Zombie Credit and (Dis-)Inflation: Evidence from Europe

Viral V. Acharya
NYU Stern, NBER, CEPR

Matteo Crosignani
New York Fed

Tim Eisert
Erasmus Rotterdam, CEPR

Christian Eufinger
IESE

NYU Stern

November 11, 2021

Firm Financing and Inflation in Europe

Low inflation and extraordinary monetary easing

- Inflation well below 2% target since end of 2012, undershooting projections
- Substantial monetary easing (negative rates, (T)LTROs, LSAPs)

Firm Financing and Inflation in Europe

Low inflation and extraordinary monetary easing

- Inflation well below 2% target since end of 2012, undershooting projections
- Substantial monetary easing (negative rates, (T)LTROs, LSAPs)

"Although we have seen the ***successful transmission of monetary policy to financing conditions****, and from financing conditions to GDP and employment,* ***the final legs of the transmission process to wages and inflation have been slower than we expected.*** *[...]* ***the pass-through from wages to prices remains weak.****"*

Draghi, 18 June 2019

Firm Financing and Inflation in Europe

Low inflation and extraordinary monetary easing

- Inflation well below 2% target since end of 2012, undershooting projections
- Substantial monetary easing (negative rates, (T)LTROs, LSAPs)

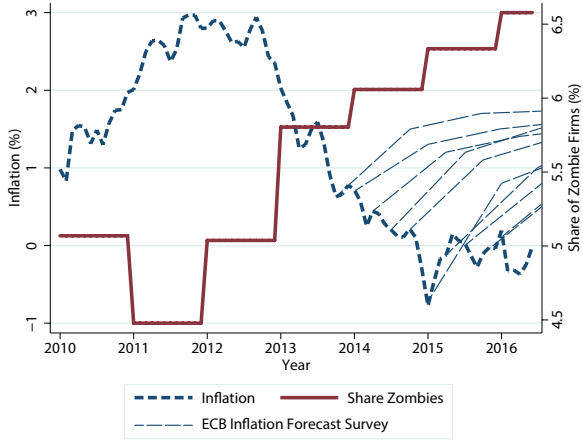
"Although we have seen the ***successful transmission of monetary policy to financing conditions****, and from financing conditions to GDP and employment,* ***the final legs of the transmission process to wages and inflation have been slower than we expected.*** *[...]* ***the pass-through from wages to prices remains weak.****"*

Draghi, 18 June 2019

Striking resemblance to Japan's "lost decades"

- Deflationary pressure, ultra accommodative central bank policies
- Zombie lending → record low borrowing cost, even for risky firms
- Zombie lending in JP: Caballero et al. (2008), Giannetti and Simonov (2013)
- Zombie lending in EU: Acharya et al. (2019), Blattner et al. (2019)

Inflation ↓ and Zombie Firms ↑



Δshare of zombie firms in manufacturing post-2012: +22pp in ITA and +0pp in GER

Case Study: Italian Cement Industry

- **Negative demand shock**
  - Difficult to export, production volumes -60% between 2008 and 2016

Case Study: Italian Cement Industry

- **Negative demand shock**
  - Difficult to export, production volumes -60% between 2008 and 2016
- **Emergence of zombie firms**
  - Cementir CEO in 2017: *"In Italy, in the cement industry, we have zombies kept alive by banks. [...] Banks do everything they can to keep these zombies alive to avoid realizing losses on their balance sheets."*
  - Plants need to work at $\approx 80\%$ capacity to cover fixed costs

  $\hookrightarrow$ Excessive productive capacity

Case Study: Italian Cement Industry

- **Negative demand shock**
  - Difficult to export, production volumes -60% between 2008 and 2016
- **Emergence of zombie firms**
  - Cementir CEO in 2017: *"In Italy, in the cement industry, we have zombies kept alive by banks. [...] Banks do everything they can to keep these zombies alive to avoid realizing losses on their balance sheets."*
  - Plants need to work at $\approx 80\%$ capacity to cover fixed costs

  ↪ Excessive productive capacity
- **Effect on prices**
  - Standardized product and inelastic demand
  - Industry representatives in a Senate hearing to discuss the ongoing crisis: *"The excessive productive capacity caused an unprecedented price competition."*

  ↪ The price of cement in Italy was 22% below the EU27 average cement price in 2015

Zombie Credit Channel

1. **Simple dynamic model of zombie firms and product inflation**
   - Zombie credit defined as credit that allows distressed firms not to default
   - ↪ Zombie credit prevents an adjustment in the productive capacity
   - ↪ Excess capacity puts downward pressure on markups and prices

Zombie Credit Channel

1. **Simple dynamic model of zombie firms and product inflation**
   - Zombie credit defined as credit that allows distressed firms not to default
   ↪ Zombie credit prevents an adjustment in the productive capacity
   ↪ Excess capacity puts downward pressure on markups and prices

2. **Empirical work to test this channel**
   - Sample of 1.1 million firms from 12 European countries across 65 industries
   - Data confirm the rise of cheap credit to impaired firms

Empirical Evidence

1. Markets (industry-country pairs) with large increase in zombie firms have
   - lower inflation and firm markups
   - lower default and entry rates
   - higher material and labor cost
   - higher sales growth and number of active firms
   - lower value added
2. Healthy firms in markets with high presence of zombie firms have
   - lower markups, profitability, sales growth
   - higher input costs
3. Misallocation of labor and capital in markets with large increase in zombie firms
   - lower net investment and productivity
   - lower employment growth for non-zombie firms in zombie markets

Related Literature

Zombie credit

- Japan in the 1990s – Peek and Rosengren (2005), Caballero et al (2008), Giannetti and Simonov (2013)
- Similar dynamics in Europe during the sovereign crisis – Acharya et al. (2019), Schivardi et al. (2017), Blattner et al. (2019), Adalet McGowan et al. (2018), Banerjee and Hofmann (2018)

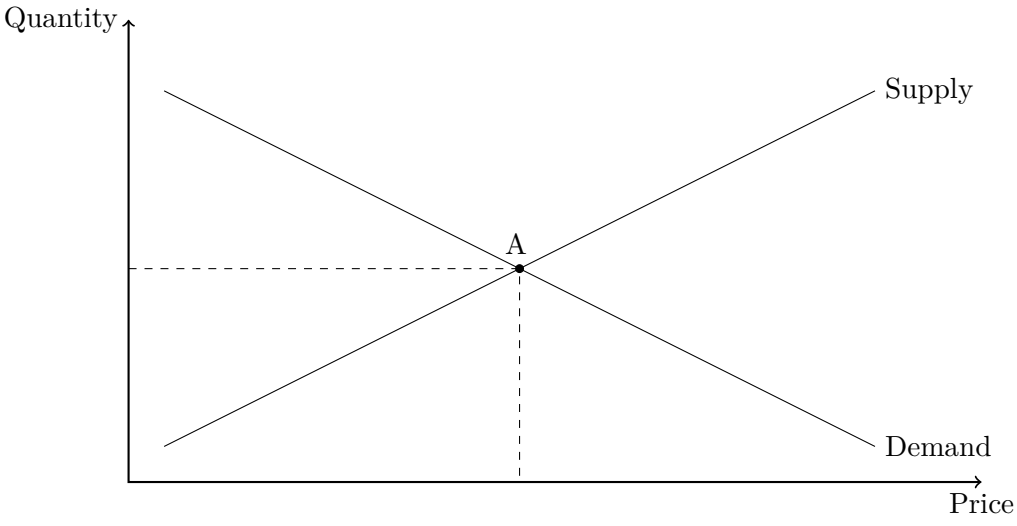
Effect of financial frictions on inflation dynamics

- "Liquidity squeeze channel" – Chevalier and Scharfstein (1996), Gilchrist et al (2017), de Almeida (2015)
- "Cost channel" – Barth III and Ramey (2001), Christiano et al (2015)

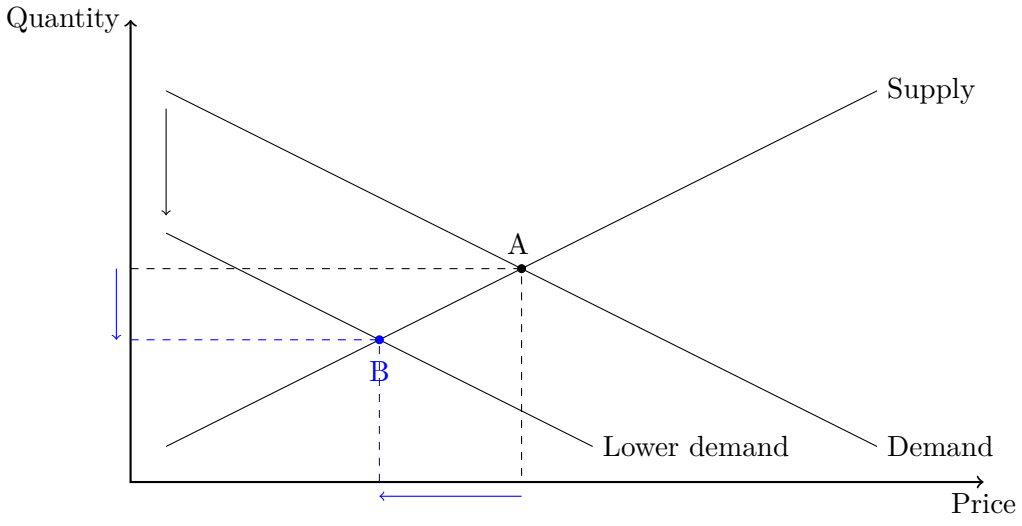
Resource Misallocation

- Bertrand et al. (2007), Peters (2020), Liu et al. (2020), Gopinath et al. (2017)

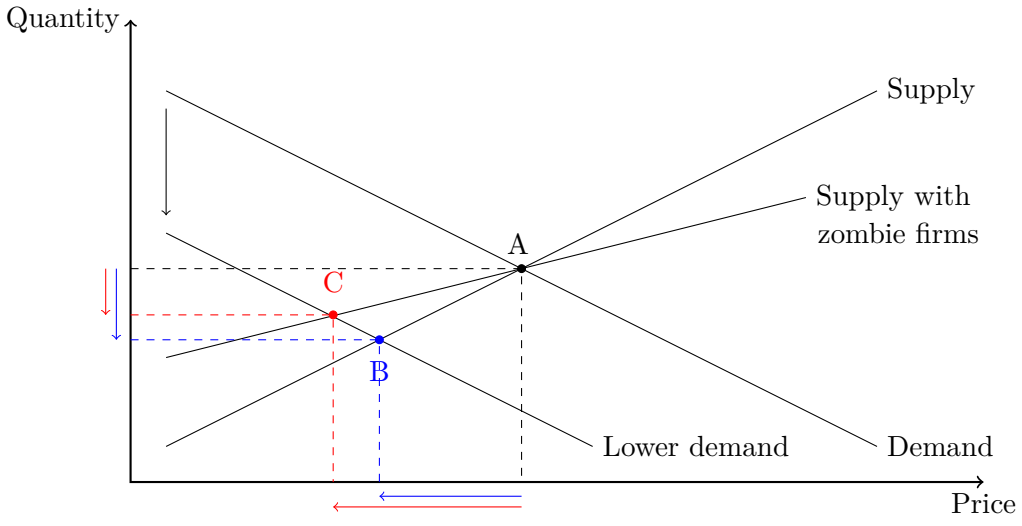
Intuition



Intuition



Intuition


Quantity
Supply
Supply with
zombie firms
A
C
B
Lower demand
Demand
Price

Takeaways

Effect of demand shock on equilibrium price $p(\alpha, Entry(\alpha), Survival(\alpha))$

$$\frac{dp}{d\alpha} = \underbrace{\frac{\partial p}{\partial \alpha}}_{>0} + \underbrace{\frac{\partial p}{\partial Entry}\frac{\partial Entry}{\partial \alpha}}_{<0} + \underbrace{\frac{\partial p}{\partial Survival}\frac{\partial Survival}{\partial \alpha}}_{<0}$$

Takeaways

Effect of demand shock on equilibrium price $p(\alpha, Entry(\alpha), Survival(\alpha))$

$$\frac{dp}{d\alpha} = \underbrace{\frac{\partial p}{\partial \alpha}}_{>0} + \underbrace{\frac{\partial p}{\partial Entry}\frac{\partial Entry}{\partial \alpha}}_{<0} + \underbrace{\frac{\partial p}{\partial Survival}\frac{\partial Survival}{\partial \alpha}}_{=0 \text{ in EqZ}}$$

Takeaways

Effect of demand shock on equilibrium price $p(\alpha, Entry(\alpha), Survival(\alpha))$

$$\frac{dp}{d\alpha} = \underbrace{\frac{\partial p}{\partial \alpha}}_{>0} + \underbrace{\frac{\partial p}{\partial Entry}\frac{\partial Entry}{\partial \alpha}}_{<0} + \underbrace{\frac{\partial p}{\partial Survival}\frac{\partial Survival}{\partial \alpha}}_{=0 \text{ in EqZ}}$$

In steady state, EqZ is characterized by:

- Lower product price and firm markups
- Less entry and default
- More active firms

compared with EqN

Takeaways

Effect of demand shock on equilibrium price $p(\alpha, Entry(\alpha), Survival(\alpha))$

$$\frac{dp}{d\alpha} = \underbrace{\frac{\partial p}{\partial \alpha}}_{>0} + \underbrace{\frac{\partial p}{\partial Entry}\frac{\partial Entry}{\partial \alpha}}_{<0} + \underbrace{\frac{\partial p}{\partial Survival}\frac{\partial Survival}{\partial \alpha}}_{=0 \text{ in EqZ}}$$

In steady state, EqZ is characterized by:

- Lower product price and firm markups
- Less entry and default
- More active firms

compared with EqN

Suppose p is exogenous and firms compete for inputs:
EqZ is characterized by higher input costs compared with EqN

Data

Setting and Data

- **Detailed firm level data**
  - Characteristics and financial info from Bureau van Dijk's Amadeus
  - Covers 75-80% of economic activity in Eurostat for selected EU countries (Kalemli-Ozcan et al., 2015)
- **Detailed product level inflation data**
  - Consumer price data from Eurostat (covers all EU countries)
  - Product level at the COICOP five-digit level
- **Eurostat**
  - Official European Statistical Office
  - Industry-country level data on no. active firms, entry, exit, labor costs, labor productivity, value added

From Product- to Industry-level Inflation

- Merge firm-level data (industry level) and inflation data (product level)
  - NACE-COICOP linking tables from national statistical institutions

▸ Transition Matrix

Ex: Inflation for "Textiles" industry (NACE 13) as weighted average of

- Clothing
- Furniture and furnishings, carpets and other floor coverings
- Household textiles
- Goods and services for routine household maintenance
- Other major durables for recreation and culture

From Product- to Industry-level Inflation

- Merge firm-level data (industry level) and inflation data (product level)
  - NACE-COICOP linking tables from national statistical institutions

▸ Transition Matrix

Ex: Inflation for "Textiles" industry (NACE 13) as weighted average of
- Clothing
- Furniture and furnishings, carpets and other floor coverings
- Household textiles
- Goods and services for routine household maintenance
- Other major durables for recreation and culture

→ **Final sample**
- Firm-time and industry-country-time level
- 1,167,460 firms in 12 European countries and 65 industries in 2009-16

Identifying Zombie Firms

Identifying Zombie Firms

Zombie firms: distressed firms obtaining credit at very low rates

1) Distressed firms ...
   - Below median interest coverage ratio (EBIT/interest expenses; 2-year avg)
   - Above median leverage (debt/assets)
2) ... obtaining credit at very low rates
   - Rate $<$ rate paid by high-quality firms

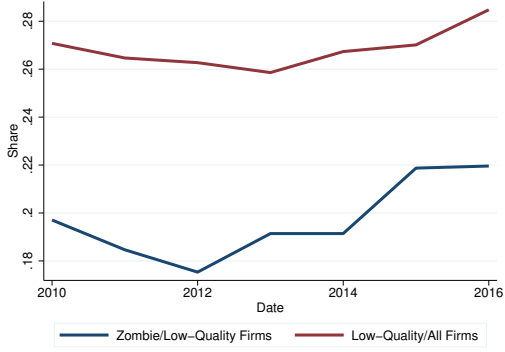
▸ Firm Rating

Identifying Zombie Firms

Zombie firms: distressed firms obtaining credit at very low rates

1) Distressed firms ...
   - Below median interest coverage ratio (EBIT/interest expenses; 2-year avg)
   - Above median leverage (debt/assets)
2) ... obtaining credit at very low rates
   - Rate $<$ rate paid by high-quality firms

▸ Firm Rating

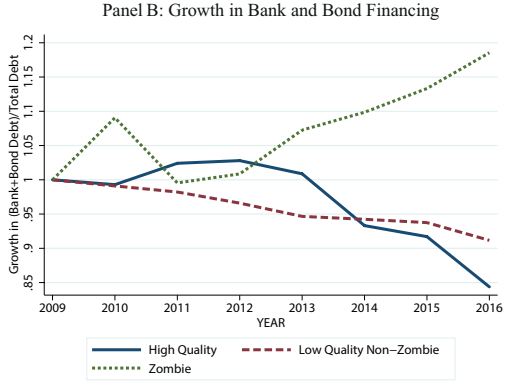


Identifying Zombie Firms

Zombie firms: distressed firms obtaining credit at very low rates

1) Distressed firms ...
   - Below median interest coverage ratio (EBIT/interest expenses; 2-year avg)
   - Above median leverage (debt/assets)
2) ... obtaining credit at very low rates
   - Rate < rate paid by high-quality firms

▸ Firm Rating



Descriptive Statistics

	High-Quality	Low-Quality No Zombie	Low-Quality Zombie	(2)-(3)
Markup	1.13	1.05	1.01	✓
EBITDA/Assets	0.090	0.046	0.014	✓
Material Cost	0.424	0.476	0.552	✓
Total Assets	1,617	1,726	1,607	✓
Tangibility	0.327	0.312	0.190	✓
IC ratio	4.90	1.01	-0.53	✓
Net Worth	0.224	0.107	0.069	✓
Leverage	0.161	0.351	0.437	✓
Share ST Debt	0.337	0.510	0.525	
Firm Age (years)	17.5	17.3	17.8	
Interest Rate	0.028	0.039	0.009	✓

Descriptive Statistics

	High-Quality	Low-Quality No Zombie	Low-Quality Zombie	(2)-(3)
Markup	1.13	1.05	1.01	✓
EBITDA/Assets	0.090	**0.046**	**0.014**	✓
Material Cost	0.424	0.476	0.552	✓
Total Assets	1,617	1,726	1,607	✓
Tangibility	0.327	0.312	0.190	✓
IC ratio	4.90	**1.01**	**-0.53**	✓
Net Worth	0.224	**0.107**	**0.069**	✓
Leverage	0.161	**0.351**	**0.437**	✓
Share ST Debt	0.337	0.510	0.525	
Firm Age (years)	17.5	17.3	17.8	
Interest Rate	0.028	0.039	0.009	✓

Zombie firms weaker than low-quality non-zombie firms along several observable dimensions

Descriptive Statistics

	High-Quality	Low-Quality No Zombie	Low-Quality Zombie	(2)-(3)
Markup	1.13	1.05	1.01	✓
EBITDA/Assets	0.090	**0.046**	**0.014**	✓
Material Cost	0.424	0.476	0.552	✓
Total Assets	1,617	1,726	1,607	✓
Tangibility	0.327	0.312	0.190	✓
IC ratio	4.90	**1.01**	**-0.53**	✓
Net Worth	0.224	**0.107**	**0.069**	✓
Leverage	0.161	**0.351**	**0.437**	✓
Share ST Debt	0.337	0.510	0.525	
Firm Age (years)	17.5	17.3	17.8	
Interest Rate	**0.028**	**0.039**	**0.009**	✓

Zombie firms weaker than low-quality non-zombie firms along several observable dimensions

Zombie firms pay extremely low interest rates even compared with high-quality firms

Descriptive Statistics

	High-Quality	Low-Quality No Zombie	Low-Quality Zombie	(2)-(3)
Markup	1.13	1.05	1.01	✓
EBITDA/Assets	0.090	**0.046**	**0.014**	✓
Material Cost	0.424	0.476	0.552	✓
Total Assets	1,617	1,726	1,607	✓
Tangibility	0.327	0.312	0.190	✓
IC ratio	4.90	**1.01**	**-0.53**	✓
Net Worth	0.224	**0.107**	**0.069**	✓
Leverage	0.161	**0.351**	**0.437**	✓
Share ST Debt	0.337	**0.510**	**0.525**	
Firm Age (years)	17.5	**17.3**	**17.8**	
Interest Rate	**0.028**	**0.039**	**0.009**	✓

Zombie firms weaker than low-quality non-zombie firms along several observable dimensions

Zombie firms pay extremely low interest rates even compared with high-quality firms

Zombie firms not younger nor more reliant on ST credit than low-quality non-zombie firms

Validating our Classification of Zombie Firms

Are we capturing temporarily weak firms?

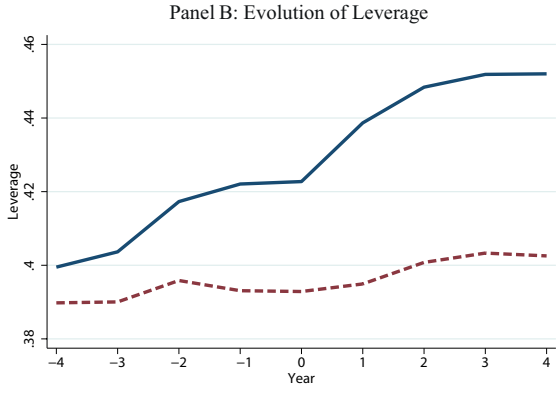
Analyze ex-post firms' characteristics: **Zombie** Vs. **Low-Quality Non-Zombie**

Validating our Classification of Zombie Firms

Are we capturing temporarily weak firms?

Analyze ex-post firms' characteristics: **Zombie** Vs. **Low-Quality Non-Zombie**

1) Firm Leverage

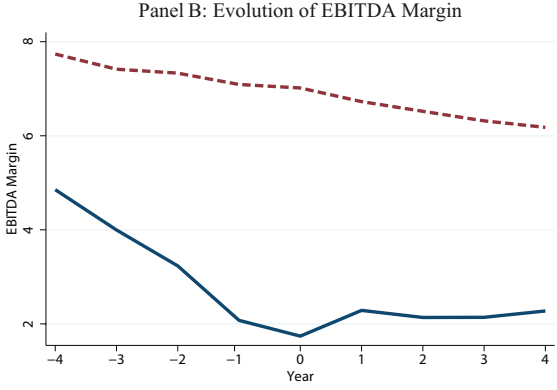


Validating our Classification of Zombie Firms

Are we capturing temporarily weak firms?

Analyze ex-post firms' characteristics: **Zombie** Vs. **Low-Quality Non-Zombie**

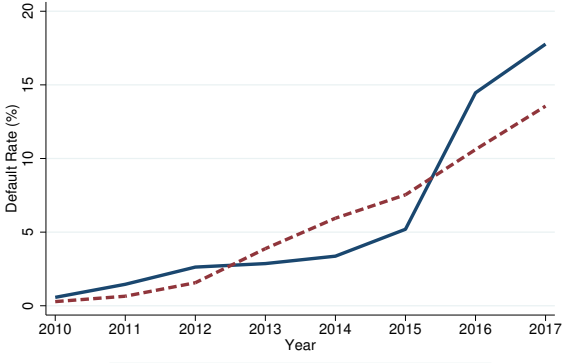
1) Firm Leverage
2) Profitability
   (EBITDA margin)



Validating our Classification of Zombie Firms

Are we capturing temporarily weak firms?
Analyze ex-post firms' characteristics: **Zombie** Vs. **Low-Quality Non-Zombie**

1) Firm Leverage
2) Profitability
   (EBITDA margin)
3) Defaults ▸ Regression



CPI Growth

Analysis at Industry-Country Level

$$\Delta CPI_{hjt,t-1} = \beta \times Share\ Zombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

- Country h, industry j, year t
- *Share Zombies* is the asset-weighted share of zombie firms in a market
- Stringent fixed effects:
  - country-year to absorb country specific (demand) shocks
  - industry-year to absorb industry specific (demand) shocks
  - industry-country to absorb time-invariant market characteristics

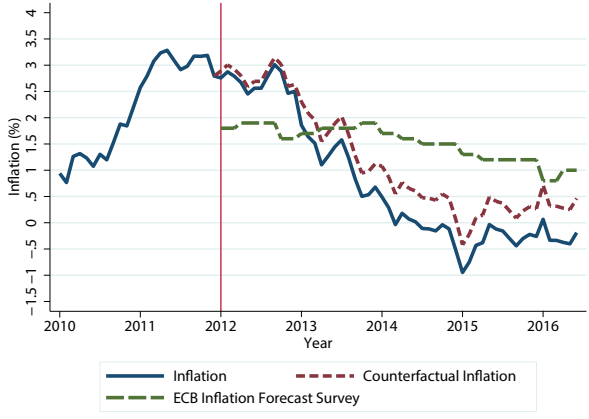
↑ Zombie Firms → ↓ Inflation

$$\Delta CPI_{hjt,t-1} = \beta \times Share\ Zombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

	ΔCPI				
Share Zombies	-0.021**	-0.018***	-0.025***	-0.023***	-0.024***
	(0.008)	(0.007)	(0.009)	(0.007)	(0.007)
Share Low-Quality					0.002
					(0.003)
Observations	3,880	3,880	3,880	3,880	3,880
R-squared	0.496	0.732	0.526	0.764	0.764
Country-Industry FE	✓	✓	✓	✓	✓
Year FE	✓				
Industry-Year FE		✓		✓	✓
Country-Year FE			✓	✓	✓

Standard errors clustered at industry-country level. ***p<0.01, **p<0.05, *p<0.1

Counterfactual Evolution of Inflation



With no rise in zombie credit, inflation in Europe would have been 0.4pp higher post-2012

Manufacturing Industry in Italy and Germany

Country	ΔCPI (%)	ΔShare Zombie	Effect (pp)	Counterfactual ΔCPI (%)
ITA	-2.60	22.44	-0.52	-2.08
GER	2.60	-0.5	0.01	2.59

Effect obtained by multiplying ΔShareZombie with -0.023 (coefficient most restrictive specification)

Bartik Type Instrument

$$\Delta CPI_{hjt,t-1} = \beta \times \widehat{ShareZombies}_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

Bartik Type Instrument

$$\Delta CPI_{hjt,t-1} = \beta \times \widehat{ShareZombies}_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

Bartik type instrument =
bank-level tier 1 ratio × country-level loan growth

bank-level tier 1 ratio
cross-sectional variation
→ quality of connected banks in 2009

country-level loan growth
time-series variation
→ country-level macro conditions

Bartik Type Instrument

$$\Delta CPI_{hjt,t-1} = \beta \times \widehat{ShareZombies}_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

Bartik type instrument =
bank-level tier 1 ratio × country-level loan growth

bank-level tier 1 ratio
cross-sectional variation
→ quality of connected banks in 2009

country-level loan growth
time-series variation
→ country-level macro conditions

Markets linked to ex-ante weaker banks are more likely to see an increase in zombie lending when the country's economic conditions decline

↑ Zombie Firms → ↓ Inflation (IV)

$$\Delta CPI_{hjt,t-1} = \beta \times \widehat{ShareZombies}_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

Second Stage	ΔCPI	ΔCPI	ΔCPI
$\widehat{Share\ Zombies}$	-0.174**	-0.192***	-0.174**
	(0.071)	(0.072)	(0.071)
Observations	2,080	1,839	2,080
First Stage	Share Zombie	Share Zombie	Share Zombie
Avg T1R (2009) ×	-11.702***	-13.877***	-11.663***
Country Loan Growth	(3.591)	(4.294)	(3.582)
F-Test	24.0	26.5	23.9
Observations	2,080	1,839	2,080
R-squared	0.693	0.693	0.693
Sample	Amadeus+DealScan	Amadeus Only	Amadeus+DealScan IT

↑ Zombie Firms → ↓ Inflation (IV)

$$\Delta CPI_{hjt,t-1} = \beta \times \widehat{ShareZombies}_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

Second Stage	ΔCPI	ΔCPI	ΔCPI
$\widehat{Share\ Zombies}$	-0.175*	-0.220**	-0.174*
	(0.089)	(0.101)	(0.089)
Observations	2,080	1,839	2,080

First Stage	Share Zombie	Share Zombie	Share Zombie
Avg T1R (2009) ×	-0.642***	-0.674***	-0.642*
-(NPL Growth)	(0.170)	(0.201)	(0.170)
F-Test	13.9	12.2	13.9
Observations	2,080	1,839	2,080
R-squared	0.691	0.690	0.691

Sample	Amadeus+DealScan	Amadeus Only	Amadeus+DealScan IT

Other Predictions

Number of Active Firms, Default, Entry

$$Y_{hjt} = \beta ShareZombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

	Δ#Firms	Default	Entry
Share Zombies	0.075****	-0.020**	-0.021**
	(0.020)	(0.008)	(0.011)
Observations	3,844	3,626	3,824
R-squared	0.675	0.885	0.895
Country-Industry FE	✓	✓	✓
Industry-Year FE	✓	✓	✓
Country-Year FE	✓	✓	✓

Standard errors clustered at industry-country level. *** p<0.01, ** p<0.05, * p<0.1

Δ#Firms: change in no. of firms; Default and entry: Fraction of firms defaulting and entering

Comprehensive publicly available data from Eurostat

Input Costs and Markups

$$Y_{hjt} = \beta ShareZombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

	Material Cost	Labor Cost	ΔMarkup
Share Zombies	0.046**	-0.008	-0.073***
	(0.023)	(0.027)	(0.026)
High Vacancy		-0.003	
		(0.004)	
Share Zombies × High Vacancy		0.138**	
		(0.052)	
Observations	3,701	922	3,261
R-squared	0.953	0.500	0.296
Country-Industry FE	✓	✓	✓
Industry-Year FE	✓	✓	✓
Country-Year FE	✓	✓	✓

Standard errors clustered at industry-country level. *** p<0.01, ** p<0.05, * p<0.1

Labor cost: change in Eurostat Labor Cost Index; material cost: material Cost/turnover

Markup estimation follows De Loecker and Warzynski (AER 2012) ▸ Details

- ↑ 10pp zombie share → ↓ 73bp in markups
- Consistent with the recent disconnect b/w cost and product price inflation

Sales and Value Added

$$\Delta Y_{hjt,t-1} = \beta ShareZombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

	ΔSales	ΔValue Added
Share Zombies	0.193***	-0.109***
	(0.067)	(0.040)
Observations	3,894	4,100
R-squared	0.496	0.488
Country-Industry FE	✓	✓
Industry-Year FE	✓	✓
Country-Year FE	✓	✓

St. errors clustered at industry-country level. *** p<0.01, ** p<0.05, * p<0.1

Robust to using Value Added/GDP or ln(value added)

Spillovers to Non-Zombie Firms

Analysis at Firm Level

$$Y_{ihjt} = \beta_1 \text{Non-Zombie}_{ihjt} + \beta_2 \text{Non-Zombie}_{ihjt} \times \text{ShareZombies}_{hjt-1} + \gamma_{hjt} + X_{it} + \epsilon_{ihjt}$$

- Firm i, country h, industry j, year t
- Non-Zombie: dummy=1 if firm is not a zombie
- ShareZombies: share of zombies in given country-industry at $t-1$
- Country-industry-year fixed effects γ
- Firm level controls: net worth, interest coverage, leverage, and log(assets)

Spillovers to Non-Zombie Firms

$$Y_{ihjt} = \beta_1 Non-Zombie_{ihjt} + \beta_2 Non-Zombie_{ihjt} \times ShareZombies_{hjt-1} + \gamma_{hjt} + X_{it} + \epsilon_{ihjt}$$

	Markup	EBIT/Sales	Sales Growth	Input Cost
Non-Zombie	0.063***	0.086***	0.060***	-0.023***
	(0.007)	(0.008)	(0.007)	(0.002)
Non-Zombie × ShareZombies	-0.235***	-0.198***	-0.153***	0.074***
	(0.044)	(0.033)	(0.032)	(0.019)
Observations	4,211,633	5,910,165	5,922,959	4,653,410
R-squared	0.565	0.157	0.033	0.517
Industry-Country-Year FE	✓	✓	✓	✓
Firm-Level Controls	✓	✓	✓	✓

Standard errors clustered at industry-country. *** p<0.01, ** p<0.05, * p<0.1

Real Effects

Net Investment and Capital Misallocation

$$Y_{hjt,t-1} = \beta ShareZombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

	Net Investment	Capital Misallocation
Share Zombies	-0.068**	0.142**
	(0.028)	(0.063)
Observations	3,464	2,976
R-squared	0.397	0.920
Country-Industry FE	✓	✓
Industry-Year FE	✓	✓
Country-Year FE	✓	✓

St. errors clustered at industry-country level. *** p<0.01, ** p<0.05, * p<0.1

Net investment: growth of fixed assets (set to zero if < 0); capital misallocation: log(MRPK)

Employment

$$Y_{hjt,t-1} = \beta ShareZombies_{hj,t-1} + \gamma_{ht} + \nu_{jt} + \mu_{jh} + \epsilon_{hjt}$$

	Employment Growth	Labor Misallocation	Labor Productivity
Share Zombies	0.002	0.113**	-0.019**
	(0.018)	(0.056)	(0.009)
Observations	3,896	2,976	3,892
R-squared	0.497	0.905	0.948
Country-Industry FE	✓	✓	✓
Industry-Year FE	✓	✓	✓
Country-Year FE	✓	✓	✓

Standard errors clustered at industry-country level. *** p<0.01, ** p<0.05, * p<0.1

Labor misallocation: log(MRPL); labor productivity: value added/no. of employees

Conclusion

Broader Implications

- **Increase in zombie firms around the world** (Banerjee and Hofmann, 2018)
  - China: govt injected funds indiscriminately into state firms post-crisis (steelmaking)
  - US: the share of zombie firms also recently increased in the US (shale oil sector)

- **Broader implications in light of the Covid-19 crisis**
  - Crisis hits firm profits and health $\Rightarrow$ loan losses will likely hit bank capital
  - Policies adopted to "freeze" the economy, including loan forbearance

- **Need for models to analyze the GE effects of zombie credit**
  - Zombie credit likely has a temporarily positive stabilizing effect ...
    ... but it might depress growth and inflation in the medium and long term

Appendix

Transition Matrix: NACE-COICOP Mapping

Table 25 **Final consumption expenditure by households ÖCPA x COICOP**

current prices, in 1000 €

ÖCPA x COICOP		01.1 Food	01.2 Non-alcoholic beverages	02.1 Alcoholic beverages	02.2 Tobacco	03.1 Clothing	03.2 Footwear	04.1 Actual rentals for housing	In
01	Products of agriculture, hunting and related services	2383080	-	-	61651	-	-	-	
02	Products of forestry, logging and related services	-	-	-	-	-	-	-	
03	Fish and fishing products	123244	-	-	-	-	-	-	
05-07	Coal a.lignite; crude petroleum a.natural gas; metal ores	-	-	-	-	-	-	-	
08-09	Other mining a. quarrying prod.; mining support services	-	-	-	-	-	-	-	
10	Food products	13300811	1163304	-	-	-	-	-	
11-12	Beverages, Tobacco products	-	776455	2414455	3150004	-	-	-	
13	Textiles	-	-	-	-	70888	-	-	
14	Wearing apparel	-	-	-	-	8382707	-	-	
15	Leather and related products	-	-	-	-	-	1944450	-	
16	Wood and products of wood and cork	-	-	-	-	-	-	-	
17	Paper and paper products	-	-	-	-	-	-	-	
18	Printing and recording services	-	-	-	-	-	-	-	
19	Coke and refined petroleum products	-	-	-	-	-	-	-	
20	Chemicals and chemical products	-	-	-	-	-	-	-	
21	Basic pharmaceutical products and preparations	-	-	-	213855	-	-	-	
22	Rubber and plastic products	-	-	-	-	-	-	-	
23	Other non-metallic mineral products	-	-	-	-	-	-	-	
24	Basic metals	-	-	-	-	-	-	-	

Back

Firm IC and "Synthetic" Rating

For all emerging market firms and developed market firms with market cap < $5 billion			
If interest coverage ratio is			
greater than	**≤ to**	**Rating is**	**Spread is**
-100000	0.499999	D2/D	19.38%
0.5	0.799999	C2/C	14.54%
0.8	1.249999	Ca2/CC	11.08%
1.25	1.499999	Caa/CCC	9.00%
1.5	1.999999	B3/B-	6.60%
2	2.499999	B2/B	5.40%
2.5	2.999999	B1/B+	4.50%
3	3.499999	Ba2/BB	3.60%
3.5	3.9999999	Ba1/BB+	3.00%
4	4.499999	Baa2/BBB	2.00%
4.5	5.999999	A3/A-	1.56%
6	7.499999	A2/A	1.38%
7.5	9.499999	A1/A+	1.25%
9.5	12.499999	Aa2/AA	1.00%
12.5	100000	Aaa/AAA	0.75%

Back

Markup Estimation - Intuition

- We follow De Loecker and Eeckhout (2019) and De Loecker and Warzynski (2012) for the firm-level markup estimation
- Output elasticity of variable input factor is only equal to its expenditure/total revenue share if price equals marginal costs (perfect competition case)
- With imperfect competition, markup drives wedge between input's revenue share and its output elasticity

Back to Sumstats Back to Regression

Markup Estimation - Theory

- Firm i minimizes contemporaneous production cost
- Production function with output $Q_{it}(V_{it}, K_{it}, \Omega_{it})$, where

$$\begin{aligned} V_{it} &= \text{variable input} \\ K_{it} &= \text{capital stock (dynamic input)} \\ \Omega_{it} &= \text{Hicks-neutral productivity term} \end{aligned}$$

- Resulting Lagrangian:

$$\mathcal{L}(V_{it}, K_{it}, \lambda_{it}) = P_{it}^{V} V_{it} + r_{it} K_{it} + F_{it} - \lambda_{it}(Q(\cdot) - \overline{Q}_{it}),$$

where

$$\begin{aligned} P^{V} &= \text{price of variable input} \\ r &= \text{user cost of capital} \\ F_{it} &= \text{fixed cost} \\ \lambda_{it} &= \text{Lagrange multiplier} \end{aligned}$$

Markup Estimation - Theory

- FOC w.r.t. variable input V is thus given by:

$$\frac{\partial \mathcal{L}_{it}}{\partial V_{it}} = P_{it}^{V} - \lambda_{it} \frac{\partial Q(\cdot)}{\partial V_{it}} = 0$$

- Rearranging yields output elasticity of input V:

$$\theta_{it}^{V} \equiv \frac{\partial Q(\cdot)}{\partial V_{it}} \frac{V_{it}}{Q_{it}} = \frac{1}{\lambda_{it}} \frac{P_{it}^{V} V_{it}}{Q_{it}}$$

- λ measures marginal cost (value of obj. function as output constraint is relaxed)
- Markup defined as $\mu = P/\lambda$, where P is output price
- Substituting λ yields following markup expression:

$$\mu_{it} = \theta_{it}^{V} \frac{P_{it} Q_{it} (= \text{turnover})}{P_{it}^{V} V_{it} (= \text{variable expenses})}$$

Markup Estimation - Empirics

- Two step procedure to get output elasticity of input, θ^v_{it}.
- For each industry we consider following translog production function:

$$q_{it} = \beta_{v1} v_{it} + \beta_{k1} k_{it} + \beta_{v2} v_{it}^2 + \beta_{k2} k_{it}^2 + \omega_{it} + \epsilon_{it}$$

where

q_{it}	=	log of deflated revenue (turnover)
v_{it}	=	log of deflated variable input (COGS + other OPEX)
k_{it}	=	log of deflated capital stock (tangible assets)
ω_{it}	=	firm's productivity

1) First step:
   - Obtain estimates of expected output ($\widehat{\psi_{it}}$) and ϵ_{it} by running

$$q_{it} = \psi_{it}(v_{it}, k_{it}) + \epsilon_{it}$$

Back to Sumstats Back to Regression

Markup Estimation - Empirics

2) Second step:
   - Use law of motion for productivity: $\omega_{it} = g_t(\omega_{it-1}) + \varepsilon_{it}$
   - Compute productivity using

$$\omega_{it} = \widehat{\psi_{it}} - \left(\beta_{v1} v_{it} + \beta_{k1} k_{it} + \beta_{v2} v_{it}^2 + \beta_{k2} k_{it}^2\right)$$

   - Nonparametrically regressing ω_{it} on its lag yields $\varepsilon_{it}(\beta)$
   - Rely on moment conditions to estimate production function parameters:

$$E\left(\varepsilon_{it}(\beta) \begin{pmatrix} v_{it-1} \\ k_{it} \\ v_{it-1}^2 \\ k_{it}^2 \end{pmatrix}\right) = 0$$

   - Using GMM techniques and block bootstrapping for SDs
   - Assume capital stock is decided a period ahead (thus not correlated with ε_{it})

Back to Sumstats Back to Regression

Markup Estimation - Empirics

3) Final step:
   - Compute estimated output elasticities using estimated PF coefficients:

$$\widehat{\theta}_{it}^{V} = \widehat{\beta}_{v1} + 2\widehat{\beta}_{v2} v_{it}$$

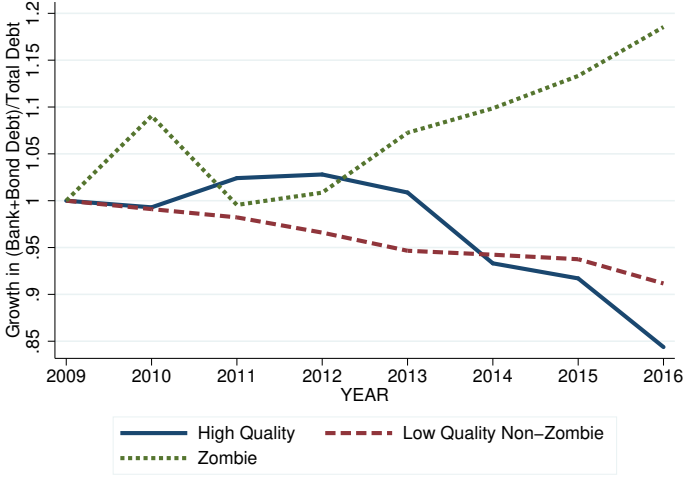
   - Firm level markups follow from

$$\mu_{it} = \theta_{it}^{V} \frac{P_{it} Q_{it}}{P_{it}^{V} V_{it}}$$

Back to Sumstats Back to Regression

Growth in Bank and Bond Debt

Back



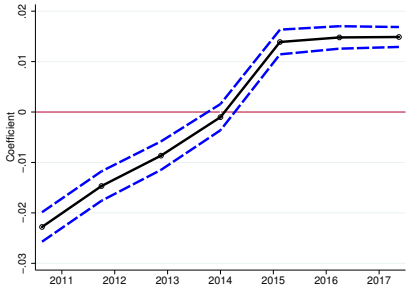
Ex-Post Defaults

Separately for every year τ:

Back

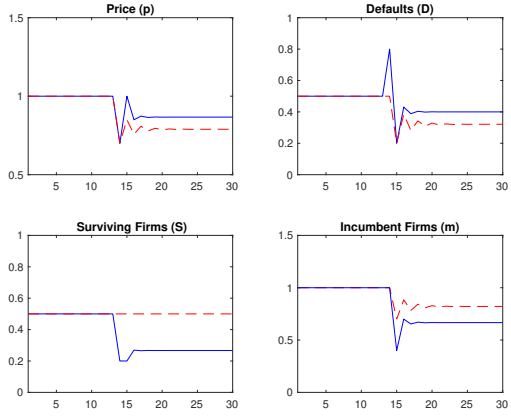
$$Default_{it} = \alpha + \beta_\tau \mathcal{I}_{t\tau} \times Zombie_{it} + \gamma X_{it} + \epsilon_{it}$$

- $\mathcal{I}_{t\tau}$ is a yearly indicator variable equal to 1 if $t = \tau$ and 0 otherwise
- X_{it} includes the uninteracted *Zombie* variable and other firm characteristics
- industry-country-year fixed effects



EqN Vs. EqZ following a Demand Shock ($\downarrow \alpha$)

Suppose the two eqm are identical before the negative demand shock



Back