Benefits for the Greek economy from resolving red loans and zombie firms

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- **Motivation & objectives**
- International evidence
- Stylized facts on NPEs and zombie firms
- Empirical analysis
- Conclusions

Greek crisis context

- Greece as a **case study** before, during and after the sovereign debt crisis, which triggered a financial crisis and protracted recession
  - Cumulative real GDP losses exceeded ¼ of total output, unemployment rate exceeded ¼ of total labor force, cumulative investment gap exceeded ½ of one year's total output
  - Severe hit on bank assets' quality and value, on payment culture. Three rounds of bank recapitalizations, ratios of banks' non-performing exposures skyrocketed to 50%
  - Institutional rigidities, including in the judicial system and the bankruptcy/insolvency framework
- **Policy response** through three economic adjustment programmes, aiming to restore fiscal and external sustainability, coupled with structural reforms to enhance productivity
- Albeit recent progress, Greece continues to suffer from **substantial investment and productivity gaps** compared to EU peers
- Greece had systematically a significant share of firms with weak prospects for recovery, based on financial ratios and firm age, labelled as **"zombies".** Such high percentage of zombie firms correlates with high **Non-Performing Exposures (NPE)** ratios on banks' balance sheets.

Motivation & Objectives

Questions

- Are there impediments in the productive reallocation of resources, as a legacy of long-standing weaknesses, exacerbated by the crisis?
- What is the cost of keeping zombie firms alive due to their negative side effects on investment, employment and productivity?

Objectives and tasks

- Estimate the share of zombie firms by sector and their correlation with NPE trends
- Analyze direct and indirect impact of the congestion of zombie firms in a sector on the overall economic activity
- Explore sectoral heterogeneity of zombies' impact
- Highlight policy priorities in relation to resolving zombie congestion and NPEs

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International interest on zombie firms since the '90s

- The study of zombie firms' impact on productivity, investment, and employment is a relatively recent field of interest.
- Developed in the early 1990s due to Japan's prolonged stagnation and low productivity after credit and real estate bubbles burst – the so-called "lost decade".
- During this period, Japanese authorities loosened bank supervision, discouraging strict actions against overindebted firms and promoting additional credit (evergreening loans) to help these firms repay loans.
- This approach postponed firm bankruptcies and prevented banks from recording losses, maintaining their capital adequacy.
- These firms have been characterized in the relevant literature as "zombie firms".
- Characteristics of "zombie firms"
  - They exhibit poor financial performance.
  - They are highly dependent on bank lending and/or government grants.
  - They can hardly meet financial obligations without concessions.

Literature review

- Caballero et al. (2008): impact of zombie firms on Japan's employment, investment, and productivity during 1981-2002
  - A higher share of zombies in an industry reduces investment and employment growth in healthy firms and widens the productivity gap favoring zombies. This occurs because healthy firms are forced to show higher productivity to compete with zombie firms. Even when accounting for sales changes, the negative impact of zombies on investment and employment growth of healthy firms remains significant.
- McGowan et al. (2018): impact of zombie firms on productivity across 12 countries during 2003-2013.
  - Mainly large, older firms are likely to be zombies, which negatively affect investment and employment growth in their industries. The presence of zombie firms widens the productivity gap with non-zombie firms, creates market distortions, and leads to inefficient capital allocation. These issues persisted even before the 2008 financial crisis, highlighting underlying economic and policy weaknesses.
- Andrews and Petroulakis (2019): impact of zombie firms on bank health and productivity growth in 11 European countries during 2001-2014
  - They found that weak banks support the existence of zombie firms, and this pattern persisted before and after the financial crisis, indicating it is not cyclical. A restrictive regulatory environment also aids zombie survival. Productive firms grow faster, especially in sectors with healthy banks, enhancing overall productivity. Conversely, a higher share of zombies reduces capital reallocation efficiency and limits healthy firms' access to bank loans, regardless of the type of borrowing measured.
- Schivardi et al. (2017): in Italy, during 2004-2013, banks with low capital adequacy disproportionately financed zombie firms during the financial crisis, negatively impacting the growth of healthy firms and increasing total factor productivity dispersion in industries with a high share of zombies.
- Da Silva and Gonçalves (2022): zombie firms in Portugal (2011-2018) negatively impacted industry investment rates and labor productivity.

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Two complementary metrics

The analysis uses two distinct descriptive metrics.

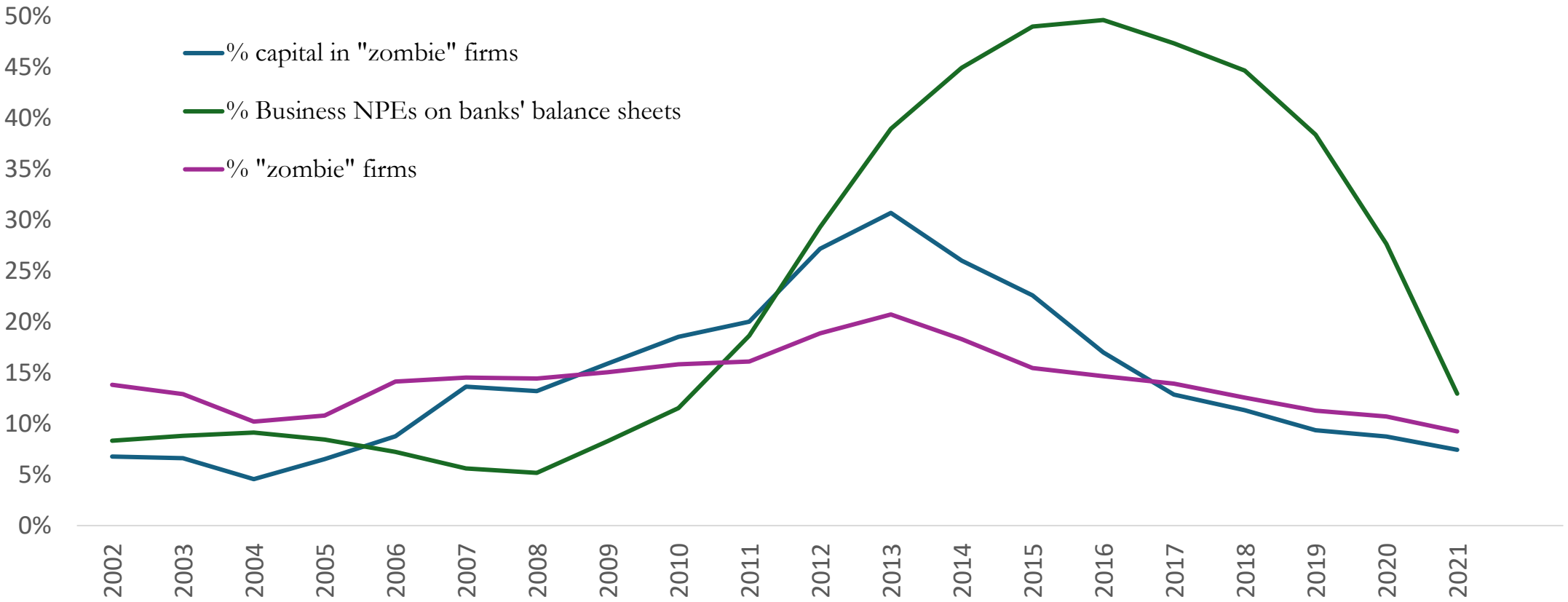
Business NPEs

- Banks balance sheet assets are recorded as Non-Performing in cases of exposures (loans) that are:
  - more than 90 days past due **&**
  - unlikely to pay, regardless of the # of days past due
- Source: Bank of Greece, sectoral breakdown during 2015-2022

Zombie firms

- Firms with weak prospects for recovery, based on financial ratios and firm age, are labelled "zombies", if, for three consecutive years:
  - the value of the interest coverage ratio is less than 1,
  - the age of the firm is equal to or greater than 10 years
- Source: ICAP data.prisma, firm breakdown during 2001-2021

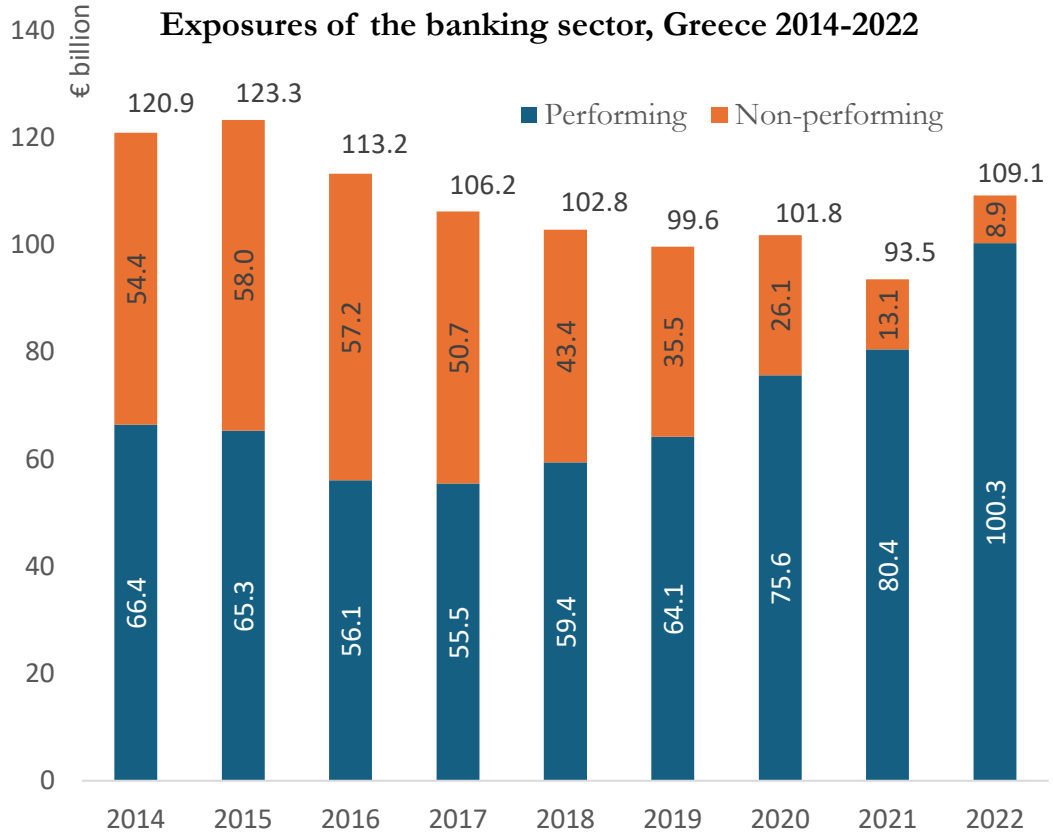
The estimated share of zombie firms in Greece correlates with the share of business NPEs and capital share sunk

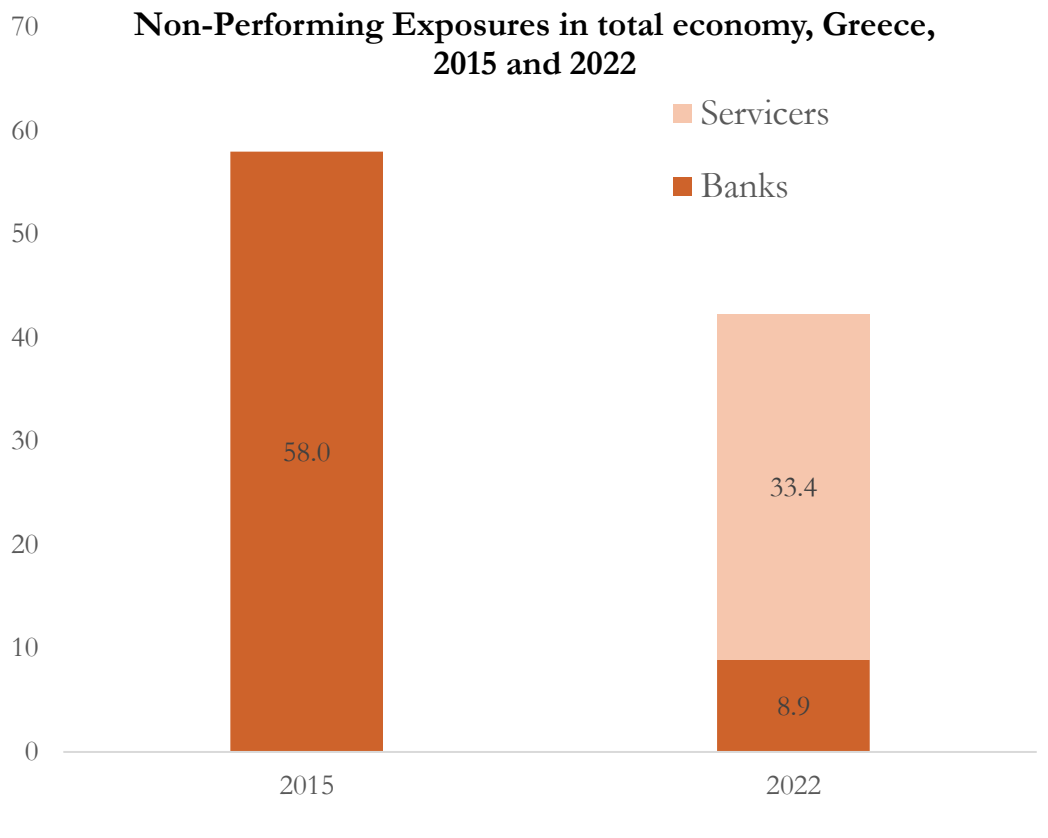


Source: Bank of Greece, ICAP data.prisma, authors' calculations

The rise and fall of **zombie firms/capital sunk preceded that of NPEs**.
During 2008-2017, higher share of capital concentration in zombie firms than zombie share. Size of average zombie firm > size of average firm

Reducing NPEs of the domestic banking system has been crucial, but is only one side of the coin



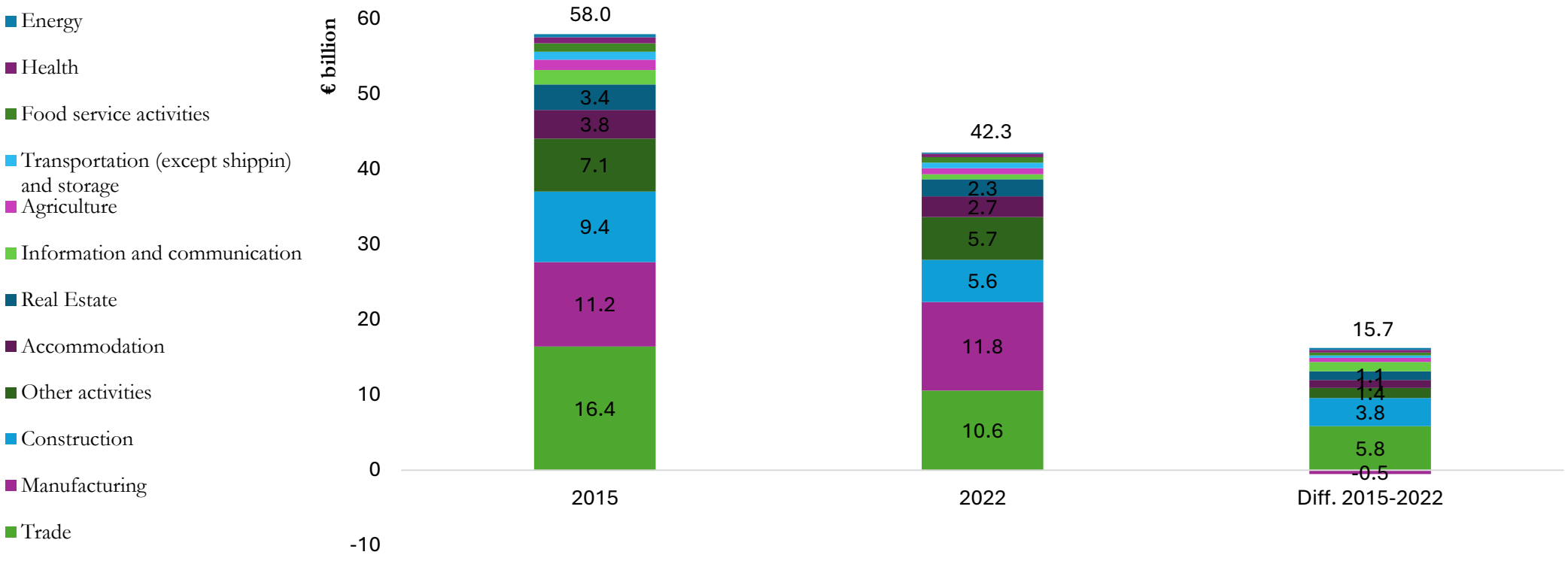


Source: Bank of Greece, ICAP data.prisma, authors' calculations

- The reduction of NPEs in banks' balance sheets had a **positive impact on new loans**
- However, **NPEs under servicers** remain unresolved in the economy. While NPEs on bank balance sheets declined by 85% during 2016-2022, the reduction of NPEs in the economy is much smaller (28% cumulatively), as the bulk of "legacy NPEs", which are managed by servicers, remain non-performing.

From a total economy standpoint, NPEs have shrunk across most sectors, but not all

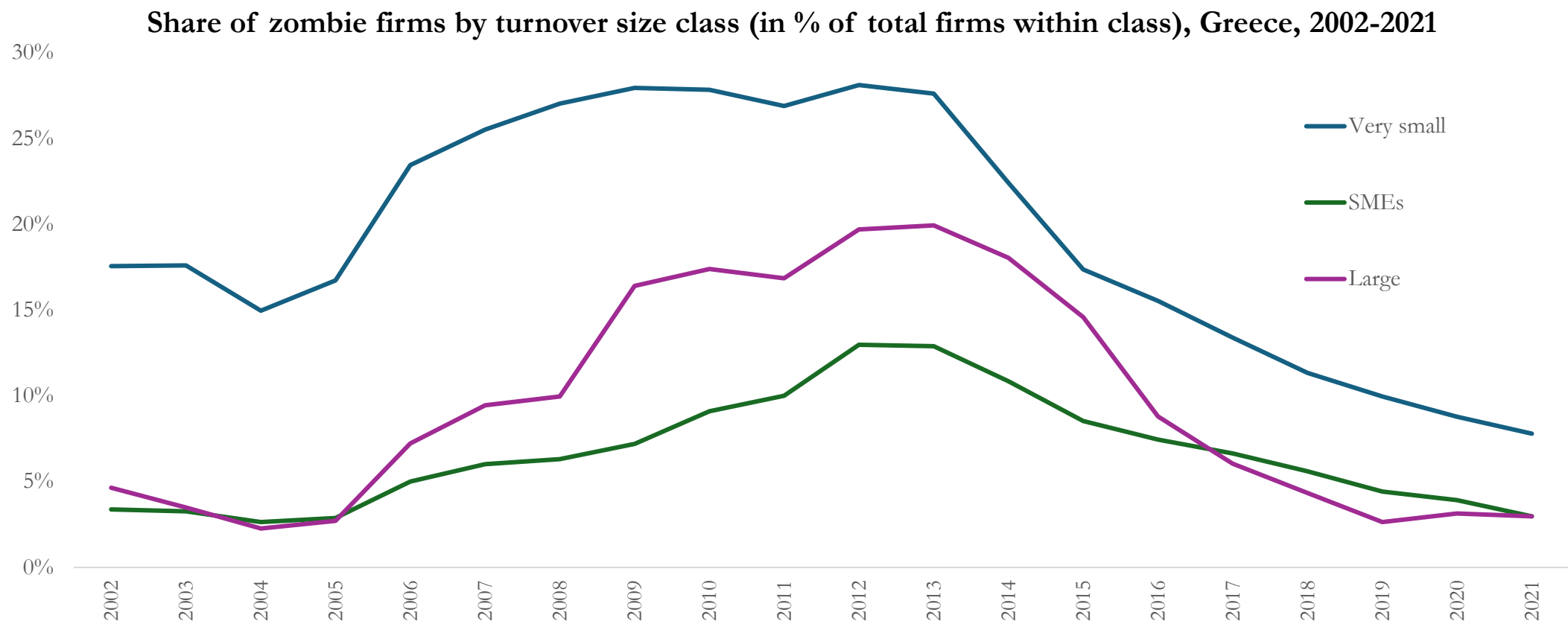
Total stock of business NPEs under both banks and servicers, Greece, 2015 and 2022



Source: Bank of Greece, authors' calculations

The **share of NPEs** remains higher in Trade, Manufacturing and Construction sectors.

Micro businesses have systematically exhibited the highest zombie rate…

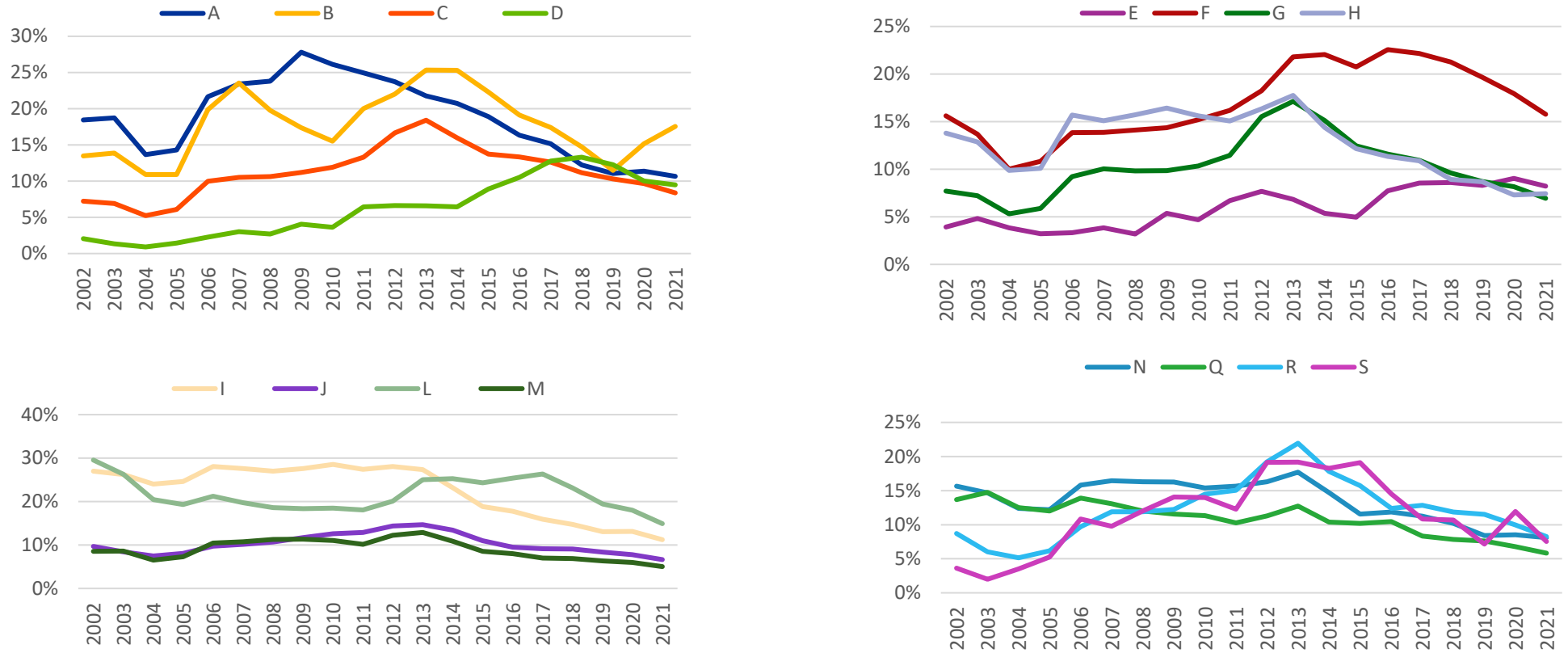


Source: ICAP data.prisma, authors' calculations. Thresholds for annual turnover used in the classification are <2 ml euros, between 2ml and 50ml euros, above 50ml euros.

…however the size-zombie share relationship has not been monotonic.
A **downward trend** in the proportion of zombie firms is evident across all size classes **after 2013**.

Zombie share by economic activity

Zombie share (in % of total # of firms in each sector), Greece, 2002-2021



Source: ICAP data.prisma, authors' calculations. Sectors are presented at the 1-digit NACE level..

Top average shares: (I) Tourism (22.5%), (L) Real estate (21.6%), (A) Agriculture (18.7%), (B) Mining-Quarrying (17.8%), (F) Construction (17.0%)
Low average shares: (E) Water supply (5.9%), (D) Electricity-Gas (6.2%), (M) Professional, scientific and technical activities (9.0%).

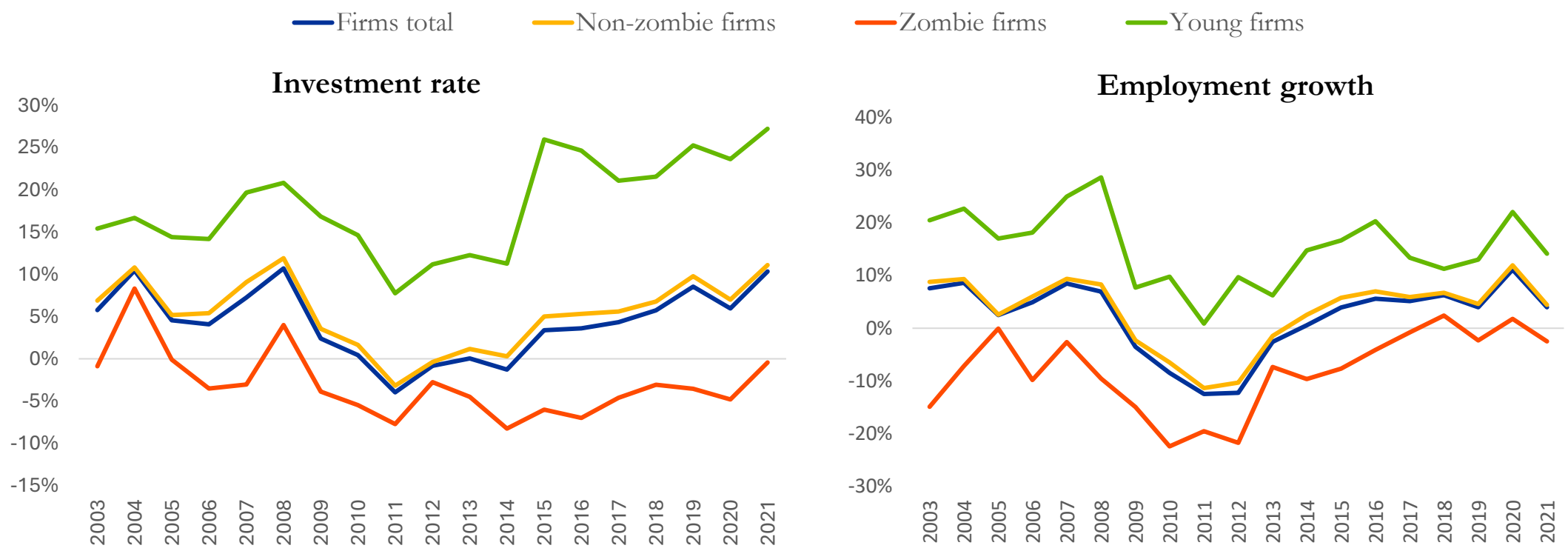
Capital concentration in zombie firms by economic activity

Zombie share (in % of total stock of capital in each sector), Greece, 2002-2021

Source: ICAP data.prisma, authors' calculations. Sectors are presented at the 1-digit NACE level..

Peak around 2010-2014 for most sections, **high heterogeneity** across sectors
Similar trends observed with zombie share, but **non-smooth**, inter alia affected by reclassification in sectors with high market and capital concentration (see case of sector D)

Investment rate and employment growth by age and zombie status



Source: ICAP, Data processing: Authors' calculations. The threshold for young age classification is <6 years old.

Non-zombie firms perform systematically better than zombie firms over time, both on investment and employment metrics.
Young firms perform significantly better.
How is the performance of non-zombie firms is affected by the existence of zombie firms?

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Data

- **Firm-level**, annual balance sheets, Greece 2001-2021, ICAP.dataprisma database
  - ICAP's database is the largest electronic repository of business activity information in Greece, encompassing financial and commercial data for businesses since 2000, as well as sectoral financial analyses.
  - In terms of the turnover of the Greek economy, comparing with ELSTAT's Business Register, the average coverage rate for the period is close to 60% (Vettas et al. 2022).
  - In terms of the number of businesses by turnover class, coverage is high for very large (annual turnover above €50 million) and large enterprises (annual turnover between €5.0 and €50 million), at 89.3% and 81.1%, respectively.
  - Conversely, very small businesses (annual turnover between €0 and €500 thousand) are underrepresented (only 2.1%) in ICAP's database, mainly due to the lack of data on sole proprietors, as most of them are not required to prepare and publish financial statements.
- **Sample**: Average of 24,648 firm observations per year, indicatively 52,539 firms in the business economy in 2021, breakdown in 12 sections (1-digit NACE) and 47 sectors (2-digit NACE)

Model specification (1) – zombie impact on firm performance

The econometric model takes the following form:

$$Y_{ist} = \beta_1 \text{Non zombie dummy}_{ist} + \beta_2 \text{Non zombie dummy}_{ist} * \text{Zombie share}_{st} + \beta_3 \text{firm controls}_{ist} + \delta_{st} + \varepsilon_{ist}$$

where i: firm, s: sector, t: time

- Y_{ist}: investment rate or employment growth or multi-factor productivity (MFP)
- δ_{st} : sector-time fixed effects
- firm controls: age, size

Alternative specifications: Zombie share (in % of total number of firms) versus Zombie capital share (in % of total stock of capital)

Hypotheses to test:

- $\beta 1>0$ ⇔ Non zombie firms perform better than zombies
- $\beta 2<0$ or $\beta 2>0$ ⇔ How does the congestion of zombies in a sector affect non-zombies' performance?
- $\beta 3$, Check age and size effects in line with literature

Model specification (2) – zombie impact on capital reallocation

Additionally, following McGowan et al. (2018), we employ the following model:

$$Y_{ist} = \beta_1 \text{MFP}_{ist-1} + \beta_2 \text{MFP}_{ist-1} * \text{Zombie share}_{st}$$

$$+\beta_3 \text{firm controls}_{ist} + \delta_{st} + \varepsilon_{ist}$$

where i: firm, s: sector, t: time,

- Y_{ist} denotes the investment rate of firm i, in sector s, in year t
- δ_{st} : sector-time fixed effects,
- firm controls: age, size.
- MFP_{ist}: multi-factor productivity (MFP)
- Alternative specifications: Zombie share (in % of total number of firms) versus Zombie capital share (in % of total stock of capital)

Hypotheses to test:

- $\beta 1 > 0$ ⇔ More productive firms invest more
- $\beta 2 < 0$ ⇔ Higher congestion of zombies hampers the reallocation of capital to more productive investments
- $\beta 3$, Check age and size effects in line with literature

Non-zombie firms record higher investment rates and are negatively affected by zombie congestion within their sector

Investment rate log(I/K) as dependent variable	Total	C	D	E	F	G	H	I	J	L	M	N	S
Non-zombie dummy	**0.0703*** **	**0.0518*** **	0.1923**	0.0982*	-0.0539	0.0670***	0.0235	**0.0851*** **	0.1070***	-0.1025**	0.0780	0.0200	0.3994
Non-zombie dummy × Industry zombie share	**-0.2956*** **	**-0.1730** **	-3.7843***	-0.8203**	0.4628*	-0.1568	0.1125	**-0.3779*** **	-0.4017**	0.4881**	0.0243	-0.1082	-1.5868
Young	**0.1803*** **	**0.2159*** **	0.3511***	0.2200***	0.1832***	0.1557***	0.1990***	**0.2005*** **	0.1830***	0.1251***	0.1565***	0.1613***	0.1185
Small/Medium dummy	**-0.0239*** **	**-0.0189** **	0.0058	0.1161	-0.0138	-0.0303***	-0.0235	**-0.0424**	-0.0165	-0.1947*	-0.0410	-0.0005	
Micro dummy	**-0.1076*** **	**-0.0779*** **	-0.0047	0.0716	-0.1164***	-0.1249***	-0.1241***	**-0.0929** **	-0.1256***	-0.2431**	-0.1473**	-0.1235***	-0.1163
Sector-year FE	**Yes**	**Yes**	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	Yes	Yes	Yes	Yes
Observations 2002-2021	**492,966**	**90,334**	15,012	2,327	39,444	148,391	18,574	**70,683**	21,475	33,408	31,995	21,005	318
Sectors 2-digit	**47**	**19**	1	2	1	3	5	**1**	4	1	5	4	1
Adjusted R^2	**0.0231**	**0.0314**	0.0708	0.0274	0.0165	0.0177	0.0227	**0.0292**	0.0144	0.0113	0.0111	0.0153	-0.0060

Source: Authors' estimations. Asterisks ***, ** and * correspond to coefficients that are statistically significant at the 99%, 95% and 90% level respectively.

A non-zombie firm records on average 7% higher investment rate per annum.
Higher zombie share concentration in a sector by 1 ppt, reduces the average investment rate of non-zombies by around 0.29% per annum.

Non-zombies record higher employment growth on specific sectors, but they seem unaffected by the degree of zombie congestion within sector

Employment growth as dependent variable	Total	C	D	E	F	G	H	I	J	L	M	N	S
Non-zombie dummy	**0.0554*** **	**0.0562*** **	0.3069	0.0937	0.1449	0.0537***	0.0317	**-0.0527**	0.0371	0.1456	-0.1007	0.0982	-0.5263*
Non-zombie dummy × Industry zombie share	**0.0602**	**0.0533**	-2.0547	-0.2767	-0.5131	0.1720	0.3088	**0.4136**	0.4437	-0.6551	1.3382	0.1734	8.1101*
Young	**0.1399*** **	**0.1580*** **	0.0909	0.1396**	0.1741***	0.1336***	0.1474***	**0.1210*** **	0.1328***	0.1724**	0.1208***	0.1299***	-0.3363
Small/Medium dummy	**0.0002**	**0.0110**	-0.1113**	0.0580	-0.0123	-0.0017	-0.0117	**-0.1008**	0.0241	-0.0428	-0.0542	-0.0285	
Micro dummy	**-0.0813*** **	**-0.0570*** **	-0.1330***	-0.0097	-0.1486***	-0.0805***	-0.0640***	**-0.2148***	-0.0474**	-0.1822***	-0.1471**	-0.1111***	-0.0229
Sector-year FE	**Yes**	**Yes**	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	Yes	Yes	Yes	Yes
Observations 2002-2021	**112,444**	**29,321**	1,087	695	6,463	45,320	4,832	**6,822**	5,511	1,886	5,952	4,441	114
Sectors 2-digit	**47**	**19**	1	2	1	3	5	**1**	4	1	5	4	1
Adjusted R^2	**0.0434**	**0.0580**	0.0336	0.0078	0.0409	0.0558	0.0390	**0.0205**	0.0335	0.0287	0.0246	0.0362	0.1603

Source: Authors' estimations. Asterisks ***, ** and * correspond to coefficients that are statistically significant at the 99%, 95% and 90% level respectively.

A non-zombie firm records on average 5.5% higher employment growth per annum.

Firm productivity is higher among non-zombies, while the effect of zombie congestion on non-zombies varies across sectors

MFP dependent variable	Total	C	D	E	F	G	H	I	J	L	M	N	S
Non-zombie dummy	**0.5380*** **	**0.3296*** **	-0.1022	1.2673***	0.1750	0.4278***	0.2542	**0.8346*** **	0.6268***	3.1616***	0.3256	1.0357***	-0.2061
Non-zombie dummy × Industry zombie share	**0.9686*** **	**2.3195*** **	4.6884	-9.4074***	5.6381***	2.0653***	1.7385	**-1.9409*** **	0.1210	-9.9932***	2.2717	-1.7258	32.9065
Young	**0.3875*** **	**0.2760*** **	0.4820***	0.0360	0.6502***	0.4885***	0.2924***	**0.3629*** **	0.1640***	0.6724***	0.1553***	0.1556***	-0.1290
Small/Medium dummy	**-0.3476*** **	**-0.1580*** **	-1.2917***	0.1063	0.3875***	-0.6751***	0.4022***	**0.3382** **	0.4340***	0.5306*	-0.5626***	-0.2315	
Micro dummy	**-0.9516*** **	**-0.6314*** **	-1.9423***	-0.6944***	-0.4128***	-1.2939***	-0.3137***	**-0.0560**	-0.1374**	-1.1187***	-1.2507***	-0.8902***	-0.0481
Sector-year FE	**Yes**	**Yes**	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	Yes	Yes	Yes	Yes
Observations 2002-2021	**175,861**	**44,310**	1,673	982	10,811	69,706	7,106	**13,086**	8,458	3,242	9,477	6,848	162
Sectors 2-digit	**47**	**19**	1	2	1	3	5	**1**	4	1	5	4	1
Adjusted R^2	**0.7075**	**0.5966**	0.4829	0.5396	0.5551	0.2999	0.6855	**0.3795**	0.5888	0.1933	0.6614	0.7818	0.7289

Source: Authors' estimations. Asterisks ***, ** and * correspond to coefficients that are statistically significant at the 99%, 95% and 90% level respectively.

As the congestion of capital in zombie firms increases, the gap between zombies and non-zombies in terms of total factor productivity widens in favour of the latter due to the higher productivity threshold non-zombies have to achieve in order to overcome the entry and activity barriers created by zombie firms. Exception in the tourism sector.

Capital reallocation to more productive investments is hampered as zombie congestion increases within a sector or in the overall economy

Investment rate log(I/K) as dependent variable	Total	C	D	E	F	G	H	I	J	L	M	N	S
MFP_{t-1}	**0.0799*** **	**0.0766*** **	0.0962	0.0272	0.0299	0.0859***	0.0743***	**0.1008*** **	0.1099***	-0.0563	0.1043***	0.0166	0.0839
MFP_{t-1} × Industry zombie share	**-0.2261*** **	**-0.2111*** **	-0.7414	0.2083	0.1124	-0.2847***	-0.1898	**-0.3478*** **	-0.3048*	0.3658	-0.3748	0.2180	-0.1083
Young	**0.0882*** **	**0.1058*** **	0.1595***	0.1193***	0.0942***	0.0795***	0.0602**	**0.0387** **	0.1401***	0.0309	0.0940***	0.1201***	0.1928
Small/Medium dummy	**0.0094**	**-0.0016**	0.0160	0.0562	0.0294	0.0215**	-0.0216	**-0.0894***	-0.0289	-0.1296	0.0065	0.0076	
Micro dummy	**-0.0419*** **	**-0.0424*** **	-0.0652	-0.0029	-0.0323	-0.0261**	-0.0827***	**-0.1409*** **	-0.0893***	-0.1650	-0.0495	-0.0949**	-0.2715**
Sector-year FE	**Yes**	**Yes**	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	Yes	Yes	Yes	Yes
Observations (2002-21)	**151,668**	**38,827**	1,402	838	9,390	59,633	6,038	**11,303**	7,299	2,857	8,098	5,812	128
Sectors 2-digit	**47**	**19**	1	2	1	3	5	**1**	4	1	5	4	1
Adjusted R^2	**0.0326**	**0.0428**	0.0635	0.0510	0.0300	0.0313	0.0245	**0.0317**	0.0333	0.0173	0.0296	0.0391	0.0398

Source: Authors' estimations. Asterisks ***, ** and * correspond to coefficients that are statistically significant at the 99%, 95% and 90% level respectively.

Higher presence of zombie enterprises causes distortions in the efficient allocation of resources, with negative consequences on investment and growth of high-productivity enterprises

Robustness checks

- We conducted the following 2 robustness checks:
  - We defined a firm as non-zombie only if it maintained this status throughout the entire sample period, thus, eliminating potential impact of status changes on estimated coefficients
  - To control for heterogeneity not only across sectors, but also across individual firms, we introduced firm-fixed effects, thus allowing coefficients to be identified solely through the time dimension.
- Both checks yielded broadly similar findings in terms of coefficient signs and statistical significance.
- We have also run the models using the alternative metric for zombie congestion, which weights firms with respect to their capital share within each sector.

Interpretation of selected findings

- Using estimates from existing literature (Tölö and Virén 2021), a back-of-the-envelope calculation shows that the **cumulative reduction in business NPEs** on banks' books by more than 40 bps over the period 2016-2023 **led to an increase in net business loan flows of about €8 billion**, out of a total increase of €22.5 billion recorded in this period (36% of actual credit expansion).
- **Non-zombie firms** exhibit higher investment rate, employment growth and MFP, compared to zombie firms. For instance, a non-zombie firm records on average 7% higher investment rate per annum (5% in manufacturing, 8% in the tourism sector).
- Higher **zombie share concentration** in a sector by 1 ppt, may reduce the average investment rate of non-zombie firms by up to 0.29% per annum.
- **Takeaways at the sector level**. A 1% reduction in zombie firms' capital share in the **manufacturing sector** can boost investment in the same sector by 4.2% per annum.

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A recap of main findings

- **Non-zombie firms** outperform zombies in terms of investment growth, employment growth and productivity.
- Higher **congestion of zombie firms** in a sector (both in number and capital stock):
  - negatively affects the rate of investment growth of healthy firms in most sectors of economic activity.
  - forces healthy firms to increase their overall productivity in order to survive.
  - prevents the reallocation of capital to more productive investments across firms and sectors.
- **Younger and larger companies** generally perform better in terms of investment and employment growth, and productivity levels.
- Specific **sectors**, like Construction, Accommodation and Food Services, and Real Estate, have higher densities of zombie firms and significant liabilities.
- **Overall**, a faster resolution of zombie firms and non-performing corporate loans, both on and off bank balance sheets, allows a more efficient allocation of resources and can boost investment, employment and growth rates in the Greek economy in the medium to long term.

Forward looking policy priorities

- Despite significant declines since their peaks, high levels of non-performing business loans (NPEs) and zombie companies remain major challenges for the Greek economy.
- The bulk of "legacy NPEs", which are managed by servicers, remain non-performing. The prolonged presence of NPEs and zombie firms hampers investment, employment, productivity, and resource allocation, affecting both individual firms and the broader economy
- **Policy Implications.** Resolving NPEs and reducing zombie firms can accelerate investment, reduce unemployment, and enhance productivity, contributing to sustainable economic growth.
- **Priority areas.** Secondary market for NPLs, out of court workouts, insolvency framework, bankruptcy code, judicial system. **Policy measures** aiming at a rapid and effective reduction in the amount of NPEs and the number of zombie companies are expected to accelerate the narrowing of the investment gap in the Greek economy, as well as to reduce the unemployment rate.
- These may enhance the prospect of strengthening the overall **productivity**, as well as the **reallocation of capital to productive investments**, which are necessary conditions for achieving strong and sustainable growth rates of the Greek economy in the medium to long term.

Annex - Selected references

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Annex – Results with capital share sunk in zombies

Annex - Results of for the whole economy and by sector of economic activity with the investment rate [log(I/K)] as the dependent variable for 2002-2021

Variables	Total	C	D	E	F	G	H	I	J	L	M	N	S
Non-zombie dummy	0.0160***	0.0387***	-0.2623***	0.1713**	-0.0323	0.0559***	0.0188	0.0421***	0.0679***	0.0599***	0.0799***	-0.0291	0.3010
	(0.0042)	(0.0086)	(0.0463)	(0.0717)	(0.0264)	(0.0085)	(0.0340)	(0.0101)	(0.0240)	(0.0189)	(0.0227)	(0.0293)	(0.2374)
Non-zombie dummy × Industry zombie capital sunk	0.0206	-0.0518*	0.3913***	-1.8631*	0.1471**	-0.0527	0.0385	-0.3156***	-0.0833	-0.2195***	0.0023	0.1400	-0.2550
	(0.0148)	(0.0306)	(0.0973)	(0.9921)	(0.0577)	(0.0386)	(0.0572)	(0.0604)	(0.0836)	(0.0657)	(0.0448)	(0.1017)	(0.5068)
Young	0.1809***	0.2155***	0.3517***	0.2197***	0.1834***	0.1555***	0.1991***	0.2011***	0.1836***	0.1232***	0.1562***	0.1617***	0.1186
	(0.0034)	(0.0089)	(0.0210)	(0.0450)	(0.0112)	(0.0061)	(0.0155)	(0.0095)	(0.0163)	(0.0117)	(0.0129)	(0.0154)	(0.1270)
Small/Medium dummy	-0.0243***	-0.0187*	0.0077	0.0944	-0.0143	-0.0303***	-0.0248	-0.0441	-0.0167	-0.1920*	-0.0411	-0.0003	
	(0.0070)	(0.0109)	(0.0478)	(0.1324)	(0.0385)	(0.0107)	(0.0295)	(0.0445)	(0.0355)	(0.1029)	(0.0741)	(0.0313)	
Micro dummy	-0.1087***	-0.0776***	-0.0037	0.0549	-0.1170***	-0.1250***	-0.1256***	-0.0948**	-0.1250***	-0.2388**	-0.1472**	-0.1227***	-0.1166
	(0.0071)	(0.0111)	(0.0421)	(0.1355)	(0.0382)	(0.0108)	(0.0294)	(0.0443)	(0.0352)	(0.1016)	(0.0743)	(0.0304)	(0.0954)
Sector-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	492,994	90,312	15,009	2,325	39,437	148,367	18,572	70,658	21,471	33,392	31,979	21,001	318
Sectors	47	19	1	2	1	3	5	1	4	1	5	4	1
Adjusted R^2	0.0230	0.0314	0.0707	0.0280	0.0166	0.0177	0.0227	0.0292	0.0143	0.0114	0.0111	0.0154	-0.0058

Annex - Results for the whole economy and by sector of economic activity with employment growth as the dependent variable for 2002-2021

Variables	Total	C	D	E	F	G	H	I	J	L	M	N	S
Non-zombie dummy	0.0558***	0.0543***	0.0649	0.1569	0.0126	0.0623***	0.0540	0.0621	0.0751**	0.0643	0.0040	0.1524***	-0.0895
	(0.0071)	(0.0121)	(0.0885)	(0.1181)	(0.1727)	(0.0106)	(0.0508)	(0.0841)	(0.0315)	(0.0690)	(0.0343)	(0.0448)	(0.0935)
Non-zombie dummy × Industry zombie capital sunk	0.0364	0.0463	0.1807	-1.3023	0.0676	0.0764	0.0319	-0.3055	0.0502	-0.2871	0.0208	-0.1223	1.7073***
	(0.0260)	(0.0466)	(0.2380)	(1.1706)	(0.3361)	(0.0535)	(0.0893)	(0.5386)	(0.1041)	(0.3109)	(0.0801)	(0.1622)	(0.0961)
Young	0.1399***	0.1567***	0.0922	0.1420**	0.1759***	0.1333***	0.1474***	0.1221***	0.1332***	0.1727**	0.1202***	0.1303***	-0.3443
	(0.0061)	(0.0134)	(0.0856)	(0.0645)	(0.0310)	(0.0079)	(0.0240)	(0.0411)	(0.0259)	(0.0725)	(0.0228)	(0.0316)	(0.3108)
Small/Medium dummy	-0.0000	0.0105	-0.1139**	0.0514	-0.0126	-0.0019	-0.0134	-0.1022	0.0227	-0.0430	-0.0538	-0.0298	
	(0.0052)	(0.0071)	(0.0502)	(0.0577)	(0.0497)	(0.0072)	(0.0238)	(0.1248)	(0.0195)	(0.0633)	(0.0644)	(0.0415)	
Micro dummy	-0.0816***	-0.0574***	-0.1301***	-0.0124	-0.1489***	-0.0806***	-0.0656***	-0.2150*	-0.0496**	-0.1856***	-0.1470**	-0.1132***	0.0031
	(0.0055)	(0.0080)	(0.0461)	(0.0645)	(0.0499)	(0.0077)	(0.0246)	(0.1243)	(0.0202)	(0.0595)	(0.0647)	(0.0421)	(0.0581)
Sector-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112,444	29,315	1,086	693	6,460	45,305	4,832	6,814	5,508	1,874	5,946	4,438	4,438
Sectors	47	19	1	2	1	3	5	1	4	1	5	4	1
Adjusted R^2	0.0508	0.0695	0.0528	0.0631	0.0443	0.0571	0.0579	0.0237	0.0473	0.0406	0.0384	0.0525	0.0525

Annex - Results for the whole economy and by sector of economic activity with MFP as the dependent variable for 2002-2021

Variables	Total	C	D	E	F	G	H	I	J	L	M	N	S
Non-zombie dummy	0.5359***	0.5287***	0.5639	0.4654	0.3612	0.5223***	-0.0759	0.6618***	0.5791***	-0.0067	0.5584***	0.8563***	1.1456**
	(0.0207)	(0.0354)	(0.3741)	(0.4185)	(0.2383)	(0.0329)	(0.1798)	(0.1077)	(0.0836)	(0.4375)	(0.0874)	(0.1414)	(0.5708)
Non-zombie dummy × Industry zombie capital sunk	0.6497***	0.6190***	-0.8159	-1.1601	1.9331***	0.9982***	1.0508***	-1.7150***	0.2543	2.7156*	-0.0949	-0.3199	6.4421***
	(0.0770)	(0.1262)	(0.6578)	(3.9621)	(0.4965)	(0.1431)	(0.2966)	(0.6450)	(0.2518)	(1.5095)	(0.2922)	(0.4435)	(0.7964)
Young	0.3878***	0.2742***	0.4848***	0.0566	0.6547***	0.4892***	0.2921***	0.3587***	0.1648***	0.6121***	0.1553***	0.1549***	-0.1794
	(0.0088)	(0.0184)	(0.1126)	(0.0887)	(0.0360)	(0.0124)	(0.0407)	(0.0354)	(0.0354)	(0.1334)	(0.0362)	(0.0418)	(0.1937)
Small/Medium dummy	-0.3516***	-0.1624***	-1.2942***	-0.1190	0.3817***	-0.6759***	0.3846***	0.3383**	0.4331***	0.4054	-0.5611***	-0.2255	
	(0.0173)	(0.0196)	(0.1572)	(0.2295)	(0.0868)	(0.0270)	(0.0723)	(0.1501)	(0.0660)	(0.3567)	(0.1588)	(0.1498)	
Micro dummy	-0.9567***	-0.6353***	-1.9399***	-0.8982***	-0.4184***	-1.2950***	-0.3325***	-0.0578	-0.1388**	-1.4674***	-1.2484***	-0.8829***	-0.0066
	(0.0178)	(0.0210)	(0.1465)	(0.2422)	(0.0876)	(0.0276)	(0.0744)	(0.1501)	(0.0662)	(0.3537)	(0.1595)	(0.1499)	(0.1841)
Sector-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	175,864	44,310	1,673	982	10,811	69,706	7,106	13,086	8,458	2,375	9,477	6,848	165
Sectors	47	19	1	2	1	3	5	1	4	1	5	4	1
Adjusted R^2	0.7092	0.5998	0.4908	0.5484	0.5569	0.3008	0.6908	0.3804	0.5929	0.2098	0.6647	0.7842	0.7882

Annex - Zombie firms and capital reallocation: sensitivity of net fixed assets to MFP Dependent variable: log (I/K)

Variables	Total	C	D	E	F	G	H	I	J	L	M	N	S
MFP_{t-1}	0.0544***	0.0609***	0.0059	0.0555***	0.0362***	0.0667***	0.0461***	0.0801***	0.0849***	0.0355***	0.0790***	0.0327***	0.1012
	(0.0016)	(0.0030)	(0.0118)	(0.0178)	(0.0102)	(0.0031)	(0.0150)	(0.0104)	(0.0102)	(0.0101)	(0.0072)	(0.0098)	(0.0654)
MFP_{t-1}× Industry zombie capital sunk	-0.0173***	-0.0546***	0.1070***	-0.2662	0.0330	-0.0890***	0.0080	-0.3538***	-0.0328	-0.0667*	-0.0337*	0.0600	-0.1604
	(0.0058)	(0.0128)	(0.0288)	(0.2366)	(0.0225)	(0.0203)	(0.0249)	(0.0699)	(0.0429)	(0.0403)	(0.0194)	(0.0390)	(0.1843)
Young	0.0880***	0.1055***	0.1606***	0.1162***	0.0945***	0.0794***	0.0588***	0.0376***	0.1382***	0.0309	0.0930***	0.1213***	0.2052
	(0.0041)	(0.0073)	(0.0378)	(0.0329)	(0.0165)	(0.0067)	(0.0215)	(0.0108)	(0.0211)	(0.0288)	(0.0209)	(0.0229)	(0.2037)
Small/Medium dummy	0.0074	-0.0014	0.0159	0.0570	0.0297	0.0212*	-0.0202	-0.0833	-0.0306	-0.1169	0.0051	0.0161	
	(0.0076)	(0.0102)	(0.0451)	(0.0921)	(0.0460)	(0.0118)	(0.0370)	(0.0730)	(0.0411)	(0.0871)	(0.0757)	(0.0645)	
Micro dummy	-0.0440***	-0.0417***	-0.0643	-0.0033	-0.0315	-0.0264**	-0.0797**	-0.1343*	-0.0875**	-0.1568*	-0.0502	-0.0876	-0.2846**
	(0.0077)	(0.0105)	(0.0428)	(0.0944)	(0.0458)	(0.0121)	(0.0373)	(0.0729)	(0.0408)	(0.0858)	(0.0755)	(0.0645)	(0.1214)
Sector-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	151,670	38,827	1,402	838	9,390	59,633	6,038	11,303	7,299	2,857	8,098	5,812	130
Sectors	47	19	1	2	1	3	5	1	4	1	5	4	1
Adjusted R^2	0.0317	0.0425	0.0661	0.0522	0.0301	0.0311	0.0241	0.0290	0.0322	0.0151	0.0295	0.0389	0.0315