Investment, Financial Frictions and the Dynamic Effects of Monetary Policy

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Paris, November 7th 2018

The views expressed are those of the authors and do not necessarily reflect the views of the Bank of Spain, the Euro-system, Bank of England, MPC, FPC or PRA.
Monetary transmission and financial frictions

- Which type of firms are more sensitive to interest rate changes?
- How much do these firms contribute to the aggregate response?
- How can financial frictions be identified from balance sheet data?
- Do financial frictions dampen or amplify monetary policy shocks?
Monetary transmission and financial frictions

- Which **type of firms** are more sensitive to interest rate changes?

- How much do these firms contribute to the **aggregate response**?

- How can **financial frictions** be identified from **balance sheet** data?

- Do financial frictions **dampen** or **amplify** monetary policy shocks?
Empirical challenges and our approach

1. Assess **heterogeneity** across firms’ characteristics.
   → Look at **firm-level** capital expenditure in U.K. and U.S.
   → Explore variation by **age**, **size**, **growth**, **leverage** and **Tobin’s Q**.

2. Evaluate **balance sheet position** across groups of firms.
   → Exploit info on **dividends and bond issuance decisions**, **credit scores**, and **equity prices**.

3. Identify a series of **monetary policy shocks**.
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Main empirical finding I: heterogeneity

- Younger firms exhibit significantly larger adjustments in investment after an interest rate change and drive the aggregate response.

- Within these, the strongest adjustment is recorded among younger firms paying no dividends.

- Peak effect occurs between two and three years after the shock.

- Results are robust to controlling for other, more traditional, firms’ characteristics.
Main empirical finding II: mechanism

- Younger firms’ borrowing is more asset-based (than earning-based)...

- ...and their investment relies more on external funds (debt)

After a contractionary monetary policy shock:

- interest payments and net worth respond homogeneously for all age groups

- borrowing, though, drops by a larger and significant amount for younger firms, especially those paying no dividends;

- sales (demand) responses are less pronounced and more homogenous across age/dividends groups.

Consistent with financial frictions playing a quantitatively important role to amplify business cycle fluctuations through collateral values.
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Outline

1. Data & approach
2. Heterogeneity
3. Financial frictions
4. Other transmission mechanisms
5. Concluding remarks

Real variables: capital expenditure, age (years since incorporation or IPO), size (by asset value), growth (by assets), net sales.

Financial variables: leverage (debt over assets); Tobin’s Q; equity; cash flows; dividends paid; share prices; interest payments, bond issuance.

U.K.: 2,435 unique listed firms and around 27,000 (firms x years) obs.
U.S.: 11,577 unique listed firms and 623,000 (firms x quarters) obs.
Investment: National Statistics vs Micro data

Levels

Growth rates

Correlation .58 (pvalue = 0)
Monetary policy shock series

- **High frequency surprises** on short rate futures in a 30 minutes window around policy announcements, available since 2001 for the U.K. (Gerko-Rey) and since 1991 for the U.S. (Gertler-Karadi).

- Monthly macro **proxy-SVAR** over 1987-2015 using the high frequency surprises as proxies to extract a shock series for the full sample (see Mertens and Ravn, 2014; Ramey 2016).

- Firms are matched with monthly interest rate surprises based on their respective filing dates.
Empirical specification: panel IV-Local Projections

$$X_{j,t+h} - X_{j,t-1} = \alpha^h_j + \sum_{g=1}^{G} \alpha^h_g \times Dg^h_{j,t} + \sum_{g=1}^{G} \beta^h_g \times Dg^h_{j,t} \times R_t + \epsilon_{j,t+h}$$

- **Baseline** $X_{j,t+h}$: capital expenditure over net PPE at horizon $h$;
- $Dg$: dummy for groups of age, size, leverage, paying dividends in previous year;
- $R_t$: interest rate in quarter $t$ (slightly more convoluted for the U.K. annual data);
- Instrument: policy shocks in the accounting period $t$, extracted from proxy-SVAR.
- $\beta^h_g$: impulse response for group $g$ at forecast horizon $h$.

- **Additional** firm-level $X_{j,t+h}$: borrowing, share prices, sales, interest payments;
  **Additional** aggregate $X_{t+h}$: industrial production, stock price index, credit spread.

- Standard errors clustered by firms and time.
The average effect: capital expenditure over net PPE

**United Kingdom**

**United States**


Consistent with the ▶ MACRO EVIDENCE using data from national statistics.

Same message when reporting at the ▶ ANNUAL FREQUENCY
Outline

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Descriptive Statistics
Firms’ size, growth and revenues as function of **AGE**

**Size**

United Kingdom

United States

**Asset growth**

**EBITDA**

Based on regressions of the variable of interest on age, squared age, sectorsXtime fixed effects (and size).
Firms’ financial characteristics as function of **AGE**

**Credit scores**

**Paying dividends**

**Leverage**

*Based on regressions of the variable of interest on age, squared age, sectorsXtime fixed effects (and size).*
Summary: younger firms tend on average to

- **be smaller** in size
- **grow faster** (in assets)
- **have less internal funds**
- **have lower**
  - credit scores (and probability of issuing bonds)
  - probability of paying dividends
- **have lower leverage**
- **have higher** (average) **Tobin’s Q**
IMPULSE RESPONSE ANALYSIS
Dynamic effects of monetary policy on investment

United Kingdom

Younger

Middle-aged

Older

United States

Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
Investment response by AGE & DIVIDENDS: U.K.

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Heterogeneity by age and dividends is ROBUST to...

1. **Size**
2. **Firm’s growth**
3. **Leverage**
4. **Tobin’s Q**
UNCONDITIONAL CORRELATIONS
Borrowing: asset-based vs. earning-based

\[ \Delta b_{i,t}^{LT} = \sum_{g=1}^{G} \beta_{1,g} x D g_{i,t} \text{COLLATERAL}_{i,t-1} + \sum_{g=1}^{G} \beta_{2,g} x D g_{i,t} \text{EBITDA}_{i,t-1} + X'_{i,t} \gamma + \epsilon_{i,t} \]

<table>
<thead>
<tr>
<th>COLLATERAL(_{t-1})</th>
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<tr>
<td>Young / nodiv</td>
<td>0.0245***</td>
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<td>(N)</td>
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Dependent variable: \(\Delta\) long-term debt

Note: the regression includes timeXsector and firm-level fixed effects. Standard errors are clustered by time and firm.
Borrowing: asset-based vs. earning-based

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Financing investment: external vs. internal funds

Based on a regression of investment on net debt and net equity issuances, cash flows, sectorXtime dummies (and firms’ controls).
CONDITIONAL CORRELATIONS
EQUITY (MKT. VALUE) responds for textbf{ALL} firms

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

Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
Larger **BORROWING** response for Younger/No Div.

**United Kingdom**

Younger & NO dividends

Older & Paying dividends

**United States**

Younger & NO dividends

Older & Paying dividends

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

**Younger & NO dividends**

- United Kingdom
  - Percent: 
    - Year 1: 0
    - Year 2: -0.25
    - Year 3: -0.5
    - Year 4: -0.25
    - Year 5: 0

- United States
  - Percent: 
    - Quarters 1: 0
    - Quarters 4: -2
    - Quarters 7: -1
    - Quarters 10: 0
    - Quarters 13: 1
    - Quarters 16: 2

**Older & Paying dividends**

- United Kingdom
  - Percent: 
    - Year 1: 0
    - Year 2: -0.25
    - Year 3: -0.5
    - Year 4: -0.25
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- United States
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Our contribution: **SIX NEW FINDINGS**...

1. Younger firms respond more than any other group and **drive the aggregate response** of investment to a monetary policy shock.

2. Results are more pronounced among young firms **paying no dividends** and robust to controlling for other firms’ characteristics.

3. Younger firms’ **capex relies more on debt** (than internal funds).

4. Younger firms’ **debt is more asset-based** (than earning-based).

5. **Net worth and interest payments** move for all firms.

6. **Borrowing** move most among younger firms.

7. **Sales responses** are homogeneous.
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Younger firms tend to use external finance (mostly debt) to fund capital expenditure, and tend to borrow against the value of the assets used as collateral.

A contractionary monetary policy shock raises credit spreads, affecting most firms relying on external finance.

A contractionary monetary policy shock pushes down asset prices & tighten their borrowing constraint, leading to a fall in investment.

**You**ng firms face **significant financial frictions** & **financial accelerator** plays a key role in the transmission of monetary policy to investment.
Extra Slides
The response of selected macro variables

Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
The response of selected macro variables cont’d

Employment

Credit Spread

United Kingdom

United States

Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
The U.S. average effect reported at annual frequency

**Quarterly**

**Annual**


[Back to average effect]
Investment responses by **SIZE** groups

**Smaller**

**Medium**

**Larger**

United Kingdom

United States

**Monetary Policy shock:** 25 basis point increase. **Standard errors clustering:** by firms and time. **Confidence band:** 90%.
'Controlling’ for (SMALLER) size

United Kingdom

NO dividends & Younger

United States

No dividends & Older

Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
'Controlling’ for (FASTER) asset growth


Back to robustness summary
Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
'Controlling’ for (LOWER) leverage

United Kingdom

NO dividends & Younger

United States

No dividends & Older

Monetary Policy shock: 25 basis point increase. Standard errors clustering: by firms and time. Confidence band: 90%.
Investment responses by **TOBIN’S Q** groups

**Monetary Policy shock:** 25 basis point increase. **Standard errors clustering:** by firms and time. **Confidence band:** 90%.
’Controlling’ for (HIGHER) Tobin’s Q

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

Back to robustness summary