Firm Investment Responses to Monetary Shocks under Climate Risk

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1. Motivation

Firms around the world are increasingly exposed to physical climate risks — including floods, hurricanes, wildfires, and rising heat — that can damage physical assets and disrupt operations. While the macroeconomic consequences of climate change have received growing attention, we still know relatively little about how firm-level climate risk exposure affects investment behavior, particularly when interacting with macroeconomic policy shocks.

Understanding this link is essential for two reasons. First, investment is a key margin through which firms adapt to or insure against future shocks. Second, climate risk may amplify financing frictions: asset destruction reduces collateral value, insurance premiums rise, and uncertainty about future environmental damage can raise risk premia or delay investment decisions. If these frictions interact with monetary policy, they may distort the aggregate transmission of policy across firms and regions.

Recent research shows that firms with greater physical climate exposure face lower valuations (Berkman et al., 2024), pay significantly higher spreads on bank loans as lenders increasingly price in climate risk (Javadi and Masum, 2021), and tighter financing conditions following natural disasters (Cortés and Strahan, 2017). However, little is known about whether climate-exposed firms respond differently to monetary policy shocks, and whether climate risk acts as a friction that dampens investment precisely when rates fall.

This project aims to answer that question using the empirical framework of Ottonello and Winberry (2020), who show that low-default-risk firms drive the investment response to monetary easing. I adopt their identification strategy — based on firm-level investment and high-frequency monetary shocks — but replace their default risk measures with firm-level proxies for physical climate risk exposure. The goal is to estimate how heterogeneous climate vulnerability reshapes the investment response to monetary policy, and whether firms in high-risk environments are less able (or willing) to scale up investment when borrowing conditions improve.

2. Research Question

Do firms with greater exposure to physical climate risk respond less to monetary policy shocks in terms of investment?

Hypothesis:Firms facing greater climate risk will show muted investment responses to expansionary monetary policy due to impaired access to finance or weaker collateral.

3. Data

The analysis relies on three main data sources. First, **firm financials** are obtained from the Compustat database and include variables such as investment, leverage, size, and liquidity (available on Github). Second, **monetary policy shocks** are measured using high-frequency shocks identified from event studies around FOMC announcements. Third, **climate risk exposure** is captured through two channels: geographic exposure based on FEMA, NOAA, and EM-DAT disaster datasets, and firm-level or industry-level ESG metrics such as MSCI climate risk ratings.

4. Empirical Strategy

To estimate heterogeneous investment responses, I adopt the identification strategy of Ottonello and Winberry (2020), using firm-level panel regressions:

$$\Delta \log K_{i,t+1} = \alpha_i + \gamma_t + \beta_1 (MPShock_t \times (ClimateRisk_i - \mathbb{E}[ClimateRisk_i])) + \beta_2 \mathbf{X}_{i,t} + \varepsilon_{i,t+1} \tag{1}$$

The variable $\Delta \log K_{i,t+1}$ represents the log change in the capital stock, capturing investment growth. The term $MPShock_t$ denotes a high-frequency monetary policy shock at time t, while $ClimateRisk_i$ is a firm-level measure of climate risk exposure. The model includes firm fixed effects α_i and time fixed effects γ_t to control for unobserved heterogeneity across firms and over time. Additionally, $\mathbf{X}_{it}$ comprises firm-level control variables such as size, leverage, and liquidity.

4.1 Identification Assumptions

(1) **Exogeneity of monetary policy shocks**: The shocks must be unanticipated and uncorrelated with firm-specific conditions. High-frequency event studies satisfy this.
(2) **No simultaneous climate events**: Estimates are not biased by natural disasters occurring in the same quarter as monetary shocks. These are controlled or excluded.
(3) **Climate risk not a proxy for other frictions**: Rich controls ensure climate risk is not conflated with size, capital intensity.
(4) **Parallel trends**: In the absence of monetary shocks, investment trends for high and low climate risk firms would evolve similarly. This is handled by firm and time fixed effects.

4.2 Interpreting β_1

The coefficient β_1 captures the **differential investment response to monetary policy shocks** depending on a firm's climate risk *relative to the mean*. If $\beta_1 < 0$: Climate-exposed firms invest less (or reduce more) after an expansionary shock, consistent with amplified financial frictions. If $\beta_1 > 0$: They invest more, suggesting adaptability or resilience to climate risks.

References

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