

Sectoral Volatility and the Investment Channel of Monetary Policy

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Research Question:

how does **dispersion in idiosyncratic shocks** affect the **investment channel** of monetary policy.

⇒ **we construct measures of idiosyncratic risk using firm-level panel data to answer these questions**

Why is this important?

Investment is:

- most **volatile** component of GDP, and strongly **procyclical**
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Our Contributions?

1. **evidence:** idiosyncratic risk in the form of higher **dispersion in productivity shocks** at the firm-level matters for monetary policy transmission.
2. **explanation:** why monetary policy is weaker in recessions: volatility rises, the extensive margin of business investment is harder to set off, and so the investment channel is weaker. (finding of Tenreyro & Thwaites)

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- regression (LP) analysis: interact monetary policy shocks with measures of volatility

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Preview of Findings

- IRFs: **qualitatively** and **economically** significant dampening of investment response to MP when volatility is high
- Moving from the 10th→90th percentile of sector volatility **approx halves IRF**
- fairly consistent pattern across measures of volatility

mechanisms in mind:

Real Options effects

- $k^* = c \cdot z^{\frac{1}{1-\alpha}}$. convexity: expected future dispersion* raises value of waiting (upside)
- harder to trigger the extensive margin **today** due to fixed costs (double-paying)
- Firms freeze investment/hiring decisions, insensitive to prices/policy today

Irreversibility frictions

- dispersion \rightarrow more likely irr. constraint binds (more likely to hit constrained space)
- constrained choice: $k_{t+1}^{cons} = (1 - \delta)k_t =$ independent of aggregate shocks/policy

Nominal Adjustment channel

- becomes relatively more attractive to reset prices than K,N

Empirics

Compustat: quarterly firm panel

- based in US
- trading in USD
- exclude Finance and Real Estate
- sample period limited to 2001-2012 by MPS series

Capital, K : perpetual inventory method to back out stocks

- $K_{it+1} = K_{it} + [X_{it} - \delta_{s,t}K_{it}] = \text{book value}_{t_0} + \text{Net Investment}_t$

CapX, X_k : investment expenditures

Labour, N : direct employment (annual) or proxy, COGS (quarterly)

LabX X_n : labour expenses (emp*avg ind wage, annual)

Output Y : revenue only, no P-Q split

3 approaches to estimating productivity

- **Cost Share:** Cobb-Douglas production function and competitive factor markets:

$$y_{it} = z_{it} + \alpha_{s(i),t} k_{i,t} + (1 - \alpha_{s(i),t}) n_{i,t} \quad \alpha_{s(i),t}^k = \text{median} \left\{ \frac{X_{it}^k}{X_{it}^k + X_{it}^n} \mid s(i), t \right\} \quad (1)$$

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$$I = f(z, X) \Leftrightarrow z = g(I, X) \quad (2)$$

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- **Generalised Method of Moments** AR1 process for TFP, set errors orthogonal to instruments. Relaxes assumptions on factor markets.

$$y_{it} - \rho_s y_{it-1} = \alpha_s^n (n_{it} - \rho_s n_{it-1}) + \alpha_s^k (k_{it} - \rho_s k_{it-1}) + \underbrace{(z_{it} - \rho_s z_{it-1})}_{\varepsilon_{it}}$$

moment condition: $E(Z\varepsilon) = 0$, *instruments:* k_t, k_{t-1}, n_{t-1} (3)

sector specific AR(1) process:

$$(z_{it} - \rho_s z_{it-1} - X_{it-1} \beta_s - f_i - \lambda_{s,t}) = \varepsilon_{it} \quad (4)$$

baseline volatility: 2nd moment

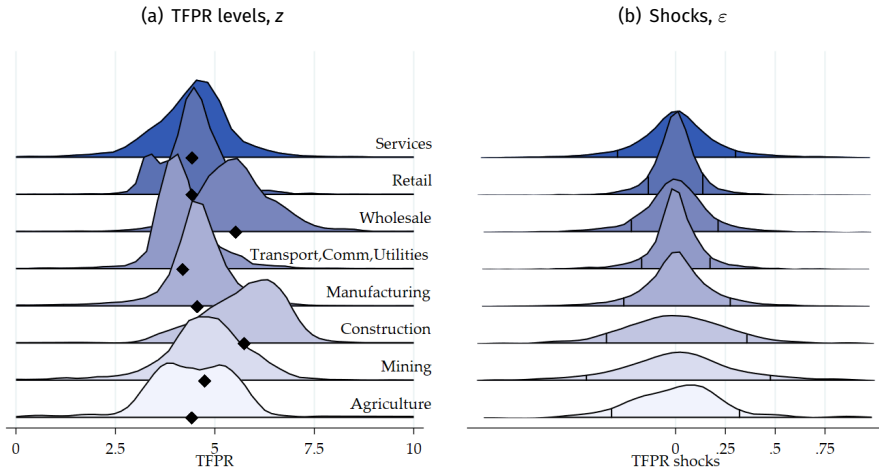
$$\text{volatility} : v_s = sd(\varepsilon_{it}|s) \quad (5)$$

$$v_{s,y} = sd(\varepsilon_{it}|s, y(t)) \quad (6)$$

(also compute other moments, e.g. IQR, 90-10 ratio, as robustness)

sector specific AR(1) process: $(z_{it} - \rho_s z_{it-1} + X_{it-1} \beta_s + f_i + \lambda_{s,t}) = \varepsilon_{it}$

(7)



LP Regressions

Direct Effect: Investment Response to Fed Tightening

- regress Investment on Miranda-Agrippino Ricco (AEJ macro 2021) high-frequency shocks

$$\Delta_{h+1} \log k_{it+h} = f_i + \lambda_{\text{sic1}(s), y(t+h)} + \beta_h^m \epsilon_t^m + \delta_h' \mathbf{X}_{ist-1} + u_{ist+h} \quad (8)$$

	(1)	(2)	(3)
Investment response (ppts) at	+4 quarters	+8qtrs	+12qtrs
Fed Tightening (1ppt)	-0.0194 (0.0157)	-0.0503** (0.0208)	-0.0172 (0.0211)
Firm FE	Yes	Yes	Yes
Industry-2digit \times Year FE	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes
Observations	188277	171377	156508
R2	0.0305	0.0284	0.0343

Standard errors in parentheses, clustered at firm and quarter levels.

covars: size, sales gr, financial conditions, tobinq, dividend, leverage, fiscal qtr

Simple Volatility-MP Interaction Specification

$$\Delta_{h+1} \log k_{i,s,t+h} = f_i + \left(\beta_h + \gamma_h v_{s,y(t)-1} \right) \epsilon_t^m + \delta_h' \mathbf{X}_{ist-1} + u_{ist+h} \quad (9)$$

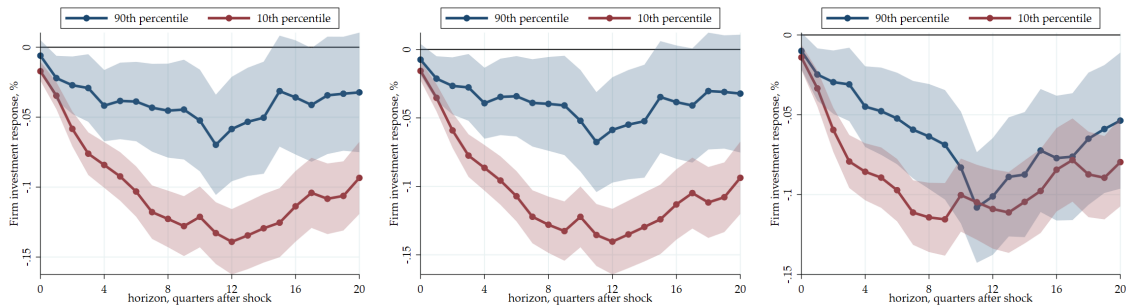


Figure 1: Implied IRFs at high and low volatility

twoway-clustered SEs at (firm,quarter) levels.

Full specification local projections:

$$\Delta_{h+1} \log k_{it+h} = f_i + \lambda_{\text{SIC1}(s),t+h} + \left(\beta_h + \beta_h^m \epsilon_t^m \right) \text{vol}_{s,y(t)-1} + \left(\delta_h' + \epsilon_t^m \delta_h^{m'} \right) \mathbf{x}_{ist-1} + u_{ist+h} \quad (10)$$

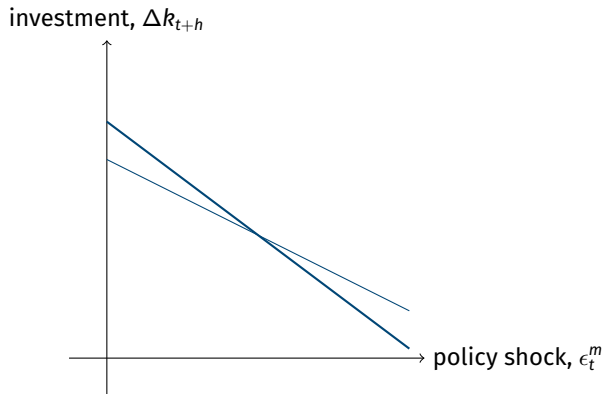
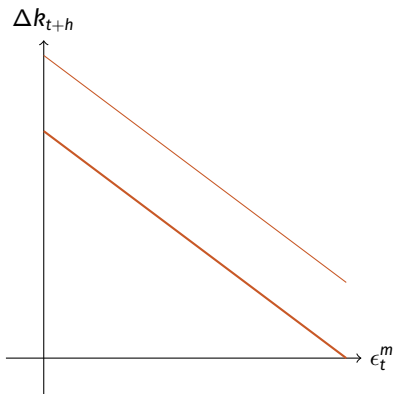
Variables:

- ϵ_t^m : high-frequency identified monetary policy shock (Miranda-Agrippino & Ricco)
- v_s : sector volatility ($v_{s,y-1}$)
- covars: size, age, leverage, liquidity, dividend status, tobin q; firm and industry-quarter effects.

Structure

- linear ϵ_t^m term is absorbed in 1-digit industry non-parametric time trends
- shifters $(\beta_h, \delta_h, f, \lambda)$ take care of *level effects* on investment
- wedges $(\beta_h^m, \delta_h^{m'})$ allows *differential slopes* wrt volatility and covariates

$$\Delta_{h+1} \log k_{it+h} = f_i + \lambda_{\text{SIC1}(s),t+h} + \left(\beta_h + \beta_h^m \epsilon_t^m \right) v_{s,y(t)-1} + \left(\delta_h' + \epsilon_t^m \delta_h^{m'} \right) \mathbf{x}_{ist-1} + u_{ist+h} \quad (11)$$



$$\Delta_{h+1} \log k_{i,s,t+h} = f_i + \lambda_{\text{SIC1}(s),t+h} + \left(\beta_h + \beta_h^m \epsilon_t^m \right) v_{s,y(t)-1} + \left(\delta_h' + \epsilon_t^m \delta_h^{m'} \right) \mathbf{x}_{ist-1} + u_{ist+h} \quad (12)$$

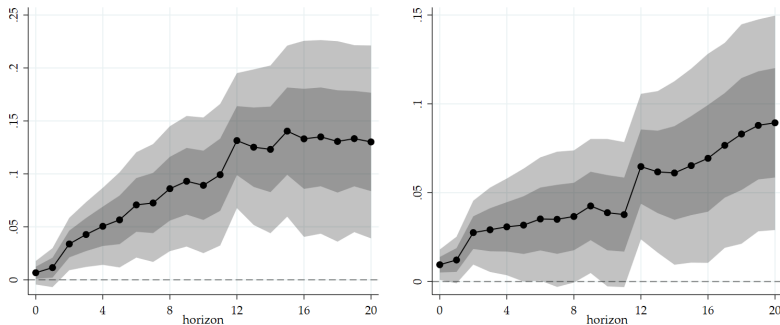


Figure 2: Cost Share Volatility (L) time-pooled (R) time-varying

twoway-clustered SEs at (firm,quarter) levels.

Qualitatively similar story across

- Cost Share, Control Function, GMM
- Time-invariant dispersion vs time-varying
- Other faster-moving quarterly proxies (sales growth volatility, VIX)

...under construction

- quarterly TFPR and volatility based on CAPX and COGS for LABX
- discriminate between channels?
 - intangible-rich firms cut back inv more wrt volatility? (irreversibility)
 - higher persistence in v makes it easier to predict dispersion, less wait-and-see? (real options)

Main takeaway:

- dispersion of idio. productivity shocks key determinant of firm investment channel of monetary policy

Policy implications:

- monetary policy is weaker when idio. volatility is high, typically in recessions

Thanks for your attention!

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