The zombie lending channel of monetary policy

Bruno Albuquerque[1] Chenyu (Sophia) Mao[2]

[1]International Monetary Fund

[2]World Bank

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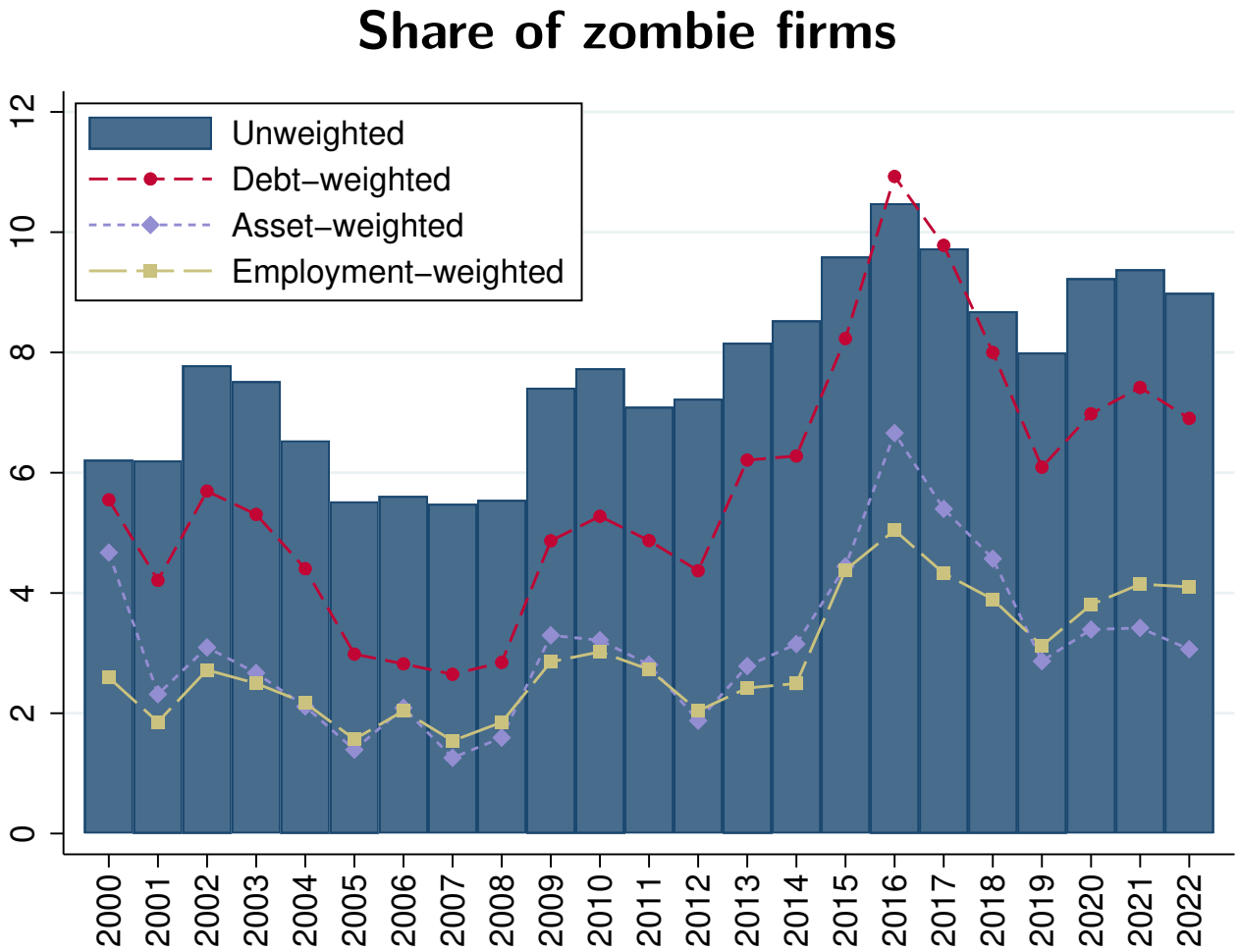
Outline

Outline

Zombie firms have been rising around the world



Source: Reproduced from Albuquerque and Iyer (2024).
Notes: Blue bars refer to the unweighted percentage share of zombie firms, and the different lines to zombie shares weighted by total debt, total assets, or employment.

Map Countries Industries Alt

Introduction

The survival of zombie firms creates negative congestion effects on healthy firms competing in the same sector. Overall productivity, investment, and employment is reduced (Caballero et al., 2008; McGowan et al., 2018; Acharya et al., 2019; Banerjee and Hofmann, 2022; Albuquerque and Iyer, 2024).

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- **Zombie firms more responsive.** Bank lending and the risk-taking channels imply that weaker firms are affected more (Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Bahaj et al., 2022; Cloyne et al., 2023).

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- **Zombie firms more responsive.** Bank lending and the risk-taking channels imply that weaker firms are affected more (Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Bahaj et al., 2022; Cloyne et al., 2023).
- **Zombie firms less responsive.** Banks face incentives to evergreen zombie loans as they internalize a higher probability of zombies defaulting when the cost of debt goes up. $\Rightarrow$ **zombie lending channel of monetary policy.**

The overall effect remains an empirical question.

What we do

How does the presence of zombie firms affect the transmission of monetary policy to nonfinancial firms?

- Assess the differential effects of contractionary MP shocks on zombies vs nonzombies.
- Large firm-level panel of 47 countries over 2000q1-2019q4.
- Exogenous variation in country-specific monetary policy conditions identified with US monetary policy shocks. US MP drives the global financial cycle (Rey, 2013; Bruno and Shin, 2015; Kalemli-Özcan, 2019; Bräuning and Ivashina, 2020).

Main contribution

Zombie lending channel in the transmission of monetary policy to nonfinancial corporates.

Preview of results

1. Zombie firms are less responsive to contractionary monetary policy: evergreening motives.
2. Lenders offer relatively better credit conditions to zombies when interest rates increase to prevent them from defaulting: **zombie lending channel**.
3. Zombie lending tends to be more prevalent among under-capitalized banks.
4. Zombie lending channel mitigated by policies that strengthen banks' balance sheets, and limit banks' incentives to engage in risky behaviour.

Outline

Data

Micro data. Nonfinancial listed firms (S&P Compustat), 47 countries (23 EMEs and 24 AEs), 24,433 firms over 2000q1-2019q4. Nfirms

Syndicated loans. Dealogic loan-level dataset.

Country data:

- Macro variables (national sources)
- Banks' NPLs and capital ratios (IMF's FSI)
- Banks' capital buffers (WB's Bank Regulation and Supervision Survey)
- iMaPP (Alam et al., 2024)
- Insolvency regimes (Araujo et al., 2022)

Monetary policy surprises. HF identification from unexpected changes in 3-month ahead Fed funds futures contracts in a 30-min window around FOMC meetings (Gürkaynak et al., 2005; Gertler and Karadi, 2015).

US MP surprises used as instruments for the country-specific one-year government bond yields.

Zombie firms

Risky, unproductive and unviable firms that manage to avoid immediate default thanks to lenders' continued support, due to misaligned incentives (Caballero et al., 2008).

Zombie firms must have for two consecutive years (Albuquerque and Iyer, 2024):

1. ICR<1
2. Leverage above the median peer at the country-sector level
3. Real sales growth<0

To **exit zombie status**, a firm needs ICR>1, **or** leverage below median sector, **or** sales growth>0 for two consecutive years.

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Zombie firms invest less, are financially fragile, and face a slightly higher cost of debt than nonzombies Table. Zombie firms typically do not recover over time.

Our definition is still consistent with an interest rate subsidy. Evidence

Outline

Identification of country-specific monetary policy shocks

High-frequency identification not possible for most jurisdictions.

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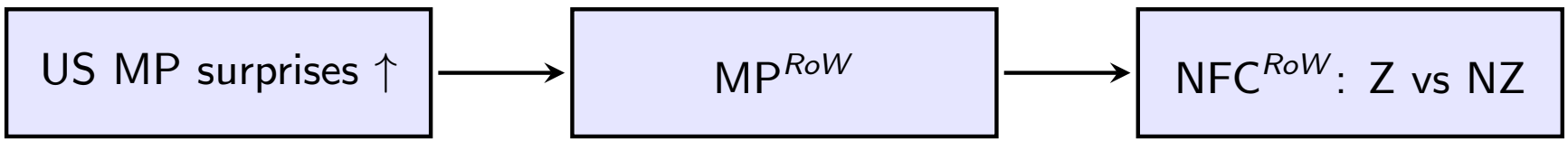
This paper. Identify exogenous variation in monetary policy conditions around the world by exploiting market surprises to US monetary policy.



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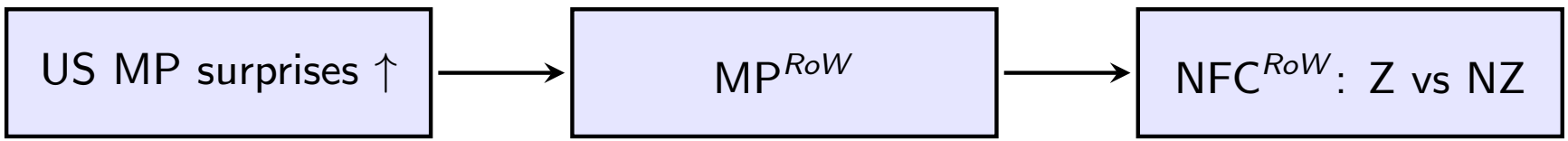

$$R_{c,t} = \alpha_c + \delta_c S_t + \Gamma_c' X_{c,t-1} + u_{c,t}, \quad \text{for each c}$$

Focus on the financial channel of unanticipated US interest rate changes, after controlling for other channels (trade, exchange rate channels).

Zombie firms respond less to monetary policy shocks

$$\begin{aligned}\Delta_h Y_{i,t+h} &= \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1}) \\ &+ \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h\end{aligned}$$

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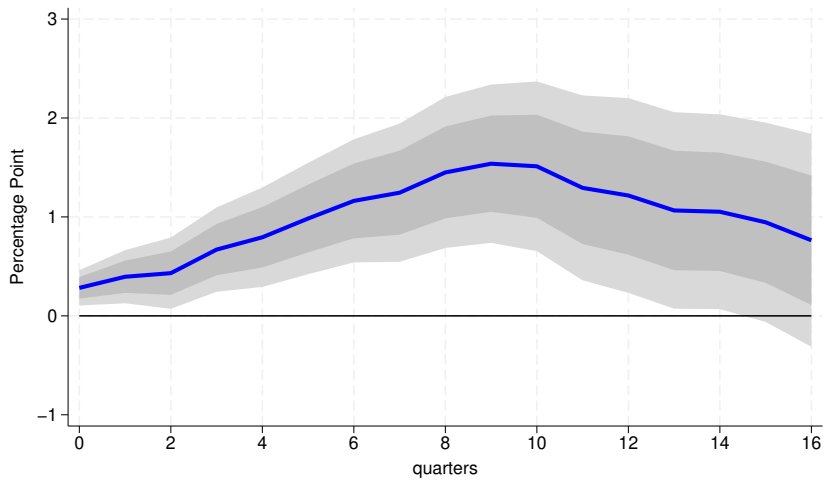
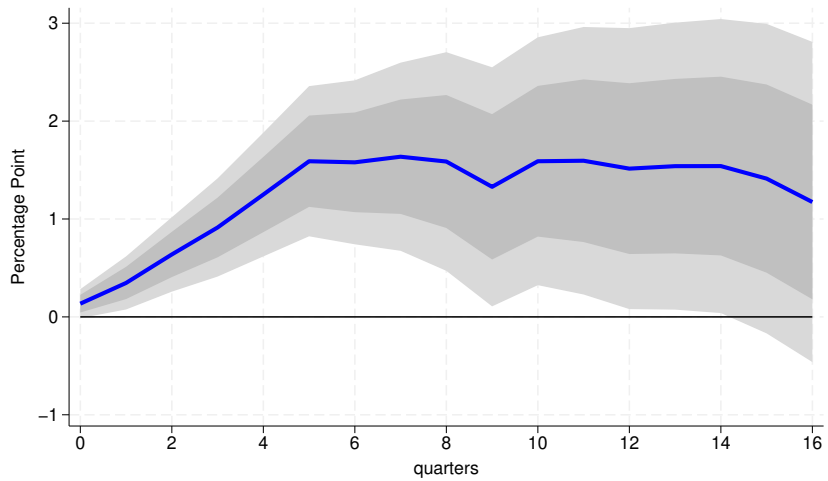
Differential response of zombie firms relative to nonzombies



Investment growth



Employment growth

Avg.effect Bootstrapped

Stronger evergreening incentives when interest rates ↑: banks offer more favorable credit conditions to zombie firms

$$\begin{aligned}\Delta_h Y_{i,t+h} &= \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1}) \\ &+ \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h\end{aligned}$$

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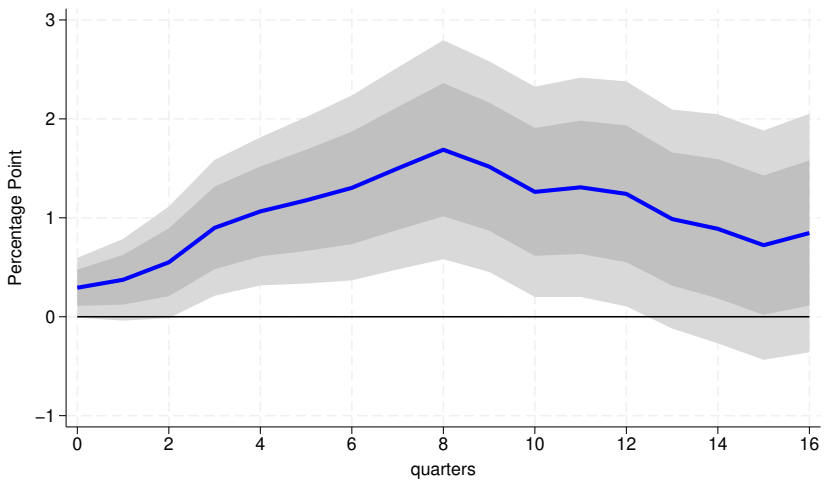
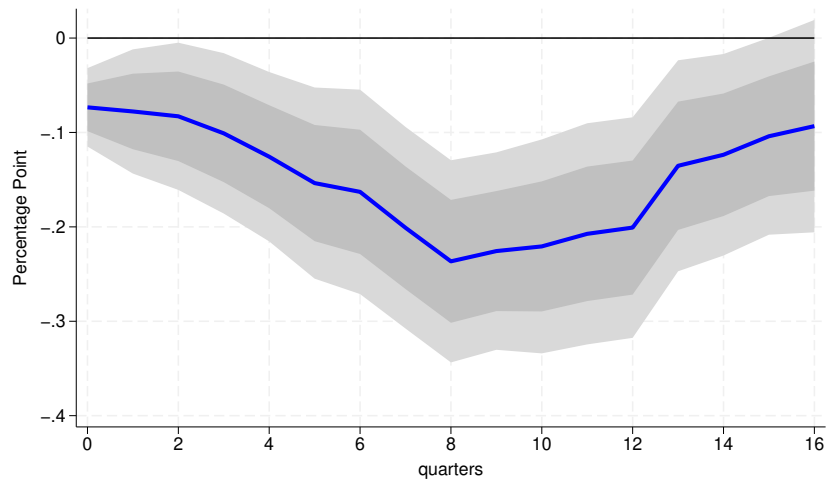


Debt growth



Interest rate change

Evergreening driven by concerns about zombies' profitability

$$
\begin{aligned}
\Delta_h Y_{i,t+h} &= \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1}) \\
&+ \phi_h DissProf_{i,t-1} + DissProf_{i,t-1} \times (\theta^h \hat{R}_{c,t} + \xi_h Z_{i,t-1} + \Theta_h X_{c,t-1}) \\
&+ \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h
\end{aligned}
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Evergreening driven by concerns about zombies' profitability

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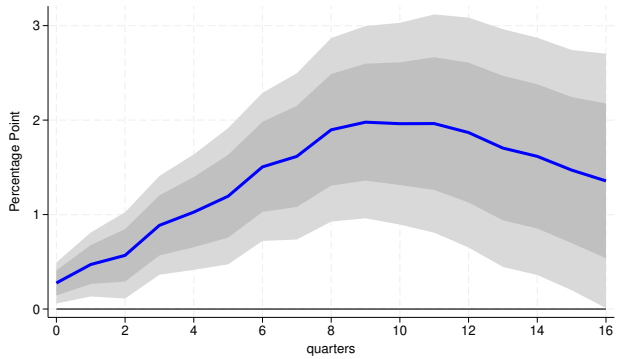
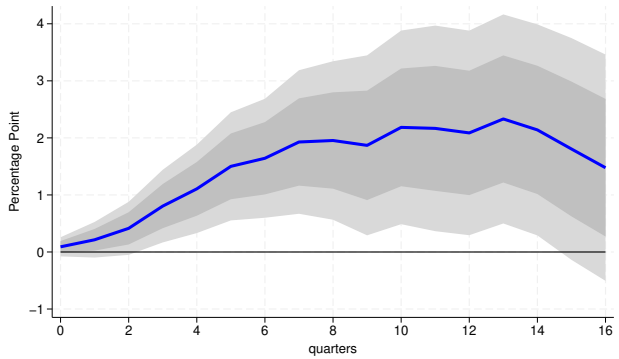
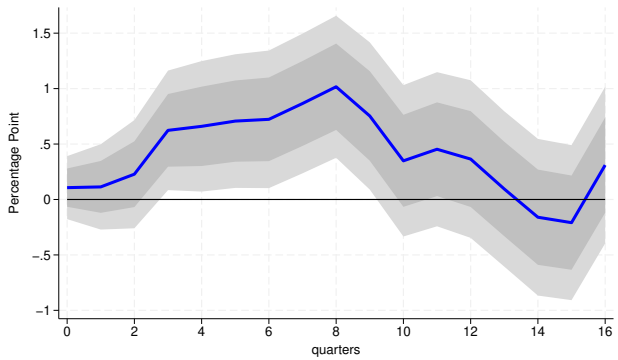
Differential response of zombies relative to distressed nonzombies (β^h - θ^h)



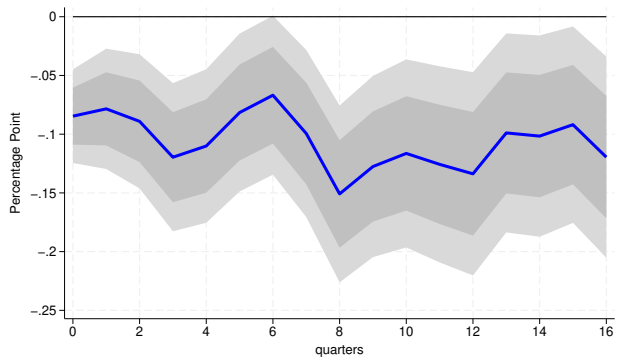
Investment growth



Employment growth



Debt growth



Interest rate change

Evidence from the syndicated loan market

$$
\begin{aligned}
Log(Loans)_{l,i,t} &= \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta + \delta Z_{i,t-1}) \\
&+ \Gamma_h Z_{i,t-1} + FE + \epsilon_{l,i,t}
\end{aligned}
$$

Results robust to controlling for loan supply and demand

	(1)	(2)
Zom_{t-1}	-0.161	
	(0.213)	
MP shock $\times$ Zom_{t-1}	0.070**	
	(0.028)	
Firm controls	✓	
Firm FE	✓	
Bank FE	✓	
Bank $\times$ Year FE		
ILST FE	✓	
Observations	77,348	
R^2	0.823	

Notes: Differential response of new loans to zombie firms vs other firms after a 100bps MP shock. Standard errors in parentheses clustered at bank level. Asterisks, *, **, and ***, denote statistical significance at the 10%, 5%, and 1% levels.

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\end{aligned}
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Results robust to controlling for loan supply and demand

	(1)	(2)
Zom_{t-1}	-0.161	-0.090
	(0.213)	(0.220)
MP shock $\times$ Zom_{t-1}	0.070**	0.077***
	(0.028)	(0.030)
Firm controls	✓	✓
Firm FE	✓	✓
Bank FE	✓	
Bank $\times$ Year FE		✓
ILST FE	✓	✓
Observations	77,348	72,547
R^2	0.823	0.843

Notes: Differential response of new loans to zombie firms vs other firms after a 100bps MP shock. Standard errors in parentheses clustered at bank level. Asterisks, *, **, and ***, denote statistical significance at the 10%, 5%, and 1% levels.

Zombie lending driven by low bank capital

	(1)	(2)	(3)	(4)
Zom_{t-1}	-0.161	-0.090		
	(0.213)	(0.220)		
MP shock $\times$ Zom_{t-1}	0.070**	0.077***		
	(0.028)	(0.030)		
MP shock $\times$ LC_{t-1}			-0.024	
			(0.025)	
Zom_{t-1} $\times$ LC_{t-1}			-0.150	
			(0.179)	
MP shock $\times$ Zom_{t-1} $\times$ LC_{t-1}			0.150*	
			(0.087)	
Firm controls	✓	✓	✓	
Bank controls			✓	
Firm FE	✓	✓	✓	
Bank FE	✓		✓	
Bank $\times$ Year FE		✓		
ILST FE	✓	✓	✓	
Firm $\times$ Year FE				
Observations	77,348	72,547	11,431	
R^2	0.823	0.843	0.868	

Notes: Differential response of loans to zombies vs other firms after a 100bps MP shock. *LC* is a dummy variable capturing low capitalized banks (below the country-specific median of the Tier 1 capital ratio). Standard errors clustered at bank level. Asterisks, *, **, and ***, denote statistical significance at 10%, 5%, and 1%.

Zombie lending driven by low bank capital

	(1)	(2)	(3)	(4)
Zom_{t-1}	-0.161	-0.090		
	(0.213)	(0.220)		
MP shock $\times$ Zom_{t-1}	0.070**	0.077***		
	(0.028)	(0.030)		
MP shock $\times$ LC_{t-1}			-0.024	-0.013
			(0.025)	(0.024)
Zom_{t-1} $\times$ LC_{t-1}			-0.150	-0.359
			(0.179)	(0.274)
MP shock $\times$ Zom_{t-1} $\times$ LC_{t-1}			0.150*	0.190*
			(0.087)	(0.099)
Firm controls	✓	✓	✓	✓
Bank controls			✓	✓
Firm FE	✓	✓	✓	
Bank FE	✓		✓	✓
Bank $\times$ Year FE		✓		
ILST FE	✓	✓	✓	
Firm $\times$ Year FE				✓
Observations	77,348	72,547	11,431	8,557
R^2	0.823	0.843	0.868	0.887

Notes: Differential response of loans to zombies vs other firms after a 100bps MP shock. *LC* is a dummy variable capturing low capitalized banks (below the country-specific median of the Tier 1 capital ratio). Standard errors clustered at bank level. Asterisks, *, **, and ***, denote statistical significance at 10%, 5%, and 1%.

Outline

Countries with higher zombie shares tend to experience lower economic growth and inflation following contractionary MP shocks

$$Y_{c,t+h} = \beta^h \hat{R}_{c,t} \times ZomShr_{c,t-1} + \delta^h ZomShr_{c,t-1} + \Theta_h X_{c,t-1} + \alpha_c^h + \alpha_t^h + \epsilon_{c,t}^h$$

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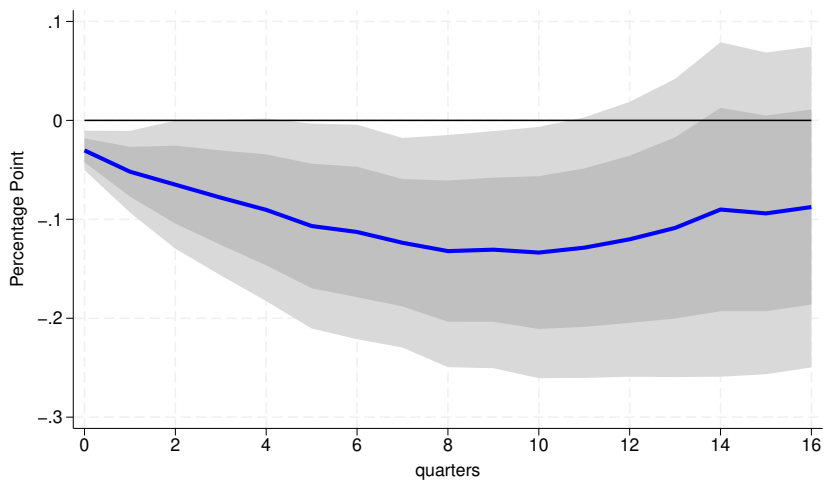
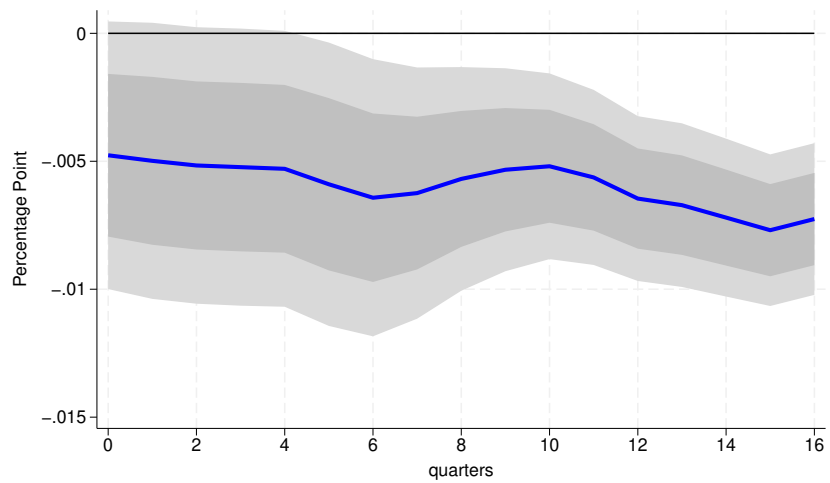
Marginal response of countries with zombie shares one-standard deviation above the mean



GDP growth



CPI inflation

Zombie lending channel can be mitigated by strengthening banks

$$\begin{aligned}\Delta_h Inv_{i,t+h} &= Zom_{i,t-1} \times (\beta_1^h \hat{R}_{c,t} + \beta_2^h \hat{R}_{c,t} \times Pol_{c,t-1} + \beta_3^h Pol_{c,t-1} + \delta_h Z_{i,t-1}) \\ &+ \gamma_h Zom_{i,t-1} + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,\end{aligned}$$

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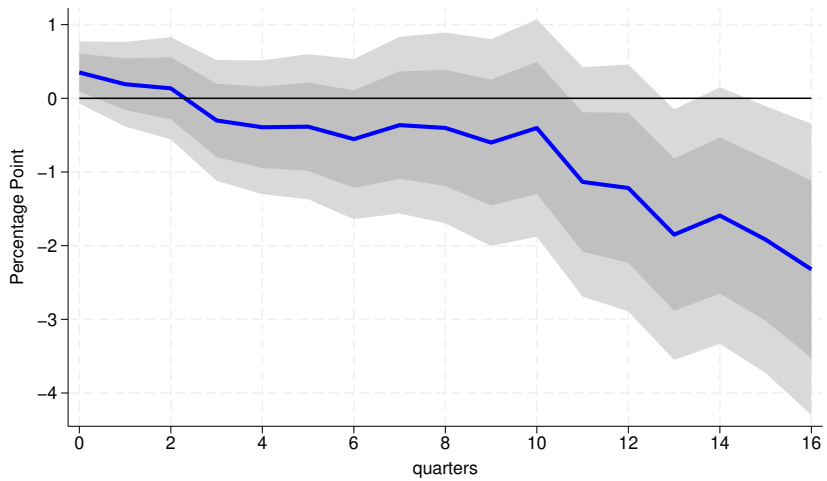
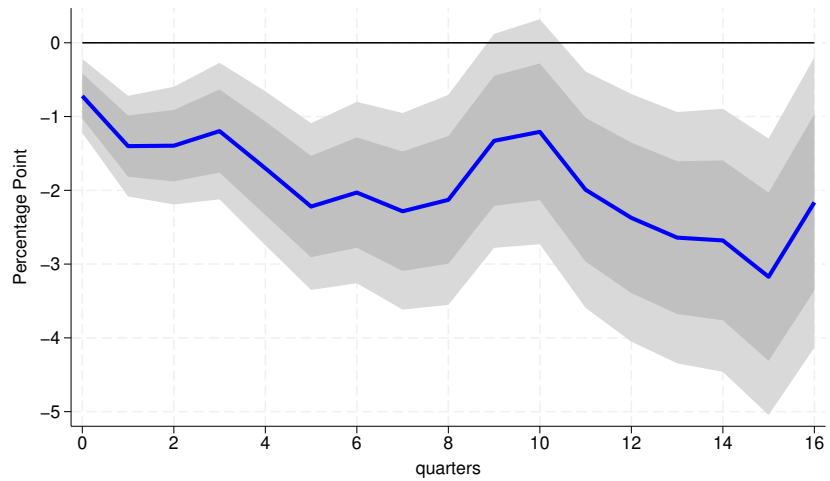
$$+ \gamma_h Zom_{i,t-1} + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$

Differential investment response of zombies vs nonzombies in countries with stronger banks



Capital buffers



NPLs

Note: Cumulative marginal effects in countries that stand above (below) the median sample of the banks' regulatory capital buffers (NPLs). Continuous Macropru Insolvency

Robustness checks

- Alternative zombie definitions Alt definitions
- Alternative interest rates
  - 10-year
  - Policy rates
- Country-specific MP shocks Choi et al. (2024)
- Information shocks
  - Jarociński & Karadi (2020)
  - Bauer & Swanson (2023)
- Alternative jurisdictions
  - US firms
  - Euro area firms
- Weighted-least squares WLS
- Drop countries with low F-stats Restricted

Main findings

1. Lenders' evergreening motives benefit zombies relative to other firms following contractionary monetary policy shocks $\Rightarrow$ *zombie lending channel*

2. By hampering the effectiveness of monetary policy transmission, zombie lending may amplify the adverse effects of monetary policy tightening on healthy corporates.

3. Trade-off between short-term gain and long-term pain: lower insolvencies in the short term, but delays a necessary creative destruction process.

4. Zombie lending can be mitigated with policies that strengthen banks' balance sheets, limit banks' incentives to engage in risky behavior, and laws that allow an efficient resolution of weak firms.

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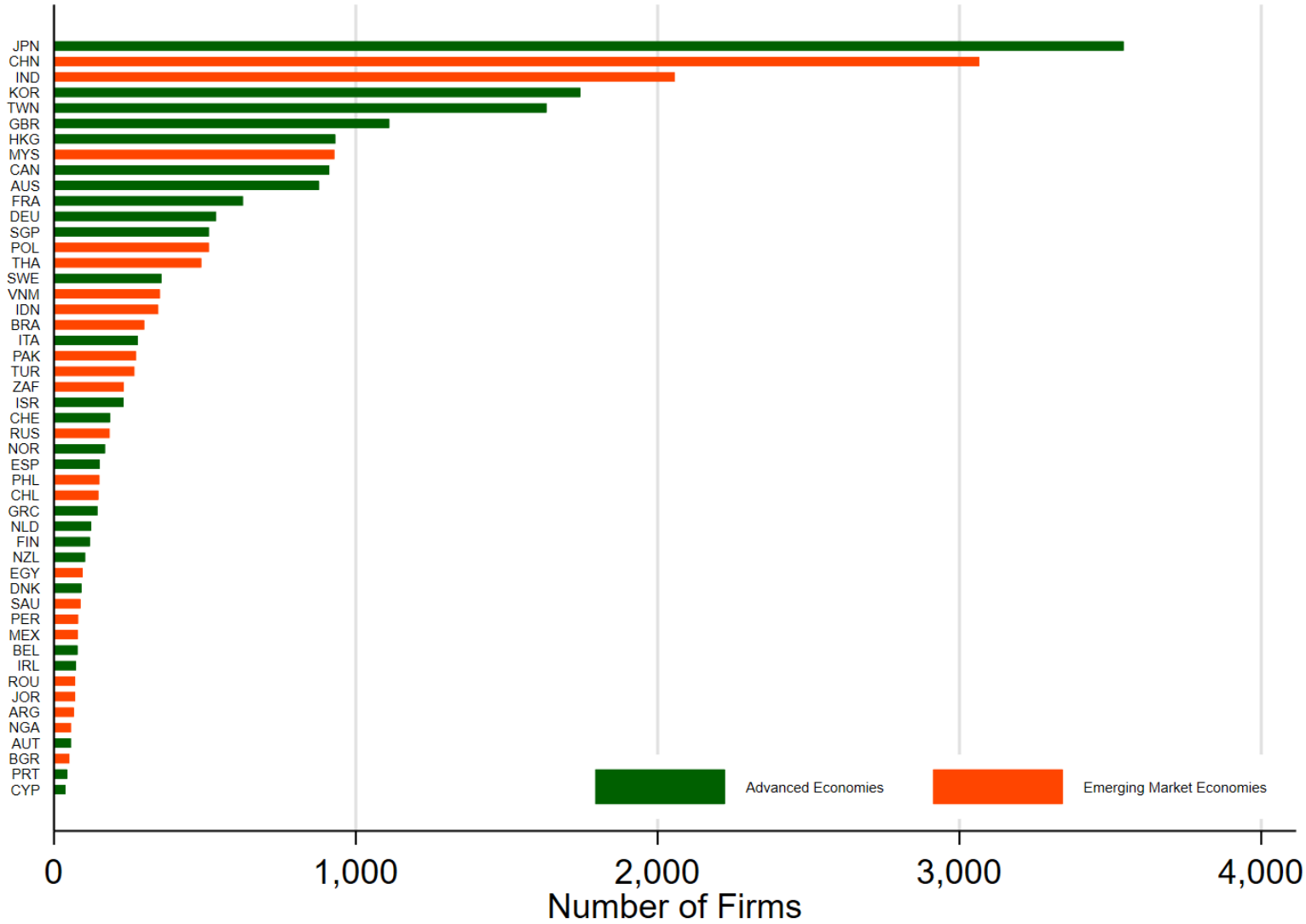
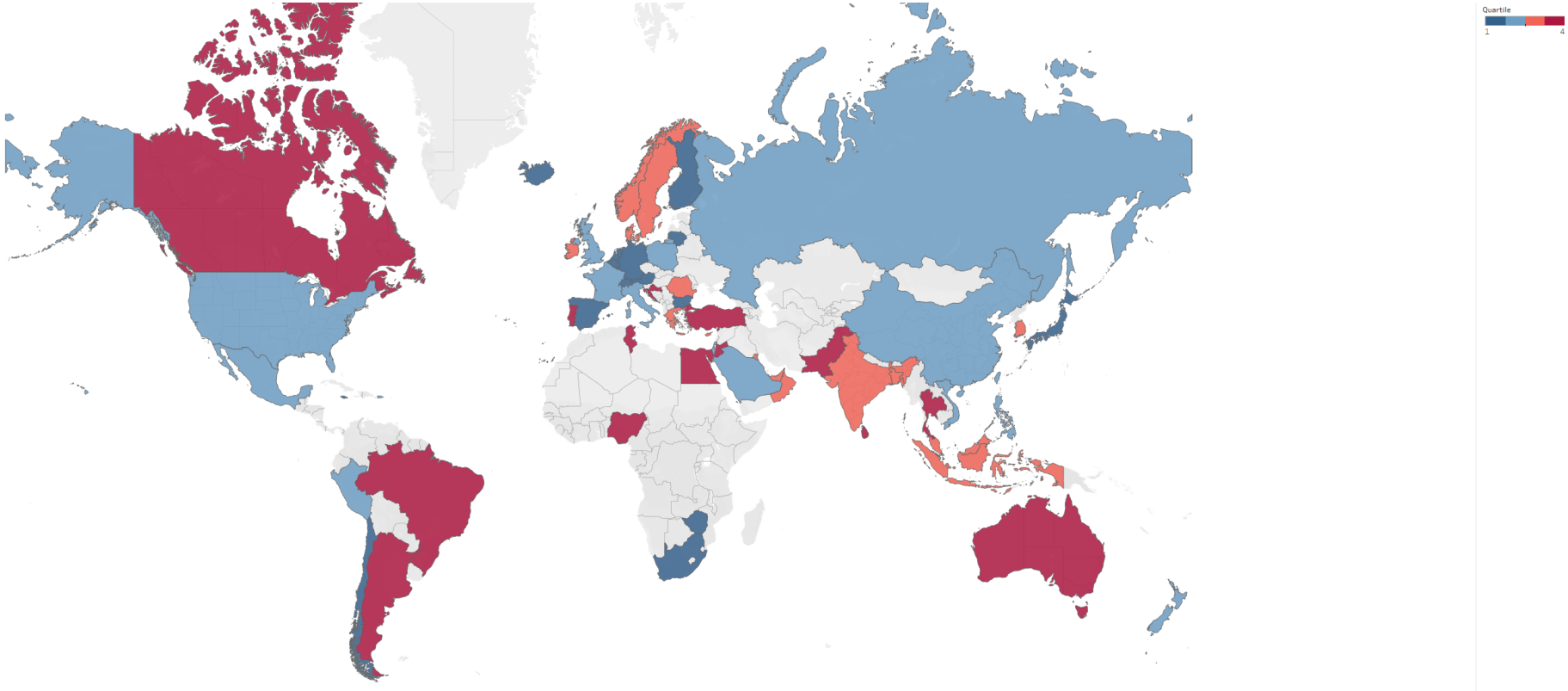
Appendix

Number of firms



Back

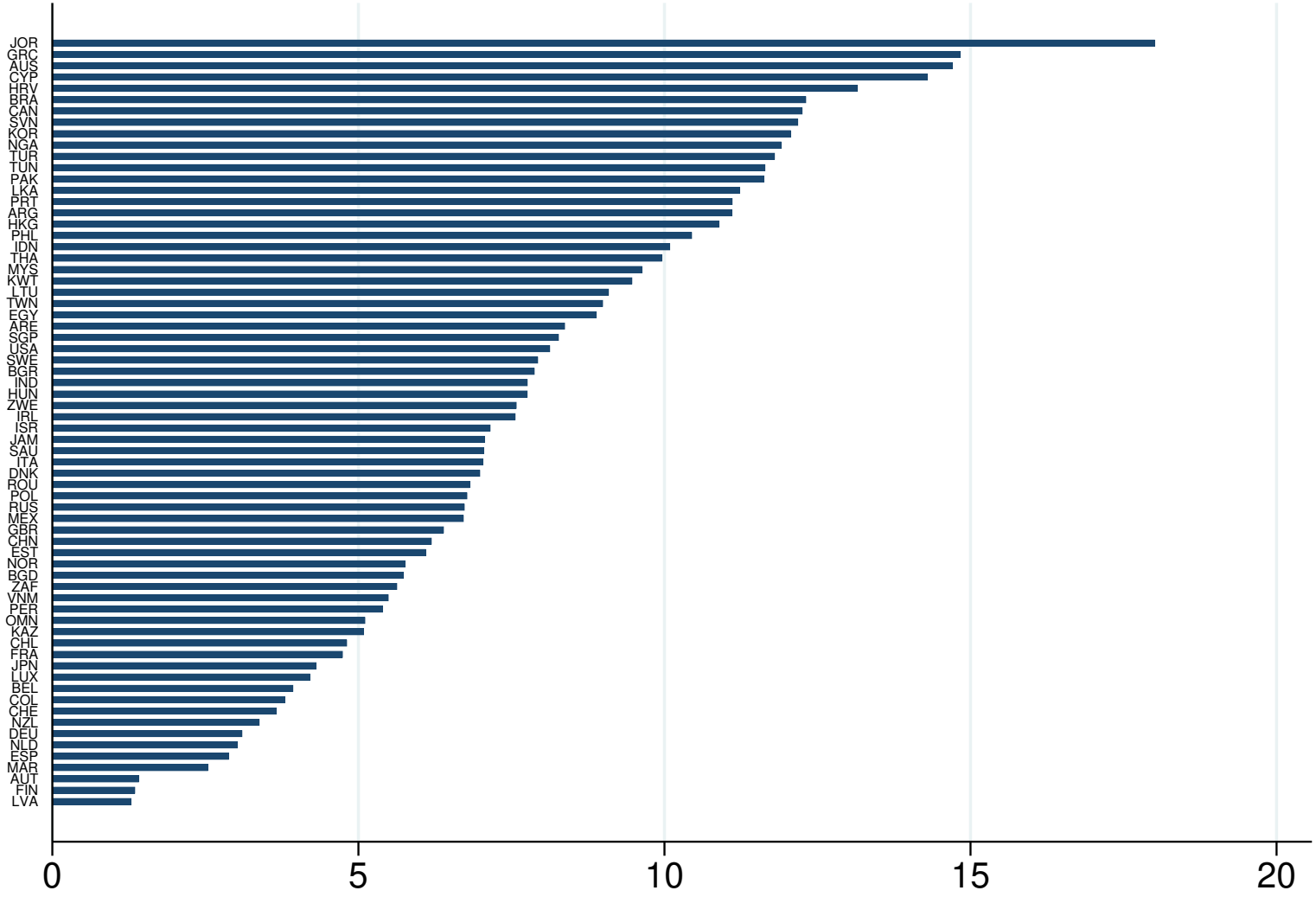
Share of listed zombie firms in 2021



Notes: Dark (light) blue colors refer to the first (second) quartiles of the country zombie shares in 2021, and orange (red) colors to the third (fourth) quartiles.

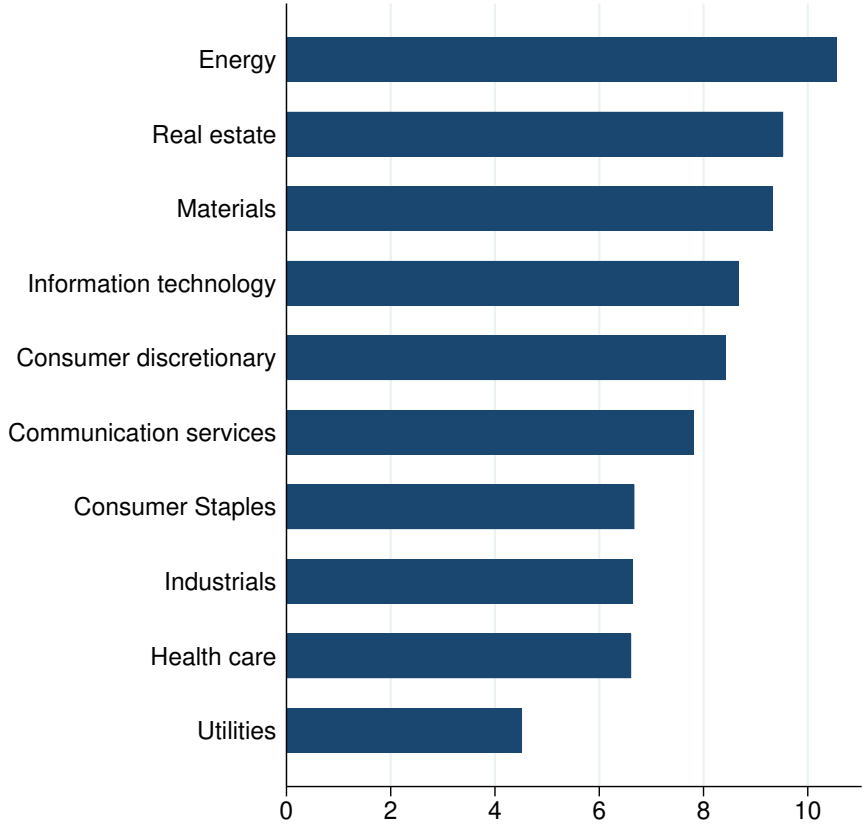
Back

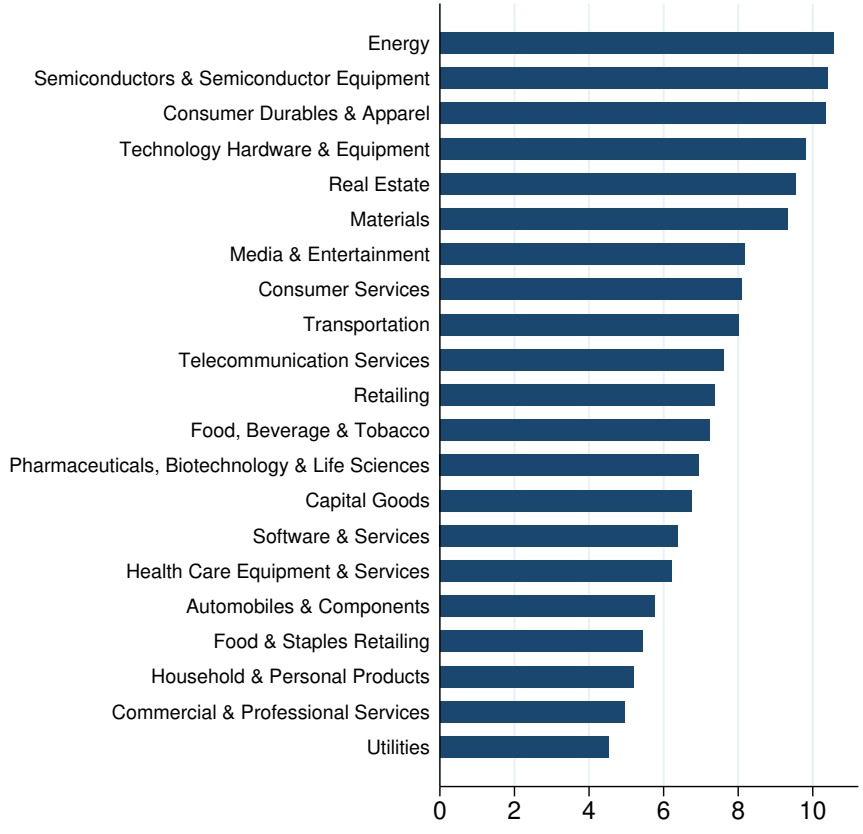
Average share of zombie firms by country



Back

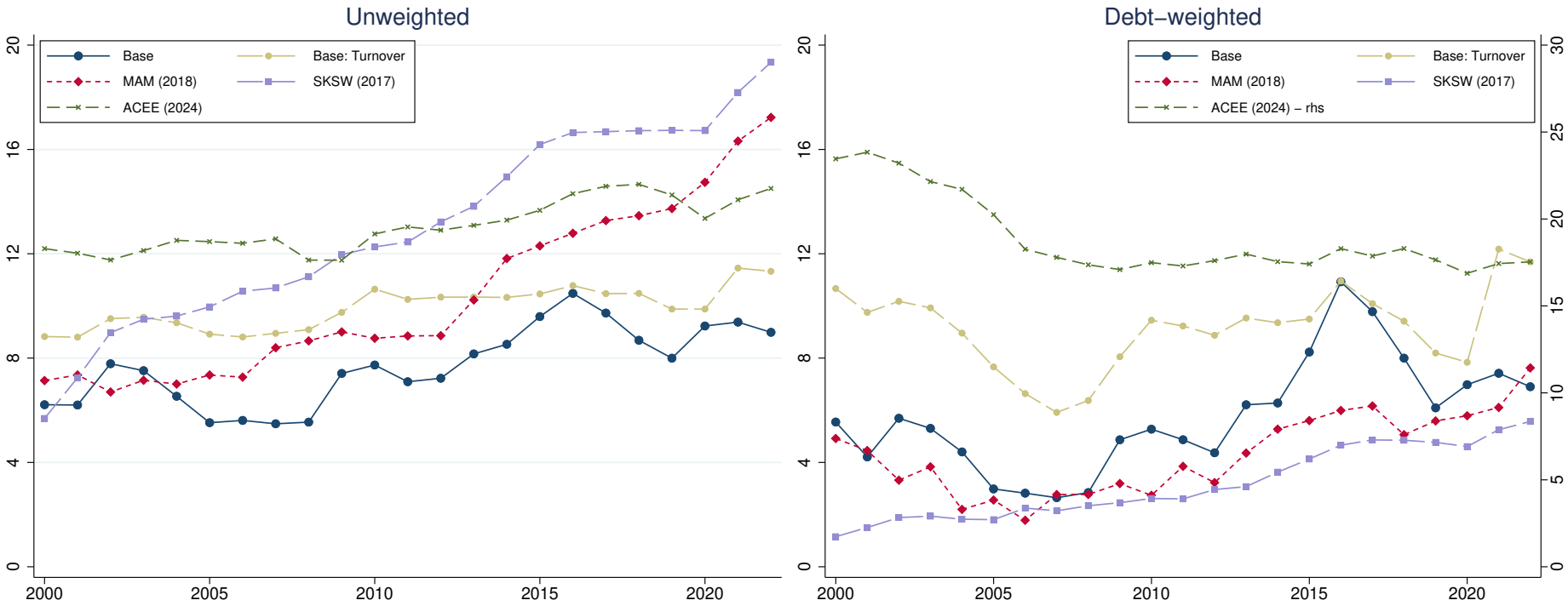
Average share of zombie firms by industry





Back

Share of zombie firms has been rising worldwide across all definitions



Notes: SKSW (2017) define zombies as those that record for at least two consecutive years ROA<0, net investments<0, and debt servicing capacity$<5\%$ (Storz et al., 2017). *MAM (2018)* take firms with ICR<1 below one for three consecutive years, and age of at least ten years old (McGowan et al., 2018). *ACEE (2024)* consider low-quality firms (BB-rated firms or lower with a two-year average ICR and leverage ratio respectively below and above the median at the country-industry-year level), and that receive subsidized credit, computed as the ratio of interest expenses lower than the AAA-rated peers (Acharya et al., 2024). *Base: Turnover* is the baseline measure but replacing the real sales growth indicator with the asset turnover ratio below the sample median.

◂ Back

Zombie firms invest less and are riskier

$$Y_{i,c,n,t} = \beta \text{Zombie}_{i,c,n,t} + \zeta_{c,n,t} + \epsilon_{i,c,n,t}$$

Panel A

	(1) Log K	(2) ΔK	(3) ΔIntan	(4) ΔEmp	(5) Liq.asset	(6) Debt	(7) ΔDebt	(8) Int.rate
Zom	-0.518***	-2.684***	-3.568***	-9.492***	-19.243***	17.946***	-2.543***	0.111*
	(0.010)	(0.051)	(0.052)	(0.102)	(0.118)	(0.084)	(0.079)	(0.057)
Observations	1,862,721	1,764,326	1,402,058	991,606	1,858,882	1,867,008	1,704,450	1,311,453
R^2	0.270	0.096	0.149	0.094	0.157	0.181	0.054	0.159

Panel B

	(1) ΔSales	(2) Turnover	(3) Log Assets	(4) ICR	(5) ROA	(6) PD	(7) Age	(8) Loan shr
Zom	-3.811***	-14.975***	-0.630***	-27.863***	-9.440***	0.793***	-1.298***	2.025***
	(0.053)	(0.270)	(0.009)	(0.756)	(0.081)	(0.011)	(0.106)	(0.130)
Observations	1,417,732	1,473,869	1,867,008	1,255,150	1,399,335	1,440,321	1,221,385	1,866,004
R^2	0.144	0.225	0.271	0.111	0.165	0.307	0.326	0.170

Notes: All regressions include country-industry-quarter fixed effects. Standard errors in parentheses clustered by country-industry-quarter. Asterisks, *, **, and ***, denote statistical significance at the 10%, 5%, and 1% levels.

◂ Back

Zombie definition consistent with an interest rate subsidy

$$\text{Risk implied cost of debt}^{Z}_{c,n,t} = \left[\frac{(1 - PD^{NZ}_{c,n,t}) + PD^{NZ}_{c,n,t} \times sec^{NZ}_{c,n,t}}{(1 - PD^{Z}_{c,n,t}) + PD^{Z}_{c,n,t} \times sec^{Z}_{c,n,t}} \times (1 + Int.rate^{NZ}_{c,n,t}) \right] - 1$$

Zombie firms receive an interest rate subsidy of 68 basis points (83-15), consistent with the concept of subsidization.

Actual cost of debt versus implied risk cost of debt

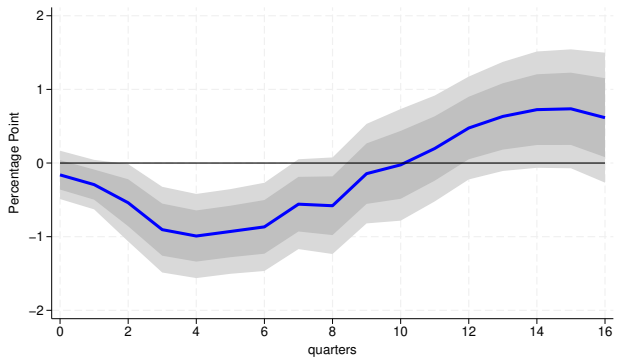
	(1) Int.rate	(2) Int.rate	(3) Risk cost of debt
Zom	0.111*	0.148***	0.832***
	(0.057)	(0.057)	(0.013)
Observations	1,311,453	1,307,925	1,307,925
R^2	0.159	0.159	0.184

Notes: All regressions include country-industry-quarter fixed effects. Standard errors in parentheses clustered by country-industry-quarter. Asterisks, *, **, and ***, denote statistical significance at the 10%, 5%, and 1% levels.

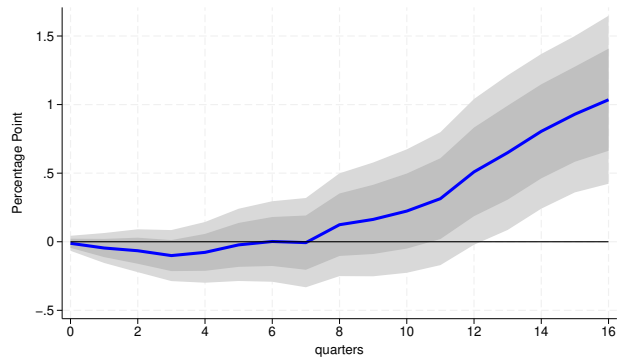
◂ Back

Firms' performance weakens after contractionary MP shocks

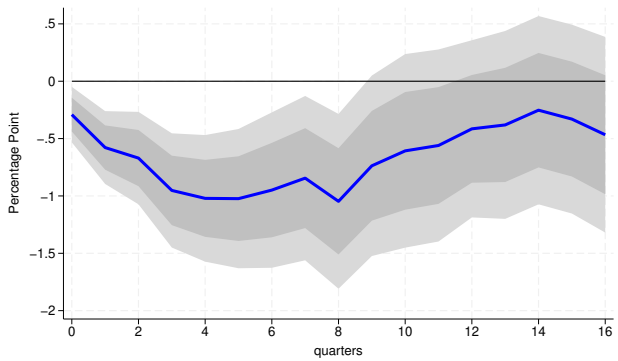
$$\Delta_h Y_{i,t+h} = \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1}) + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$



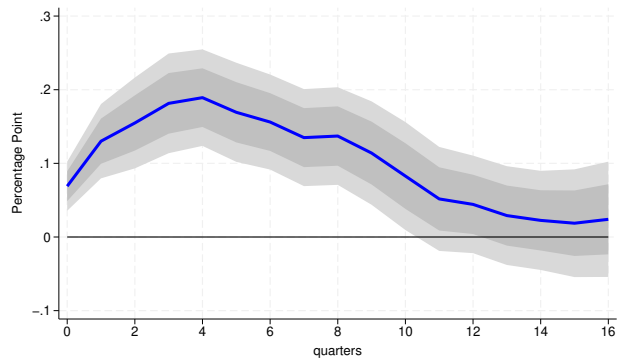
Investment growth



Employment growth



Debt growth

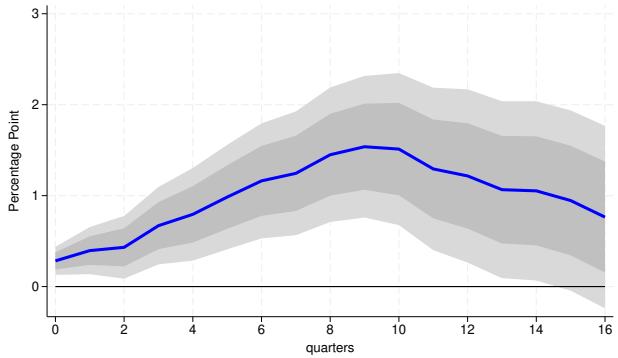


Interest rate change

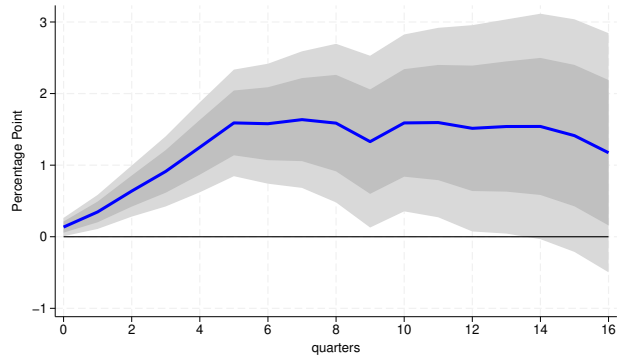
Back

Bootstrapped standard errors

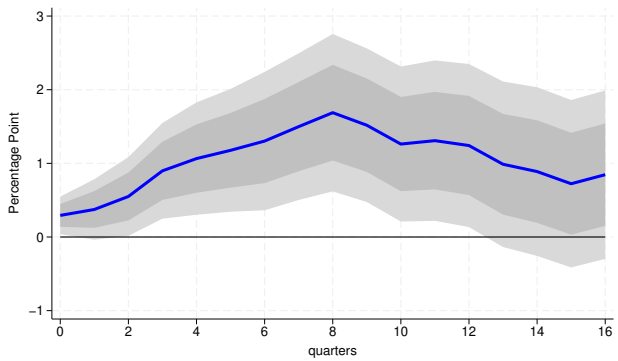
$$\Delta_h Y_{i,t+h} = \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1})$$
$$+ \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$



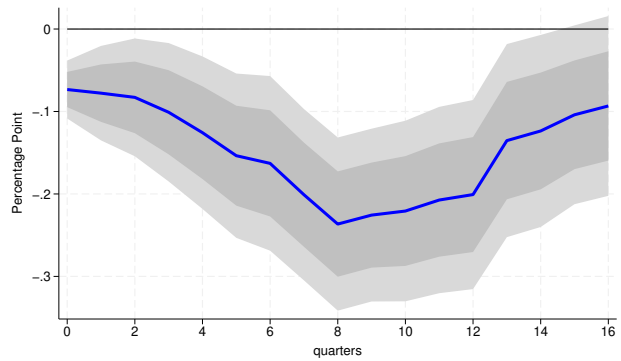
Investment growth



Employment growth



Debt growth



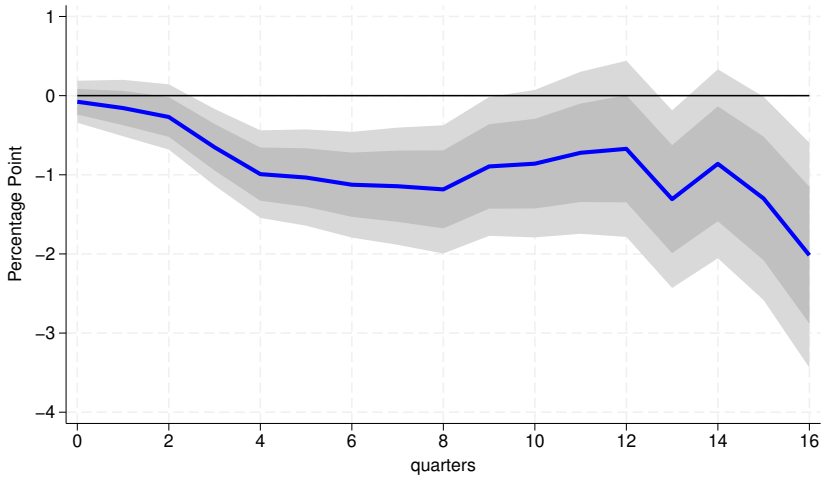
Interest rate change

Back

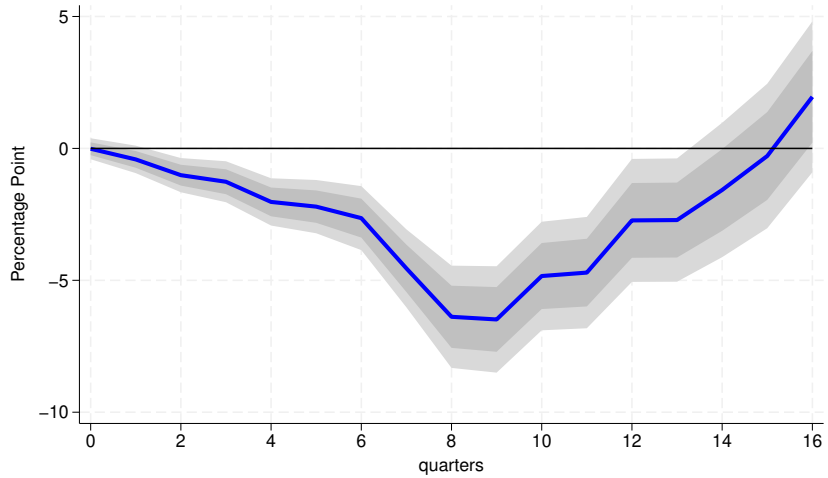
Zombie lending channel can be mitigated by stronger banks

$$\Delta_h Inv_{i,t+h} = Zom_{i,t-1} \times (\beta_1^h \hat{R}_{c,t} + \beta_2^h \hat{R}_{c,t} \times Pol_{c,t-1} + \beta_3^h Pol_{c,t-1} + \delta_h Z_{i,t-1})$$
$$+ \gamma_h Zom_{i,t-1} + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$

Differential investment response of zombies vs nonzombies in countries with stronger banks



Capital buffers



NPLs

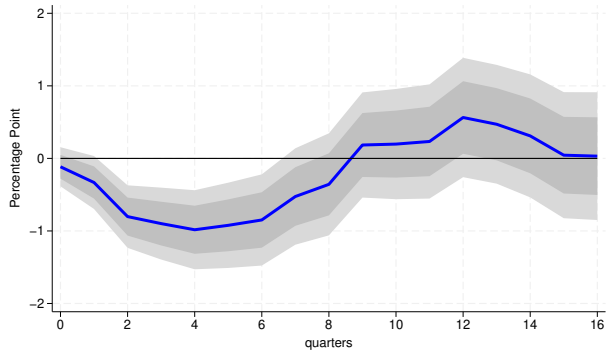
Note: Cumulative differential effects for zombie firms relative to nonzombies when bank capital buffers (NPLs) increase (decrease) by one-standard deviation.

Back

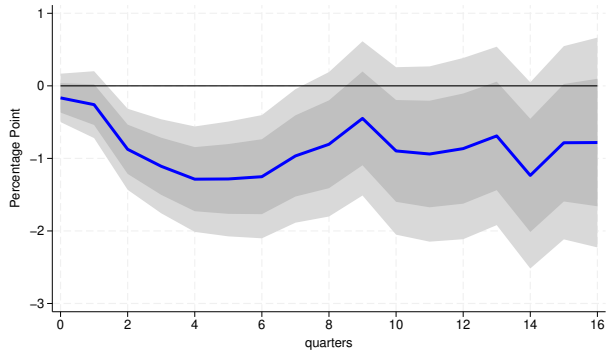
Zombie lending can be mitigated by tighter macroprudential policies

$$\Delta_h Inv_{i,t+h} = Zom_{i,t-1} \times (\beta_1^h \hat{R}_{c,t} + \beta_2^h \hat{R}_{c,t} \times Pol_{c,t-1} + \beta_3^h Pol_{c,t-1} + \delta_h Z_{i,t-1})$$
$$+ \gamma_h Zom_{i,t-1} + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$

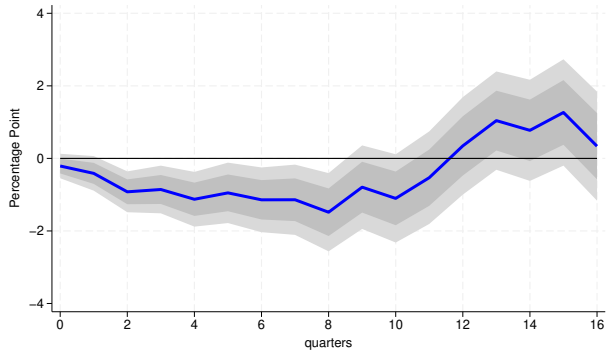
Differential investment response of zombies vs nonzombies in countries with tighter macropru



Overall index



Loan – targeted



Supply – loans

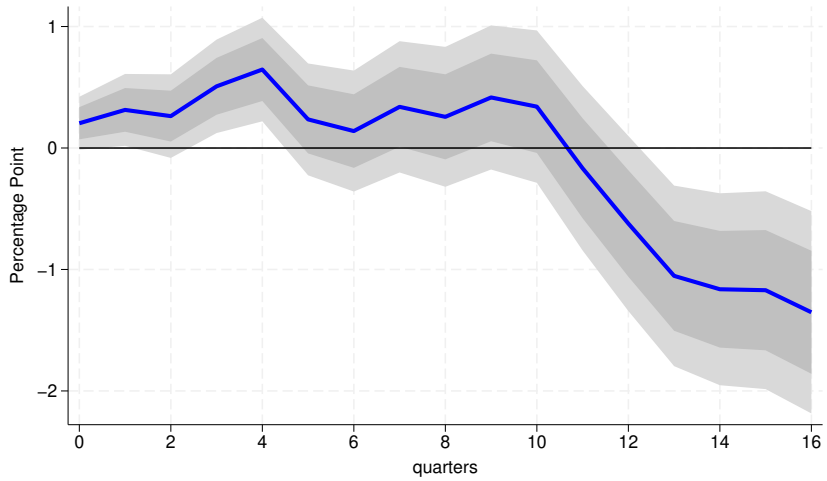
Notes: Cumulative differential effects in countries that stand above the median sample of selected macroprudential policies. Loan supply policies include limits to: credit growth, loan loss provisions, loan restrictions, loan-to-deposit ratio, and foreign currency loans.

Back

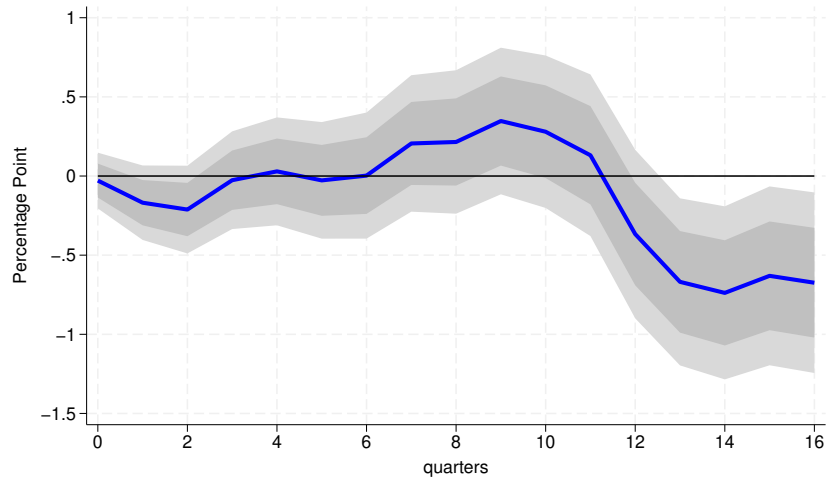
Zombie lending mitigated over the medium term in jurisdictions with well-developed insolvency regimes

$$\Delta_h Inv_{i,t+h} = Zom_{i,t-1} \times (\beta_1^h \hat{R}_{c,t} + \beta_2^h \hat{R}_{c,t} \times Pol_c + \delta_h Z_{i,t-1})$$
$$+ \gamma_h Zom_{i,t-1} + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$

Differential investment response of zombies vs nonzombies in countries with well-prepared insolvency regimes



Overall indicator



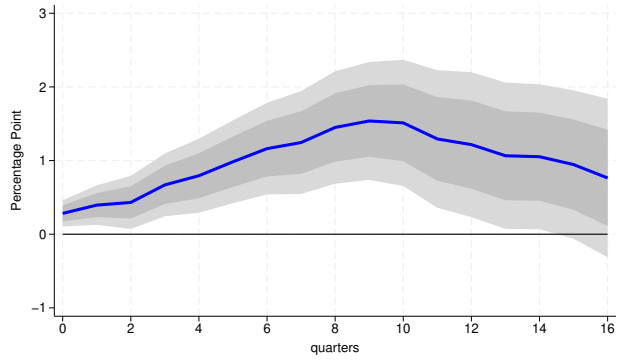
Out-of-court restructuring

Note: Cumulative differential effects in countries with the Araujo et al. (2022) crisis preparedness indicator one-standard deviation above the mean.

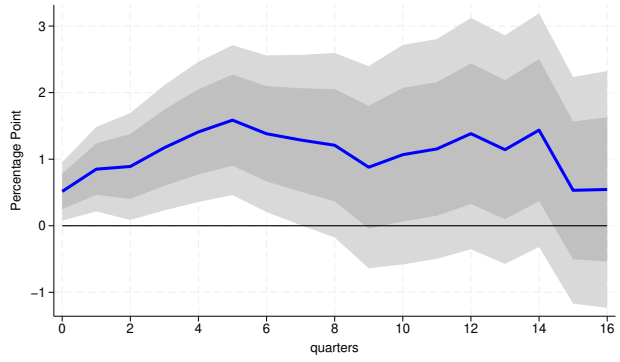
Back

Alternative zombie definitions

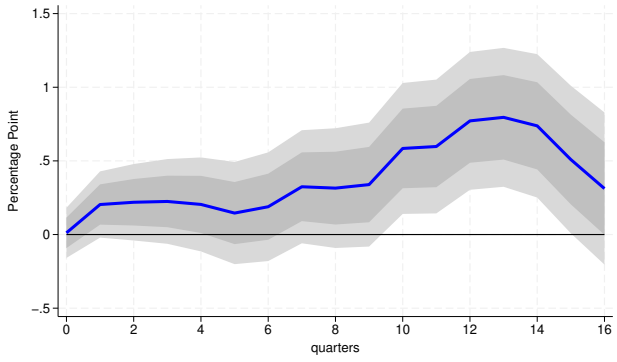
Differential investment response of zombie firms relative to nonzombies



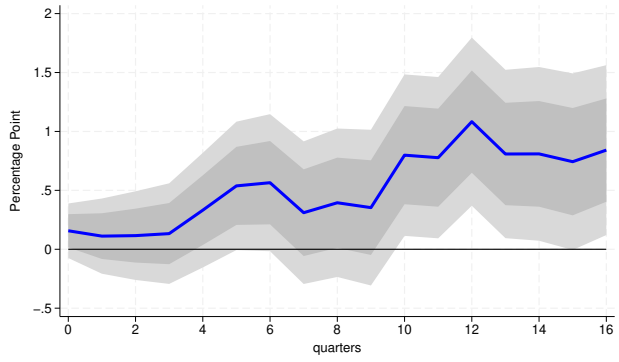
Baseline definition



Banerjee and Hofmann (2022)



McGowan et al. (2018)

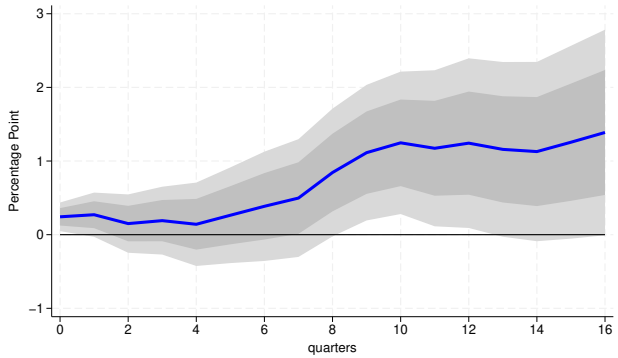


Acharya et al. (2024)

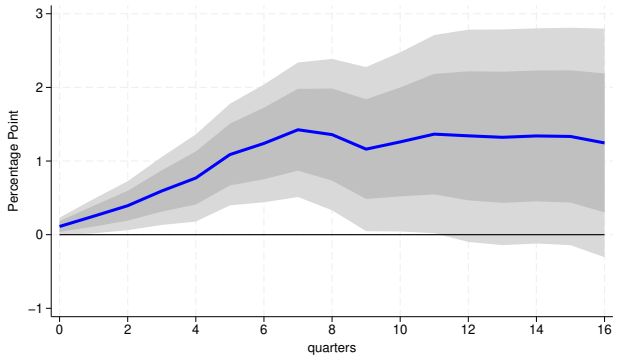
Back

Zombie firms respond less to monetary policy shocks: 10y yields

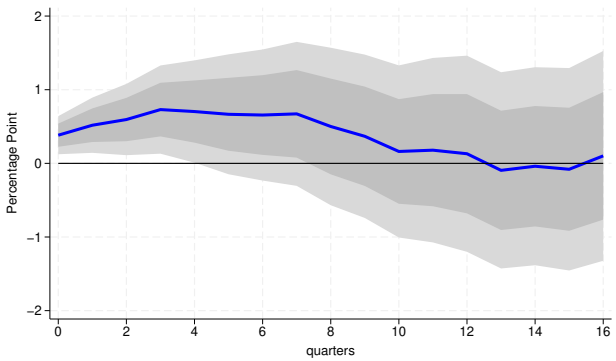
$$\Delta_h Y_{i,t+h} = \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1}) + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$



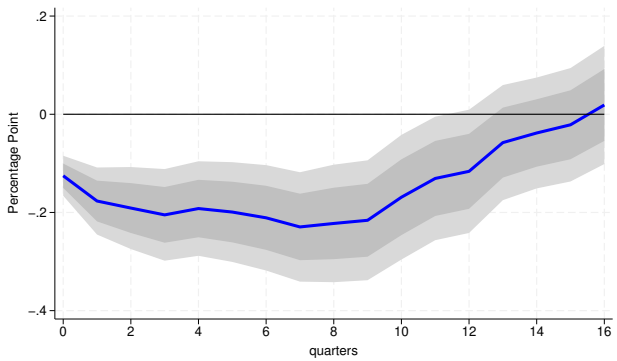
Investment growth



Employment growth



Debt growth

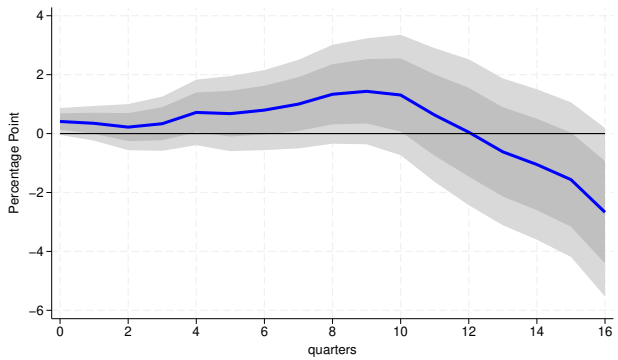


Interest rate change

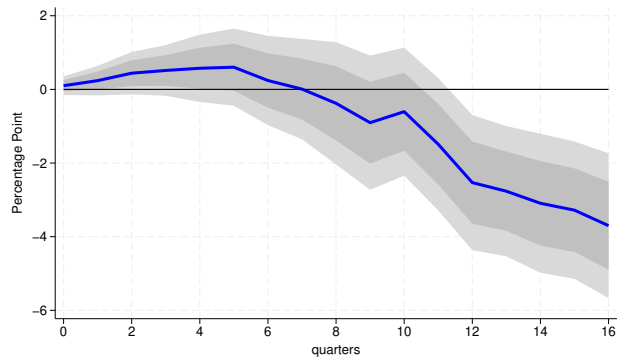
Back

Zombie firms respond less to monetary policy shocks: 3-month rates

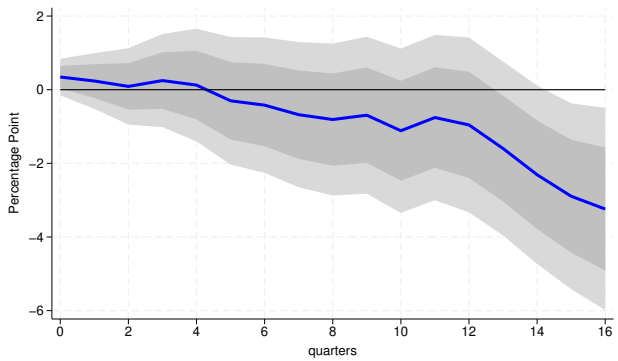
$$\Delta_h Y_{i,t+h} = \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1} + \Theta_h X_{c,t-1}) + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$



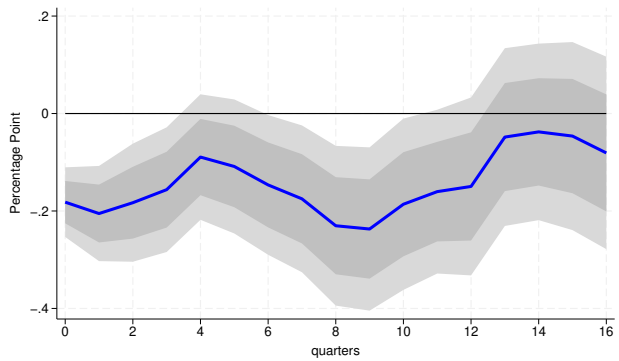
Investment growth



Employment growth



Debt growth

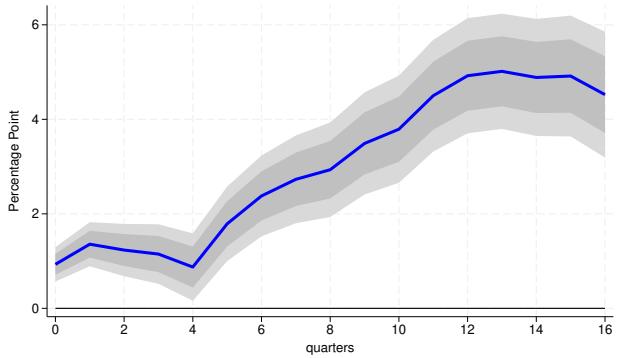


Interest rate change

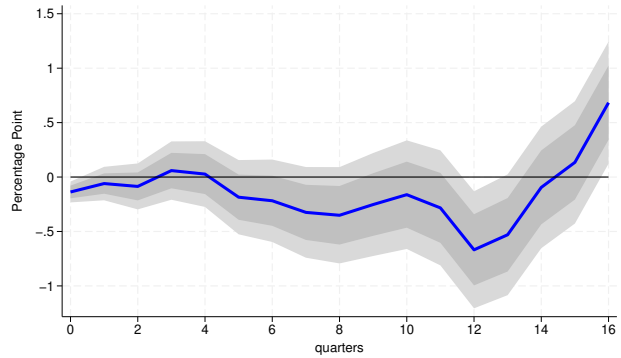
Back

Country-specific monetary policy shocks: Choi et al. (2024)

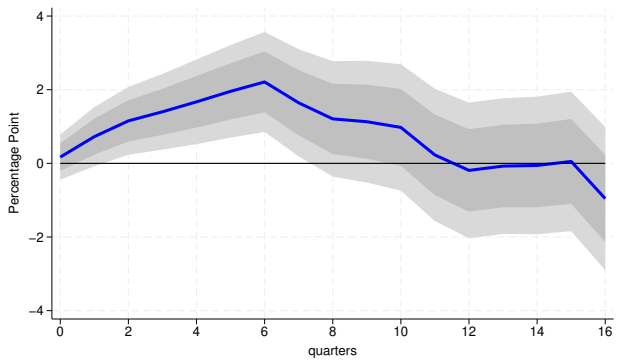
$$\Delta_h Y_{i,t+h} = \gamma_h Zom_{i,t-1} + Zom_{i,t-1} \times (\beta^h \hat{R}_{c,t} + \delta_h Z_{i,t-1}) + \Gamma_h Z_{i,t-1} + \alpha_i^h + \alpha_{c,s,t}^h + \epsilon_{i,t}^h,$$



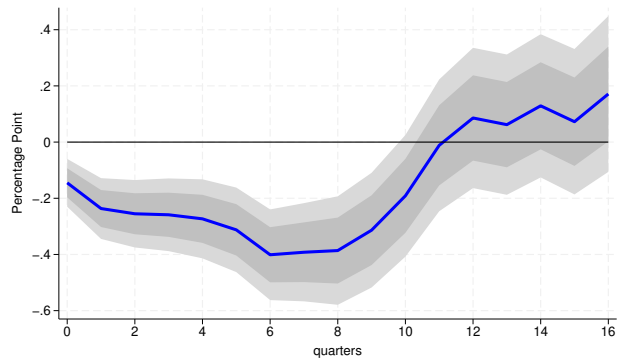
Investment growth



Employment growth



Debt growth

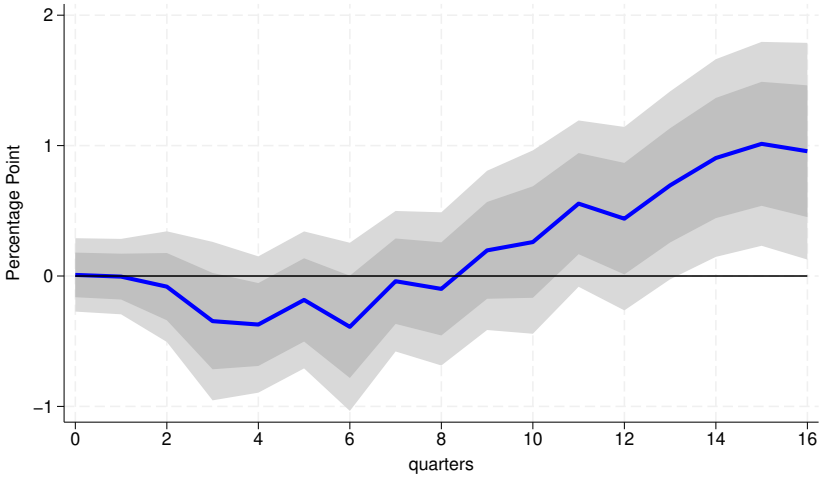


Interest rate change

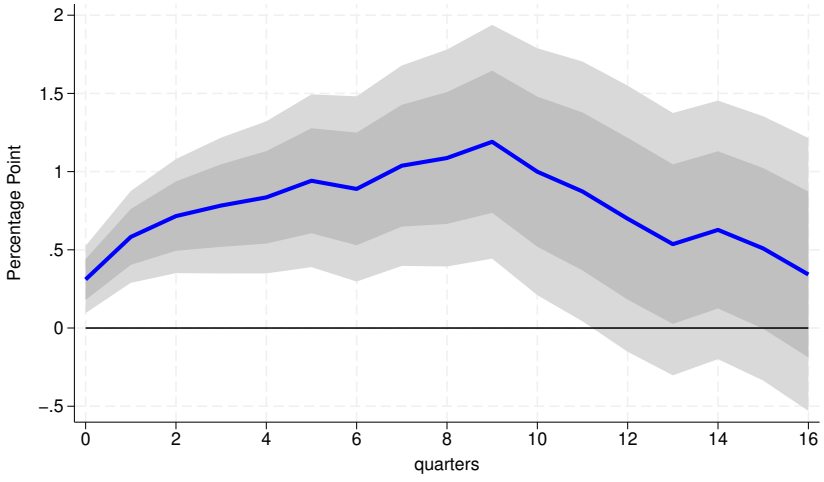
Back

Alternative MP shocks: Jarociński and Karadi (2020)

Effects of contractionary monetary policy on investment growth



Average effect

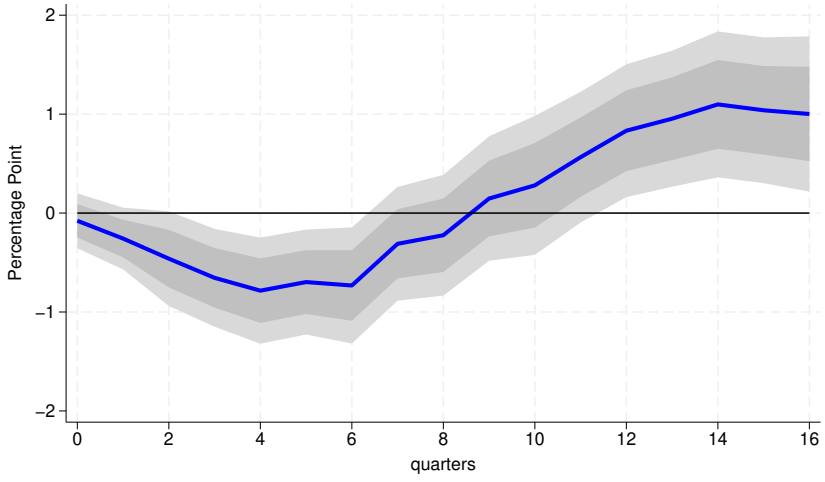


Zombies vs nonzombies

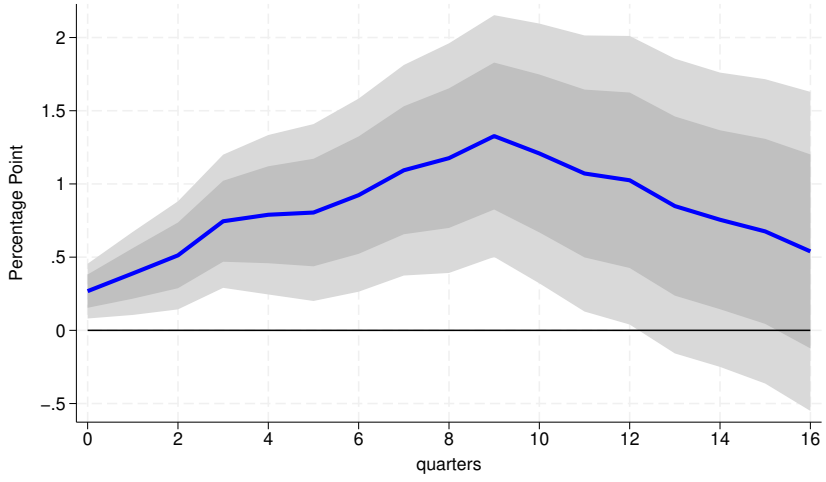
Back

Alternative MP shocks: Bauer and Swanson (2023)

Effects of contractionary monetary policy on investment growth



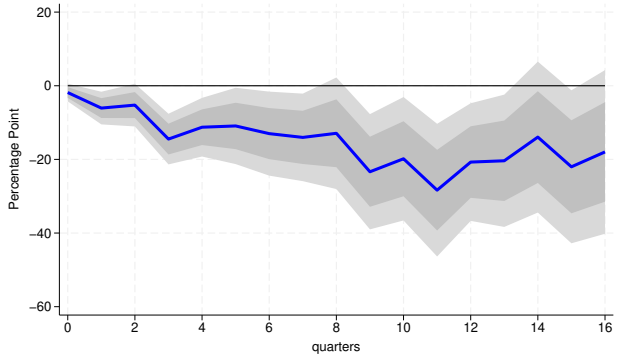
Average effect



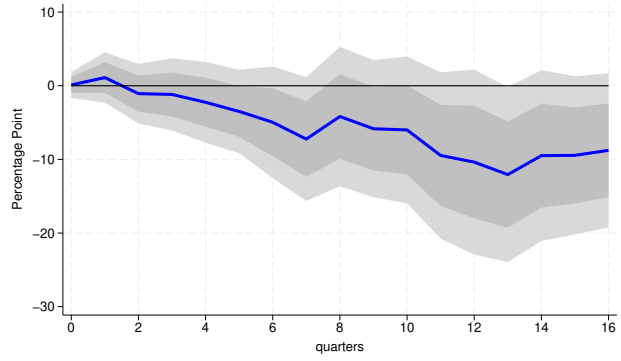
Zombies vs nonzombies

◂ Back

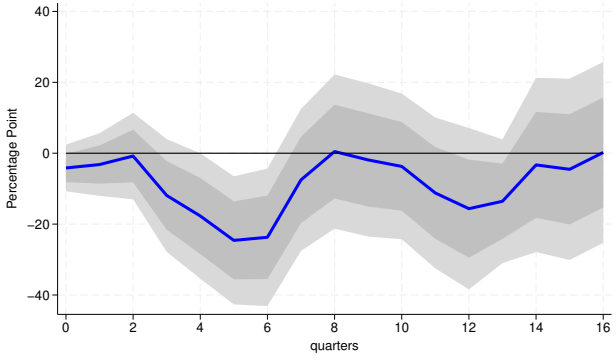
US zombie firms respond more to monetary policy shocks



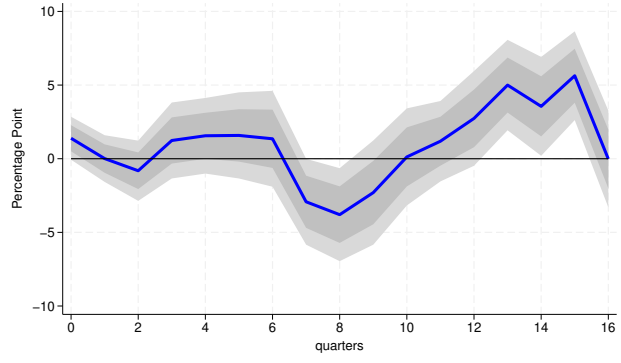
Investment growth



Employment growth



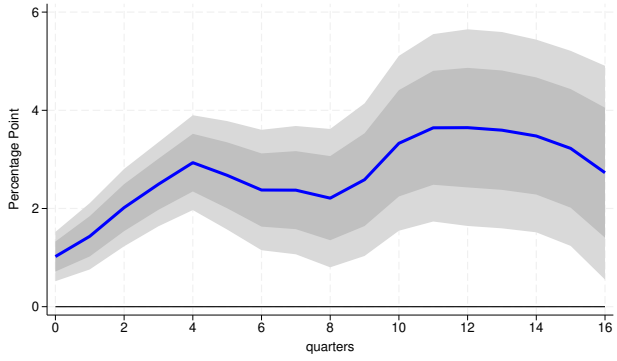
Debt growth



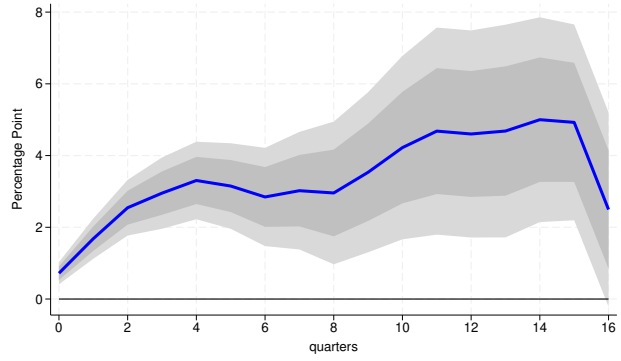
Interest rate change

Back

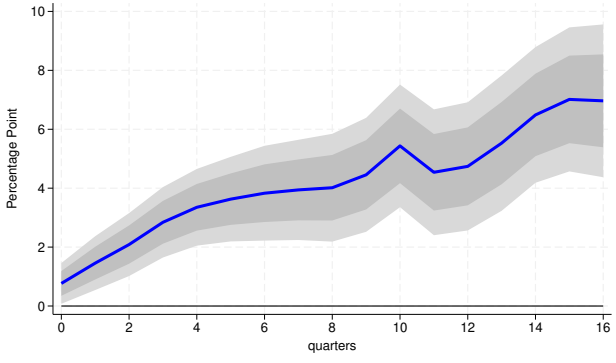
Euro area zombie firms respond less to monetary policy shocks



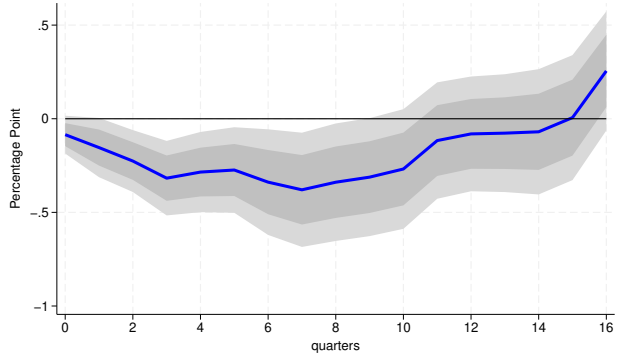
Investment growth



Employment growth



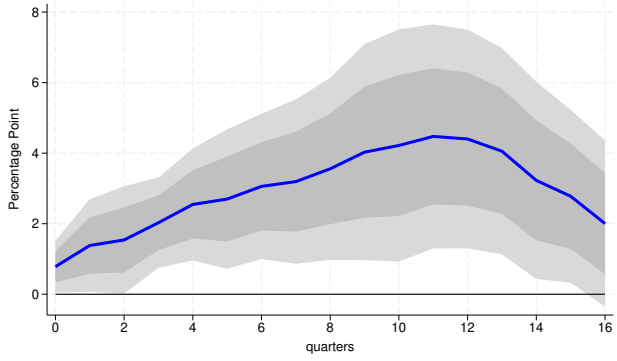
Debt growth



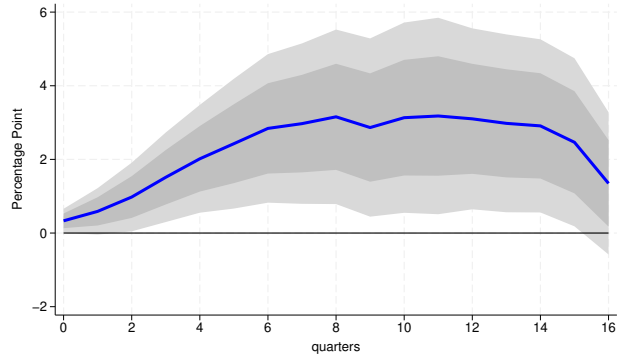
Interest rate change

Back

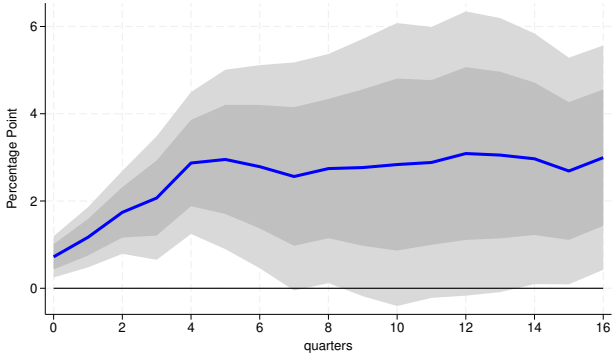
Weighted-least squares with firms' total assets as weights



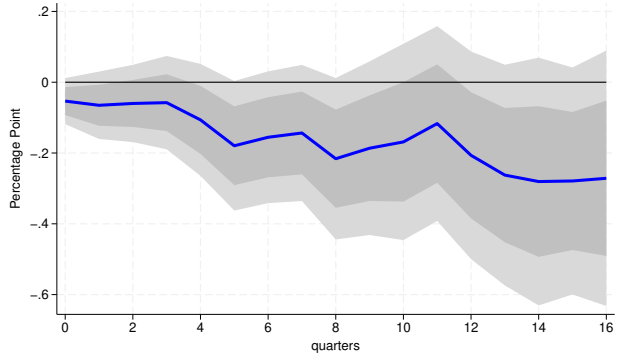
Investment growth



Employment growth



Debt growth



Interest rate change

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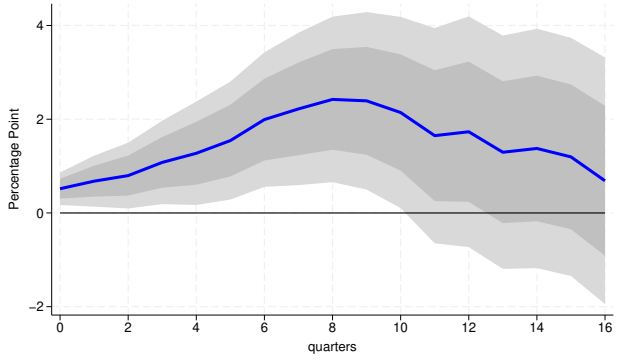
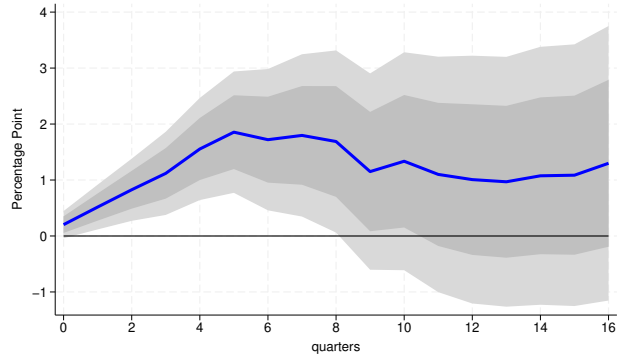
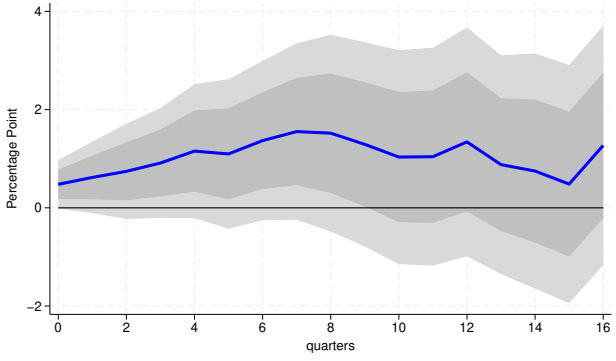
Restricted country sample



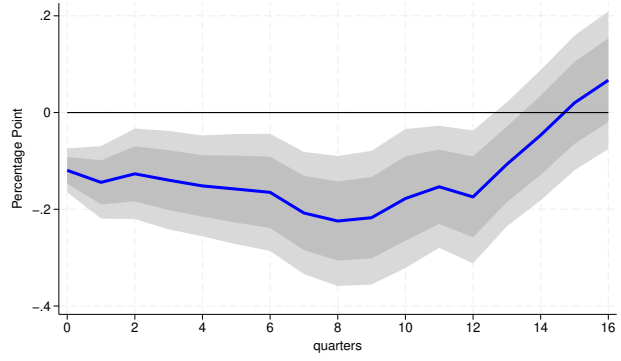
Investment growth



Employment growth



Debt growth



Interest rate change

Back

Model predictions

1. When interest rates $\uparrow$, banks tend to offer better credit conditions to zombie firms.
2. Evergreening allows zombie firms to cut investment less, at the expense of healthy firms.
3. Banks with higher capital face less incentives to evergreen zombies' loans.

Firms

A static model with two periods $t = 0, 1$ and two types of agents (Faria-e-Castro et al., 2024):

- Firms (b, z): pre-existing loans b and productivity z
- Lenders a: risk-neutral with deep pockets, endowed with capital a

Firm's problem

$$\begin{aligned} V(z, b; Q) \quad &= \quad \max_{b', k' \geq 0} -b - k' + Qb' + \beta^f [z(k')^\alpha - b'] \\ &s.t. \quad b' \leq \theta k' \end{aligned}$$

There exists a $Q^{min}(z, b)$ such that the firm defaults iff $Q < Q^{min}(z, b)$. The threshold is given by:

$$Q^{min}(z, b) = \beta^f + \frac{1}{\theta} - \frac{(\beta^f \alpha z)^{1/\alpha}}{\theta} \left(\frac{1 - \alpha}{\alpha b} \right)^{\frac{1-\alpha}{\alpha}}$$

The threshold is increasing in b and decreasing in z.

Lenders

Lender's problem (Relationship Lending)

$$W(z,b,a) = \max_{Q \geq \beta^k} \mathbb{1}[V(z,b;Q) \geq 0] \times [u(a+b) - Qb'(z;Q) + \beta^k b'(z;Q) - u(a)]$$

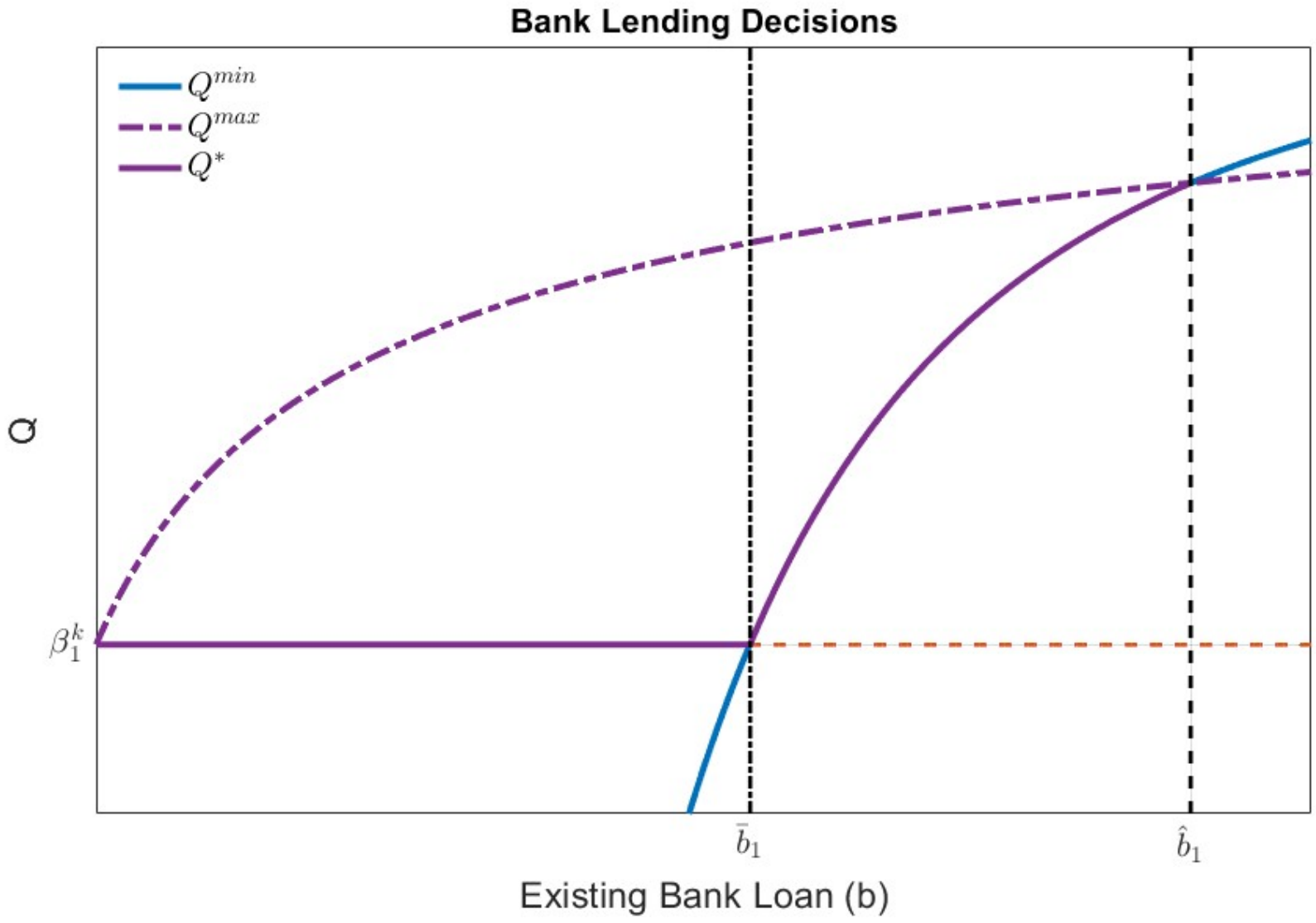
Solving for $Q^{max}(z,b,a)$, the maximum Q at which the bank is willing to lend:

$$Q^{max}(z,b,a) : W(z,b,a;Q^{max}) = 0$$

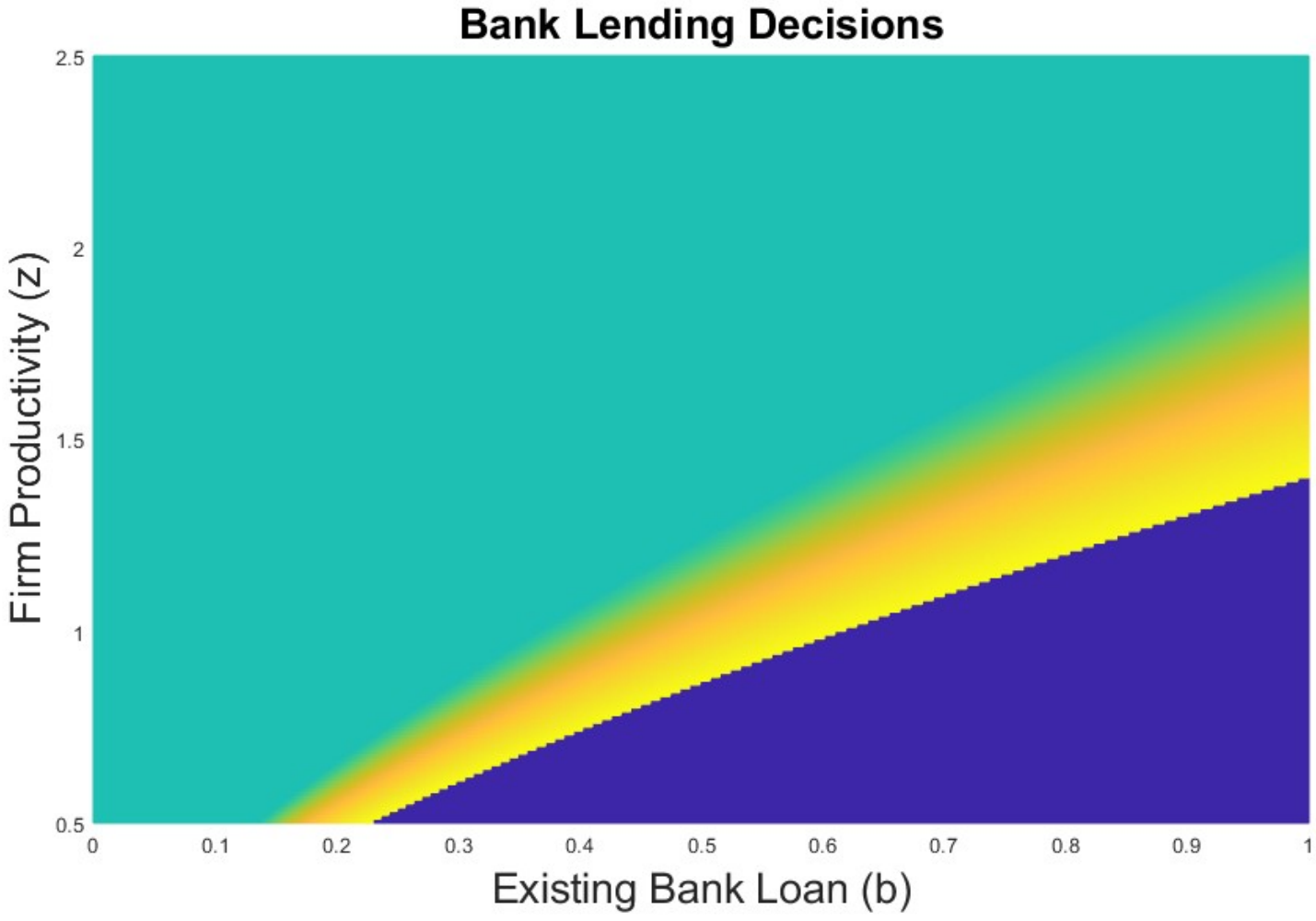
The bank's optimal policy can be written as:

$$Q^*(b,z,a) = \begin{cases} \beta^k & \text{if} \quad Q^{min}(z,b) \leq \beta^k \leq Q^{max}(z,b,a) \\ Q^{min}(z,b) & \text{if} \quad \beta^k \leq Q^{min}(z,b) \leq Q^{max}(z,b,a) \\ 0 & \text{otherwise} \end{cases}$$

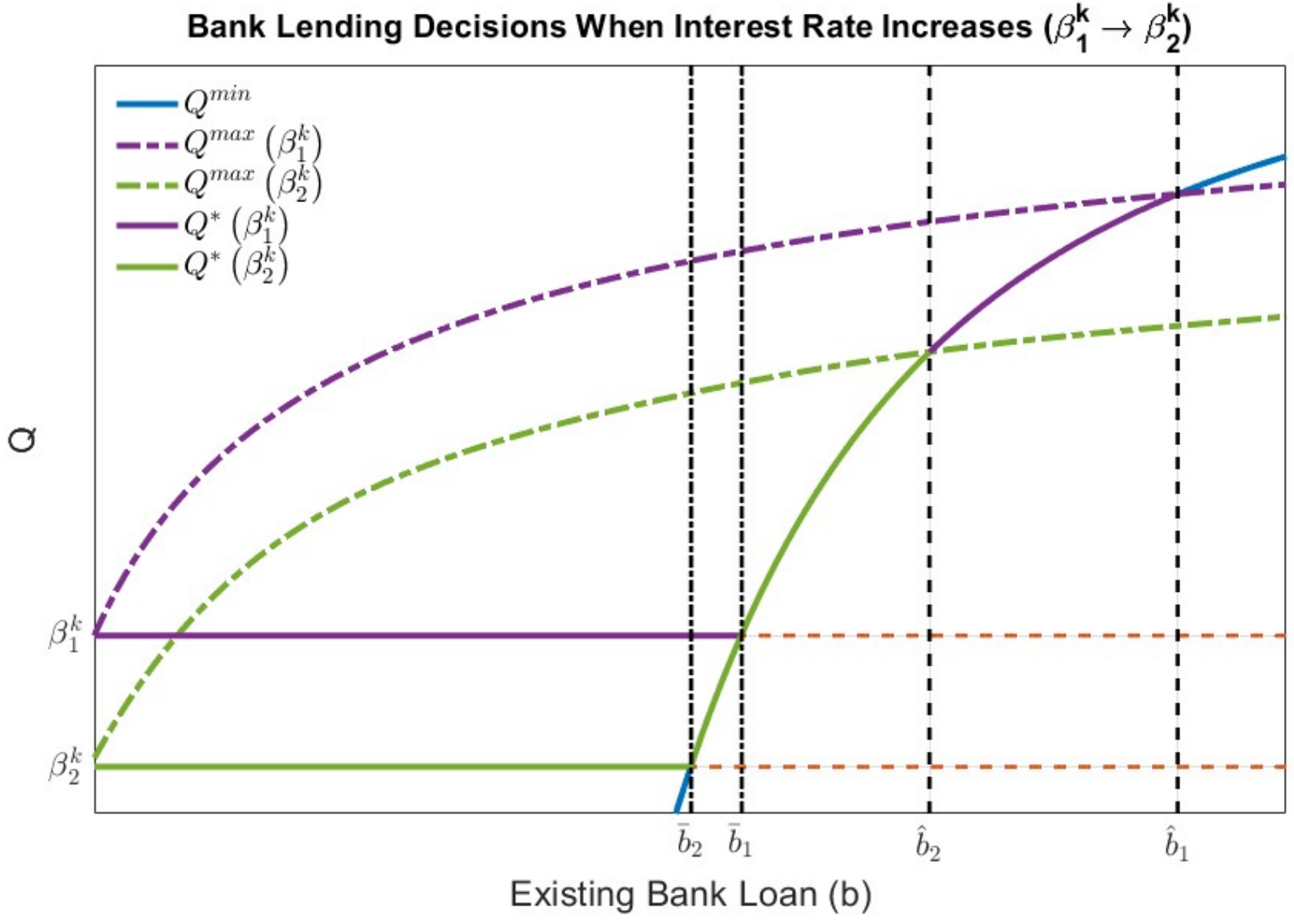
Lenders have incentives to evergreen firms closer to default



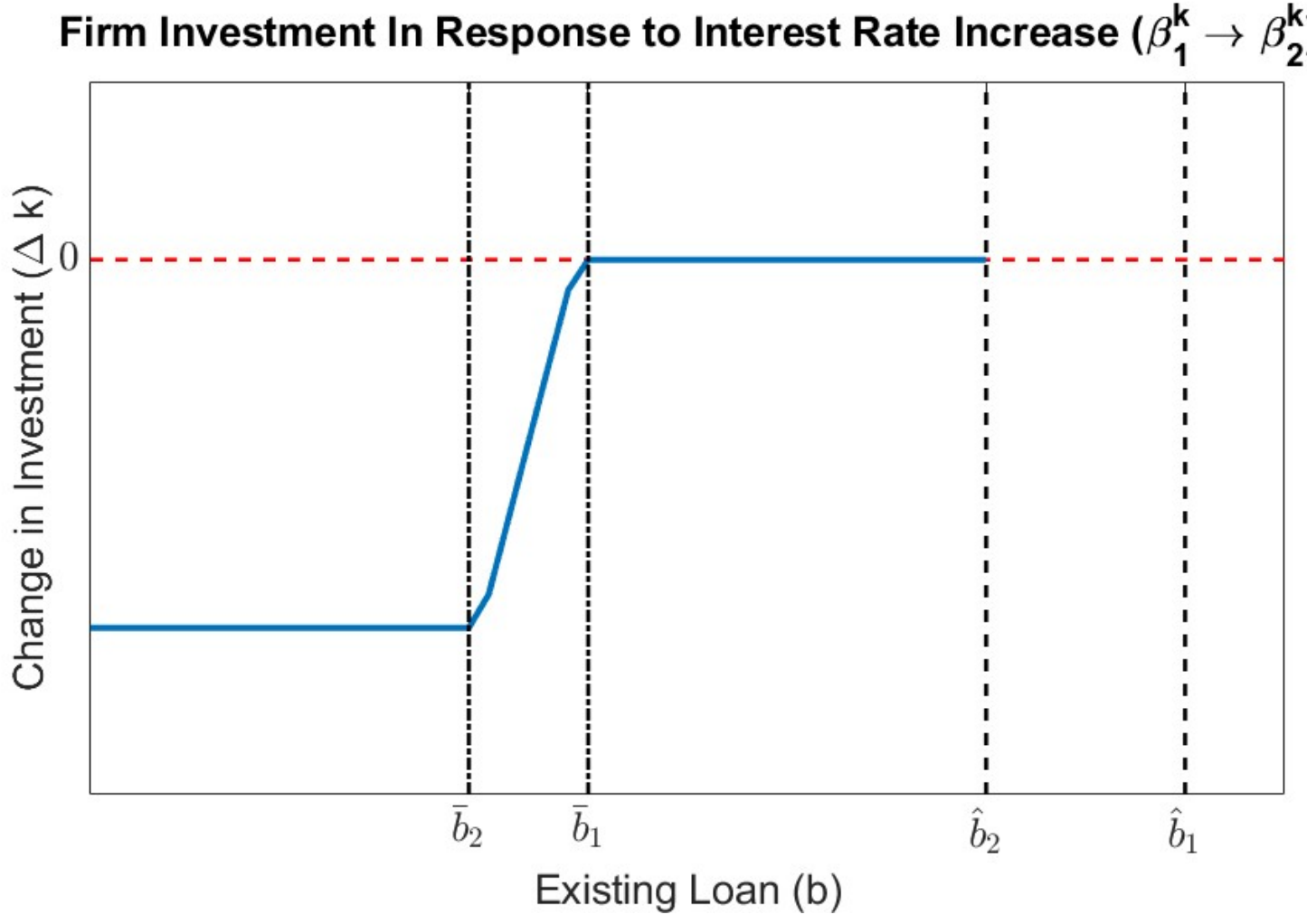
Lenders take firms' leverage and productivity in their lending decisions



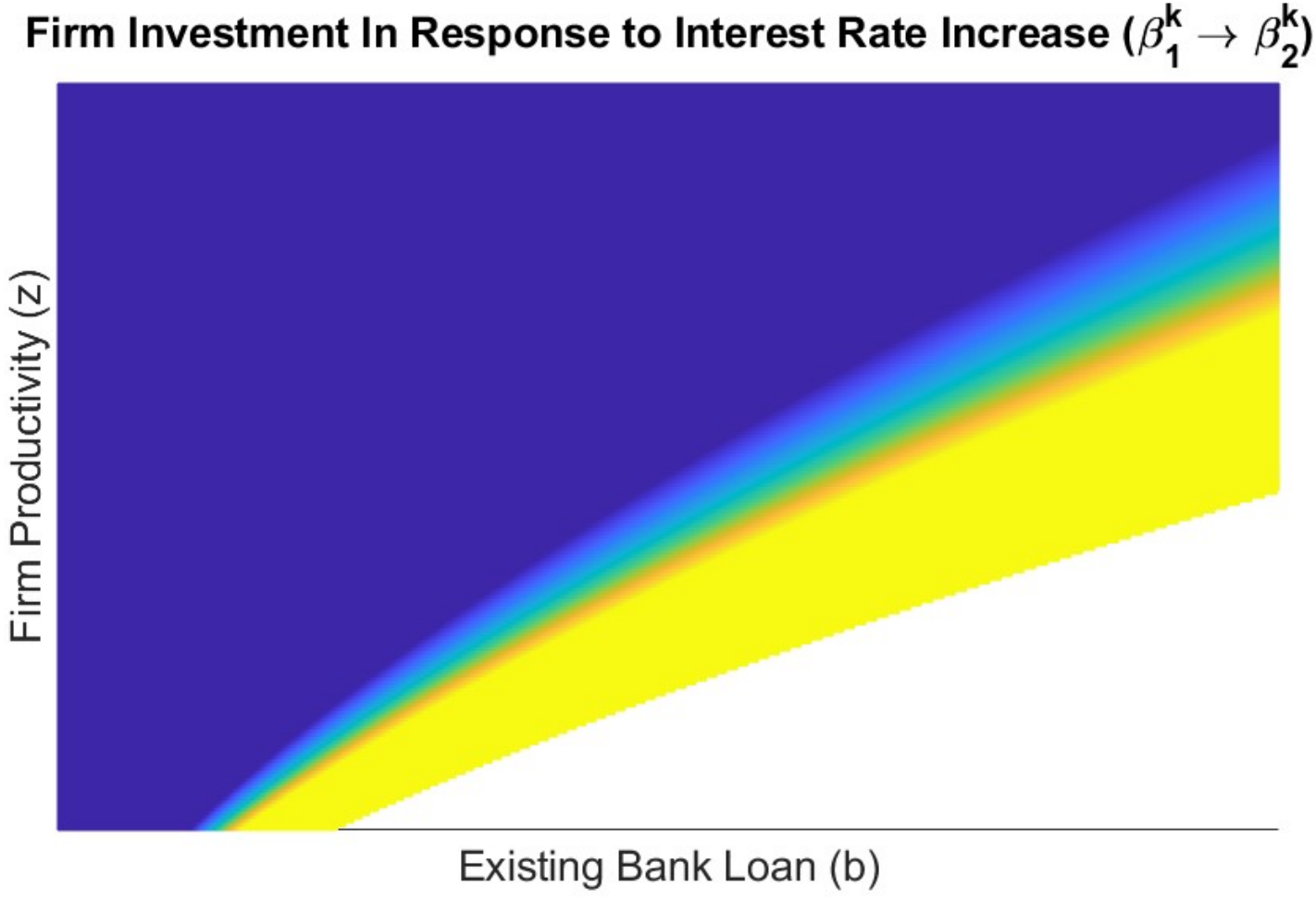
Zombie firms enjoy relatively more favorable credit conditions when interest rates increase...



... and thus decrease their investment less than other firms



Firms' investment is influenced jointly by its productivity and pre-existing loan



Note: The different colors refer to the degree of the investment decline following an interest increase. The dark blue color refers to firms with a larger contraction in investment (where the interest rate passthrough is higher), while the yellow color refers to firms without an investment decline. The colors in between refer to a partial interest rate passthrough.

High-capitalized banks face less incentives to evergreen