Firm Financial Conditions and the Transmission of Monetary Policy

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Introduction

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- Focus on financial frictions that affect firms' marginal cost of capital curves
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- Use firm characteristics to proxy for severity of firms' financial frictions
  [e.g., size (Gertler–Gilchrist, 1994), default risk (Ottonello–Winberry, 2020), age (Cloyne et al, 2023)]

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This paper:

- Differences in firms' marginal benefit curves for capital, i.e., their marginal productivity, also drive firms' heterogeneous responses to monetary policy.
- Proxy for these differences using firms' Excess Bond Premia (EBPs)
  - EBPs are part of credit spreads in excess of default risk [Gilchrist–Zakrajsek, 2012]
  - Evidence that credit spreads encode firms' marginal product [Philippon, 2009]

Overview of Main Results

Empirics:

1. Monetary policy easing $\rightarrow$ larger decrease in *high-EBP* firms' credit spreads
2. Monetary policy easing $\rightarrow$ larger increase in *low-EBP* firms' investment

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Rationalize empirics in model where firms differ in the slopes of their MB curves

- Firms face same MC curve, due to homogeneous financial intermediaries
- Result: Low-EBP firms have flatter MB curves i.e. marginal products of capital more resilient to investment.
  - Production function estimates for low- and high-EBP firms verify result.

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2 key implications of model hold in data:

- Low-EBP firms' investment is more sensitive to changes in their credit spread
- MP transmission to *aggregate* investment depends on EBP distribution

Related Literature and Our Paper

- Heterogeneous responses to monetary policy by severity of firms' financial frictions

  Liability structure (FOP-2018, GKL-2022), age and dividends (CFFS-2023), size (GG-1994, CM-2020), leverage (AC-2021, CDK-2021, Wu-2018, LM-2021, OW-2020), credit default swap (PY-2022), liquid assets (Jeenas-2019, JL-2022), liquidity constraints (KLS-1994), mg productivity (GNTA-2021), information frictions (Ozdagli-2018, CH-2020)

  - This paper: EBP shapes responses of firms' investment & credit spreads to mon pol

- Determinants of investment: user cost theory of capital, q-theory:

  Jorgenson-1963, Tobin-1969, Philippon-2009, GZ-2007, GZ-2012, GSZ-2014.

  - This paper: EBP shapes heterogeneous response of investment to credit spreads

- Time-varying aggregate effects of monetary policy:

  Distribution of price adjustments (Vavra-2014) and durable expenditure (MW-2021);
  MP less effective in US (TT-2016) and international (JST-2020) recessions.

  - This paper: cross-sectional EBP distribution shapes these time-varying effects

- **Slope of firm's MB curve is key ingredient behind each contribution**

Data and EBP Calculation

Data Sources and Sample Period

- Databases on U.S. nonfinancial firms:
  - Corporate yields: Lehman/Warga and ICE
  - Stock returns: CRSP
  - Balance sheet: Compustat
- After merging: 11,913 bonds, 1,872 firms, from 1973 to 2021
  - Sample tilted towards large firms, who drive business cycles [Carvalho–Grassi 2019]
- Sample longer than other papers because we ...
  - Use *both* Lehman/Warga (1973–1997) *and* ICE (1998–2021)
  - Use Bu, Rogers and Wu (2021) monetary policy shocks (1985-2021)
    - Bridge periods of conventional and unconventional monetary policy
    - purged of information effect and unpredictable ex-ante
    - Results robust to using other monetary policy shocks (e.g., Swanson 2021).

EBP Calculation (Gilchrist and Zakrajsek, 2012)

- Decompose credit spread S_{ikt} as follows:

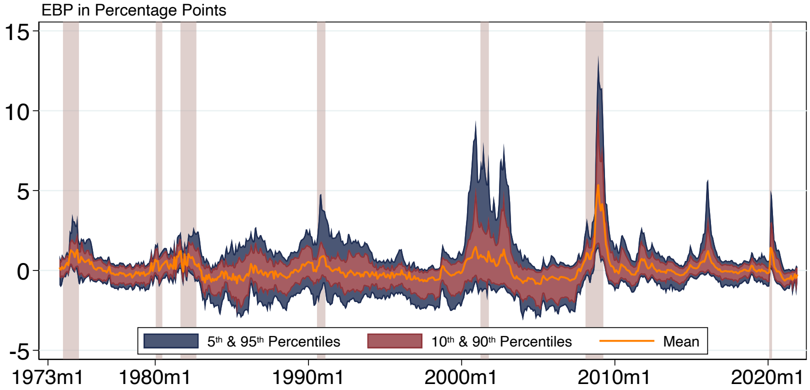
$$logS_{ikt} = \beta DD_{it} + \gamma^{'}\mathbf{Z}_{ikt} + \varepsilon_{ikt}$$

$$\hat{S}_{ikt} = exp\Big[\hat{\beta}DD_{it} + \hat{\gamma}^{'}\mathbf{Z}_{ikt} + \frac{\hat{\sigma}^2}{2}\Big]$$

$$EBP_{ikt} = S_{ikt} - \hat{S}_{ikt}$$

- EBP_{ikt} is component of spread in excess of default risk.
  - Higher $EBP_{ikt} \rightarrow$ firm i faces tighter ex-default risk financial conditions.
  - Our results are robust to purging higher-order DD_{it} terms.

Cross-sectional EBP Distribution Over Time



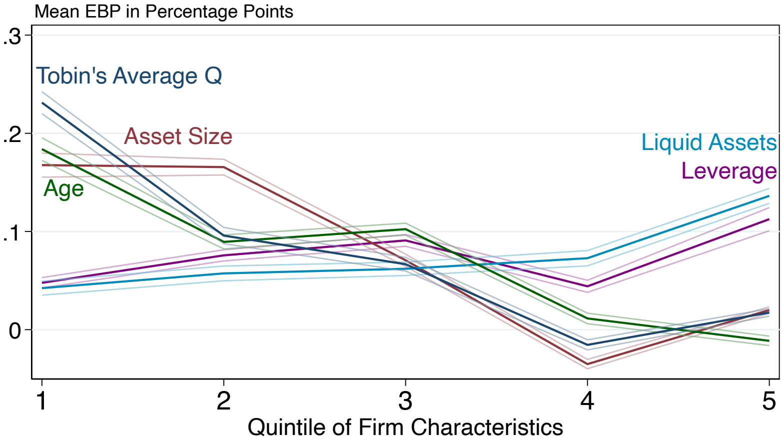
▸ FOR v. GZ Spread comparison ▸ FOR v. GZ EBP comparison ▸ Ex. DD^2 EBP comparison

Firms' EBPs are persistent. . .

. . . necessary for them to encode information about firms' states

		$EBP_{ik,t+1}$ Quintiles				
		1	2	3	4	5
$EBP_{ik,t}$ Quintiles	1	0.85	0.11	0.02	0.01	0.01
	2	0.13	0.67	0.16	0.03	0.02
	3	0.02	0.18	0.62	0.16	0.02
	4	0.01	0.04	0.18	0.66	0.11
	5	0.01	0.01	0.02	0.13	0.83

EBP Heterogeneity Across Firm Characteristics



Note. Shadings represent 90% confidence intervals.

Common Features of Regression Specifications

Estimate heterogeneous effects of MP using interaction with lagged EBP :

$$\underbrace{EBP_{it-1}^{ma}}_{\frac{1}{\tau}\sum_{j=1}^{\tau} EBP_{it-j}} \times \underbrace{\varepsilon_t^m}_{\text{Monetary policy shocks}}$$

where $n = 12$ in monthly data and $n = 4$ in quarterly data (Jeenas, 2019)

- Robust to using dummy variables: EBP_{it-1}^{low} vs. EBP_{it-1}^{high} (Cloyne et al., 2023)
- Robust to horseraces vs. other state variables (default risk, age, size, liquidity, Tobin's q)
- Define ε_t^m s.t. $\varepsilon_t^m > 0 \Rightarrow$ an easing shock/rate cut (Ottonello & Winberry, 2020)

To estimate unconditional effect of ε_t^m, use macro-fin controls in baseline:

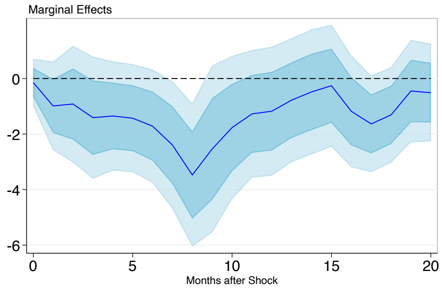
- Robust to using sector-time fixed effects
- Macro-fin controls: FR-Chicago NAI, GDP growth, EPU, Yield Curve PCs
- Firm controls: FE, leverage, size, age, liquidity, sales growth, current assets, Tobin's q

Standard errors are two-way clustered by firm/bond and time (Cameron et al., 2011)

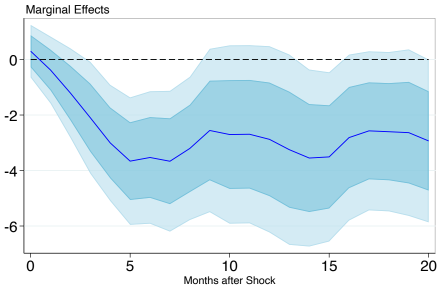
Monetary Policy and Bond-level Spreads

MP Easings Decrease Credit Spreads More for High-EBP Firms

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ EBP_{ikt-1}^{ma} \times \varepsilon_t^m + \gamma^h \mathbf{Z}_{it-1} + e_{ikth}$$



(a) β_1^h: ε_t^m



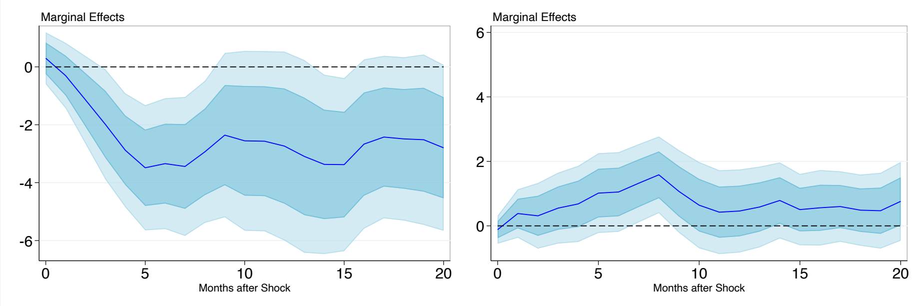
(b) β_2^h: $EBP_{ikt-1}^{ma} \times \varepsilon_t^m$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

▸ Time-Sector Fixed Effects ▸ Heterogeneity with Dummy Variables ▸ Alternative MP shocks ▸ EBP purged of DD^2

EBP Heterogeneous Response Robust to Default Risk

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h \; EBP_{ikt-1}^{ma} \times \varepsilon_t^m + \beta_3^h \; DD_{it-1}^{ma} \times \varepsilon_t^m + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ikth}$$



(a) β_2^h: $EBP_{ikt-1}^{ma} \times \varepsilon_t^m$

(b) β_3^h: $DD_{it-1}^{ma} \times \varepsilon_t^m$

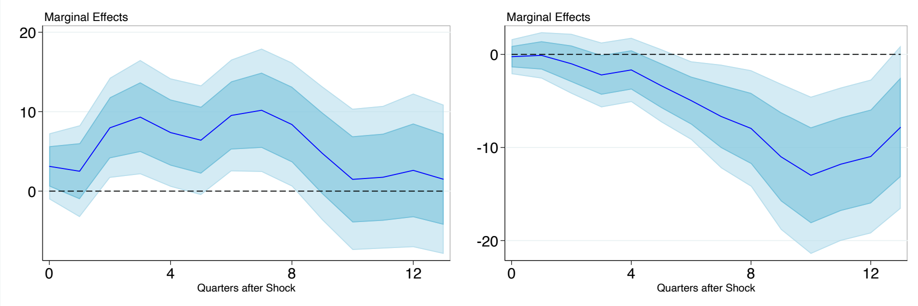
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Robust to heterogeneity by ▸ Leverage ▸ Credit Rating ▸ Age ▸ Size ▸ Liquidity ▸ Tobin's q

Monetary Policy and Firm-level Investment

MP Easings Increase Investment More for Low-EBP Firms

$$\log\left(K_{it+h}/K_{it-1}\right) = \beta_i^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ EBP_{it-1}^{ma} \times \varepsilon_t^m + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_1^h: ε_t^m (b) β_2^h: $EBP_{it-1}^{ma} \times \varepsilon_t^m$

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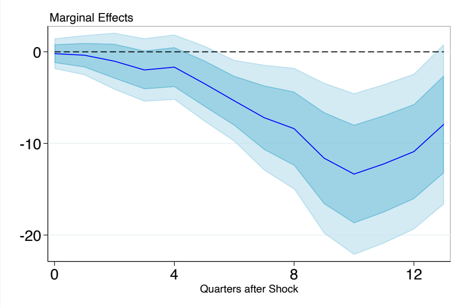
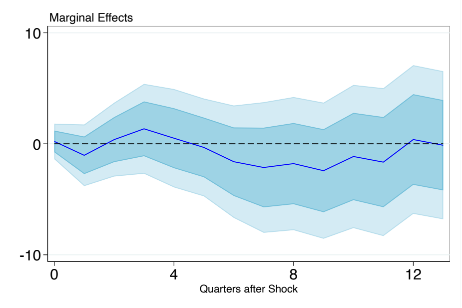
EBP Heterogeneous Response Robust to Default Risk

$$\log\left(K_{it+h}/K_{it-1}\right) = \beta_i^h + \beta_1 \varepsilon_t^m + \beta_2^h \; EBP_{it-1}^{ma} \times \varepsilon_t^m + \beta_3^h \; DD_{it-1}^{ma} \times \varepsilon_t^m + \gamma^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_2^h: $EBP_{it-1}^{ma} \times \varepsilon_t^m$



(b) β_3^h: $DD_{it-1}^{ma} \times \varepsilon_t^m$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

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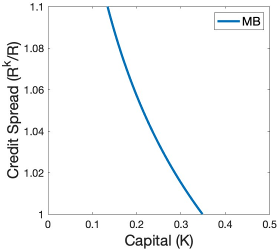
Theoretical Interpretation

Model Setup

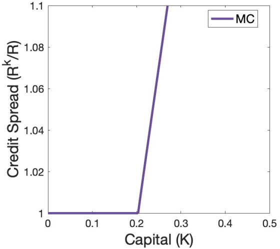
- Heterogeneous goods-producing firms
  - Decreasing returns to scale production (K^α)

  $\Rightarrow$ marginal benefit (MB) curve for capital
  - Heterogeneous MB curves
    - level = marginal product of capital (MPK)
    - **slope = resilience of MPK to investment**
    - flat slope $\Rightarrow$ resilient investment prospects
    - modeled by varying capital intensity (α)



- Homogeneous financial intermediaries:
  - Financial frictions à la Gertler–Karadi (2011)

  $\Rightarrow$ marginal cost (MC) of capital curve
  - Homogeneous net worth, and constraints

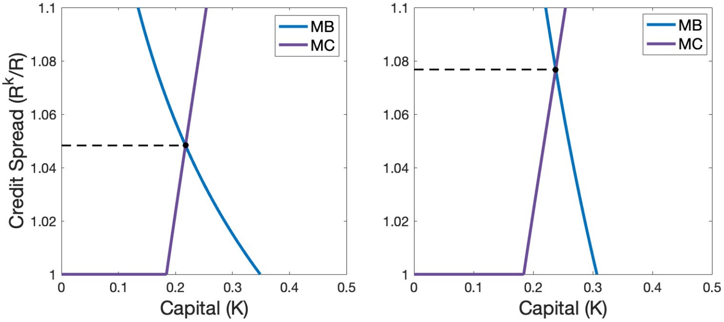


Firms with Flatter MB Curves Have Lower EBPs

Markets segmented between islands: (i) flat-MB curve firms; (ii) steep-MB curve firms

- Interpretation of island: intermediaries hold portfolios with specific types of assets/fixed asset shares [Chernenko–Sunderam (2012), Greenwood–Vissing-Jorgensen (2018)]
- Given absence of default risk, EBP = credit spread

▸ Production Function Estimation

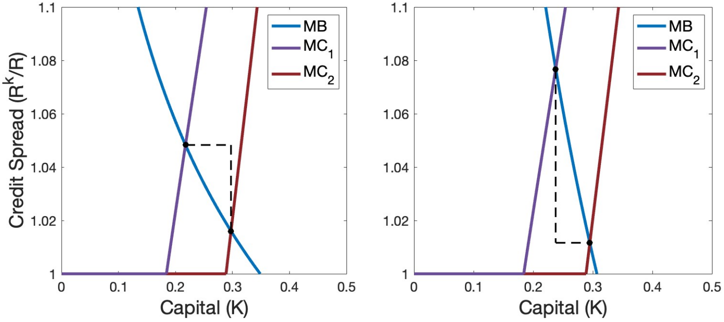


(a) Low-EBP Firm (b) High-EBP Firm

Monetary Policy on Spreads and Investment by EBP

- Monetary easing ⇒ increase equity of intermediaries ⇒ MC shifts rightward
- **Lower-EBP** firms with **flatter MB** experience:

  (A) a milder fall in spreads; and (B) a larger increase in investment.



(a) Low-EBP Firm (b) High-EBP Firm

Micro- and Macro- Implications

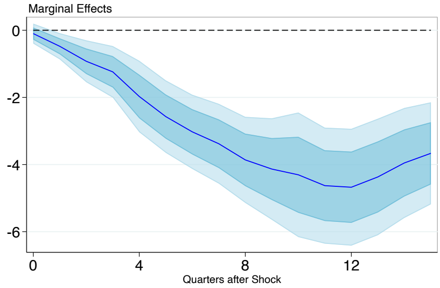
Microeconomic Implication of our Model

- Slope of MB curve matters not just for monetary policy, but for any shift in credit supply—dominant shock in capital markets. [e.g, Gilchrist & Zakrajsek (2007)]

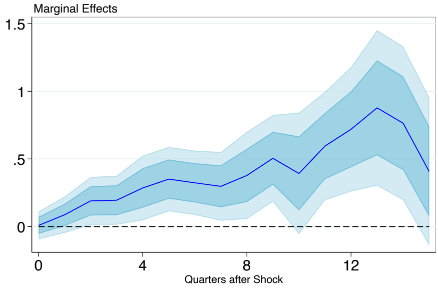
- Test: If changes in firms' spreads (ΔS_{it}) are due to changes in credit supply, then a fall in spreads should increase investment more for low-EBP firms.

Lower Spreads Boost Investment More for Low-EBP firms

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \Delta S_{it} + \beta_2^h \Delta S_{it} \times EBP_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_1^h: $\Delta S_{i,t}$



(b) β_2^h: $\Delta S_{i,t} \times EBP_{it-1}^{ma}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

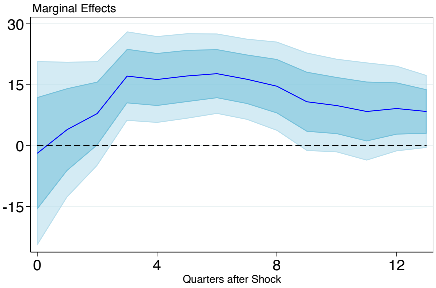
▸ Time-Sector Fixed Effects ▸ Heterogeneity with Dummy Variables ▸ EBP purged of DD^2 ▸ EBP Heterogeneity and NW shocks

Macroeconomic Implication of our Model

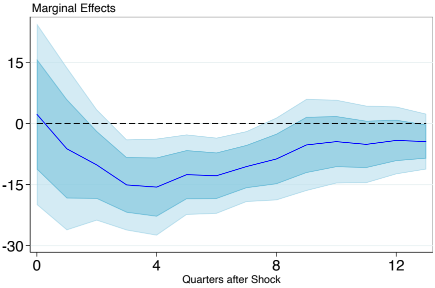
- When more firms have lower EBPs, i.e., are on flatter segments of their MB curves, aggregate investment should be more sensitive to monetary policy.
- Test: A more left-skewed EBP distribution should make the transmission of monetary policy to aggregate investment more potent.

Left-Skewed EBP Distribution Increases Aggregate MP Effects

$$\log\left(\frac{I_{t+h}}{I_{t-1}}\right) = \beta_0^h + \beta_1^h \varepsilon_t^m + \beta_2^h \varepsilon_t^m \times EBP_{t-1}^{skew} + \beta_3^h \varepsilon_t^m \times \boldsymbol{M}_{t-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Y}_{t-1} + e_{th}$$



(a) β_1^h: ε_t^m



(b) β_2^h: $\varepsilon_t^m \times EBP_{t-1}^{Skew}$

▸ Display other moments ▸ Alt. EBP^{skew} ▸ EBP percentiles ▸ EBP Moments vs. Recession Indicators ▸ Alt. MP shocks

Conclusion

- We show that the resilience of firms' marginal products of capital, not only financial frictions, matter for firms' responsiveness to monetary policy.

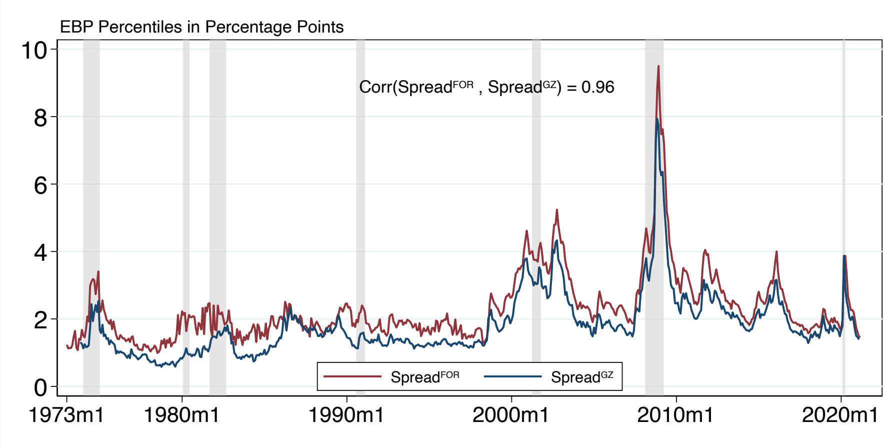
We do so by showing:

1. Monetary policy easing → larger decrease in *high-EBP* firms' credit spreads
2. Monetary policy easing → larger increase in *low-EBP* firms' investment
3. Rationalize these empirics in model where firms differ in the slopes of their MB curves for capital.

- Importantly, variation in firm-level EBP heterogeneity has first-order impact of monetary policy's aggregate effects.

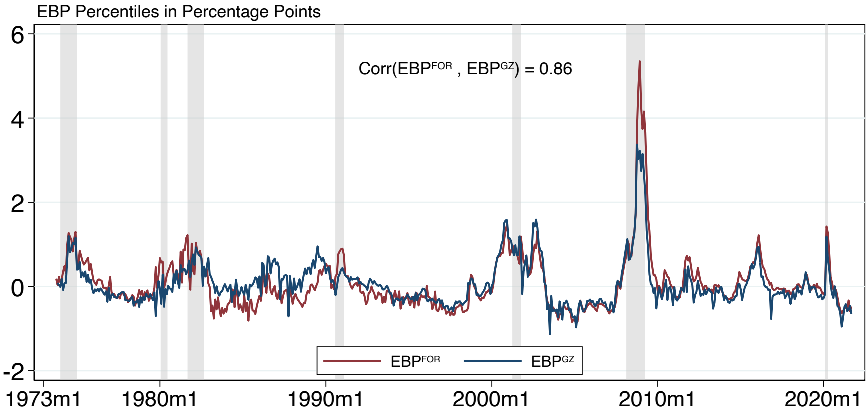
Appendix

Credit Spreads: Comparison with GZ



Back

Excess Bond Premium: Comparison with GZ



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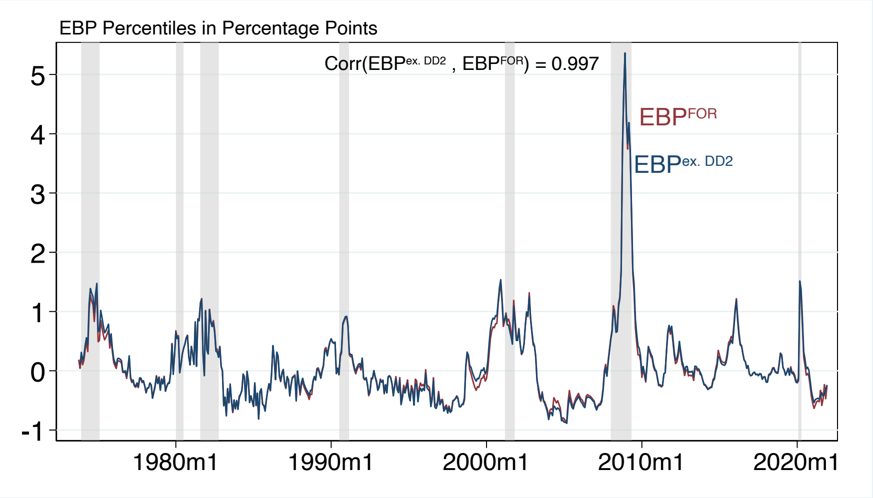
Excess Bond Premium Purged of DD^2



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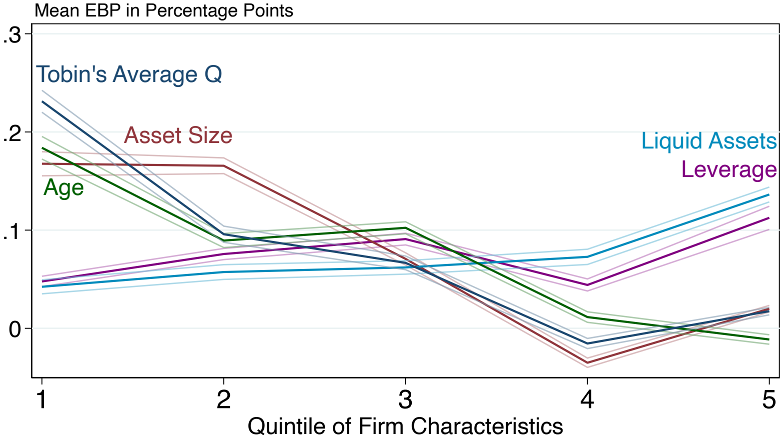
EBP Heterogeneity Across Firm Characteristics

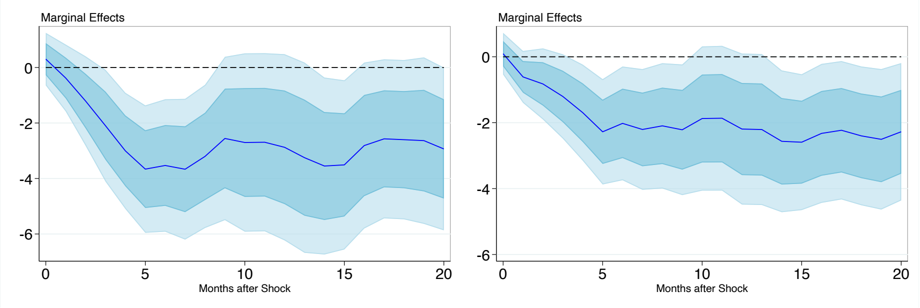


Note. Shadings represent 90% confidence intervals.

Back

MP Easing Lowers Credit Spreads Heterogeneously

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \alpha_{s,t}^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times EBP_{ikt-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) Macro-Fin Controls

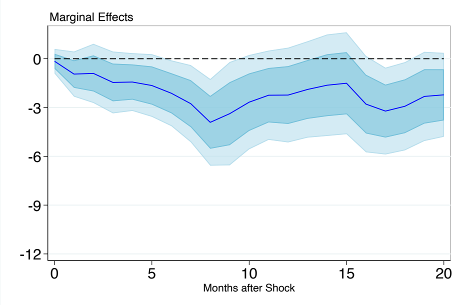
(b) Time-Sector Fixed Effects

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

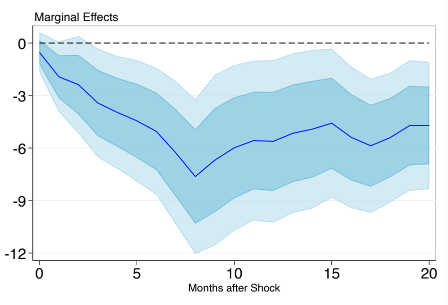
- Heterogeneous response of spreads to MP by **cross-sectional** firm EBP back

MP Easing Lowers Credit Spreads Heterogeneously

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \; \varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{low} + \beta_2^h \; \varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high} + \gamma^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_1^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{low}$



(b) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

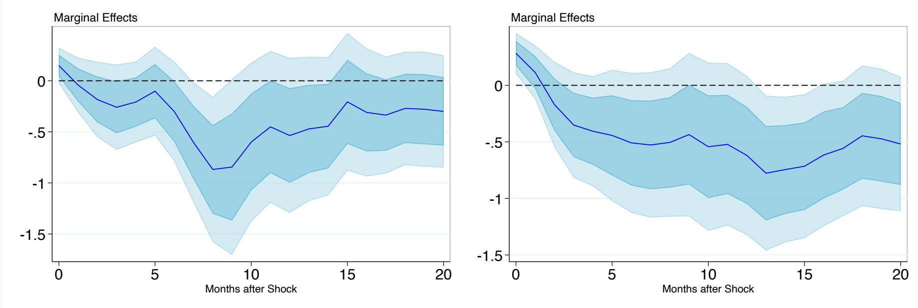
- Credit Spreads of **High**-EBP Firms More Responsive to MP.

back

MP Easing Lowers Credit Spreads Heterogeneously

Baseline results robust to Swanson (2021) shocks

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ EBP_{ikt-1}^{ma} \times \varepsilon_t^m + \boldsymbol{\gamma}^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_1^h: ε_t^m

(b) β_2^h: $EBP_{ikt-1}^{ma} \times \varepsilon_t^m$

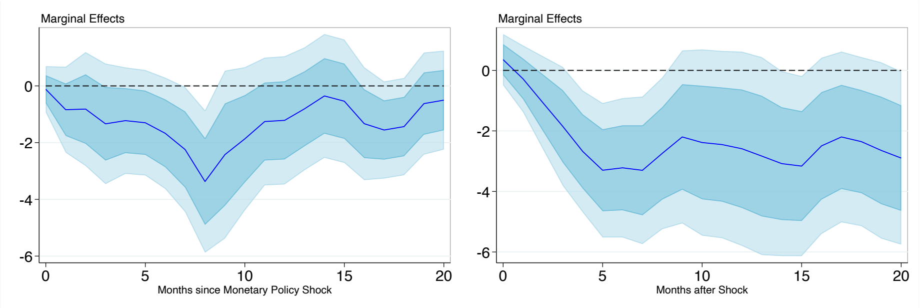
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

back

MP Easing Lowers Credit Spreads Heterogeneously

EBP purged of DD^2; results also robust to controlling for further powers of DD.

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + {\color{blue}\beta_1^h}\, \varepsilon_t^m + {\color{red}\beta_2^h}\, \varepsilon_t^m \times EBP_{ikt-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) ${\color{blue}\beta_1^h}$: ε_t^m

(b) ${\color{red}\beta_2^h}$: $\varepsilon_t^m \times EBP_{ikt-1}^{ma}$

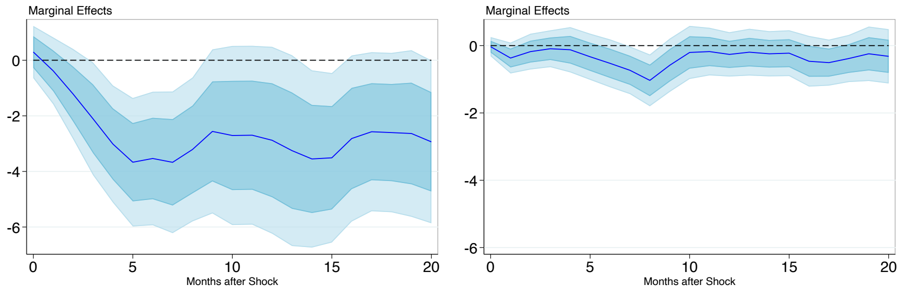
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

- Credit Spreads of **High**-EBP Firms More Responsive to MP.

back

Heterogeneous Response by EBP Robust to Leverage

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h \varepsilon_t^m \times EBP_{ikt-1}^{ma} + \beta_3^h \varepsilon_t^m \times Lev_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_2^h: $\varepsilon_t^m \times EBP_{ikt-1}^{ma}$

(b) β_3^h: $\varepsilon_t^m \times Lev_{it-1}^{ma}$

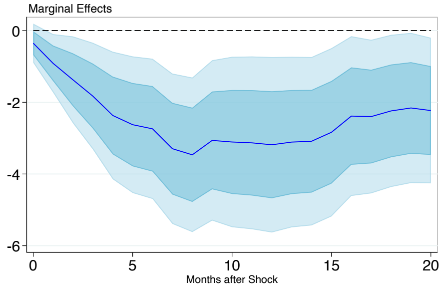
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Leverage measured as in Ottonello and Winberry (2020)

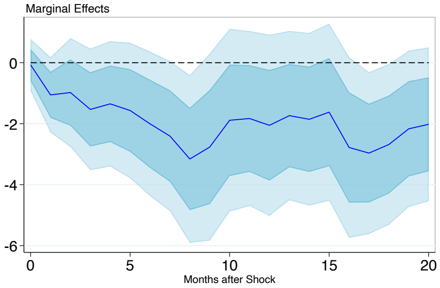
back

Heterogeneous response by EBP robust to Cred. Rat.

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h \varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high} + \beta_3^h \varepsilon_t^m \times \mathbf{1}\text{Rate}_{it-1}^{low} + \gamma^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high}$



(b) β_3^h: $\varepsilon_t^m \times \mathbf{1}\text{Rate}_{it-1}^{low}$

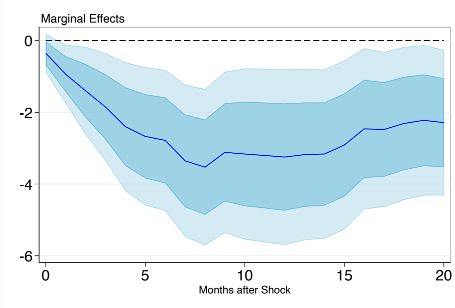
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Credit Rating measured as in Ottonello and Winberry (2020)

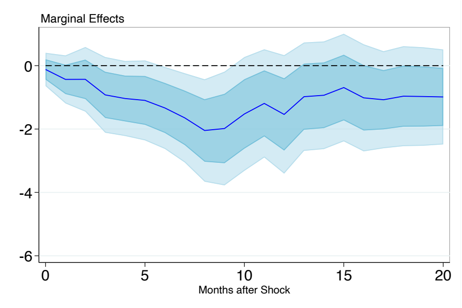
back

Heterogeneous Response by EBP Robust to Age

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h \ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high} + \beta_3^h \ \varepsilon_t^m \times \mathbf{1}\text{Age}_{it-1}^{low} + \gamma^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high}$



(b) β_3^h: $\varepsilon_t^m \times \mathbf{1}\text{Age}_{it-1}^{low}$

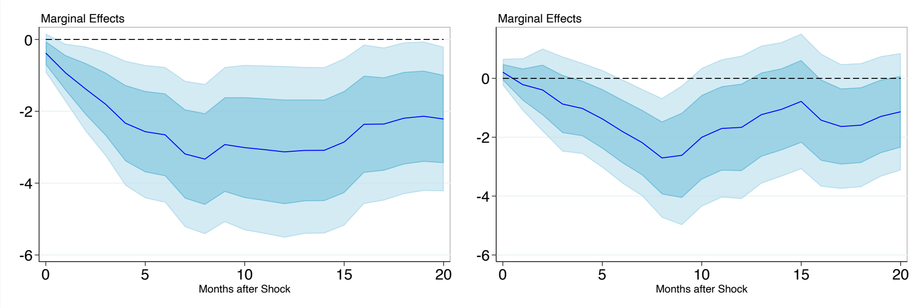
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Age measured as in Anderson and Cesa-Bianchi (2021)

▶ back

Heterogeneous Response by EBP Robust to Size

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high} + \beta_3^h\ \varepsilon_t^m \times \mathbf{1}\text{Size}_{it-1}^{low} + \gamma^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{ikt-1}^{high}$ (b) β_3^h: $\varepsilon_t^m \times \mathbf{1}\text{Size}_{it-1}^{low}$

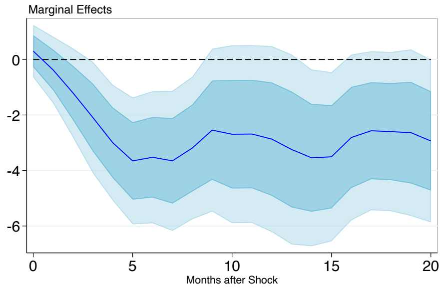
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Size measured as in Gertler and Gilchrist (1994)

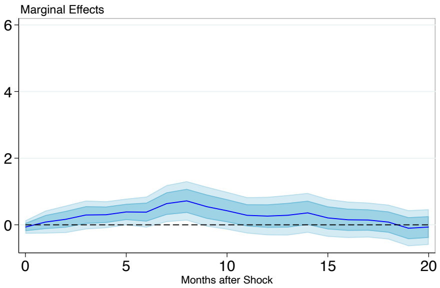
back

Heterogeneous Response by EBP Robust to Liquidity

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times EBP_{ikt-1}^{ma} + \beta_3^h\ \varepsilon_t^m \times Liq_{it-1}^{ma} + \gamma^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_2^h: $\varepsilon_t^m \times EBP_{ikt-1}^{ma}$



(b) β_3^h: $\varepsilon_t^m \times Liq_{it-1}^{ma}$

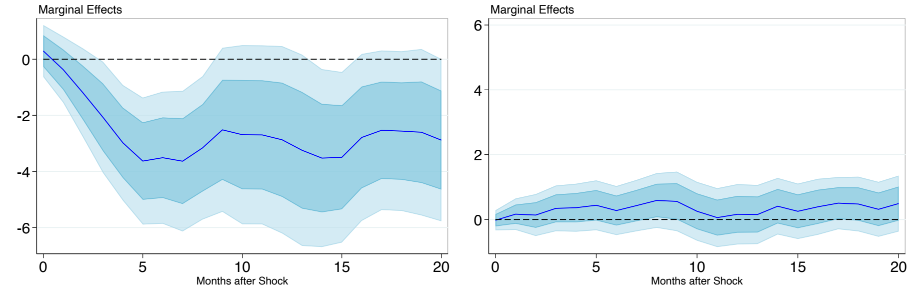
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Liquidity measured as in Jeenas (2019)

back

Heterogeneous Response by EBP Robust to Tobin's q

$$S_{ikt+h} - S_{ikt-1} = \beta_k^h + \beta_1^h \varepsilon_t^m + \beta_2^h \; \varepsilon_t^m \times EBP_{ikt-1}^{ma} + \beta_3^h \; \varepsilon_t^m \times Q_{it-1}^{ma} + \gamma^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_2^h: $\varepsilon_t^m \times EBP_{ikt-1}^{ma}$ (b) β_3^h: $\varepsilon_t^m \times Q_{it-1}^{ma}$

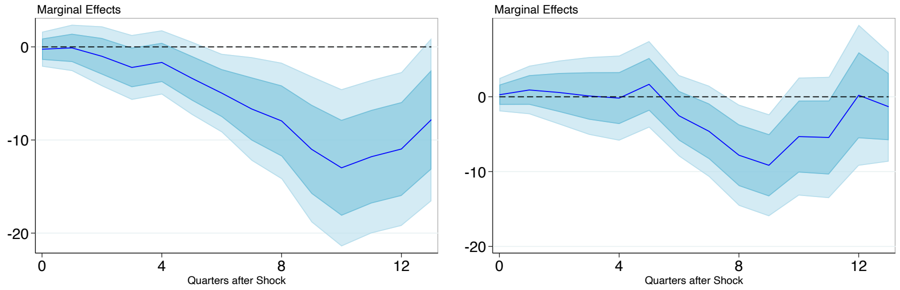
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Tobin's (average) q measured as in Jeenas (2019)

back

MP Easing Raises Investment Heterogeneously

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \alpha_{s,t}^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times EBP_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) Macro-Fin Controls (b) Time-Sector Fixed Effects

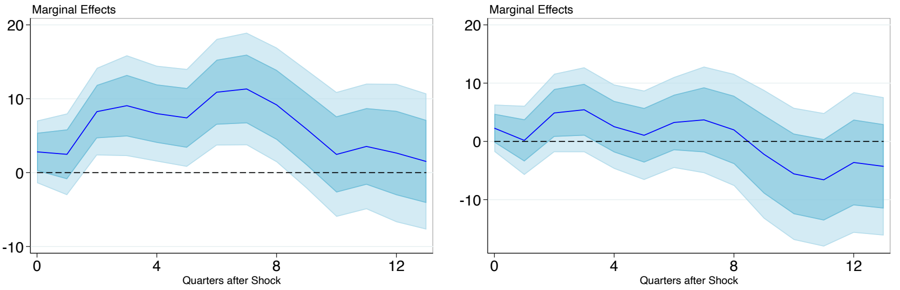
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

- Heterogeneous response of Inv. to MP is by **cross-sectional** firm EBP

back

MP Easing Raises Investment Heterogeneously

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h\ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low} + \beta_2^h\ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{high} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_1^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low}$

(b) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{high}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

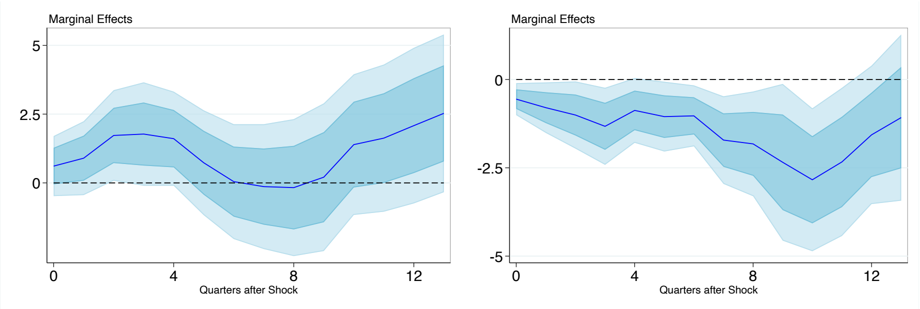
- Investment of **Low**-EBP Firms More Responsive to MP

back

MP Easing Raises Investment Heterogeneously

Baseline results robust to Swanson (2021) shocks

$$\log\left(K_{it+h}/K_{it-1}\right) = \beta_i^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ EBP_{it-1}^{ma} \times \varepsilon_t^m + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_1^h: ε_t^m (b) β_2^h: $EBP_{it-1}^{ma} \times \varepsilon_t^m$

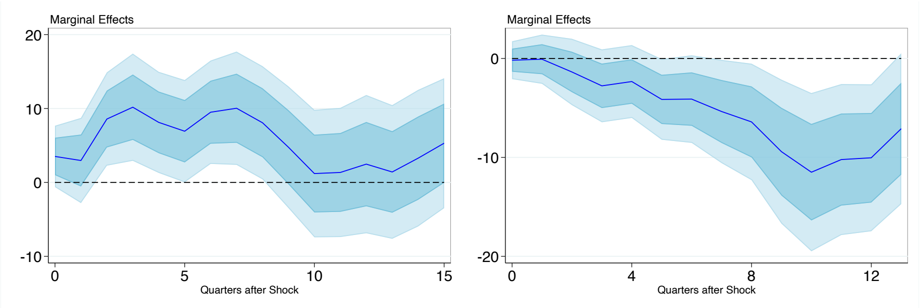
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

back

MP Easing Raises Investment Heterogeneously

EBP purged of DD^2; results also robust to controlling for further powers of DD.

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h\ \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times EBP_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_1^h: ε_t^m (b) β_2^h: $\varepsilon_t^m \times EBP_{it-1}^{ma}$

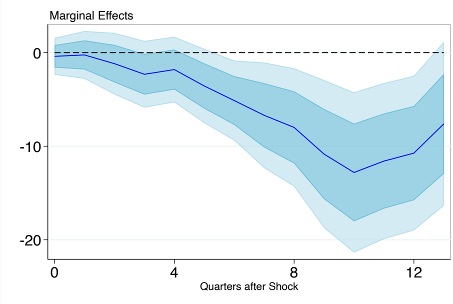
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

- Investment of **Low**-EBP Firms More Responsive to MP

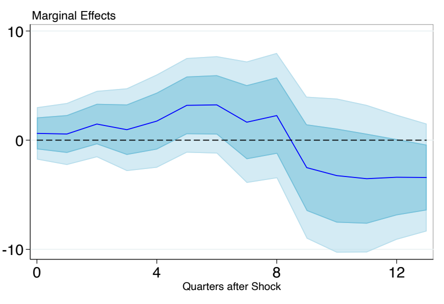
back

Heterogeneous Response by EBP Robust to Leverage

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times EBP_{it-1}^{ma} + \beta_3^h\ \varepsilon_t^m \times Lev_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_2^h: $\varepsilon_t^m \times EBP_{it-1}^{ma}$



(b) β_3^h: $\varepsilon_t^m \times Lev_{it-1}^{ma}$

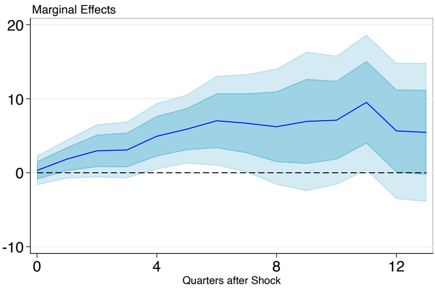
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Leverage measured as in Ottonello and Winberry (2020)

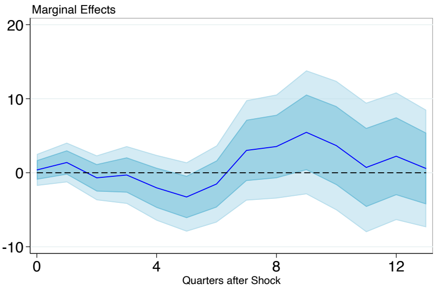
back

Heterogeneous response by EBP robust to Cred. Rat.

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low} + \beta_3^h\ \varepsilon_t^m \times \mathbf{1}\text{Rate}_{it-1}^{high} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low}$



(b) β_3^h: $\varepsilon_t^m \times \mathbf{1}\text{Rate}_{it-1}^{high}$

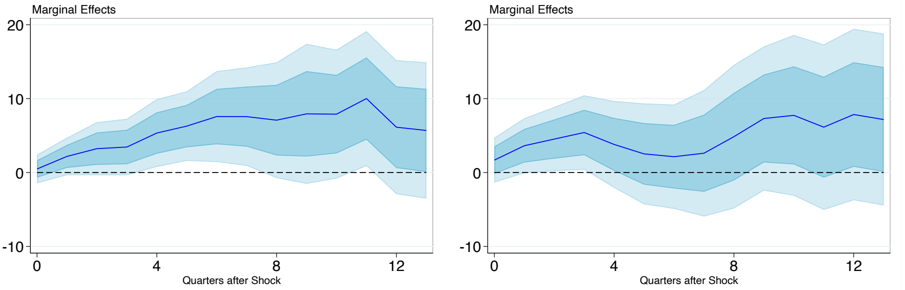
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Credit Rating measured as in Ottonello and Winberry (2020)

back

Heterogeneous Response by EBP Robust to Age

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low} + \beta_3^h\ \varepsilon_t^m \times \mathbf{1}\text{Age}_{it-1}^{high} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low}$

(b) β_3^h: $\varepsilon_t^m \times \mathbf{1}\text{Age}_{it-1}^{high}$

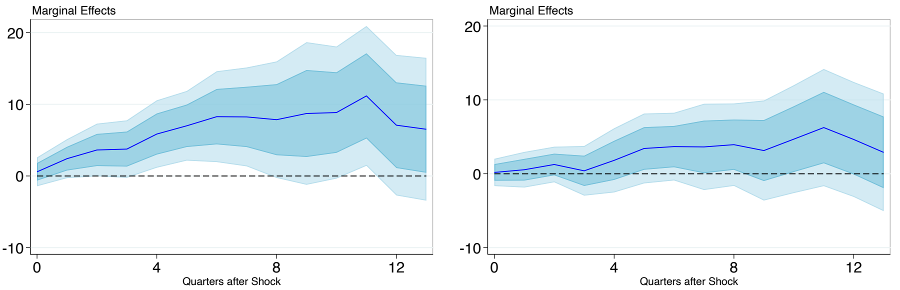
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Age measured as in Anderson and Cesa-Bianchi (2021)

back

Heterogeneous Response by EBP Robust to Size

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low} + \beta_3^h\ \varepsilon_t^m \times \mathbf{1}\text{Size}_{it-1}^{low} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_2^h: $\varepsilon_t^m \times \mathbf{1}\text{EBP}_{it-1}^{low}$

(b) β_3^h: $\varepsilon_t^m \times \mathbf{1}\text{Size}_{it-1}^{low}$

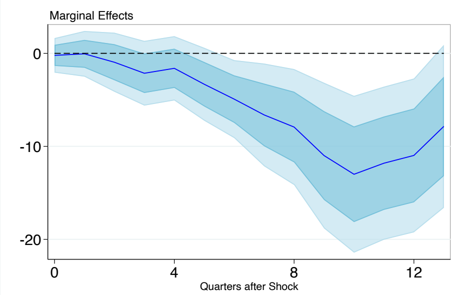
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Size measured as in Gertler and Gilchrist (1994)

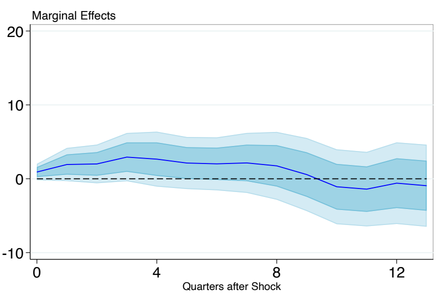
back

Heterogeneous Response by EBP Robust to Liquidity

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \varepsilon_t^m + \color{blue}{\beta_2^h}\ \varepsilon_t^m \times EBP_{it-1}^{ma} + \color{red}{\beta_3^h}\ \varepsilon_t^m \times Liq_{it-1}^{ma} + \gamma^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) $\color{blue}{\beta_2^h}$: $\varepsilon_t^m \times EBP_{it-1}^{ma}$



(b) $\color{red}{\beta_3^h}$: $\varepsilon_t^m \times Liq_{it-1}^{ma}$

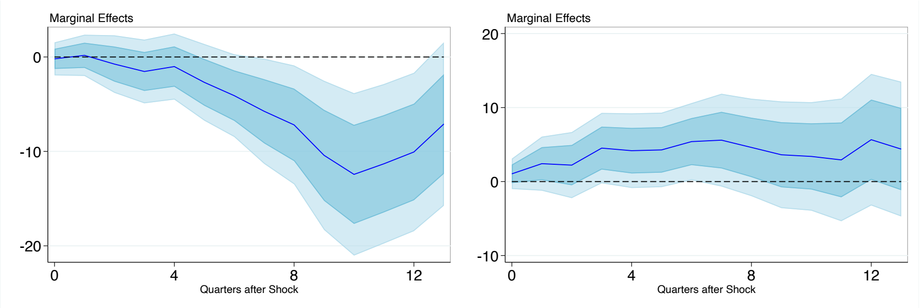
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Liquidity measured as in Jeenas (2019)

▸ back

Heterogeneous Response by EBP Robust to Tobin's q

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h \varepsilon_t^m + \beta_2^h\ \varepsilon_t^m \times EBP_{it-1}^{ma} + \beta_3^h\ \varepsilon_t^m \times Q_{it-1}^{ma} + \gamma^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_2^h: $\varepsilon_t^m \times EBP_{it-1}^{ma}$ (b) β_3^h: $\varepsilon_t^m \times Q_{it-1}^{ma}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

Tobin's (average) q measured as in Jeenas (2019)

back

Production Functions for Low- & High-EBP Firms

$$\log Y_{i,t} = \beta_i + \alpha \log K_{i,t} + \omega_{i,t} + \gamma \log M_{i,t} + \delta \log O_{i,t} + \varepsilon_{i,t}$$

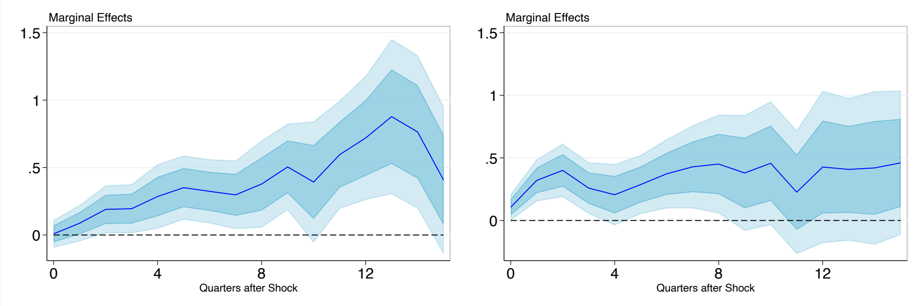
	(1)	(2)	(3)	(4)
$\log Y_{i,t}$	Low-EBP	High-EBP	Low-EBP	High-EBP
$\log K_{i,t}$	0.88***	0.77***	0.19***	0.14
	(.037)	(.037)	(.043)	(.099)
$\log M_{i,t}$			0.56***	0.59***
			(.038)	(.037)
$\log O_{i,t}$			0.27***	0.29***
			(.020)	(.013)

- Low-EBP firms have higher capital intensity $\Rightarrow$ flatter MB curve for capital.
- α estimates for low- & high-EBP firm are statistically distinct and robust to sector-time fixed effects.
- Use model-analogue regression to calibrate model.

back

A Lower Spread Boosts Investment Heterogeneously

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \alpha_{s,t}^h + \beta_1^h\ \Delta S_{i,t} + \beta_2^h\ \Delta S_{i,t} \times EBP_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



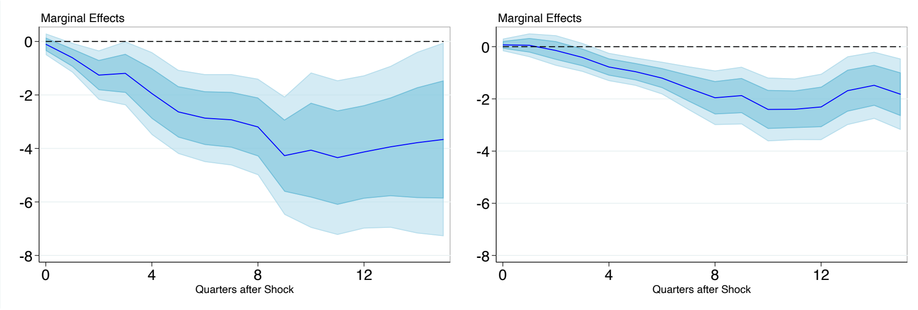
(a) Macro-Fin Controls (b) Time-Sector Fixed Effects

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

- Heterogeneous response of Inv. to ΔS is by **cross-sectional** firm EBP back

A Lower Spread Boosts Investment Heterogeneously

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \color{blue}{\beta_1^h}\ \Delta S_{i,t} \times \mathbf{1}\text{EBP}_{it-1}^{low} + \color{red}{\beta_2^h}\ \Delta S_{i,t} \times \mathbf{1}\text{EBP}_{it-1}^{high} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) $\color{blue}{\beta_1^h}$: $\Delta S_{i,t} \times \mathbf{1}\text{EBP}_{it-1}^{low}$ (b) $\color{red}{\beta_2^h}$: $\Delta S_{i,t} \times \mathbf{1}\text{EBP}_{it-1}^{high}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

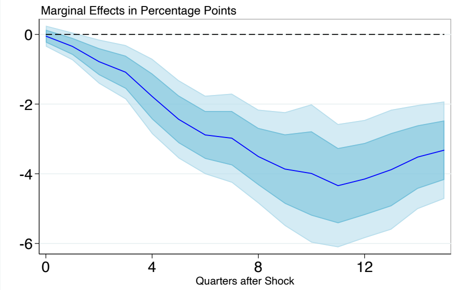
- Investment of **Low**-EBP Firms More Responsive to $\Delta S_{i,t}$

back

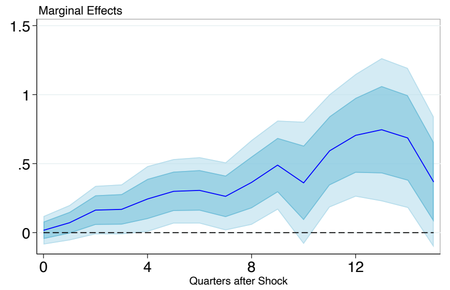
A Lower Spread Boosts Investment Heterogeneously

EBP purged of DD^2; results also robust to controlling for further powers of DD.

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \color{blue}{\beta_1^h}\ \Delta S_{i,t} + \color{red}{\beta_2^h}\ \Delta S_{i,t} \times EBP_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) $\color{blue}{\beta_1^h}$: ε_t^m



(b) $\color{red}{\beta_2^h}$: $\varepsilon_t^m \times EBP_{it-1}^{ma}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

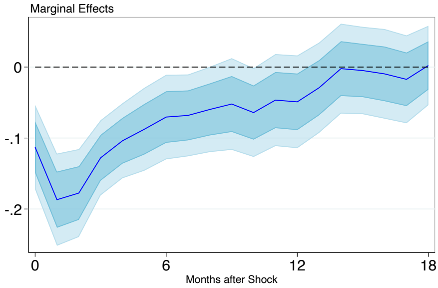
- Investment of **Low**-EBP Firms More Responsive to $\Delta S_{i,t}$

back

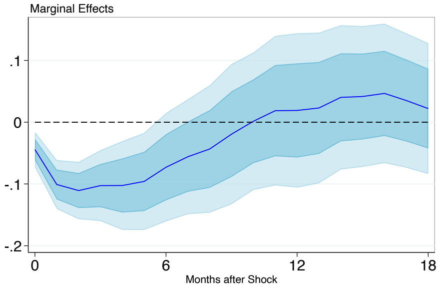
Net Worth Shocks & EBP Heterogeneity on Spreads

ε_t^{NW} **is the orthogonalized intermediary capital risk factor of He et al. (2017)**

$$S_{ikt+h} - S_{ikt-1} = \beta_i^h + \beta_1^h\ \varepsilon_t^{NW} + \beta_2^h\ \varepsilon_t^{NW} \times EBP_{ikt-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{ikt-1} + e_{ikth}$$



(a) β_1^h: ε_t^m



(b) β_2^h: $\varepsilon_t^m \times EBP_{it-1}^{ma}$

Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

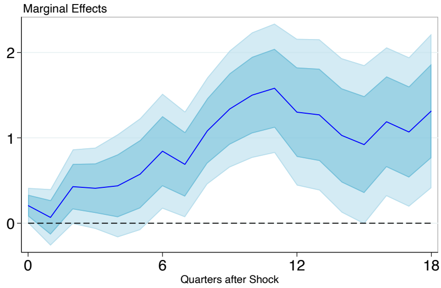
- Spreads of **High**-EBP Firms More Responsive to increase in ε_t^{NW}

back

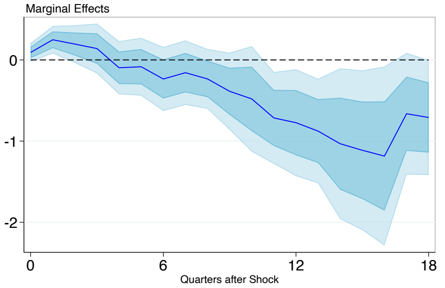
Net Worth Shocks, EBP Heterogeneity on Investment

ε_t^{NW} **is the orthogonalized intermediary capital risk factor of He et al. (2017)**

$$\log\left(\frac{K_{it+h}}{K_{it-1}}\right) = \beta_i^h + \beta_1^h\ \varepsilon_t^{NW} + \beta_2^h\ \varepsilon_t^{NW} \times EBP_{it-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{it-1} + e_{ith}$$



(a) β_1^h: ε_t^m



(b) β_2^h: $\varepsilon_t^m \times EBP_{it-1}^{ma}$

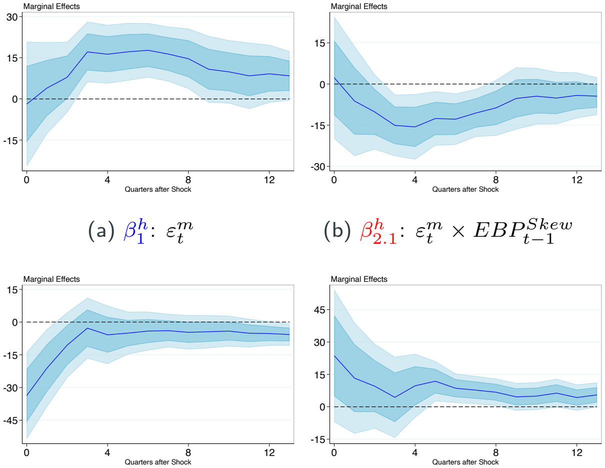
Note. The inner and outer shaded areas correspond to the 68% and 90% confidence intervals, respectively.

- Investment of **Low**-EBP Firms More Responsive to increase in ε_t^{NW}

back

Moments of EBP Dist. and MP's Aggregate Effects

$$\log\left(I_{t+h}/I_{t-1}\right) = \beta_0^h + \beta_1^h \varepsilon_t^m + \boldsymbol{\beta}_2^h \varepsilon_t^m \times \boldsymbol{M}_{t-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{t-1} + e_{th}$$



(a) β_1^h: ε_t^m

(b) $\beta_{2.1}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Skew}$

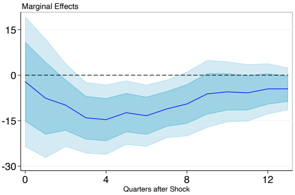
(c) $\beta_{2.2}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Med}$

(d) $\beta_{2.3}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Disp}$

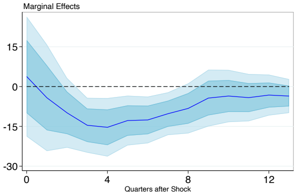
back

Left-Skewed EBP Dist. Increases Agg. MP Effects

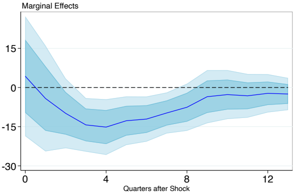
$$\log\left(I_{t+h}/I_{t-1}\right) = \beta_0^h + \beta_1^h \varepsilon_t^m + \beta_2^h \varepsilon_t^m \times EBP_{t-1}^{skew} + \boldsymbol{\gamma}^h \mathbf{Z}_{t-1} + e_{th}$$



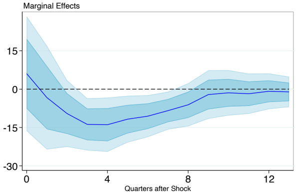
(a) β_2^h: $\varepsilon_t^m \times EBP_{t-1}^{Skew95-05}$



(b) β_2^h: $\varepsilon_t^m \times EBP_{t-1}^{Skew85-15}$



(c) β_2^h: $\varepsilon_t^m \times EBP_{t-1}^{Skew80-20}$

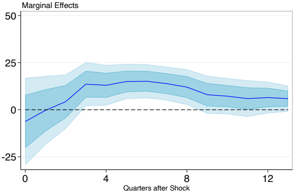


(d) β_2^h: $\varepsilon_t^m \times EBP_{t-1}^{Skew75-25}$

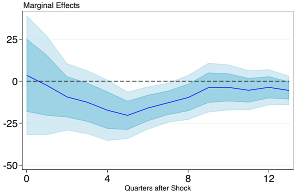
▸ back

Percentiles of EBP Dist. and MP's Aggregate Effects

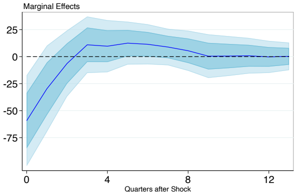
$$\log\left(I_{t+h}/I_{t-1}\right) = \beta_0^h + \beta_1^h \varepsilon_t^m + \boldsymbol{\beta}_2^h \varepsilon_t^m \times \boldsymbol{P}_{t-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{t-1} + e_{th}$$



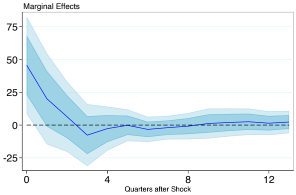
(a) β_1^h: ε_t^m



(b) $\beta_{2.1}^h$: $\varepsilon_t^m \times EBP_{t-1}^{10}$



(c) $\beta_{2.2}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Med}$

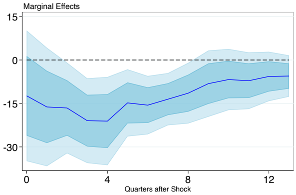


(d) $\beta_{2.3}^h$: $\varepsilon_t^m \times EBP_{t-1}^{90}$

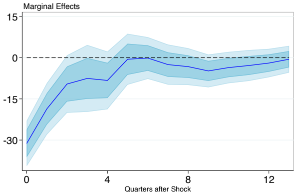
back

EBP Skew vs. Recession Index on MP Agg. Effects

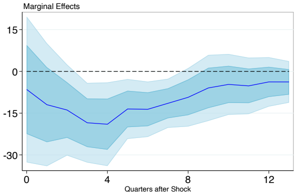
$$\log\left(I_{t+h}/I_{t-1}\right) = \beta_0^h + \beta_1^h \varepsilon_t^m + \color{red}{\beta_2^h} \varepsilon_t^m \times EBP_{t-1}^{skew} + + \color{blue}{\beta_3^h} \varepsilon_t^m \times Rec_{t-1} + \boldsymbol{\gamma}^h \mathbf{Z}_{t-1} + e_{th}$$



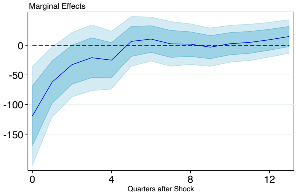
(a) $\color{red}{\beta_2^h}$: $\varepsilon_t^m \times EBP_{t-1}^{Skew}$



(b) $\color{red}{\beta_2^h}$: $\varepsilon_t^m \times Rec_{t-1}^{Prob}$



(c) $\color{red}{\beta_2^h}$: $\varepsilon_t^m \times EBP_{t-1}^{Skew}$



(d) $\color{red}{\beta_2^h}$: $\varepsilon_t^m \times Rec_{t-1}^{NBER}$

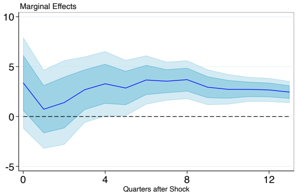
back

Moments of EBP Dist. and MP's Aggregate Effects

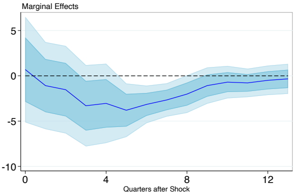
Baseline results robust to Swanson (2021) shocks

▸ back

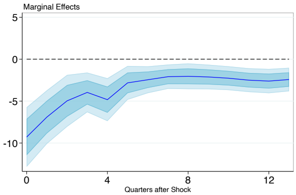
$$\log\left(I_{t+h}/I_{t-1}\right) = \beta_0^h + \beta_1^h \varepsilon_t^m + \boldsymbol{\beta}_2^h \varepsilon_t^m \times \boldsymbol{M}_{t-1}^{ma} + \boldsymbol{\gamma}^h \mathbf{Z}_{t-1} + e_{th}$$



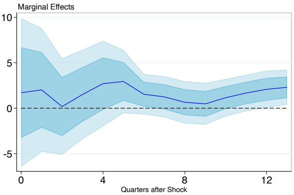
(a) β_1^h: ε_t^m



(b) $\beta_{2.1}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Skew}$



(c) $\beta_{2.2}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Med}$



(d) $\beta_{2.3}^h$: $\varepsilon_t^m \times EBP_{t-1}^{Disp}$