A TALE OF TWO MARGINS: MONETARY POLICY AND CAPITAL MISALLOCATION IN SPAIN

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MOTIVATION

- Many central banks have been taking an **expansionary stance** in the last decade (*conventional* and *unconventional*)
  - Response to the Great Financial Crisis and COVID-19

- Impact of **expansionary monetary policy** on the economy:
  - Intended consequences: boosting demand and decreasing financial frictions.
    - *Baqaee et al, 2021 ; Cloyne et al, 2018; González et al, 2021;...*
  - Unintended consequences: less cleansing, less investment intangibles, misallocation of credit.
    - *Acharya et al, 2019; Caballero et al, 2008; Caggese and Pérez-Orive, 2021…*

- Low interest rates can be linked to an increase in misallocation. *Reis (2013), Gopinath et al (2017),…*

What is the impact of expansionary monetary policy shocks on the allocation of capital?

What are the main channels driving this impact?

OUR CONTRIBUTION

Theoretical framework: Efficient capital allocation if the marginal return of capital is equalized across firms within sector (Hsieh & Klenow, 2009) → In absence of frictions, capital would move from low to high productive firms (high MRPK firms).

- Focus on *capital misallocation* : dispersion of MRPK as a proxy for misallocation.

Data: yearly balance sheet data for the quasi universe of Spanish firms 2000-2016.

Empirical strategy: Local projections à la Jordà (2005).

Aim: understanding the **impact of ECB monetary policy easing** on:

Misallocation. Decreases MRPK dispersion within industry → positive reallocation.

Intensive margin

- Investment. a) Average investment increases; b) high MRPK firms invest *relatively more* than low MPRK firms.
- Is it a financial friction story?
  - *High MRPK firms a) borrow relatively more than low MPRK firms; b) build on cash reserves.*
  - *Proxies for MP sensitivity in the literature: age (Cloyne et al. 2021) , leverage , liquidity (Jeenas, 2020).*

→ It is high MRPK firms driving the result.

Heterogeneity of MRPK is key for the transmission of monetary policy

→In line with theoretical findings of *González et al. 2021*.

More: robustness, extensive margin.

Data

Firm level data

- Yearly balance sheet data from **Central de Balances Integrada (CBI)** (quasi-universe) for the period 2000-2016.

Entry/exit data

- Micro data from **Directorio Central de Empresas** (DIRCE/INE), matched with CBI.

Aggregate level data: Output gap, government spending, inflation, unemployment and GDP growth.

Monetary Policy shocks

[More on MP shocks]

- *Jarociński and Karadi (2020):* high frequency identification + sign restriction: a surprise policy tightening raises interest rates and reduces stock prices, while the complementary positive central bank information shock raises both.
- Shock aggregation at annual frequency to match the frequency of firm level data: weighting scheme similar to *Ottonello and Winberry (2020)*, considering last quarter in t-1

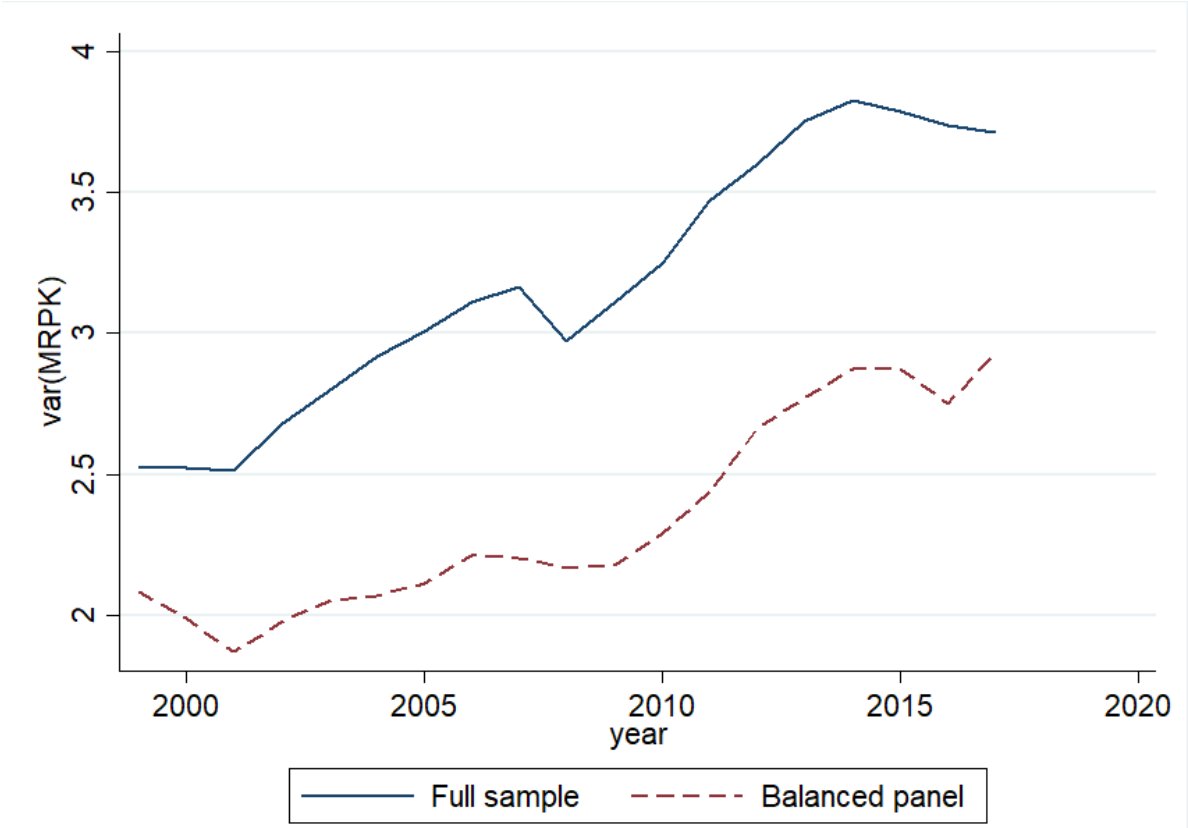
$$\epsilon_t^{MP} = \sum_{m \in t} \omega_a(m)\epsilon_m^{MP} + \sum_{m \in t-1,q4} \omega_b(m)\epsilon_m^{MP}$$

[More]

Capital Misallocation

CAPITAL MISALLOCATION IN SPAIN

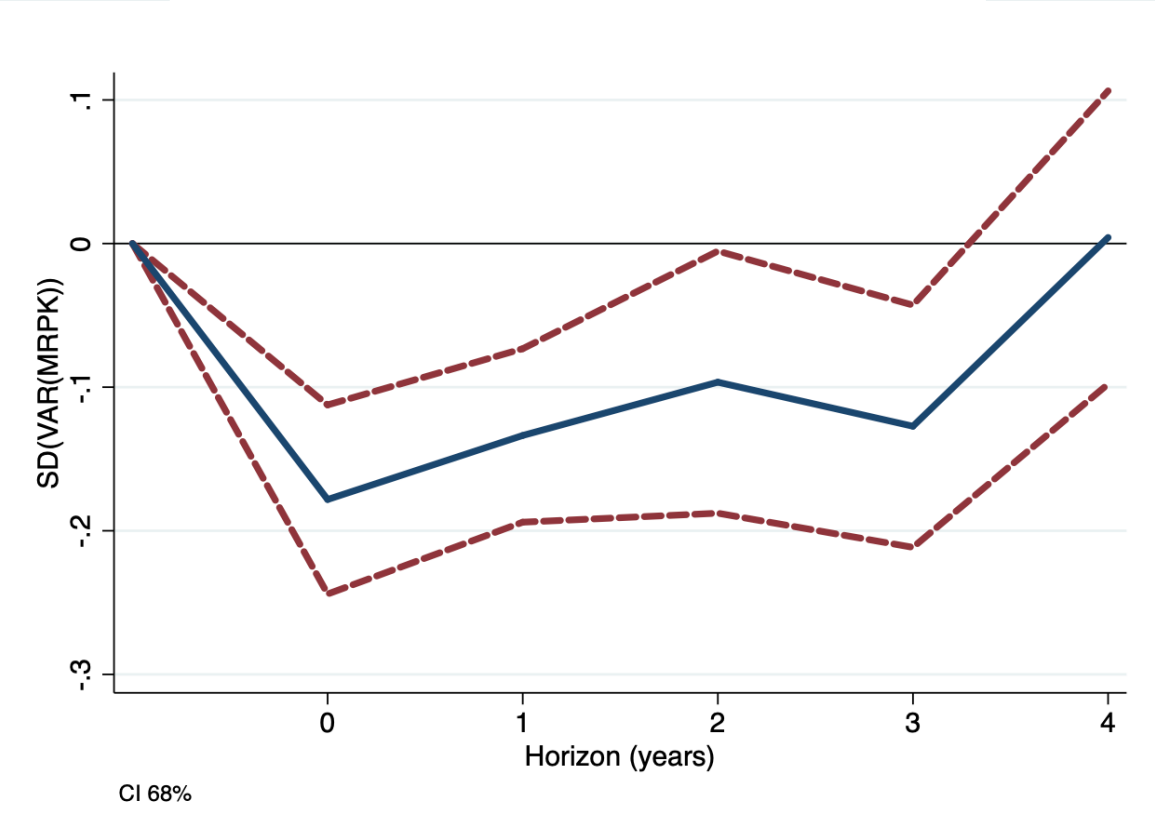
- MRPK = ln(value added/tangible capital)
- Hsieh and Klenow (2009): Misallocation as average of industry level VAR(MRPK).



Effect of a monetary policy shock (easing) on MRPK dispersion:

$$\Delta y_{j,t+h,t-1} = \gamma_0^h + \beta^h \epsilon_t^{MP} + \gamma_1^h \epsilon_{t-1}^{MP} + \gamma_i^h y_{j,t-1} + \varphi^{h\prime} Q_t + \delta^{h\prime} S_{j,t} + \mu_j + u_{t,h}$$

- $\Delta y_{j,t+h,t-1}$ is the change in the variance of MRPK of sector j from t-1 to t+h, at horizon h=0,..,5
- Control for lagged shock and lagged level of the dependent.
- Q_t is a vector of aggregate controls: output gap, unemployment, government spending, inflation and GDP growth.
- $S_{j,t}$ is sales growth of industry j at time t.
- μ_j are industry fixed effects.



Expansionary shock **improves the allocation of resources**

After a 25bps surprise decrease in interest rates, the variance of MRPK of decreases 0.15 standard deviations of the variance of MRPK, and this persists for three years.

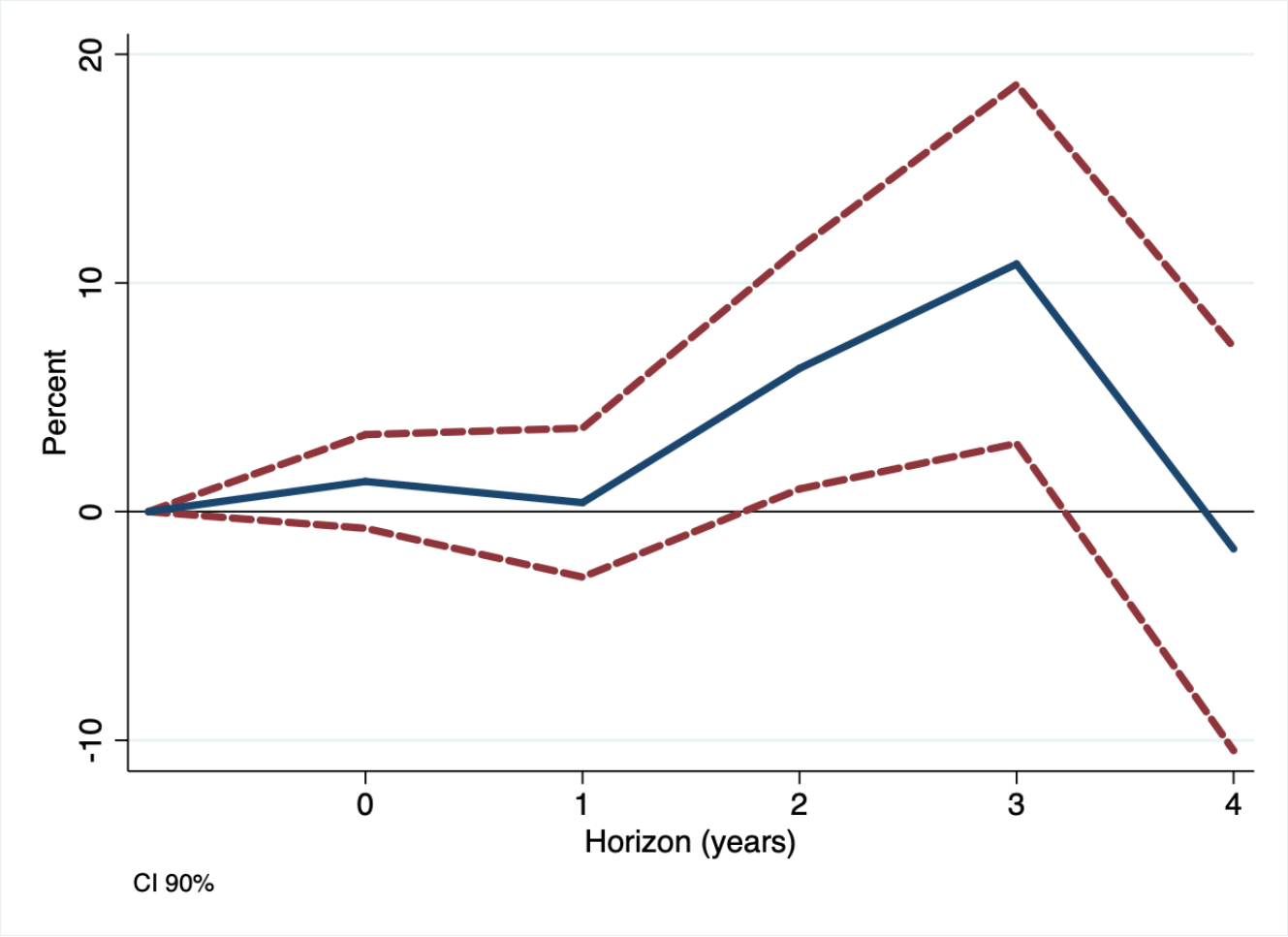
Intensive Margin

Effect of monetary policy easing shock on average investment:

$$\Delta k_{it+h,t-1} = \gamma_0^h + \boldsymbol{\beta_1^h \epsilon_t^{MP}} + \varphi^h Z_{i,t-1} + \varphi^{h\prime} Q_t + \delta^{h\prime} S_{j,t} + \mu_j + \varepsilon_{i,t+h}$$

- $\Delta k_{it+h,t-1}$ firm log change in physical capital from t-1 to t+h, h=0,1..5.
- $Z_{i,t-1}$ is vector of lagged firm level controls: sales growth, employment, leverage, age, cash ratio.
- Q_t is a vector of aggregate: output gap, unemployment, government spending, inflation and GDP growth.
- $S_{j,t}$ is sales growth of industry j at time t.
- μ_j are industry fixed effects.

THE IMPACT OF MONETARY POLICY ON AVERAGE INVESTMENT



Expansionary shock **increases investment in average** in the medium run…

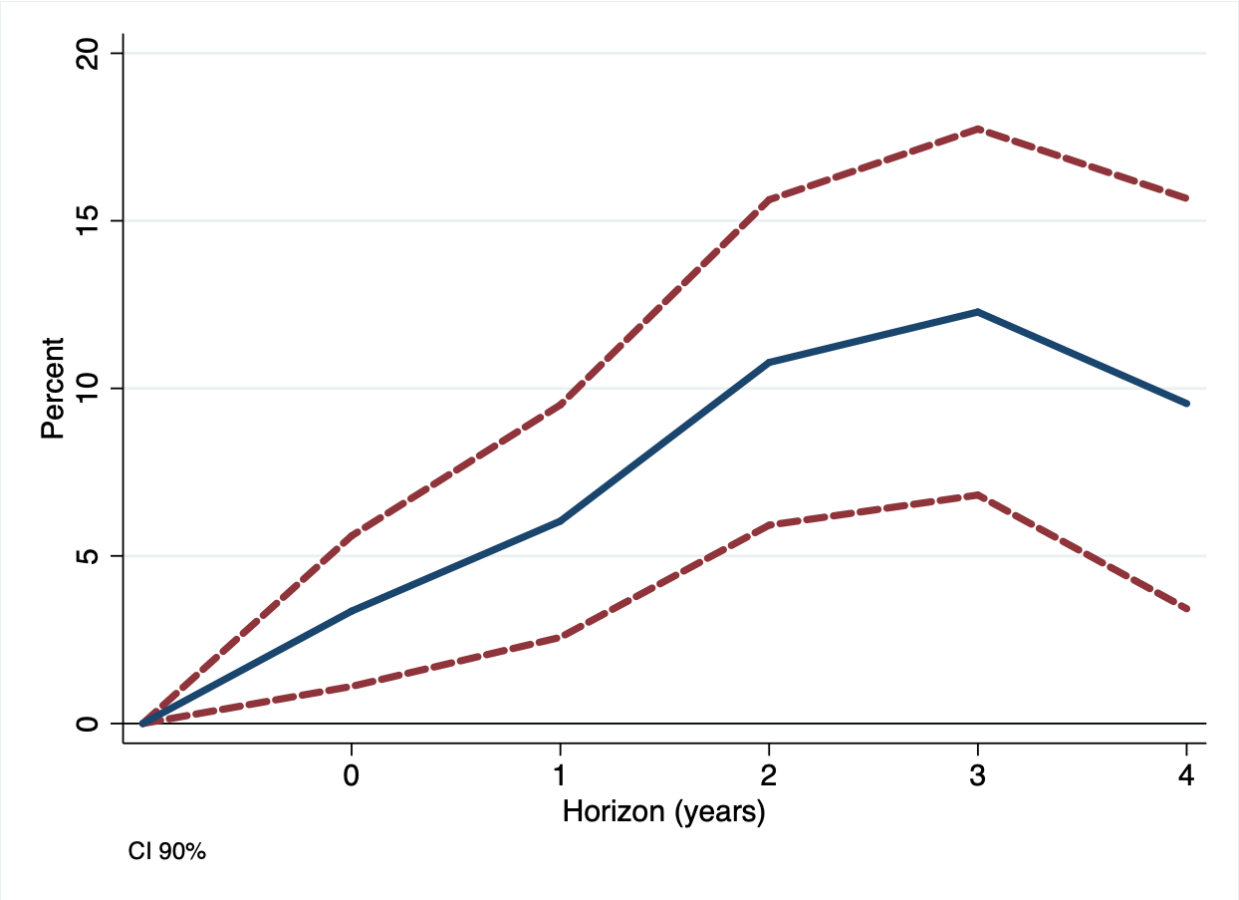
After a 25bps surprise decrease in interest rates, capital stock increases 10% on average after 3 years.

Has monetary policy easing induced relatively higher investment of more productive firms w.r.t low productive firms?

$$\Delta k_{i,j,t+h,t-1} = \gamma_0^h + \boldsymbol{\beta_1^h \epsilon_t^{MP}} * (\boldsymbol{MRPK_{i,t-1} - E_j[MRPK_{i,t-1}]}) + \beta_2^h (MPRK_{i,t-1} - E_j[MPRK_{i,t-1}]) + \varphi^h Z_{i,t-1} + \theta_{tj}^h + \varepsilon_{i,t+h}$$

- $\Delta k_{it+h,t-1}$ log change in physical capital from t-1 to t+h, h=0,1…,5.
- $\boldsymbol{(MRPK_{i,t-1} - E_j[MRPK_{i,t-1}])}$ is the deviation of firm level MRPK from the industry's average MRPK in our sample.
  - Standardized to ease the interpretation of $\boldsymbol{\beta_1^h}$
- $Z_{i,t-1}$ is vector of lagged firm level controls: sales growth, employment, leverage, age, cash ratio.
- θ_{tj}^h are sector-time FE.
- Standard errors are clustered at year-sector.

MONETARY POLICY AND INVESTMENT OF HIGH MRPK FIRMS

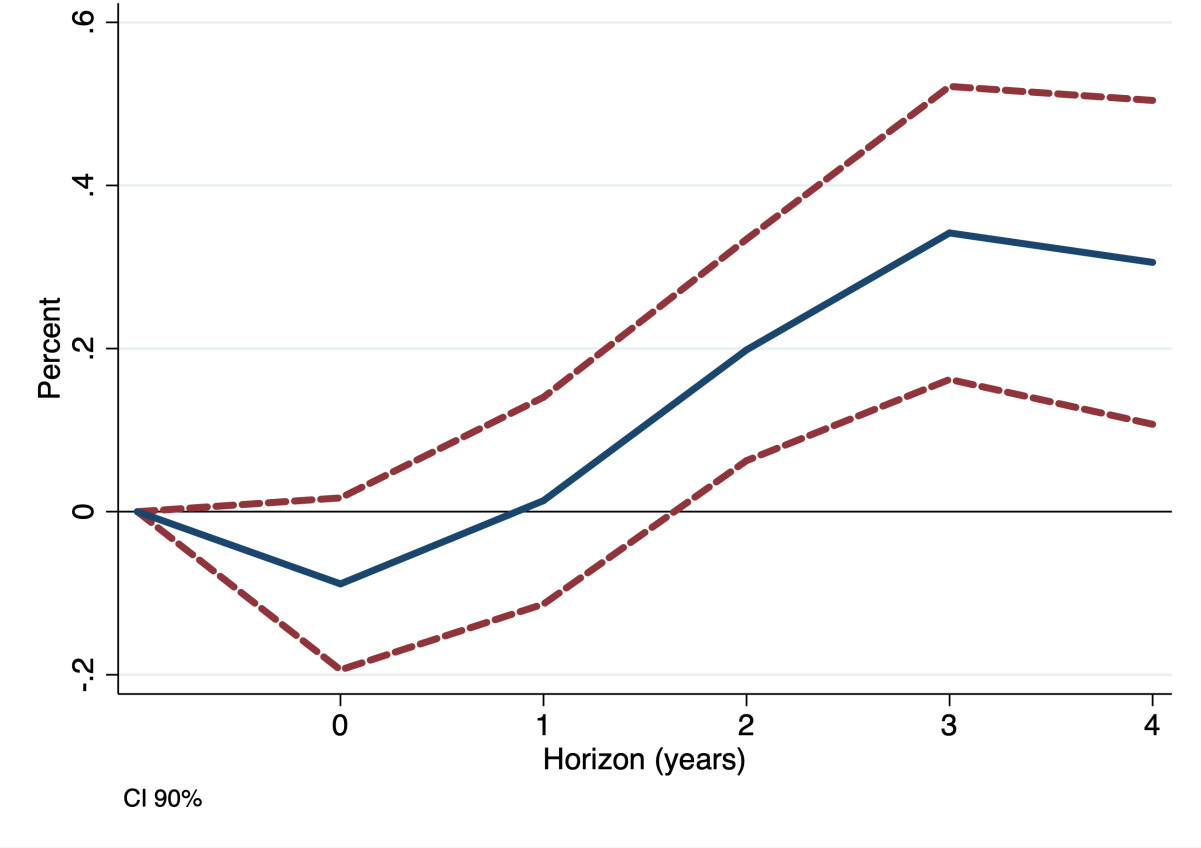


… but **relatively more that of high MRPK firms.**

After a 25bps surprise decrease in interest rates, firms with one standard deviation higher deviation from their industry's mean MRPK increase their capital stock by about 13% at the peak 3 years after the shock.

Is it a financial friction story?

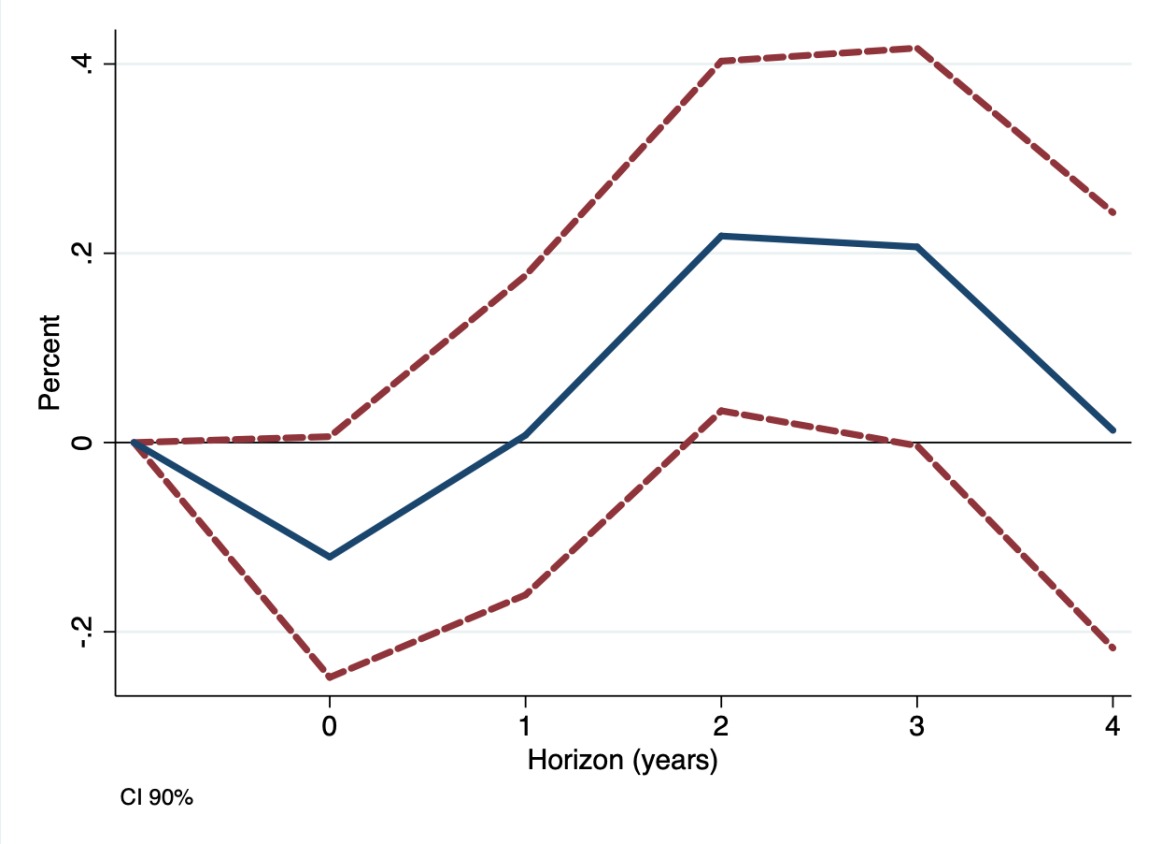
$$\Delta leverage_{it+h,t-1} = \gamma_0^h + \beta_1^h \epsilon_t^{MP} * (MRPK_{i,t-1} - E_j[MRPK_{i,t-1}]) + \beta_2^h (MRPK_{i,t-1} - E_j[MRPK_{i,t-1}]) + \varphi^h Z_{i,t-1} + \theta_{tj}^h + \varepsilon_{i,t+h}$$



High MRPK firms **increase their leverage** relatively more after an expansionary monetary policy shock…

After a 25bps surprise decrease in interest rates, firms with one standard deviation higher deviation from their industry's mean MRPK increase their leverage ratio by nearly 0.4pp at the peak 3 years after the shock.

$$\Delta cash_{it+h,t-1} = \gamma_0^h + \beta_1^h \epsilon_t^{MP} * (MRPK_{i,t-1} - E_j[MRPK_{i,t-1}]) + \beta_2^h (MRPK_{i,t-1} - E_j[MRPK_{i,t-1}]) + \varphi^h Z_{i,t-1} + \theta_{tj}^h + \varepsilon_{i,t+h}$$



… and high MRPK firms **build up cash holdings** relatively more, instead of using them as a source of funds.

After a 25bps surprise decrease in interest rates, firms with one standard deviation higher deviation from their industry's mean MRPK increase their cash ratio by 0.2pp at the peak 2-3 years after the shock.

- **Cloyne et al, 2021:** younger firms not paying dividends are more sensitive to expansionary monetary policy shock.
  - Good proxy for financial frictions.

- **Jeenas, 2019**:
  - Firms with *less liquid assets* are more responsive to monetary policy shocks.
  - Firms with *more leverage* are more responsive to monetary policy shocks.

How does this relate to the higher sensitivity of high MRPK firms?

- Let $x_{i,j,t}$ be *leverage*, *cash ratio* or the *log of age*.
- Allow the heterogeneous sensitivity of investment to a monetary policy shock with respect to $x_{i,j,t}$ to vary according to the quartile of the industry's $(MRPK_{i,t-1} - E_j[MRPK_{i,t-1}])$ the firm belongs to.

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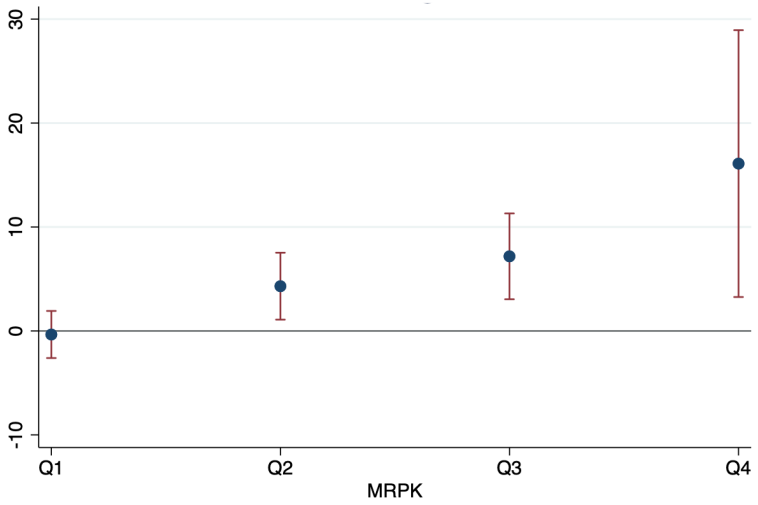
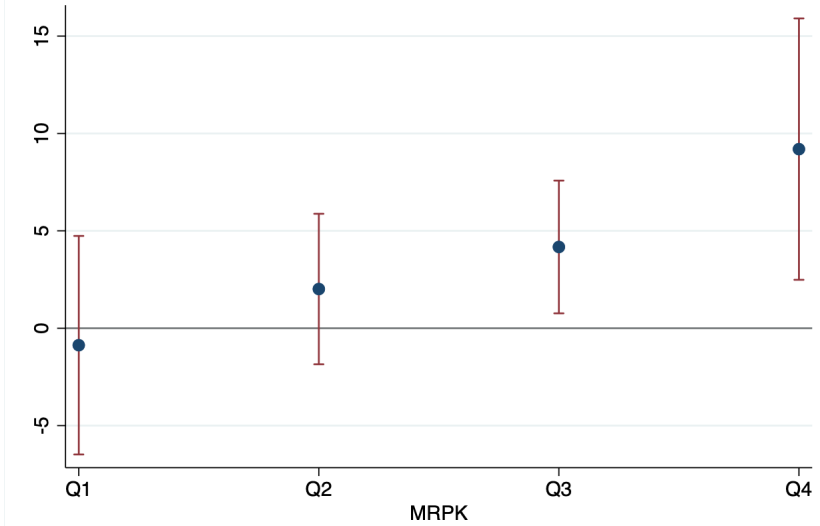
$$\Delta k_{i,t,t-1} = \sum_{q=q1}^{q4} \beta_{1t}^{q} I^{q}_{\{MRPK_{i,j,t-1} \in q\}} * x_{i,t-1} * \epsilon_t^{MP} + \sum_{q=q1}^{q4} \beta_{2t}^{q} I^{q}_{\{MRPK_{i,t-1} \in q\}} * \epsilon_t^{MP} + \sum_{q=q1}^{q4} \beta_{3t}^{q} I^{q}_{\{MRPK_{i,t-1} \in q\}} + \varphi^h Z_{i,t-1} + \theta_{tj} + \varepsilon_{i,t+h}$$

[Summary statistics]

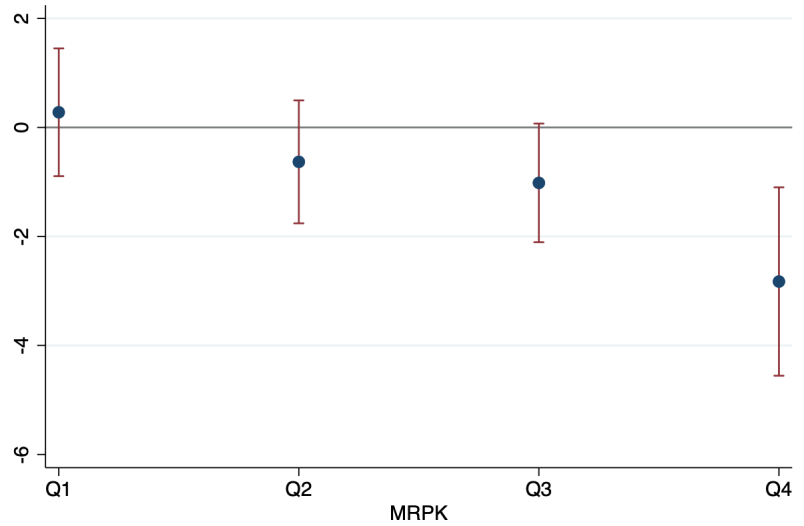
Leverage



(-) Liquidity

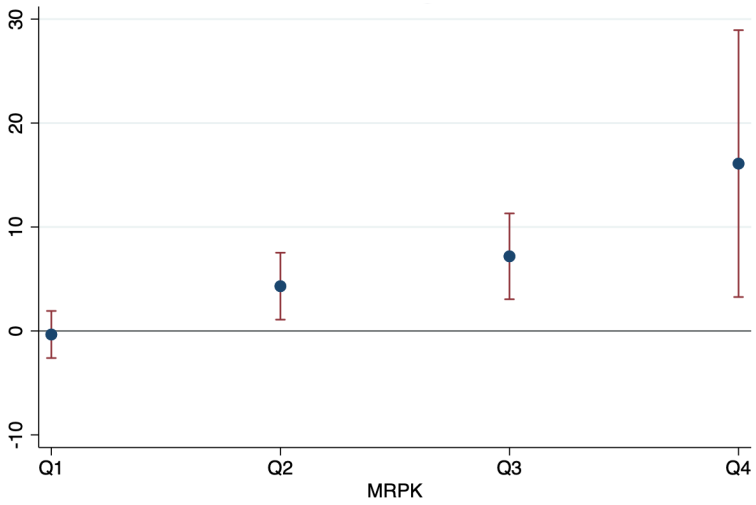


Age

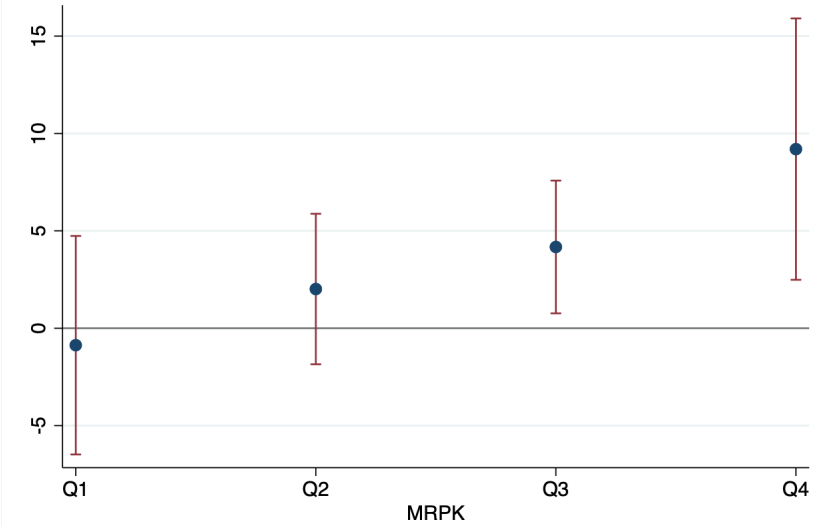


- **High MRPK firms** show a higher sensitivity of investment after a monetary policy shock with respect to their leverage, liquidity and age.

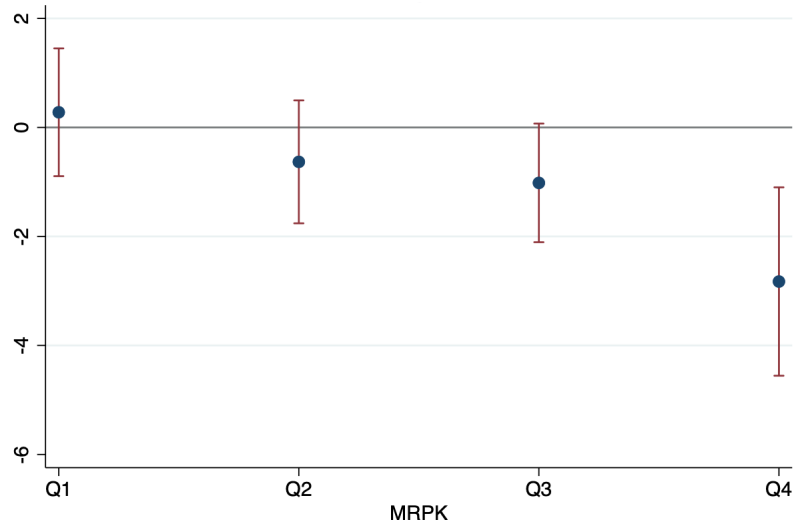
Leverage



(-) Liquidity



Age



- **High MRPK firms** show a higher sensitivity of investment after a monetary policy shock with respect to their leverage, liquidity and age.

→ **MRPK at the firm level is key for the transmission of monetary policy to investment:**

- High MRPK firms are constrained (they have a higher propensity to invest).
- Monetary policy expansion eases financial constraints and allows them to invest .

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Robustness. Results are robust to:

- Different weighting schemes of the monetary policy shock. MORE
- Keeping only balanced panel. MORE
- Using TFPR yields similar results. MORE
- Importance of using monetary policy shocks MORE
    - Using 'levels' of EONIA yields opposite results on misallocation.

Extensive margin. MORE

After an expansionary monetary policy:

- Entry increases in the short run, decreases in the medium run. MORE
    - Lower share of 'gazelles' entering in the short run.
- Exit does not change in the short run, overshoots in the medium run. MORE

CONCLUSIONS

Empirical approach under Hsieh and Klenow, 2009 theoretical framework using local projections and monetary policy surprises to understand the impact of **expansionary monetary policy** on **misallocation**.

1. Expansionary monetary policy *decreases dispersion of MRPK* within sector
   - Point at *lower misallocation*.

2. At the firm level, investment increases, but that of high MRPK firms relatively more.

3. Evidence point at a financial friction story, since high MRPK firms:
   - Increase their leverage relatively more
   - Build up cash reserves instead of using them.

4. We find that firms that are younger, with more leverage and less cash holdings are *more responsive* to expansionary monetary policy shock…
   - … but this is mainly for high MRPK firms.

Importance of heterogeneity of MRPK in the transmission of monetary policy

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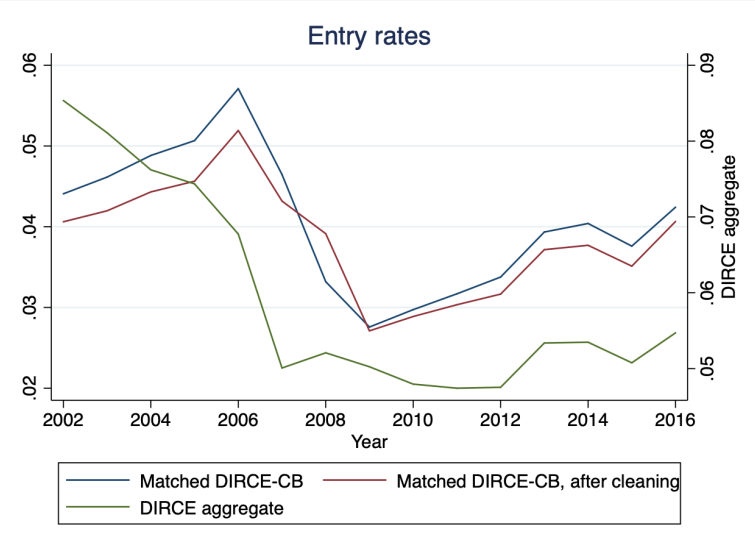
Eurosistema

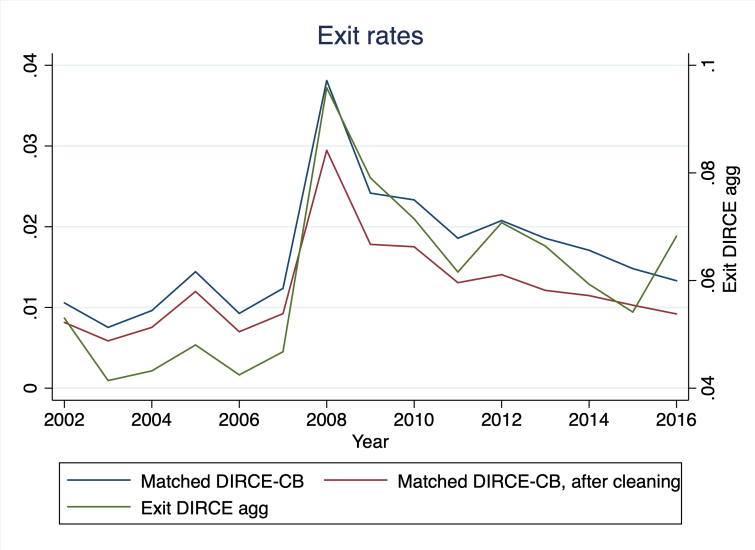
THANK YOU FOR YOUR ATTENTION

Appendix

- **Data:** merged micro data from DIRCE with CB (only available from 2002).
  - Define as entry the minimun of 'Activación' year in DIRCE and 'Año de creación' in CB.
  - Define as exit the last recorded year of 'baja' in DIRCE.
  - Keep only employer firms: better coverage of CB.

- Compute **entry/exit rates** at industry level from this matched data.
- Define **gazelles** as firms younger than 5 years old with average annualised growth greater than 20% per annum, over a three year period.
  - Use ex-post performance to compute the share of gazelles among all entrants





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$$\Delta y_{j,t+h,t-1} = \gamma_0^h + \beta^h \epsilon_{j,t}^{MP} + \gamma_1^h \epsilon_{j,t-1}^{MP} + \gamma_i^h y_{j,t-1} + \varphi^{h\prime} Q_t + + \delta^{h\prime} S_{j,t} + \mu_j + u_{t,h}$$

- $\Delta y_{j,t+h,t-1}$ is the change in entry/exit rate of sector j from t-1 to t+h, at horizon h=0,..,5
- Control for lagged shock and lagged level of the dependent.
- Q_t is a vector of aggregate: output gap, unemployment, government spending, inflation and GDP growth.
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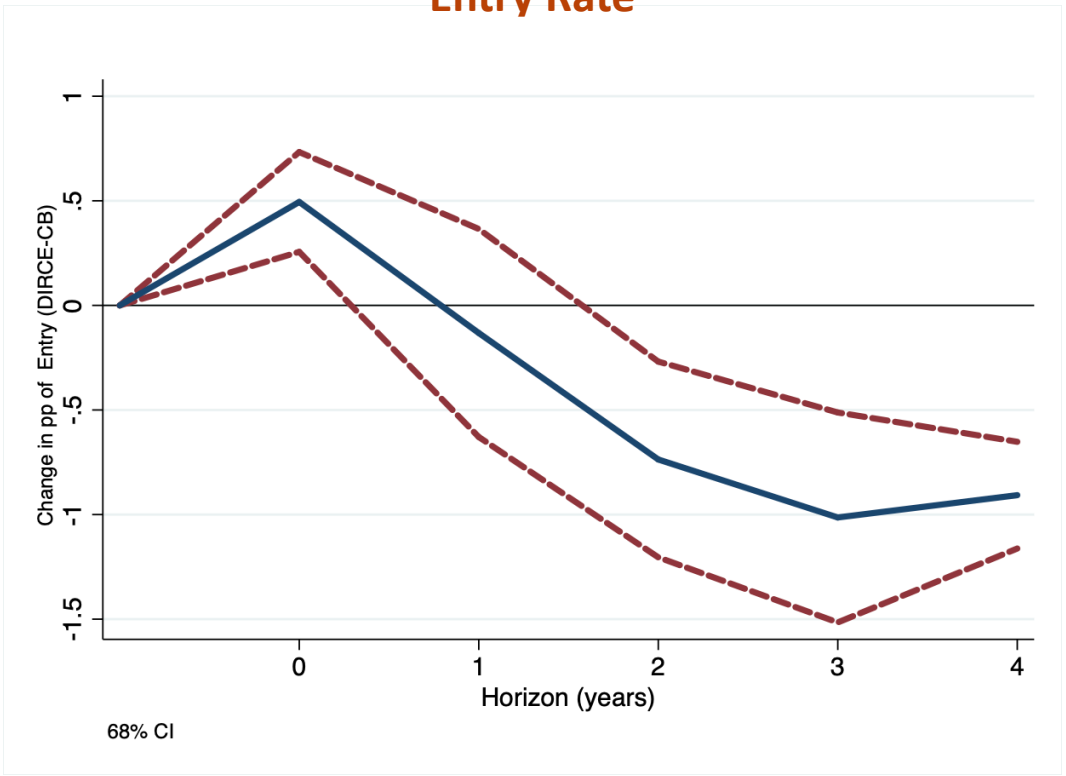
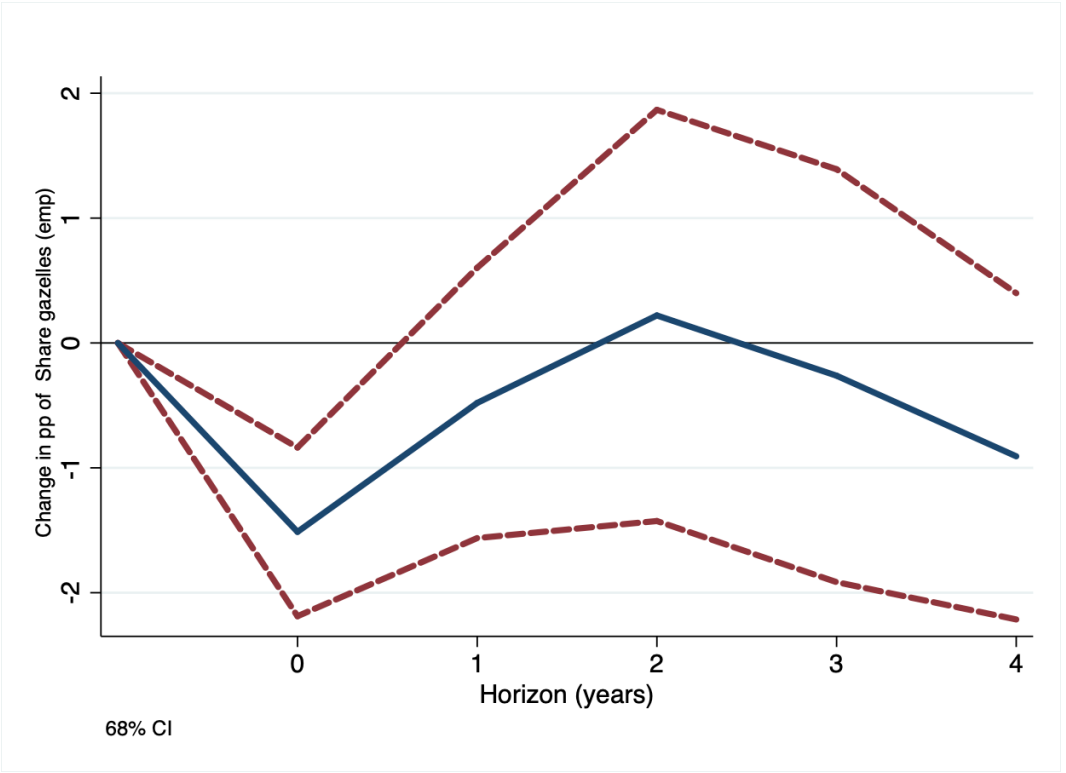
Entry Rate

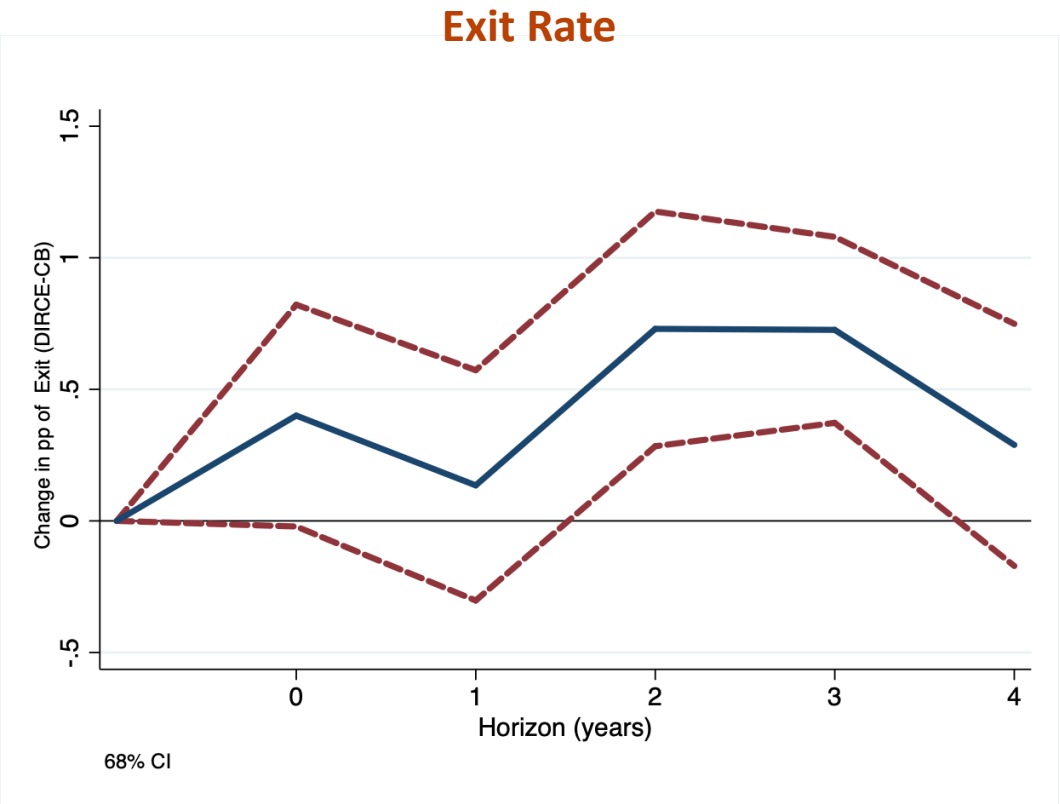


A monetary policy expansion increases entry in the short run, but decreases it in the medium run.

Gazelles as share of entrants



A monetary policy expansion reduces in the short run the share of gazelles entering.



A monetary policy expansion does not change exit in the short run, but it overshoots in the medium run

Firm level data

- Yearly balance sheet data from **Central de Balances Integrada (CBI)** (quasi-universe) for the period 2000-2016.
- Use 2-digit sector. Firm level variables (employment, log diff of tangible capital, sales, value added, leverage, age, net financial assets) winsorized at top and bottom 1%. Investment and MRPK are winsorized at the 0.5% level.
- Deflate nominal variables with 2-digit industry VA deflator, and capital with 2-digit industry capital deflator.
- Drop firms in agriculture, mining, FIRE and public administration (Cloyne et al. 2018)
- Drop firm–level observations with negative capital or negative value-added, and only firms with coherent employment
- Entry/exit data: **Directorio Central de Empresas** (DIRCE/INE) matched with CBI.

Aggregate level data: Output gap, government spending, unemployment and GDP growth.

Monetary Policy shocks

- Jarociński and Karadi (2020): high frequency identification + sign restriction: a surprise policy tightening raises interest rates and reduces stock prices, while the complementary positive central bank information shock raises both.
- Shock aggregation at annual frequency to match the frequency of firm level data: weighting scheme similar to Ottonello and Winberry(2020), considering last quarter in t-1.

$$\epsilon_t^{MP} = \sum_{m \in t} \omega_a(m)\epsilon_m^{MP} + \sum_{m \in t-1,q4} \omega_b(m)\epsilon_m^{MP}$$

[Back]

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	count	mean	p50	p95	sd
Investment	3750393	-0.01	-0.05	0.89	0.64
Marginal Product of Capital	3745279	0.47	0.50	3.74	2.00
MP shock*lagged demean MRPK (STD)	3750393	-0.10	-0.01	10.19	6.83
Lagged demean MRPK (STD)	3750393	0.03	-0.03	1.60	0.90
TFP	3331124	0.50	0.46	1.62	0.66
Sales growth	3396022	-0.04	-0.02	1.23	0.82
Leverage	3750393	0.21	0.11	0.71	0.25
Employees	3750393	8.89	3.85	35.00	16.37
Net Financial Assets to Total Assets	3685680	0.17	0.18	0.91	0.48
Cash to Total Assets	3750393	0.14	0.07	0.54	0.18
Age	3750393	12.86	11.00	28.00	8.64
Output gap	3750393	-1.44	-0.85	3.20	3.97
Govt spending	3750393	374.14	395.05	421.44	45.78
Unemployment rate	3750393	16.76	17.86	26.10	6.27
GDP growth	3750393	1.50	2.98	4.10	2.56
Weighted MP shock	3750393	-2.98	0.05	7.51	7.35
Within-year weighted MP shock	3750393	-1.34	0.57	4.01	4.49

Descriptive statistics for quartiles of $(MRPK_{i,t-1} - E_j[MRPK_{i,t-1}])$

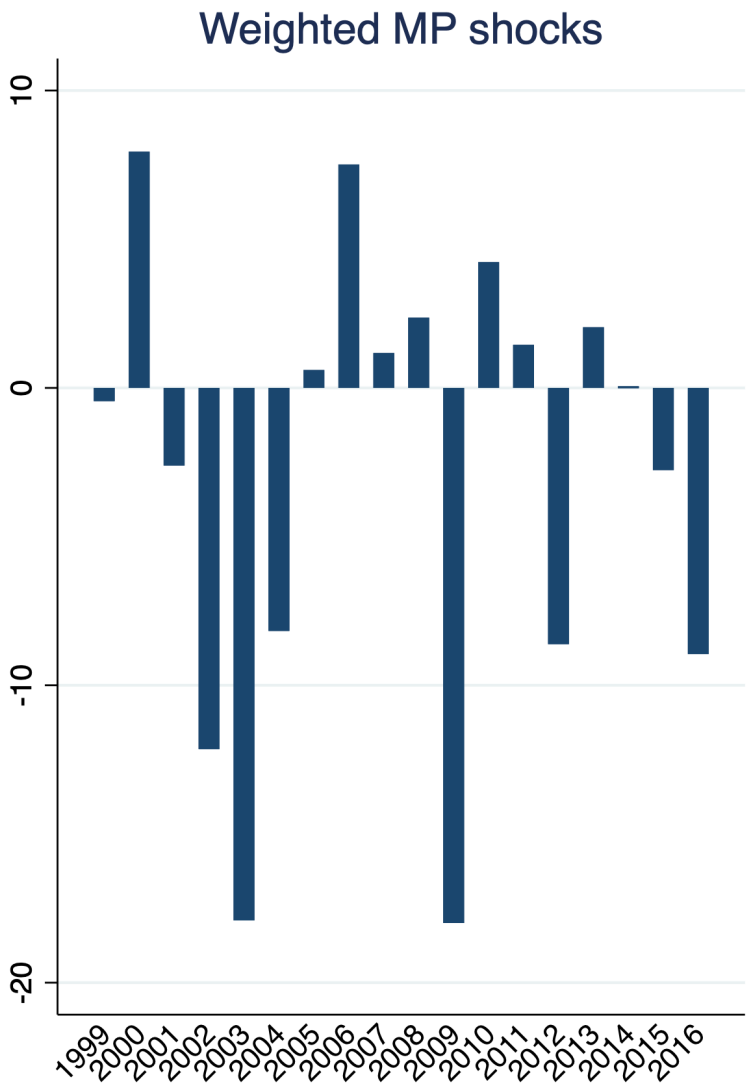
Q1	count	mean	p50	p95	sd
Investment	937627	-0.05	-0.03	0.26	0.41
Marginal Product of Capital	935136	-1.46	-1.12	0.19	1.37
MP shock*lagged demeaned MRPK (STD)	937627	2.95	-0.05	17.57	7.79
Lagged demeaned MRPK (STD)	935136	-1.02	-0.91	-0.32	0.58
TFP	740181	-0.05	-0.03	0.70	0.53
Sales growth	866911	0.04	0.01	1.42	0.84
Leverage	937627	0.31	0.26	0.81	0.27
Employees	937627	6.58	2.00	26.23	14.29
Cash to Total Assets	937627	0.07	0.03	0.29	0.11
Age	937627	13.43	12.00	28.00	8.43

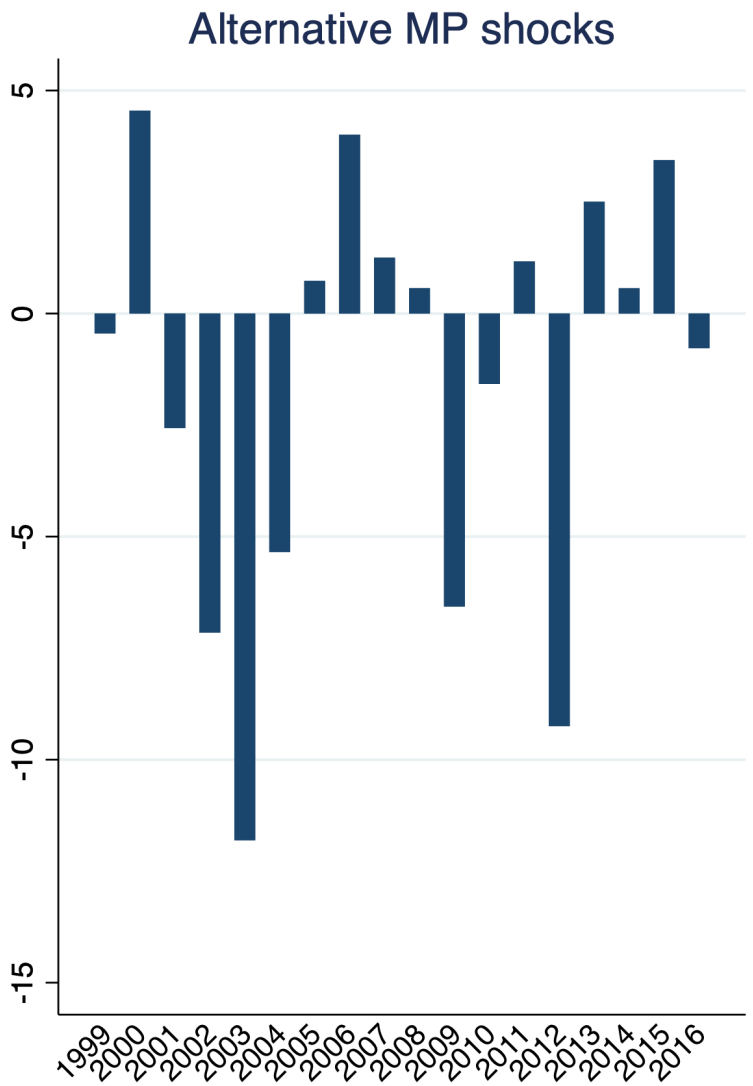
Q2	count	mean	p50	p95	sd
Investment	937586	-0.05	-0.06	0.48	0.44
Marginal Product of Capital	936572	-0.07	0.19	1.37	1.22
MP shock*lagged demeaned MRPK (STD)	937586	0.84	-0.02	5.94	2.51
Lagged demeaned MRPK (STD)	936572	-0.29	-0.28	0.19	0.36
TFP	844439	0.28	0.29	0.91	0.45
Sales growth	856719	-0.04	-0.02	1.14	0.78
Leverage	937586	0.22	0.15	0.71	0.24
Employees	937586	9.74	4.00	38.08	17.34
Cash to Total Assets	937586	0.12	0.06	0.44	0.15
Age	937586	13.09	11.00	28.00	8.70

Q3	count	mean	p50	p95	sd
Investment	937609	-0.05	-0.09	0.81	0.55
Marginal Product of Capital	936839	0.91	1.17	2.52	1.32
MP shock*lagged demeaned MRPK (STD)	937609	-0.75	0.01	2.25	2.53
Lagged demeaned MRPK (STD)	936839	0.23	0.23	0.82	0.40
TFP	863133	0.59	0.60	1.23	0.45
Sales growth	846271	-0.06	-0.04	1.13	0.79
Leverage	937609	0.17	0.07	0.65	0.23
Employees	937609	9.78	4.17	37.83	16.94
Cash to Total Assets	937609	0.16	0.09	0.57	0.19
Age	937609	12.60	11.00	28.00	8.70

Q4	count	mean	p50	p95	sd
Investment	937571	0.09	-0.10	2.00	0.99
Marginal Product of Capital	936732	2.50	2.53	5.17	1.59
MP shock*lagged demeaned MRPK (STD)	937571	-3.42	0.06	8.14	9.56
Lagged demeaned MRPK (STD)	936732	1.07	0.99	2.43	0.72
TFP	883371	1.09	1.05	2.15	0.60
Sales growth	826121	-0.10	-0.06	1.23	0.87
Leverage	937571	0.13	0.02	0.58	0.21
Employees	937571	9.46	4.02	36.00	16.52
Cash to Total Assets	937571	0.21	0.12	0.71	0.23
Age	937571	12.31	10.00	27.00	8.70

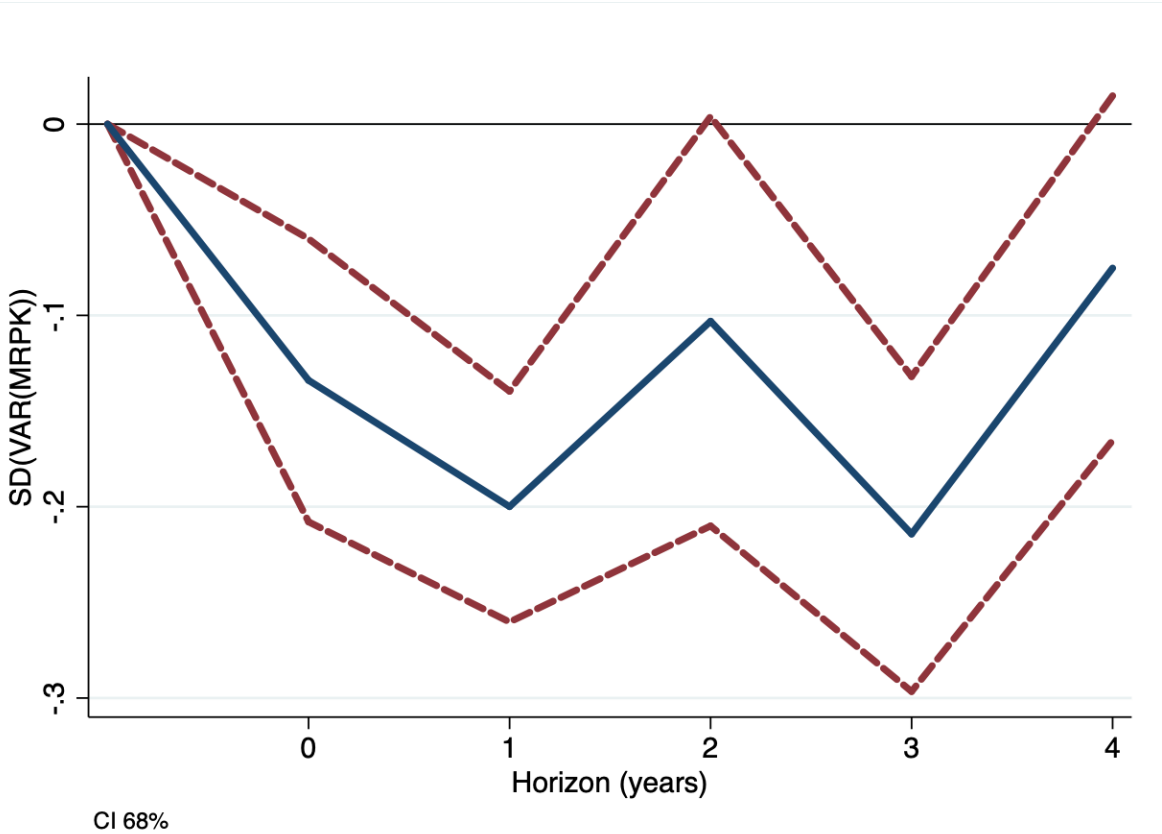
[BACK]


Weighted MP shocks
10
0
-10
-20
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

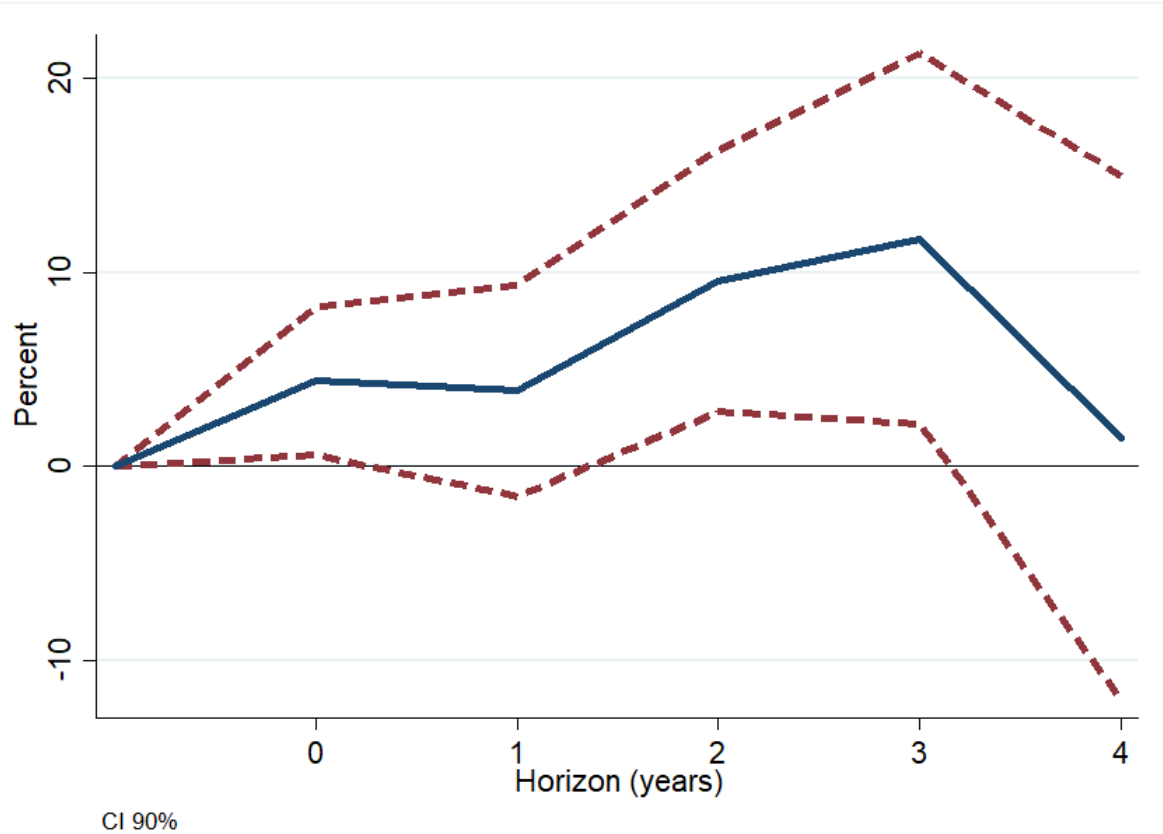

Alternative MP shocks
5
0
-5
-10
-15
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

[BACK]

Sector level – Impact on dispersion MRPK

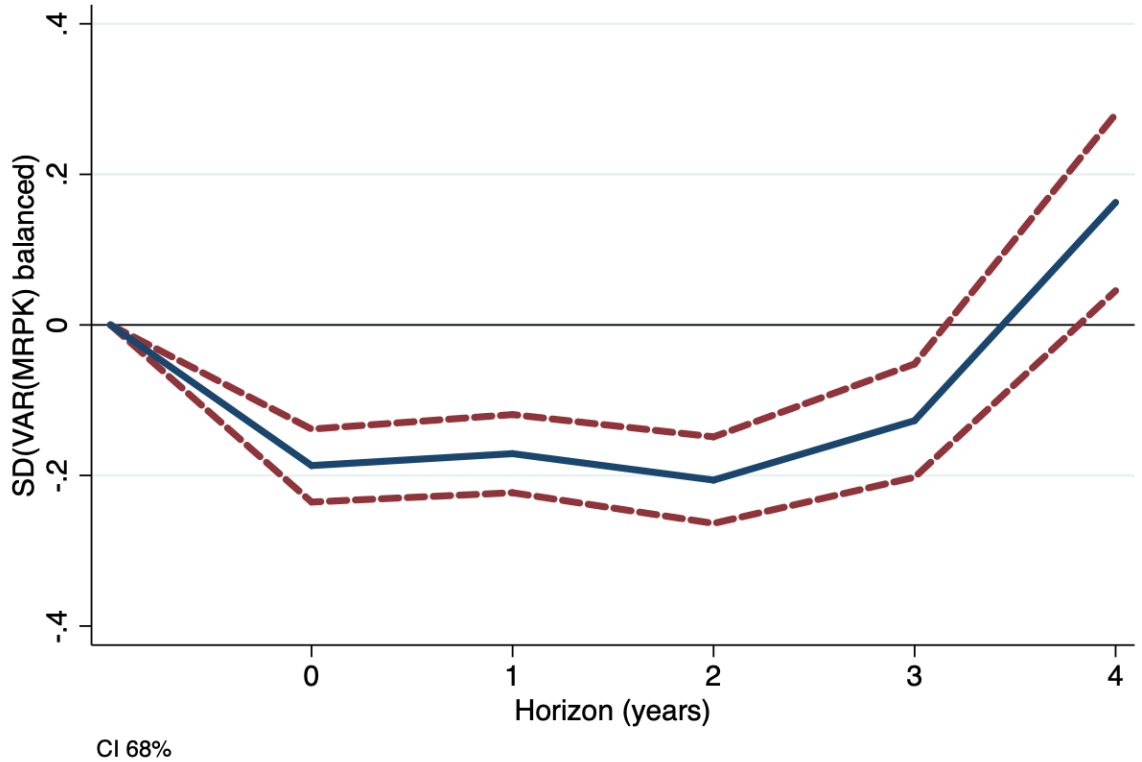


Firm level – Heterogeneous impact on investment

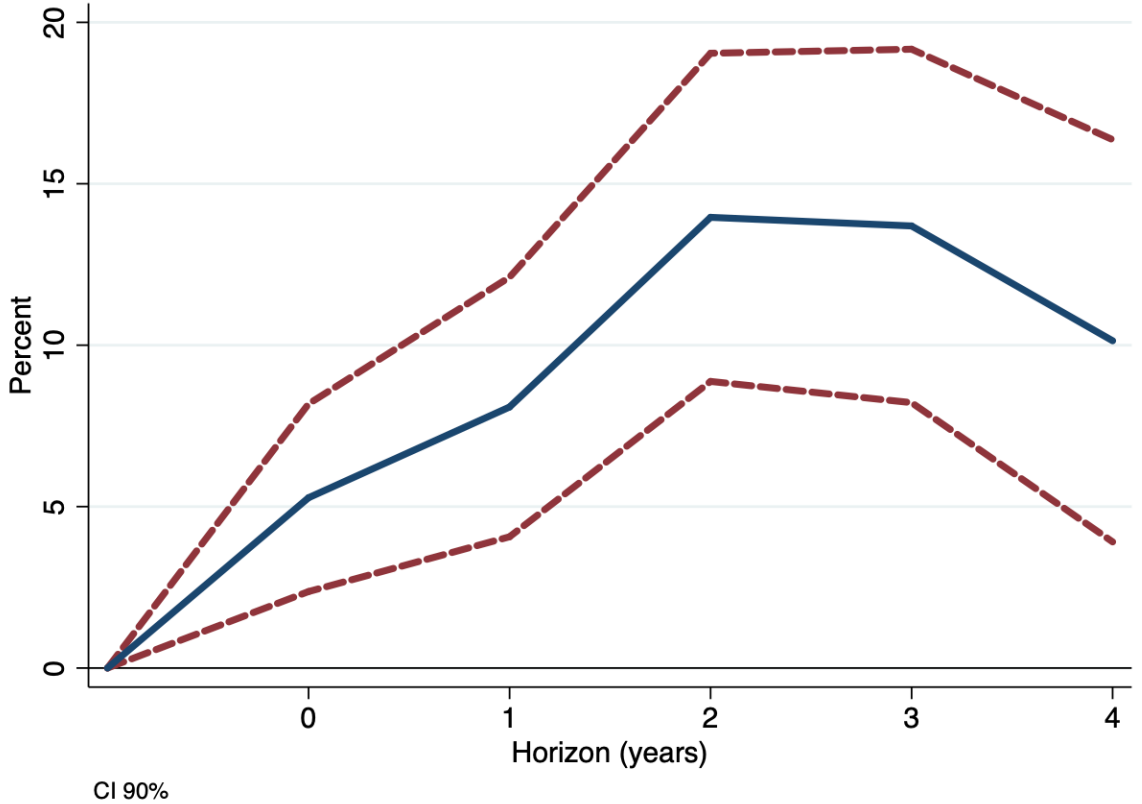


[BACK]

Sector level – Impact on dispersion MRPK

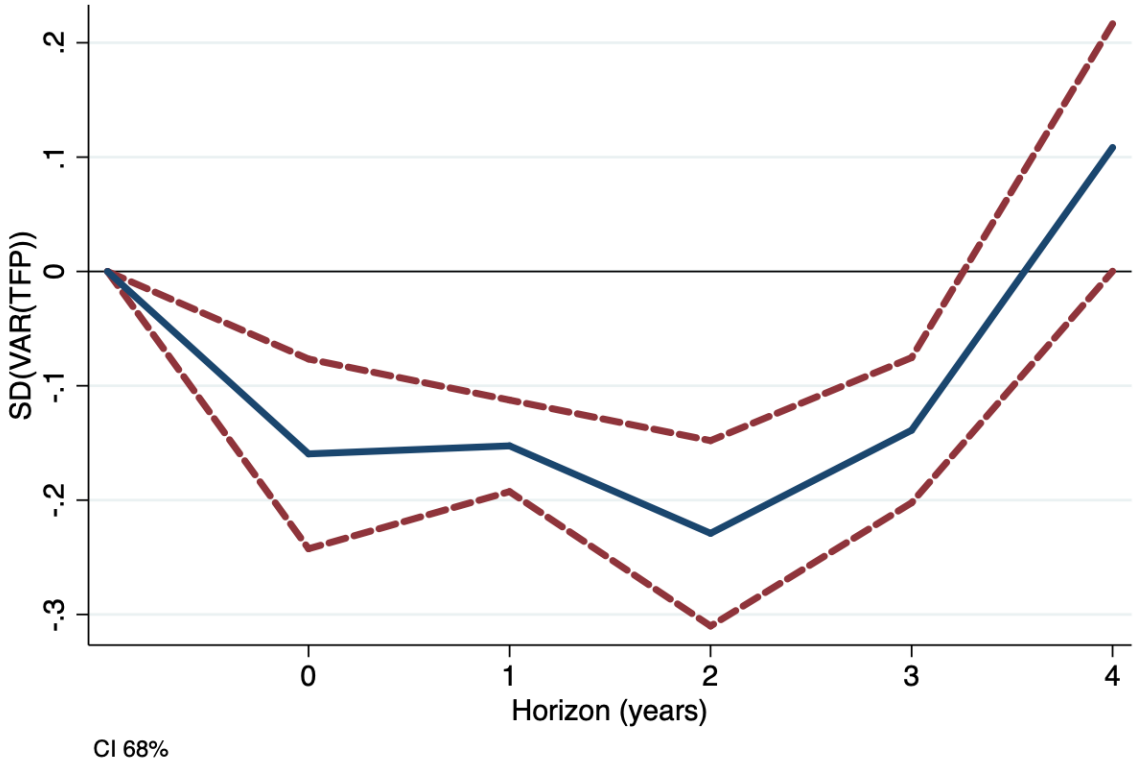


Firm level – Heterogeneous impact on investment

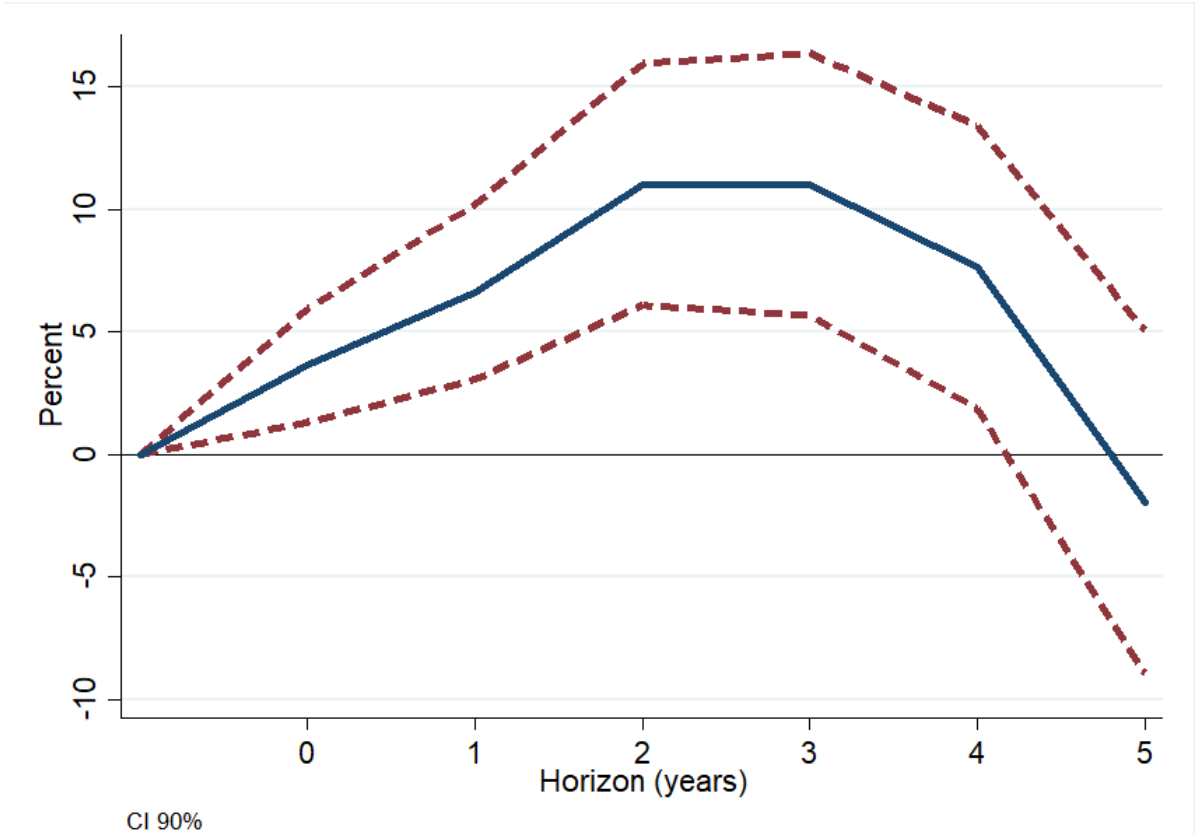


[BACK]

Sector level – Impact on dispersion TFPR

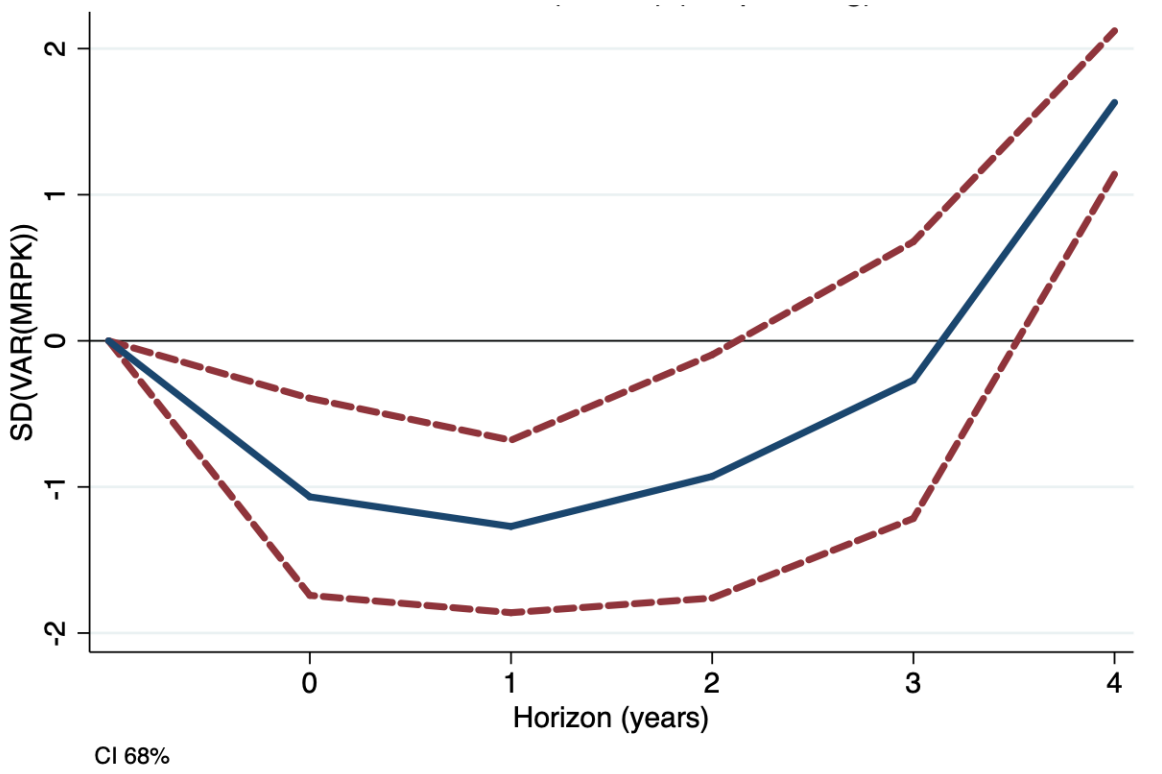


Firm level – Heterogeneous impact on investment

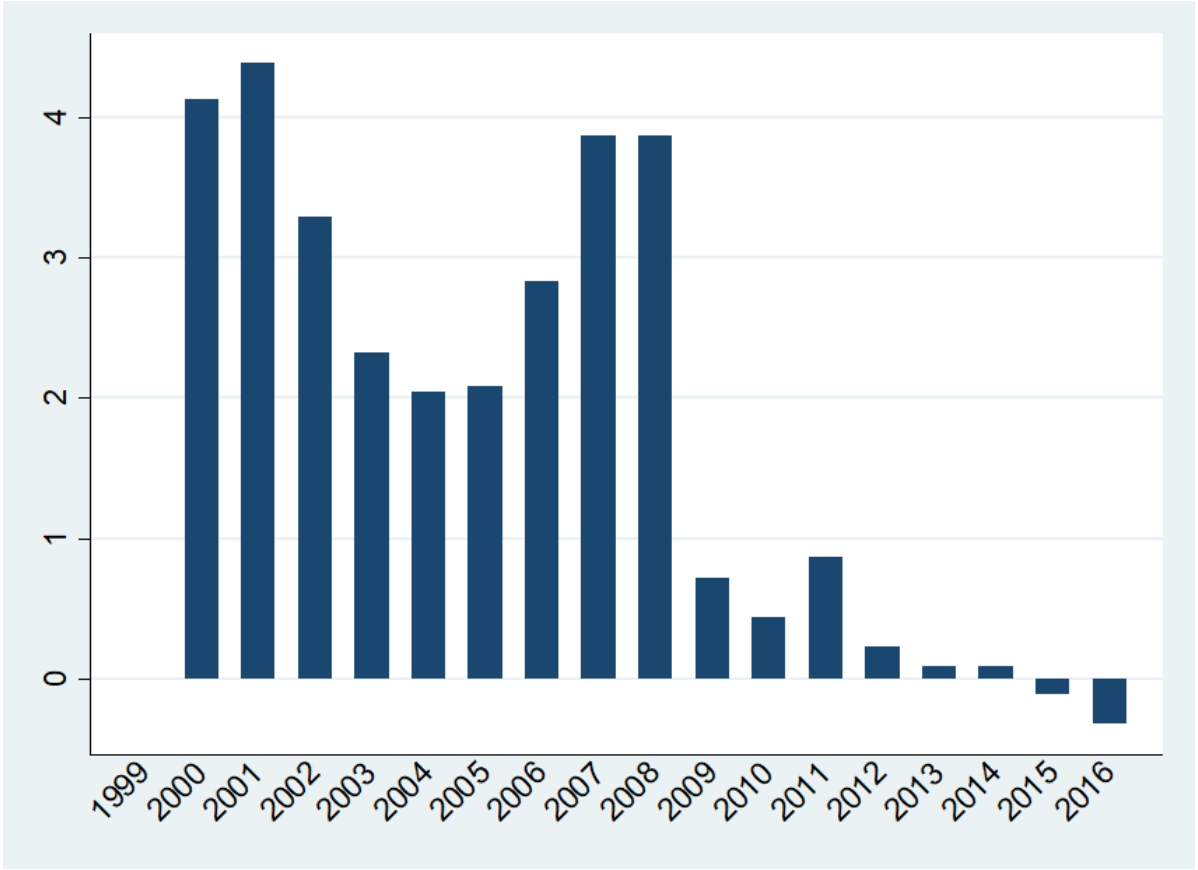


[BACK]

Sector level – Impact on dispersion MRPK



EONIA levels



An increase in the level of EONIA rates is associated with an improvement in the allocation of resources

[BACK]