, local macroeconomic indicators, and detailed credit market data. Credit risk is measured through annual flows of new non-performing loans relative to previous-year loan stocks, disaggregated by micro-firms, non-financial companies, and households. Additional dependent variables capture lending rates, guarantee intensity on outstanding loans, deposit dynamics, and medium- and long-term loan growth, allowing us to assess adjustments in credit pricing, contractual safeguards, and liquidity conditions. Extreme weather exposure is measured using provincial-level records of climate-related events, alternatively normalized by population and surface area. The baseline specification is a fixed effects model, where each credit market indicator is regressed on lagged climate exposure and local economic controls. This framework allows us to identify the differential impact of climate shocks across borrower categories and financial transmission channels.

4. Preliminary Results

The empirical evidence indicates that extreme weather events exert statistically and economically significant effects on local credit markets. Climate shocks are associated with an increase in the annual flow of new non-performing loans across all borrower categories, with stronger effects for micro-firms and non-financial companies compared to households. The results are robust across both exposure-weighted and borrower-based measures, indicating that extreme events increase not only the volume of impaired credit but also the number of distressed borrowers. At the same time, lending conditions tighten, as reflected in higher short-term rates on revocable credit lines, consistent with a risk-pricing response by financial intermediaries. In parallel, the intensity of guarantees on outstanding loans increases, suggesting an adjustment in contractual safeguards and a strengthening of collateral requirements in climate-affected provinces. On the quantity side, medium- and long-term lending slows down, particularly in investment-related segments such as construction and machinery,

while deposit dynamics display signs of precautionary liquidity behavior. Overall, the findings point to a multi-channel transmission mechanism whereby extreme weather events deteriorate credit quality, trigger contractual and pricing adjustments, and reshape local financial dynamics in a territorially differentiated manner.

5. Conclusion

This paper provides new evidence that extreme weather events have measurable and territorially heterogeneous effects on local credit markets in Italy. Climate shocks deteriorate credit quality, constrain lending, and increase reliance on public guarantees, with stronger impacts in structurally fragile and highly exposed provinces.

By integrating climate finance and regional science perspectives, the study highlights that climate change is not only a macroeconomic phenomenon but also a spatially differentiated financial stability challenge. Incorporating territorial climate exposure into financial and regional policy design is essential for enhancing resilience and supporting sustainable development.

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