

Monetary Policy, Corporate Finance & Investment

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Monetary Policy and Firm Finance

- ▶ How does monetary policy affect firm **investment**? Which type of firms are **most responsive**?
- ▶ How do **firms' balance sheets** respond?
- ▶ How important are **financial frictions**?

Our Approach

■ Firm-level panel approach for the US and UK

- ▶ *Heterogeneity in the dynamic effects of policy across firms.*
- ▶ *Micro data with macro identification of policy rate changes.*

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■ Which firms change **investment** the most?

- ▶ *Which proxies for financial constraints should we focus on?*
- ▶ **Age**, size, growth, leverage, liquidity, dividend status, Q
- ▶ *Multivariate heterogeneity analysis.*

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■ What happens to these firms' **balance sheets**?

- ▶ *Borrowing, equity, earnings/cash flows, share prices.*

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■ Heterogeneity used to examine the **transmission mechanism**.

Main Findings

■ Investment

1. **Age** is a robust predictor: **Younger firms** respond the most.
Quantitatively important to account for the aggregate response.
2. Especially pronounced for firms **not paying dividends**.
3. **Robust** to controlling for *more traditional* characteristics.

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■ Firm Finance

4. **Younger firms**: lower earnings, lower credit scores and leverage. Less likely to pay dividends. **Borrowing** is more **asset-based**.
5. After a contractionary monetary policy, **net worth falls** for all firms. But **borrowing** falls the most for younger firms paying no dividends.

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- **Interpretation of the evidence/channel:** *higher interest rates* →
→ *lower asset values* → *borrowing falls* → *investment falls*.

Literature

Empirics...

- ▶ **Age & employment** (Haltiwanger et al., 2013, Bahaj et al., 2018)
- ▶ **Age, size, leverage & business cycles**
(Dinlersoz et al., 2018, Crouzet & Mehrotra 2018)
- ▶ **Firm Finance & business cycles**
(Covas & den Haan, 2011, Begenau & Salomao, 2018)
- ▶ **Investment & financial frictions** (Fazzari et al. 1988, Gertler & Gilchrist 1994, Ottonello & Winberry 2018, Jeenas, 2018)
- ▶ **Firm borrowing constraints** (Lian & Ma, 2018, Drechsel, 2018)

Financial frictions...

- ▶ **Age & growth prospects** (Cooley-Quadrini, 2001, Cooper et al. 2006)
- ▶ **Leverage, asset prices/collateral values & monetary policy**
(Bernanke, Gertler & Gilchrist, 1999, Kiyotaki & Moore, 1997, etc.)

Outline

Data & Approach


Age as a Proxy for Financial Constraints

Heterogeneity in the Response of Investment

Firm Finance and Balance Sheet Response

Concluding remarks

Firm Data: Panel of Public Firms

- ▶ Compustat quarterly panel (US). Worldscope annual panel (UK). Sample period: 1986-2016. 
- ▶ Also make use of corporate bonds and asset price data (CRSP and Thomson Reuters)
- ▶ **Key variables of interest:**
 - ▶ **Investment:** capital expenditure/net PPE.
 - ▶ **Age:** Worldscope years since incorporation.
 - ▶ **Other variables:** assets, debt, leverage (debt/assets), liquidity, Tobin's Q, equity, share prices, earnings/sales, **dividends paid**, interest payments.

Monetary Policy: Identification

- ▶ Gertler-Karadi approach: **High frequency surprises** in short rate futures around policy announcements.
- ▶ Instrument available since 2001 for the U.K. (Gerko-Rey) and 1991 for the U.S. (Gertler-Karadi).
- ▶ Gertler-Karadi (2015)/Mertens-Ravn (2013): surprises as proxies for structural shocks in the Vector Autoregression.
- ▶ Identifies a series of monetary policy shocks for the full sample.

▶ SHOCK SERIES

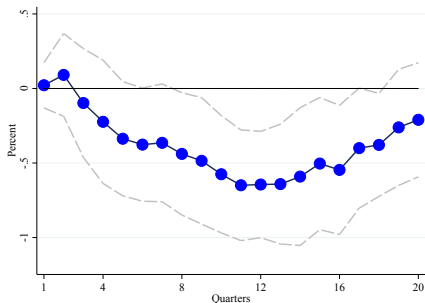
Empirical Specification

$$\Delta_h X_{i,t+h} = \gamma_i^h + \sum_{g=1}^G \beta_g^h \cdot \mathbf{I}[Z_{i,t-1} \in g] \cdot R_t + \sum_{g=1}^G \alpha_g^h \cdot \mathbf{I}[Z_{i,t-1} \in g] + \epsilon_{i,t+h}$$

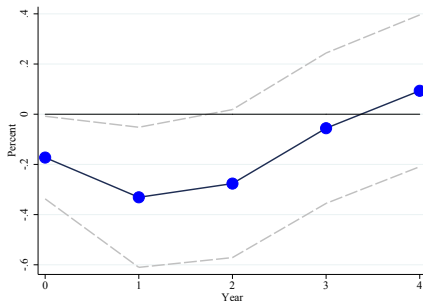
- ▶ Baseline $X_{i,t+h}$: **capex/net PPE** at horizon h . Also look at equity, borrowing, earnings, share prices etc.
- ▶ $Z_{i,t-1}$: variable defining a **group**: age, size, growth, leverage, beta, paying dividends in previous year. Could be multivariate.
- ▶ R_t : interest rate in GK/GR instrumented with structural shocks.

Sense Check: The Average Effect

United States



United Kingdom



Response of the investment ratio to a 25 basis point increase in interest rates. Confidence bands 90%. Firm-time clustering.

Consistent with [▶ MACRO EVIDENCE](#) using data from national statistics.
IRFs even more similar when reporting at the same [▶ ANNUAL FREQUENCY](#)

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Age as a Proxy for Financial Constraints

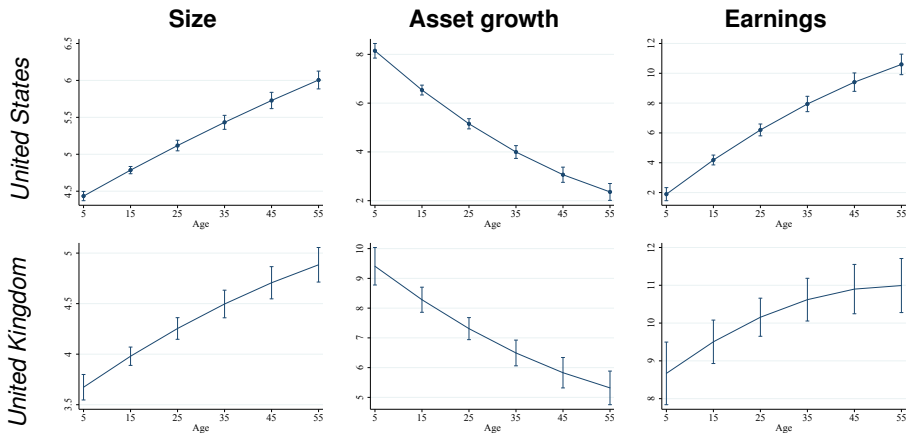
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Size, Growth and Earnings by AGE

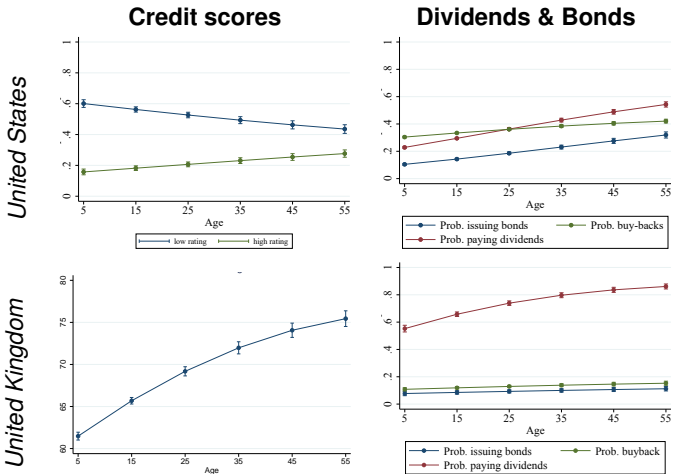
Younger firms are smaller, have lower cash-flows but grow faster



Regressions of the variable of interest on age, squared age, sectorsXtime fixed effects (and size).

Financial Characteristics by AGE

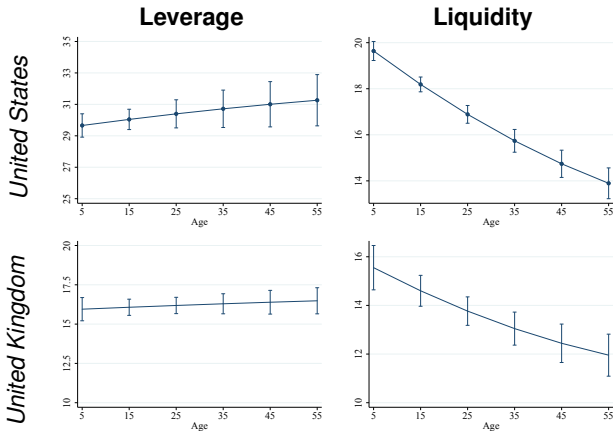
Younger firms: lower credit scores/less likely to pay dividends.



Based on regressions of the variable of interest on age, squared age, sectorsXtime fixed effects (and size).

Leverage and Liquidity by AGE

Younger firms are less leveraged/hold more liquid assets



Based on regressions of the variable of interest on age, squared age, sectorsXtime fixed effects (and size).

Summary: What Does Age Capture?

Younger firms tend to:

- ▶ be **smaller**
- ▶ have **lower earnings**
- ▶ have **lower**
 - ▶ **credit scores**
 - ▶ probability of **paying dividends**

But younger firms also have:

- ▶ **lower leverage** and **higher liquid assets**
- ▶ **faster growth** and **higher (average) Tobin's Q**

Outline

Data & Approach

Age as a Proxy for Financial Constraints

Heterogeneity in the Response of Investment

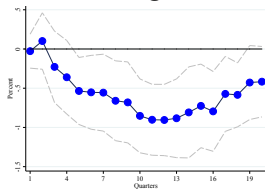
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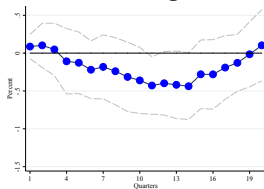
Response of Investment by AGE

United States
United Kingdom

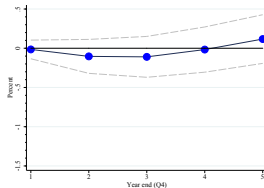
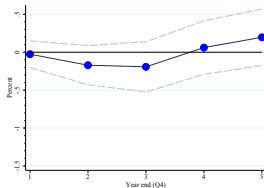
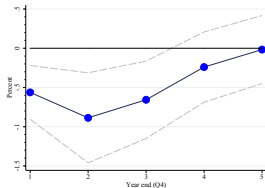
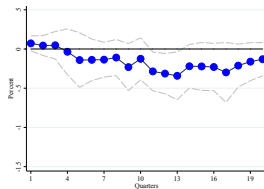
Younger



Middle-aged

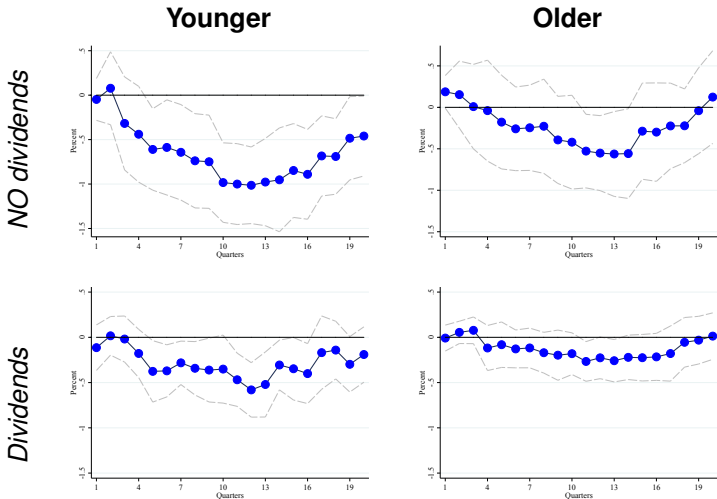


Older



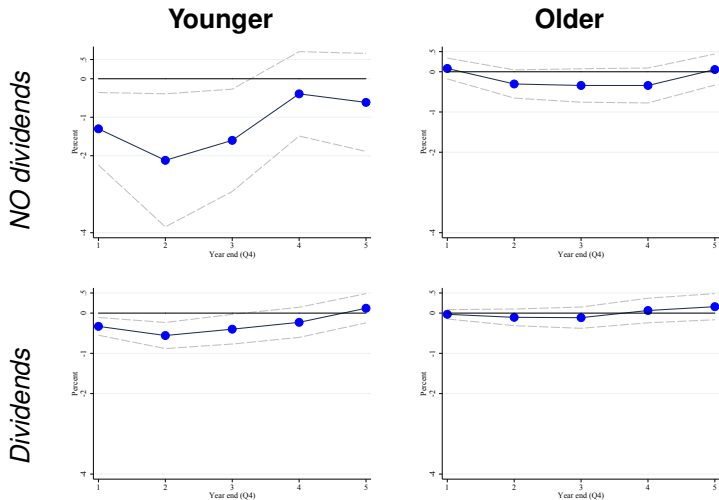
25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

Investment Response by AGE & DIVIDENDS: U.S.



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Investment Response by AGE & DIVIDENDS: U.K.



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YOUNGER Firms Drive the Average Effect

	Younger		Older	
	No Div	Paid Div	No Div	Paid Div
U.S.	75.5%	6.7%	13.0%	4.8%
	[68.1 , 82.8]	[-1.6 , 15.5]	[11.7 , 14.5]	[1.9 , 7.4]
U.K.	83.6%	13.1%	2.9%	0.4%
	[70.4 , 96.8]	[2.9 , 23.2]	[-2.2 , 8.1]	[-5.9 , 6.9]

Notes: 95% CI in square brackets

Multidimensional Heterogeneity Analysis

Age is correlated with a range of other factors. Do our IRFs simply capture one of these other factors? **No**.

Results are robust to conditioning on:

1. Size [▶ charts](#)
2. Leverage [▶ charts](#)
3. Liquidity [▶ charts](#)
4. Firm growth [▶ charts](#) and Tobin's Q [▶ charts](#)
5. Risk [▶ see section 7.2 in the paper](#)

Outline

Data & Approach

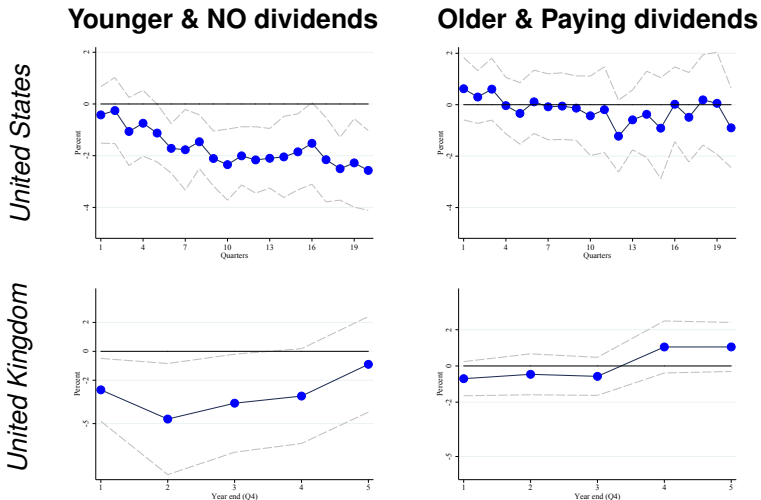
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BORROWING responds most for Younger/No Div.



25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

► Muted, more homogeneous and less persistent response of interest payments

Borrowing: Asset vs. Earning-Based

$$\Delta B_{i,t} = \sum_{g=1}^G \beta_{1,g} \cdot \mathbf{I}[Z_{i,t-1} \in g] \cdot \text{COLL}_{i,t-1} + \sum_{g=1}^G \beta_{2,g} \cdot \mathbf{I}[Z_{i,t-1} \in g] \cdot \text{EBITDA}_{i,t-1} + X'_{i,t} \gamma + \epsilon_{i,t}$$

	U.K.		U.S.	
	Young / No Div	Old / Div	Young / No Div	Old / Div
COLLATERAL				
EBITDA				

Dependent variable: Δ long-term debt

Note: regressions include time-sector, group and firm fixed effects, plus a range of other lagged firms' characteristics as controls. Standard errors are clustered by time and firm.

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COLLATERAL	0.025*** (0.009)	0.012 (0.009)		
EBITDA	-0.013 (0.011)	0.069*** (0.019)		

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	U.K.		U.S.	
	Young / No Div	Old / Div	Young / No Div	Old / Div
COLLATERAL	0.025*** (0.009)	0.012 (0.009)	0.063*** (0.013)	0.038** (0.014)
EBITDA	-0.013 (0.011)	0.069*** (0.019)	0.007 (0.016)	0.048** (0.018)

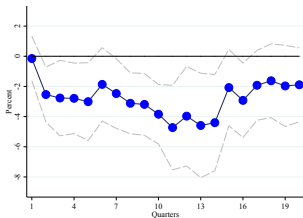
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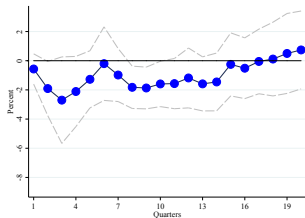
EQUITY (MKT. VALUE) falls

United States

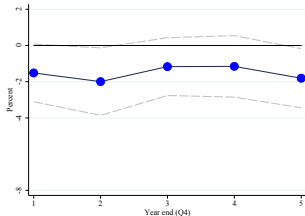
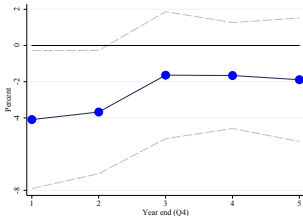
Younger & NO dividends



Older & Paying dividends



United Kingdom

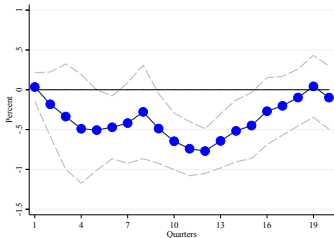


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

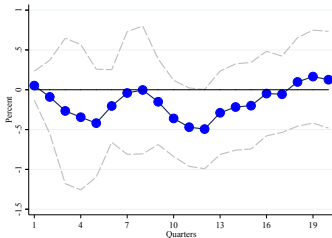
▶ Share Price

Response of EARNINGS

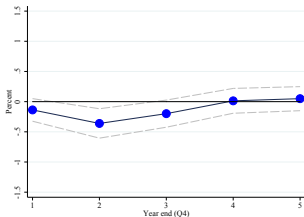
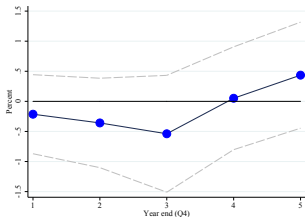
Younger & NO dividends



Older & Paying dividends



United Kingdom



25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

▶ EBITDA

Transmission Mechanism

To recap:

- ▶ Net worth falls for all groups.
- ▶ Borrowing of younger-no dividend firms is more correlated with asset values than with earnings.
- ▶ Borrowing only significantly falls for these firms.

Other channels?

1. Demand
2. Growth and profitability
3. Liquidity
4. Risk

Sensitivity analysis

Results are robust to

- ▶ survival bias
- ▶ information effect
- ▶ sectoral heterogeneity
- ▶ ending the sample in 2007

Our contribution: **FIVE NEW FINDINGS...**

1. **Younger firms** respond more than any other group and **drive the aggregate response** of investment to interest rate changes
2. Results are more pronounced for young firms **paying no dividends** and robust to controlling for other firm characteristics

Our contribution: **FIVE NEW FINDINGS...**

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2. Results are more pronounced for young firms **paying no dividends** and robust to controlling for other firm characteristics
3. Younger firms' **borrowing is more asset-based** (than earning-based)
4. **Net worth** and **share prices** move for **all firms**
5. **Borrowing responds most** for younger firms.

...and AN INTERPRETATION

- ▶ Younger firms tend to borrow against the value of their assets to fund capital expenditure.
- ▶ Rate increases push down asset prices and collateral values.
- ▶ Borrowing constraints tighten: borrowing and investment falls.
- ▶ Younger firms account for a sizable part of the aggregate response of investment.

Young firms face financial frictions. Fluctuations in collateral and asset values can play a key role in the MTM.

Extra Slides

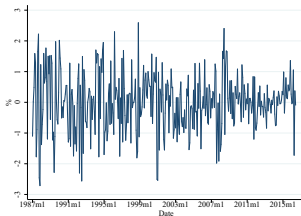
Monetary Policy Surprises and Shocks

High-frequency Surprises

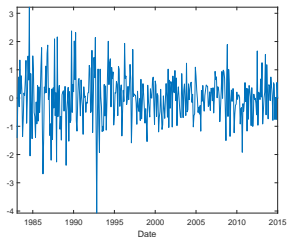
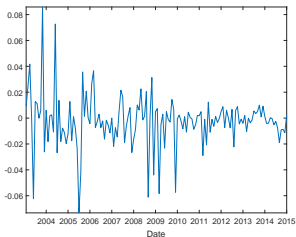
United States



Policy Shocks



United Kingdom



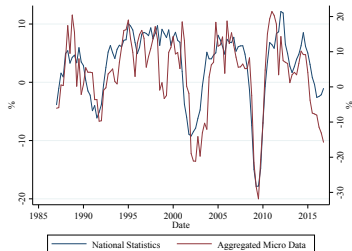
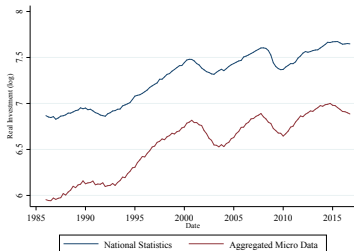
▶ Back

Investment: National Statistics vs Micro data

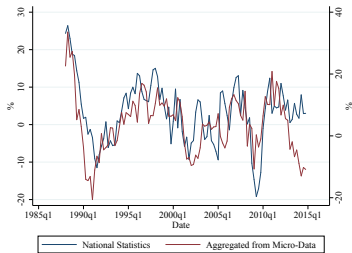
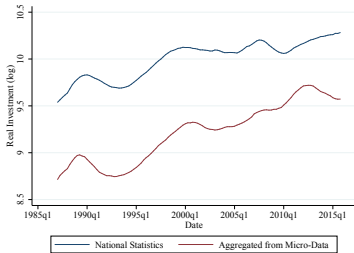
Levels

Growth rates

United States

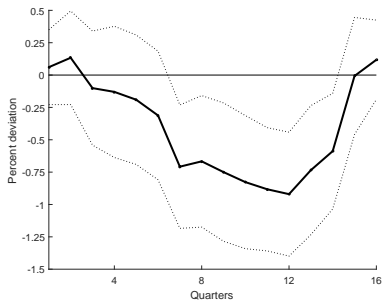


United Kingdom

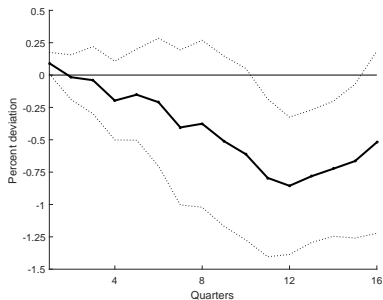


The response of aggregate investment

United Kingdom



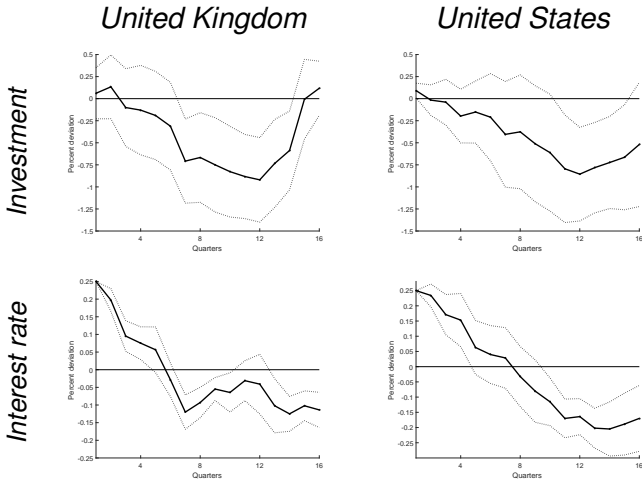
United States



Monetary Policy shock: 25 basis point increase. Bootstrapped Standard errors.

[▶ Back to average effect](#)

The response of aggregate investment



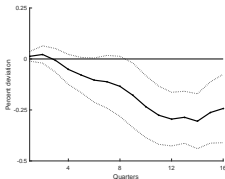
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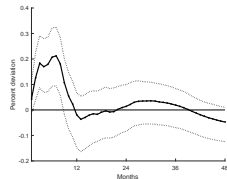
The response of selected macro variables

United States

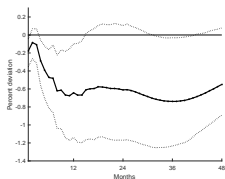
Employment



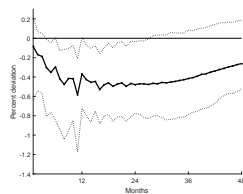
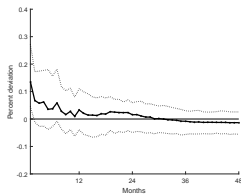
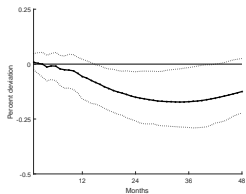
Credit Spread



IP



United Kingdom

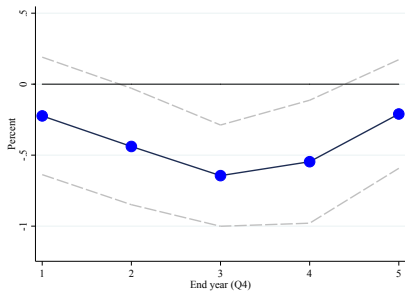


Monetary Policy shock: 25 basis point increase. Bootstrapped Standard errors.

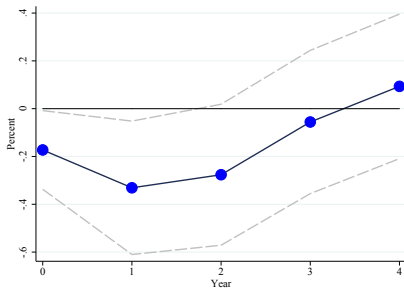
[▶ Back to average effect](#)

The U.S. average effect reported at annual frequency

United States



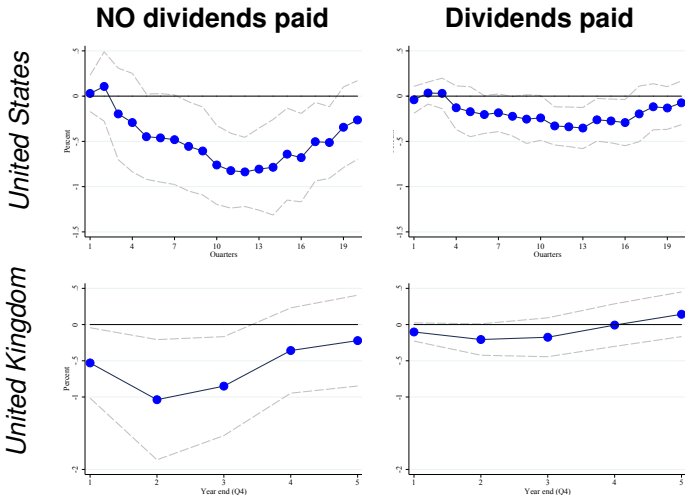
United Kingdom



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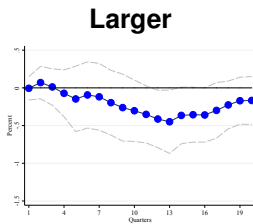
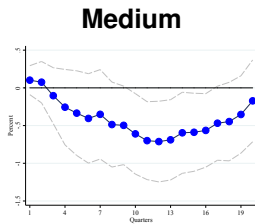
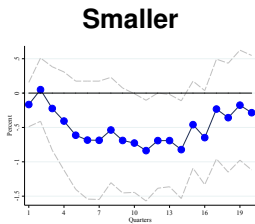
Investment responses by **PAYING DIVIDENDS**



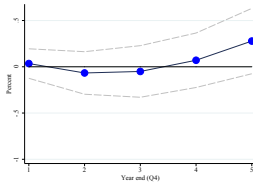
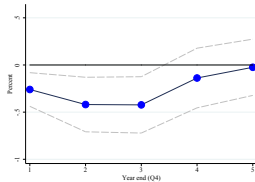
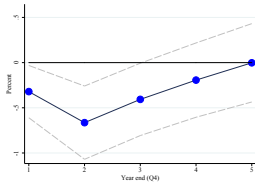
25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

Investment response by SIZE

United States



United Kingdom



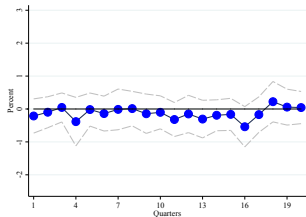
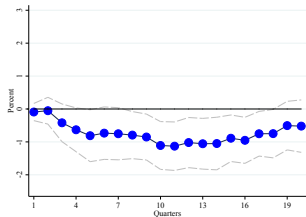
25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

'Controlling' for (SMALLER) size

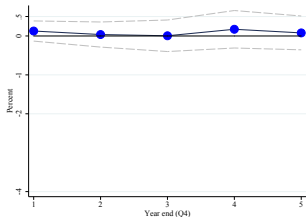
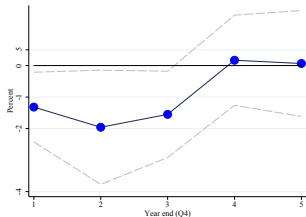
NO dividends & Younger

PAY dividends & Older

United States



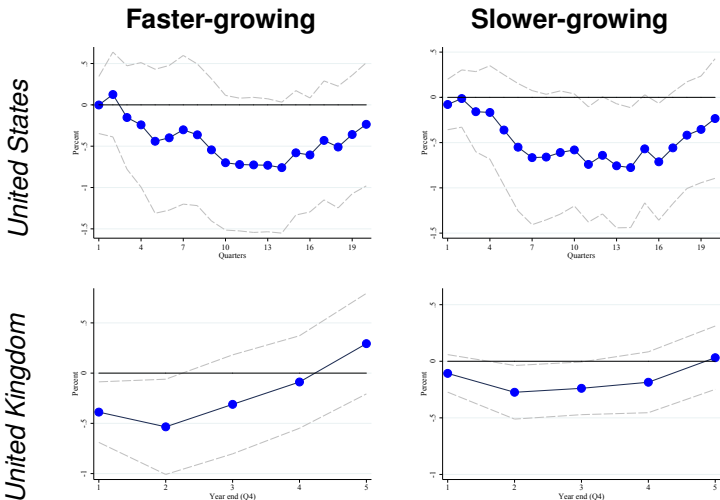
United Kingdom



25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

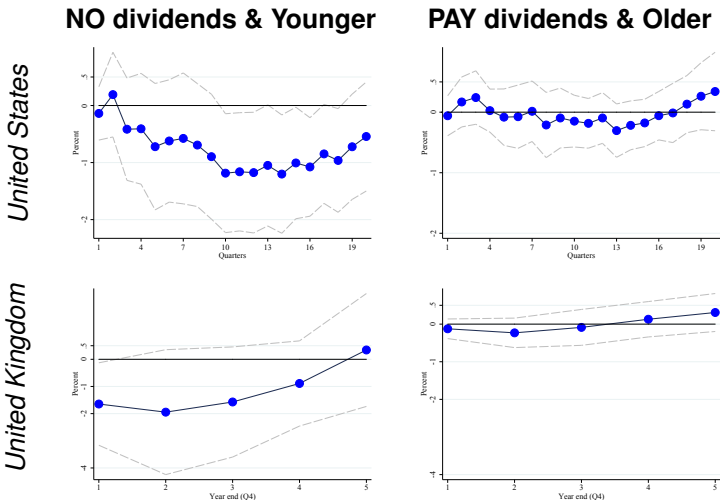
[▶ Back to robustness summary](#)

Investment response by **ASSET GROWTH**



25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

'Controlling' for (FASTER) asset growth



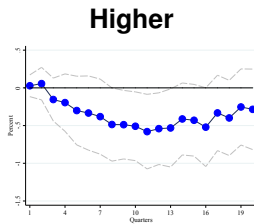
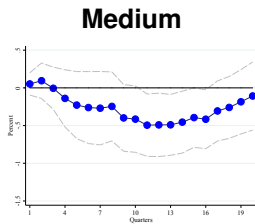
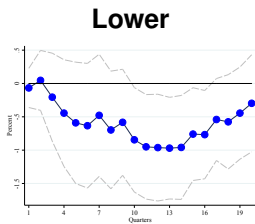
25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

[▶ Back to robustness summary](#)

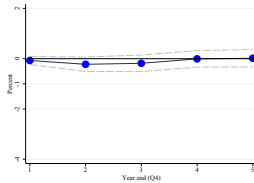
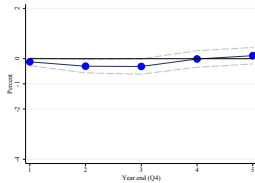
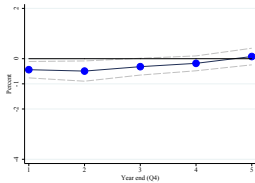
[▶ Back to mechanism](#)

Investment response by **LEVERAGE**

United States



United Kingdom

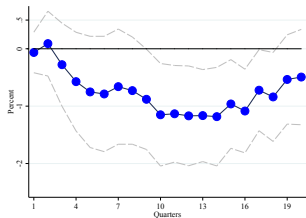


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

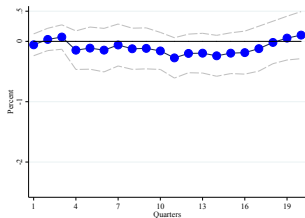
'Controlling' for (LOWER) leverage

NO dividends & Younger

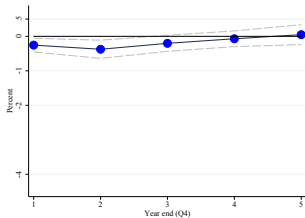
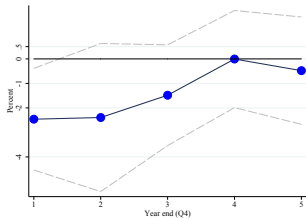
United States



PAY dividends & Older



United Kingdom

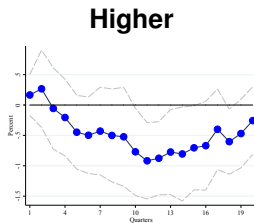
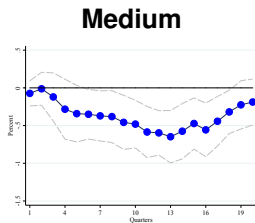
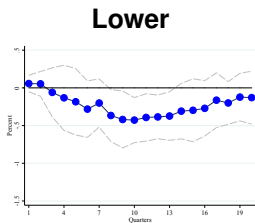


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

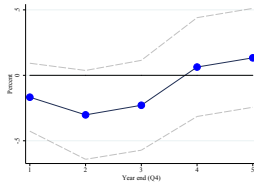
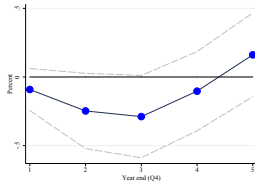
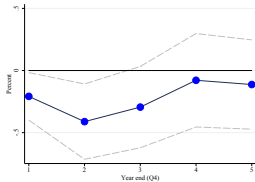
[▶ Back to robustness summary](#)

Investment response by LIQUIDITY

United States



United Kingdom

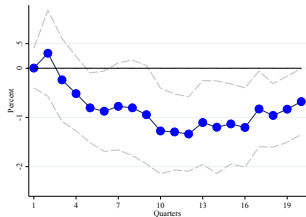


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

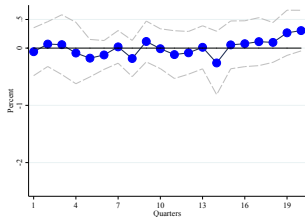
'Controlling' for (HIGHER) liquidity

NO dividends & Younger

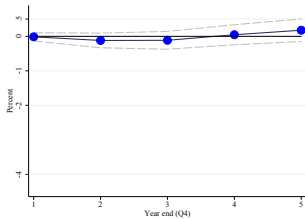
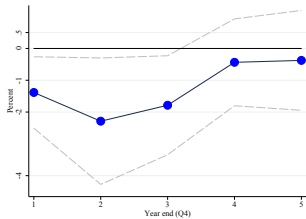
United States



PAY dividends & Older



United Kingdom

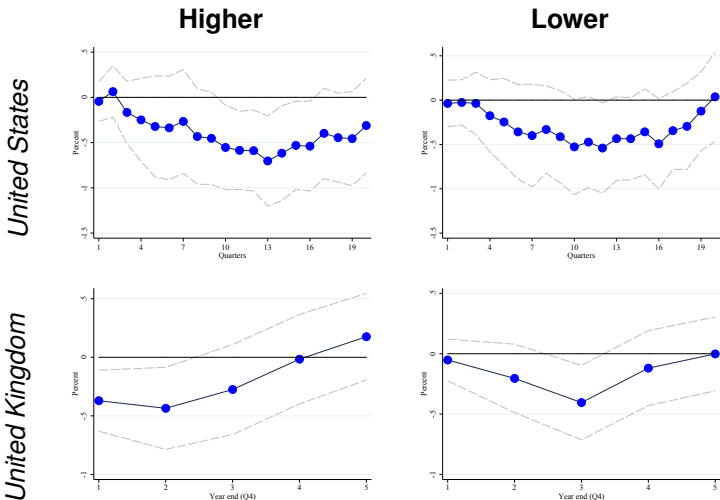


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

[▶ Back to robustness summary](#)

[▶ Back to mechanism](#)

Investment response by TOBIN'S Q

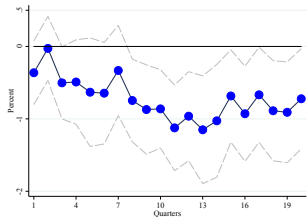


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

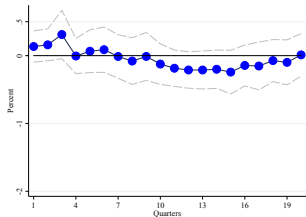
'Controlling' for (HIGHER) Tobin's Q

United States

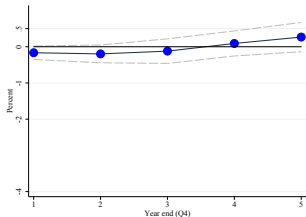
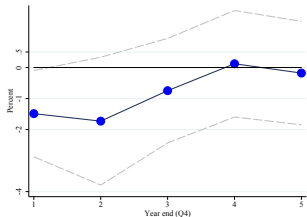
NO dividends & Younger



PAY dividends & Older



United Kingdom

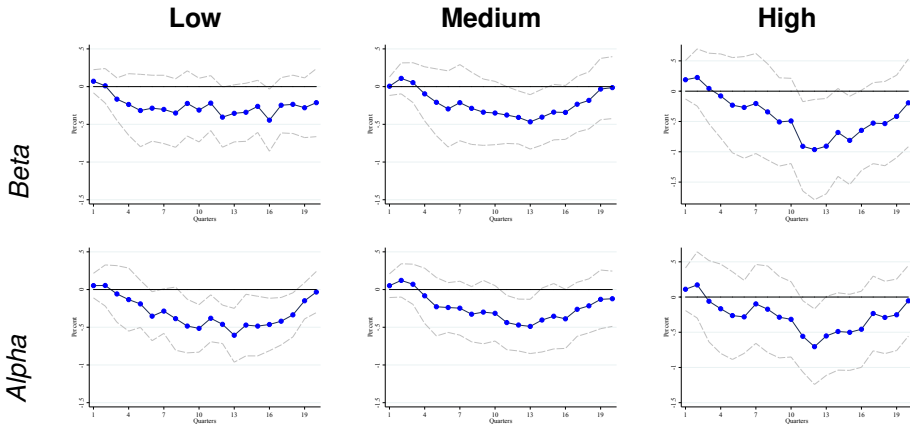


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

[▶ Back to robustness summary](#)

[▶ Back to mechanism](#)

US Investment Response by **BETA** and **ALPHA**



25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

'Controlling' for (HIGH) Alpha/Beta (US)

Alpha
Beta

NO dividends & Younger **PAY dividends & Older**

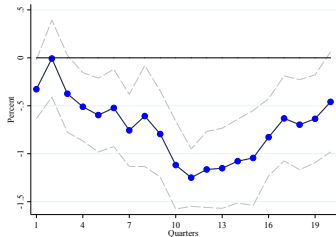
25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

[▶ Back to robustness summary](#)

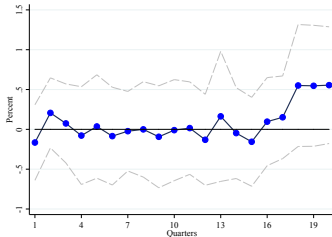
[▶ Back to mechanism](#)

Firms Who Grow Old

United States Young & NO dividends



Old & Paying dividends

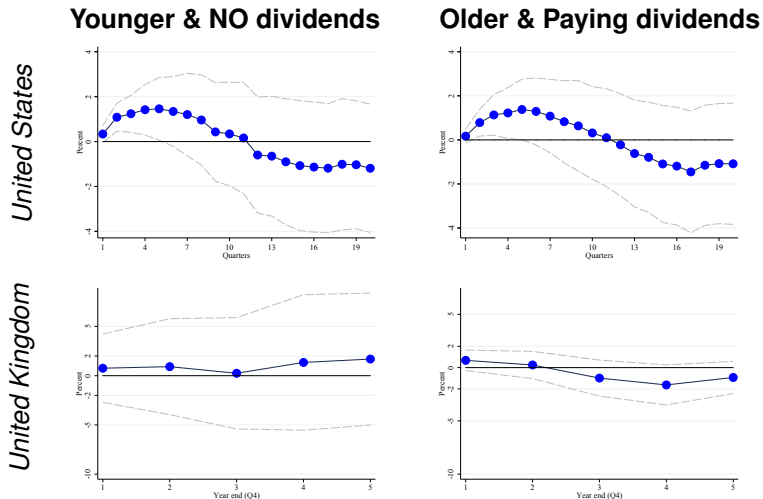


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

▶ [Back to robustness summary](#)

▶ [Back to mechanism](#)

More homogeneous **INTEREST PAYMENTS** response

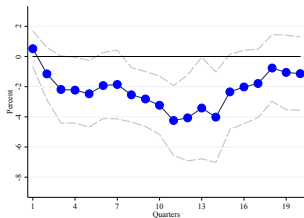


25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

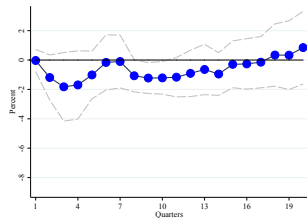
SHARE PRICE falls

Younger & NO dividends

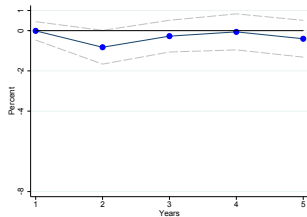
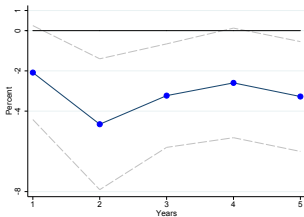
United States



Older & Paying dividends



United Kingdom

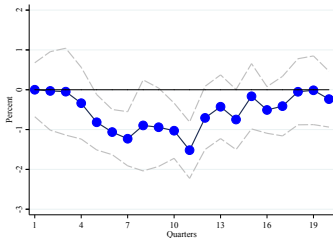


Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.

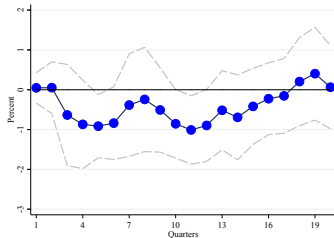
[▶ Back](#)

Response of EBITDA

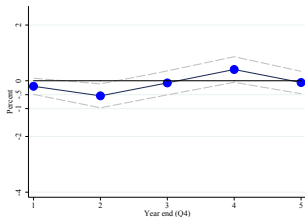
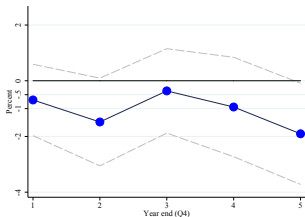
Younger & NO dividends



Older & Paying dividends



United Kingdom



25 basis point increase in interest rates. Standard errors clustering by firm and time. Confidence band: 90%.

[Back](#)