Employment and the Collateral Channel of Monetary Policy[1]

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[1]The views expressed are those of the presenter and not necessarily those of the Bank of England, the MPC, the FPC or PRC.

Research Questions

1. Which **types of firms** are most sensitive to monetary policy shocks (and drive the aggregate response)?

2. What is the role of firm finance and financial frictions?

3. Does monetary policy propagates via asset prices and corporate debt?

Main Result I: Heterogeneous Effects of Monetary Policy

- **Younger firms with higher leverage** show largest employment response after an interest rate change

- Younger firms with higher leverage secure most of their borrowing against their director's homes.

- Younger firms with higher leverage drive **the response of aggregate employment to monetary policy.**

- Real estate - key source of collateral (securing 75% of **SME** loans).

Main Result II: Evaluating the Collateral Channel

- In regions with **more sensitive house prices** to monetary policy
  $\longrightarrow$ employment of younger/more levered firms reacts even more.

- Borrowing changes significantly **only** for younger/more levered firms
  in regions with higher house prices sensitivity to monetary policy.

- Results robust when we focus only on firms whose directors live in a
  different area $\longrightarrow$ *not driven by heterogeneity in local demand*.

- Consistent with monetary policy working through **corporate debt
  collateralized on housing** (over and above any effect through AD).

Three Sources of Variation and Empirical Challenges

1. Time-series variation in high-frequency monetary policy shocks

   $\rightarrow$ To identify the **average** effect of monetary policy

2. Firm-level variation by age, leverage and size.

   $\rightarrow$ To identify the **heterogeneous** effect of monetary policy

3. Regional variation in house price sensitivity to monetary policy shocks

   $\rightarrow$ **Mechanism**: does it work via collateral value fluctuations?
   $\rightarrow$ Compare firms in higher vs lower house price sensitive regions
   $\rightarrow$ Compare firms whose directors live in higher vs lower house price sensitive regions AND is a **different region** from their firm

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Related Literature

- **Firm-level employment and firm dynamics**:
  Davis-Haltiwanger-Schuh (1996); Fort-Haltiwanger-Jarmin-Miranda
  (2013); Dinlersoz-Kalemli-Ozcan-Hyatt-Penciakova (2018).

- **Exploiting regional variation (in housing wealth fluctuations):**
  Mian-Sufi (many), Chaney-Sraer-Thesmar (2012); Bahaj-Foulis-Pinter
  (2017); Hurst-Keys-Seru-Vavra (2016), Giroud-Muller (2018).

- **Corporate debt heterogeneity:**
  Lian-Ma (2018); Begenau-Salomao (2018); Drechsel (2018).

- **Investment and monetary policy (public firms/manufacturing):**
  90s literature; Gertler-Gilchrist(94); Crouzet-Mehrotra(18); Ottonello-
  Winberry(18); Jeenas(18); Cloyne-Ferreira-Froemel-Surico (2018).

Firm Data
Overview

UK Accounting Data: Bureau van Dijk (BVD) & Companies House

- Covers ~1.5 million UK firms, 1997-2016

- Covers **small**, **medium** and large firms in all sectors; private & public

- Information on employment, age, leverage and size as well as on **corporate property** and **director residential addresses**

- BVD is a live database – selection issue, dead firms leave the database after $\sim$ 5years, can't keep track of ownership structure etc.

- Use **archived** data (Gopinath et al. 2017; Bahaj, Foulis, Pinter, 2017)
  Illustrating the Selection Effect ; Filings

General Methodology
Identifying Monetary Policy Effects

- High frequency surprises on short rate futures in a 30 minutes window around policy announcements, since 2001 Gerko-Rey (2017)

- Monthly macro proxy-SVAR over 1982-2016 using the high frequency surprises as proxies to extract the shock for the full sample (Stock-Watson 2012, Mertens-Ravn 2013, Ramey 2016)

Firm Level Responses
Local Projection (Jorda, 2005)

Linear Effects:

$$ln(EMP_{t+h,i}) - ln(EMP_{t-1,i}) = \beta^h \times \Delta r_t + \varepsilon_{i,t}^h$$

- Horizon $h = 0, 1, 2, 3, 4$ years after the shock
- Δr_t: change in interest rate (instrumented by policy shock)
- standard errors following Driscoll-Kraay (1998)

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Heterogeneous Effects. Flexible non-parametric specification:

$$ln(EMP_{t+h,i}) - ln(EMP_{t-1,i}) = \delta_{j,t}^h + \sum_{g=1}^{G} \alpha_g^h \times Dg_{i,t-1}^h + \sum_{g=1}^{G} \beta_g^h \times Dg_{i,t-1}^h \times \Delta r_t + \varepsilon_{i,t}^h$$

- Two specifications considered:
  - Separate estimates for groups, $Dg_{i,t-1}^h$, of age, leverage, etc
  - Estimates **relative** to Gth group, including industry-time FE $\delta_{j,t}^h$

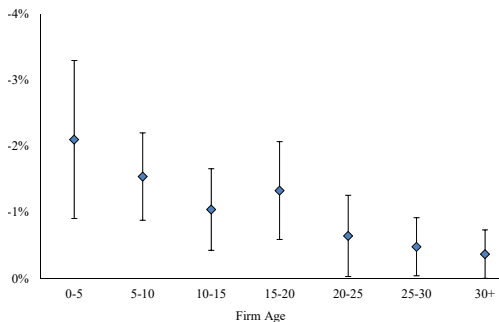# The Average Effect of Monetary Policy on Employment
25bp Contractionary Shock
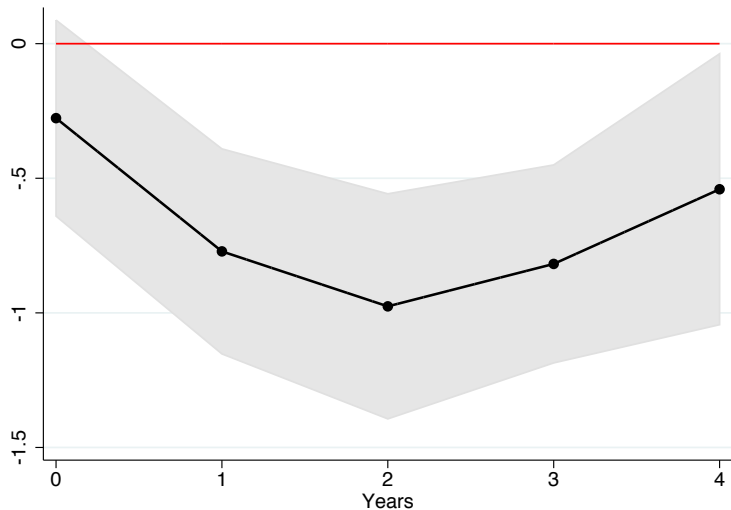
Outline

1. Data and Approach

2. Cross-sectional Variation

3. The Heterogeneous Responses of Employment

4. Evaluating the Collateral Channel

Descriptive Statistics

Median values by Age, Leverage and Size Groups						
	AGE		**LEVERAGE**		**SIZE**	
	0-15	15+	Below	Above	1-250	250+
Variable			**Median**		**Employees**	
Number of Employees	28	68	57	47	40	551
Total Assets (£'000s)	2485	4794	4342	3234	3149	35362
2y Real Asset Growth %	1.9	1.2	1.5	1.4	1.5	1.4
2y Employment Growth %	2.2	0.8	1.2	1.8	1.6	1.1
Age (years)	6.8	29	21	11	15	20
Leverage (debt over assets)%	70	54	41	79	.61	.61
Director in different region	61	58	59	61	58	71
Director average miles distance	27	25	27	26	24	39

The Relationship between Age, Leverage and Size
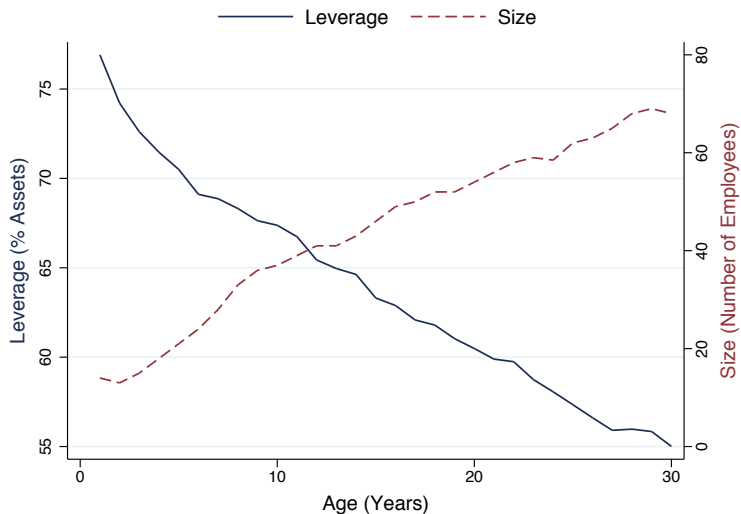
The Role of Personal Guarantees

	Lending Secured by Personal Guarantee (1)	Interest Rate (2)
Young, High Leverage	63%	3.80%
Young, Low Leverage	52%	3.06%
Old, High Leverage	49%	3.27%
Old, Low Leverage	33%	3.24%

Real Estate as Collateral

- Main **source of collateral**: 75% of SME loans secured on property

- Real estate prices are affected by **monetary policy** International Evidence

- Estimate **house price betas** (or planning application refusal rates) for 173 U.K. regions → Put firms in **high** and **low** responsive regions
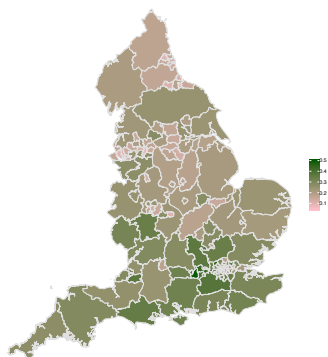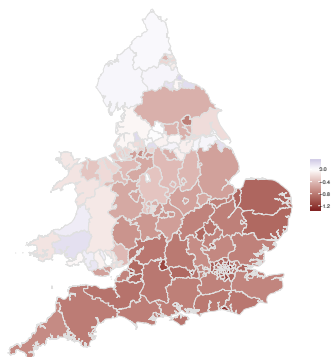
- Homes of firm directors as collateral: worth ≈ 80% of GDP
  Real Estate and Firm Borrowing   Real Estate by Firm Size
  - Every £1.1m increase in director home values generates 1 job
    [**Bahaj**-**Foulis**-**Pinter** (2017): "**Home Value & Firm Behaviour**"]

Identification: ∼ 50% of directors live in a **different region** to their firm

Proxies for House Price Elasticities across Regions

House Price Responses to MP shocks (red) ; Planning Application refulsal rate (green)

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The Employment Response to Monetary Policy across firms

Cumulated Response over a two-year Horizon

AGE

LEVERAGE

SIZE
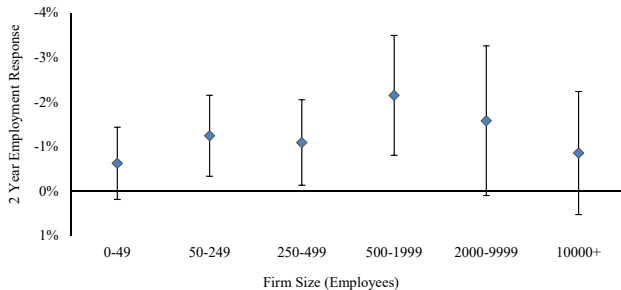
Grouping by Firm AGE and LEVERAGE
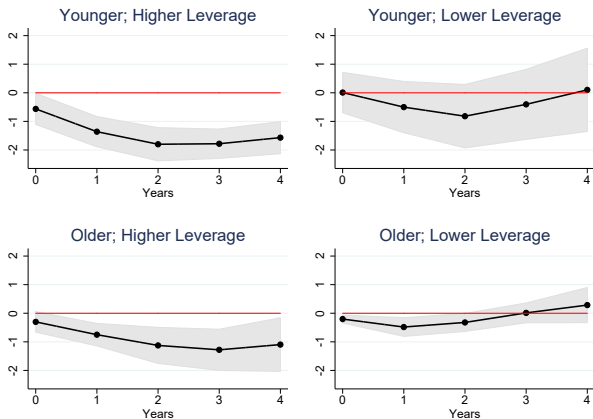
Notes: Responses to a 25bp contractionary monetary policy shock. Shaded area corresponds to 90% confidence intervals.

Grouping by Firm AGE and LEVERAGE: relative effects

Adding industryXtime and (NUTS1-region)Xtime FEs. Baseline: older/less levered.
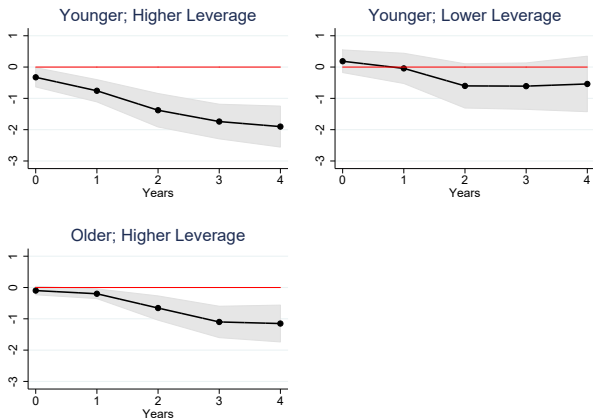
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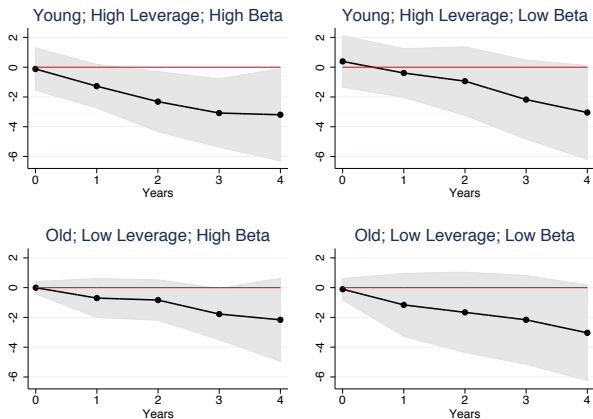
Employment Responses by Director Region HP Elasticity
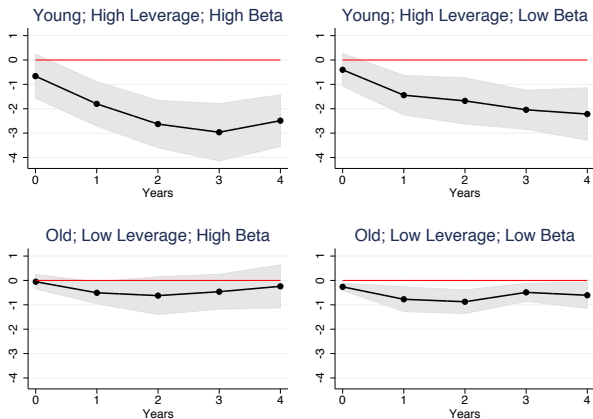
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Employment Responses by Director Region HP Elasticity

Adding industryXtime and (NUTS1-region)Xtime FEs. Relative to old/low-lev/low-beta.
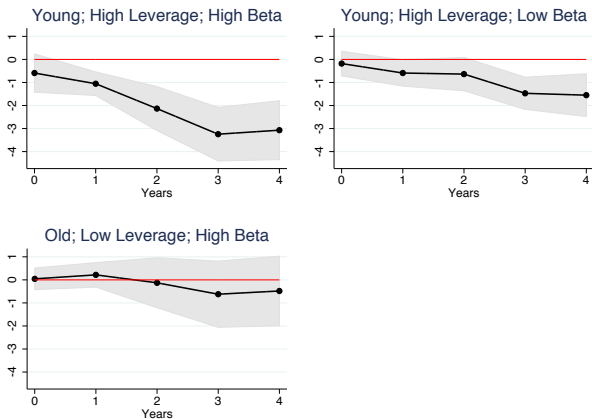
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Heterogeneity not driven by local demand

Results robust to:

1. including regionXtime FEs. Akin to U.S. counties.

2. limiting to firms whose directors live at least 30 miles away.

3. limiting to firms whose directors live in a different region.

4. limiting to firms in the tradable sector.

The balance sheet channel versus aggregate demand effects

- **Borrowing** (total debt):
  - Exposed to net worth fluctuations in the financial accelerator

- **Prepaid Expenses** (current assets):
  - Extent of dependence from borrowing to pay wages in advance

- **Sales** (turnover):
  - Heuristic proxy for any possible (aggregate) demand effect
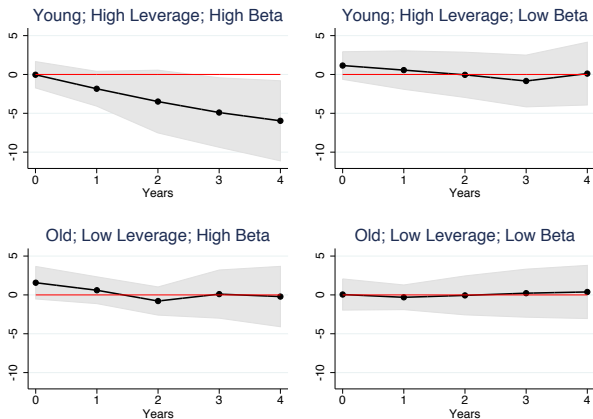
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The Response of Current Assets to Monetary Policy
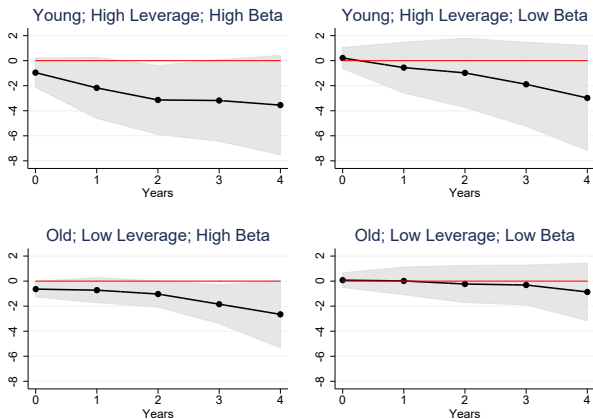
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The Response of Turnover to Monetary Policy

Notes: Responses to a 25bp contractionary monetary policy shock. Shaded area corresponds to 90% confidence intervals.

Robustness and Extensions

- Insights from Theoretical Models

- Lower vs Higher Credit Score
- Including Bank-Time Fixed Effects
- Including Region-Time Fixed Effects
- Excluding the Period of Zero Lower Bound
- The Response of Fixed Assets
- The Response of Directors' cash flows

Conclusions

- **Younger firms with higher leverage** adjust their employment the most and **drive the aggregate** response

- Younger firms with higher leverage tend to be smaller, have lower credit scores and most of their **borrowing is asset-based**.

- Only for younger firms with higher leverage in most house price sensitive regions **borrowing fall** significantly after a contractionary monetary policy shock. Sales respond homogeneously

- Through **corporate debt collateralized on house values**, monetary policy affects firms' decisions (over and above its effect through AD).

Appendix Material

Filings of Firm Accounts

Illustrating the Variation

- Annual data but firms have different accounting periods.
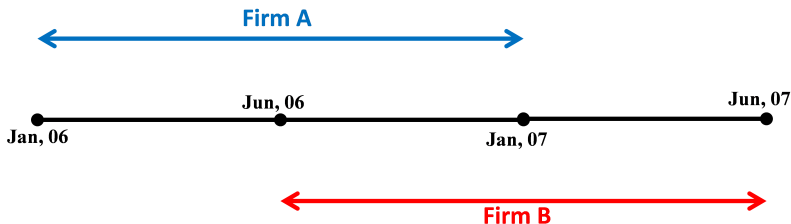
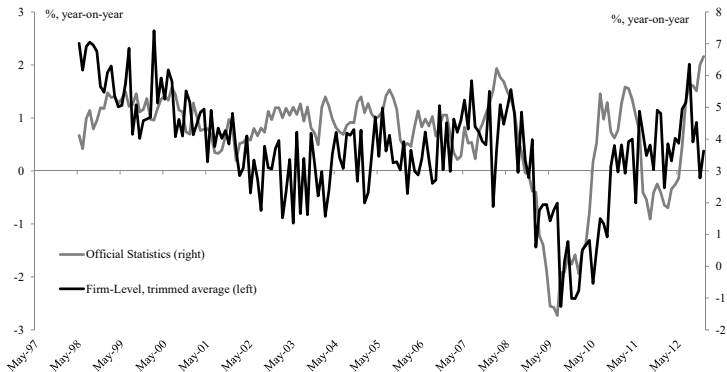# Distribution of Filing Dates by Month
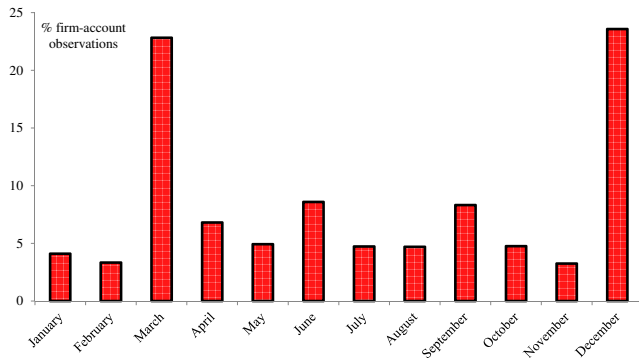
Illustrating the Selection Effect
Fraction of Companies Present in August 2015 Vintage
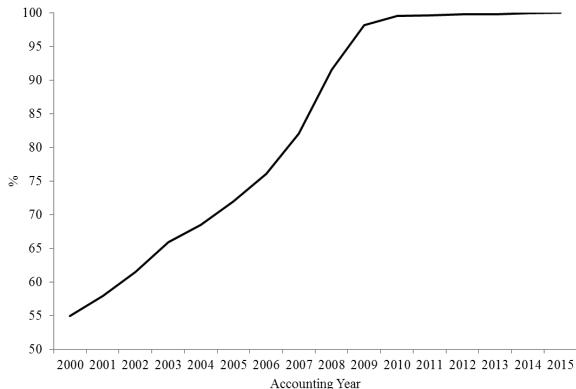
Notes: the figure displays the proportion of companies in each statement year, as derived from the full panel of 21 discs, that are present in the August 2015 disc.
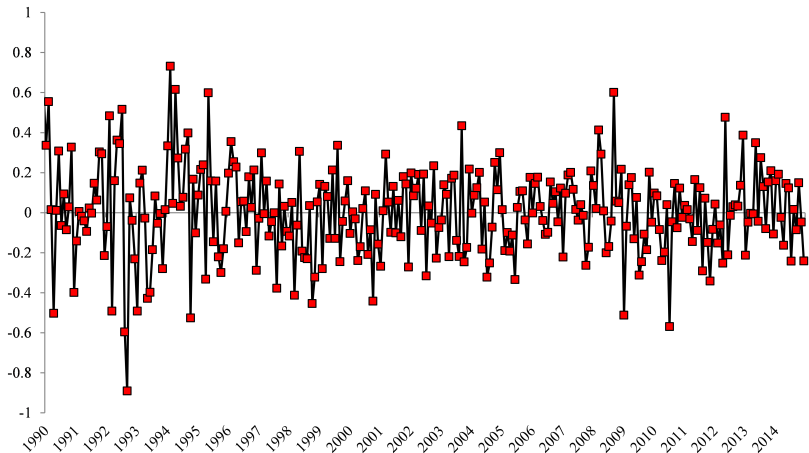
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# Employment growth: micro vs macro data

Monetary Policy VAR
Gerko and Rey (2017)

Off-the-shelf approach

- Shock instrument from Gerko-Rey (2017), covering 2000m1-2015m1
- High frequency market reaction to monetary policy announcements
  - Using Bank of England's MPC Minutes, Inflation Report
  - Interpretation is a monetary policy news shock

- Specification as in Gerko-Rey (2017) (augmented to include labour variables). Proxy SVAR, estimated over 1982-2016.
  - VAR series: 5-year gilts, IP, Prices, £/$, corporate bond spread, unemployment rate, employment of firms in our industries
  - F-stat for relevance of instrument is above 10
  - The estimated shock goes into our firm level regression

Shock Series Extracted from the VAR
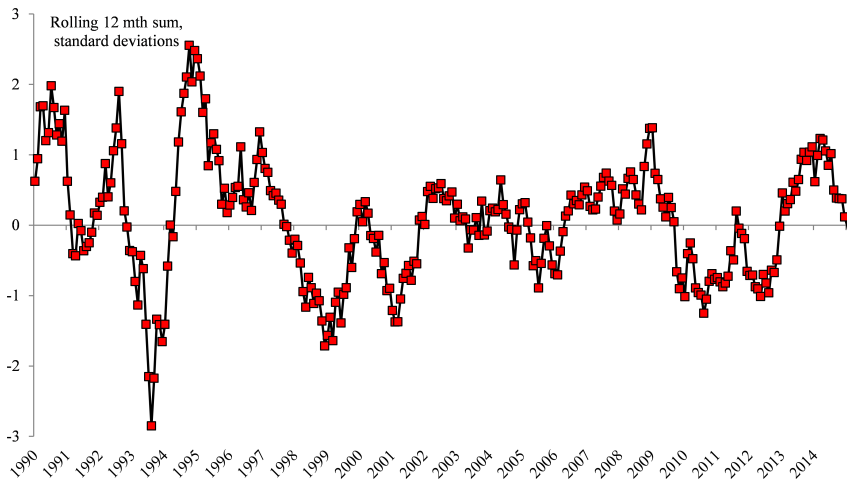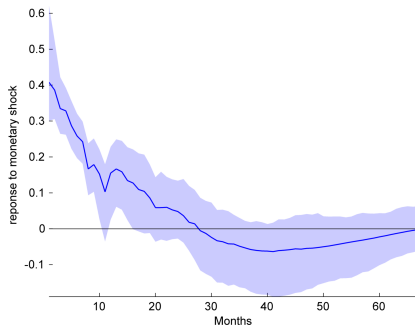
Back

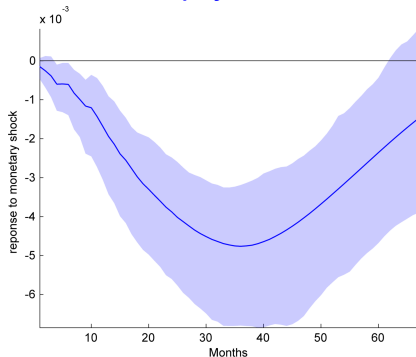# Aggregate Responses to Monetary Policy Shock

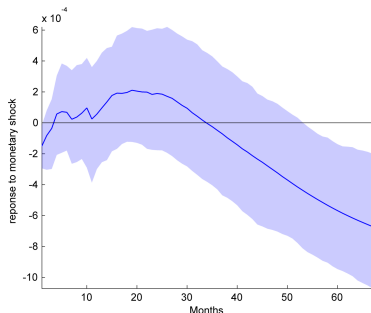25 basis points hike, on average, over the first year

Notes: Estimates are from a proxy SVAR estimated on UK monthly data over the period
1982-2016. Monetary policy shocks are identified using the Gerko-Rey (2017) series. The blue
solid lines are the point estimates, and the shaded areas are the 90% confidence intervals
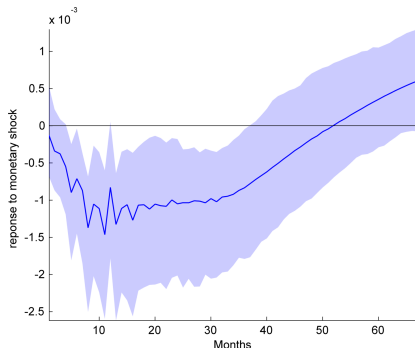constructed from a wild recursive bootstrap.

Aggregate Responses to Monetary Policy Shock

1sd monthly contractionary shock: 25bps

Retail Prices (ex Mortgages)

Industrial Production

Notes: Estimates are from a proxy SVAR estimated on UK monthly data over the period 1982-2016. Monetary policy shocks are identified using the Gerko-Rey (2017) series. The blue solid lines are the point estimates, and the shaded areas are the 90% confidence intervals constructed from a wild recursive bootstrap.

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Estimating Regional Housing Betas

- Estimate **house price betas** for 173 UK regions response to monetary policy shocks

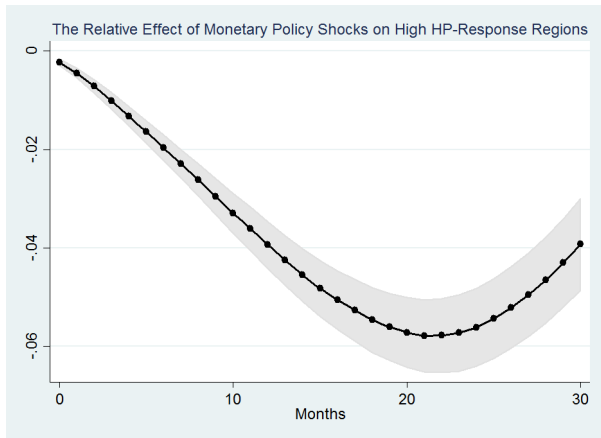- Use monthly regional house price indices

- For each region j estimate:

$$\log\left(P_{t+h}\right) - \log\left(P_{t-1}\right) = a + \beta^h \times MP_t + controls + \varepsilon_t^h$$

- Estimate for $h = 0, ..., 24$ months

- Sum the first 24 months of βs to get a coefficient B_j for region j:

$$B_j = \sum_{i=1}^{24} \beta^i$$

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Monetary Policy and House Prices

Relative Response Across Regions

The Relative Effect of Monetary Policy Shocks on High HP-Response Regions

Notes: Responses to a 25bp contractionary monetary policy shock. Black solid line is point estimate at the regional level. Shaded area corresponds to 90% confidence intervals.
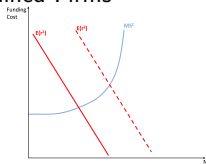
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Insights from Theoretical Models

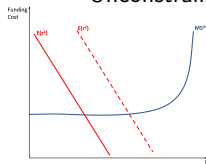Do constrained firms respond **more/less** to monetary policy shocks?

- Seminal papers of Gertler (1994) and Kashyap et. al (1994) suggest that **financially constrained** firms respond **more**

- Recently Ottonello-Winberry (2017) challenged these findings and shows that **financially less constrained** (low-leverage) firms respond **more**:

Figure: Marginal Benefit (red) and Marginal Cost (blue) Curves

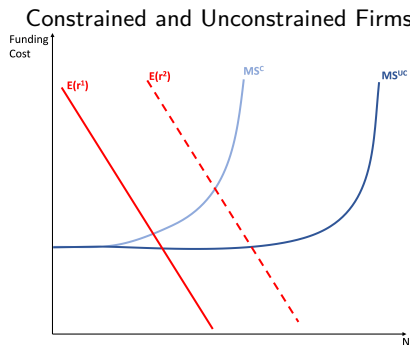Figure: Marginal Benefit (red) and Marginal Cost (blue) Curves at the Firm-level

Constrained and Unconstrained Firms

Insights from Theoretical Models

Monetary policy shocks affect asset prices, **shifting the marginal cost curve** too

- The marginal cost curve shift can be larger for constrained firms → overall firm activity of constrained firms can respond more!

Constrained and Unconstrained Firms
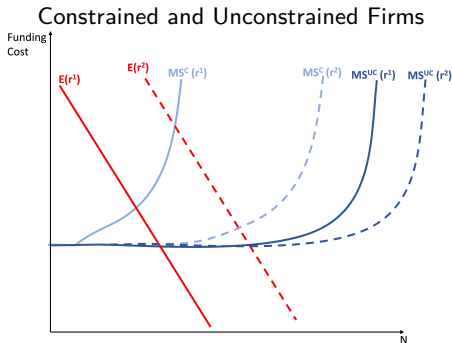
Relation to Ottonello-Winberry
6-step Reconciliation

1. There seems to be only an apparent tension between findings
2. OW show that low-leverage firms respond more – we show that high-leverage respond more
3. **Dinlersoz-Kalemli-Ozcan-Hyatt-Penciakova (2018)**: leverage-age relationship is very different between public and private firms:
   - We use private-firm dominated sample
   - OW uses public firm dominated sample (Compustat)
4. (3) suggests that the common factor between us and OW is that young respond the most
   - we also show that within highly levered firms, young respond more
5. **Cloyne-Ferreira-Froemel-Surico (2018)** confirmed OW result in that low leverage respond more in Compustat
   - but within low leverage firm, only young respond
6. Age is the main determining factor [not leverage]

Leverage-Age Relationship Among Private/Public Firms

Emin Dinlersoz, Sebnem Kalemli-Ozcan, Henry Hyatt, Veronika Penciakova (2018)

Financial Debt/Total Assets (quadratic in age)