

Revisiting Zombie firms From survival to revival



December 2025

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Executive summary

Executive Summary

Following the sovereign debt crisis and the Covid-19 pandemic, Greek firms have faced a mix of new opportunities, persistent challenges and external threats. This study examines the period 2015–2023, encompassing both the recovery phase and the pandemic's impact on the Greek corporate sector, with the primary objective of identifying the presence and characteristics of “zombie” firms within the economy, using firm-level data from Orbis database.



Economic recovery and firm performance

- ▶ Following the 2 crises, **Greece's economic growth supported business activity** and contributed to the gradual decompression of the economy.
- ▶ In the post-Covid era, **Greek firms managed to improve their profitability** reflecting financial stabilisation and demonstrating a **strong rebound**.
- ▶ A **typical Greek firm** during this period exhibited **low leverage** and **adequate liquidity**.



Zombie firms: characteristics and performance

- ▶ Zombie companies exhibit weaker business activity and liquidity. A **typical (median) zombie company is smaller in terms of revenue, more reliant on debt, faces greater difficulty in meeting short-term obligations, and is generally older**.
- ▶ The **profitability gap between zombies and non-zombies is on average 21.8%** (2015–2023), underscoring the different performance paths between healthy and non-healthy companies.

Executive Summary



Evolution of zombie firms in Greece

- ▶ **The share of zombie firms has significantly decreased**, reaching **2-4% in 2023**.
- ▶ **COVID-19** caused a **temporary increase in zombie share**, but **levels stabilised in 2021**, supported by government intervention packages.
- ▶ While **support was necessary** and prevented defaults, **it may have delayed restructuring** of financially weak firms, keeping failure rates artificially low (OECD, 2024).
- ▶ **The persistence of firms remaining in zombie status** has also declined to a minimum, with only **1%** of those first classified as zombies in 2015 remaining in zombie status by 2023.
- ▶ By 2021, around **two-thirds (66%) of zombie firms had recovered**, showing that a significant share of Greek firms managed to return to financial health. At the same time, **14% of zombie firms failed and exited the market**.



Firm size and sectoral differences

- ▶ From 2015 to 2023, **zombie shares** averaged **8.1% for micro firms, 2.3% for SMEs, and 1.3% for large firms**, showing that micro firms are the most vulnerable, especially in times of crisis. **By 2023, zombie shares across all size groups reach their lowest levels**, despite a temporary spike during the pandemic.
- ▶ The **share of micro zombies** exhibits significant **volatility**, peaking at **13.8% in 2020**, before rapidly declining in around 5% the subsequent years.
- ▶ **Zombie firms dropped significantly by 68% in 2023**, despite the market's volatility following the economic instability and the pandemic.
- ▶ **Industry, Commerce, and Services** consistently had the **largest numbers of zombie firms in absolute terms** throughout the period, due to their large firm base.
- ▶ **Commerce (77%) and Tourism (75%) recorded the steepest reductions**, while **Industry and Services** also declined notably.



Zombie firms and failure risk

- ▶ **Zombie firms** are about **2.7 times more likely to fail** than healthier firms.
- ▶ **Smaller, newer, and highly leveraged firms** face **elevated failure risk**.

2

What was
examined

Analyse zombies and their link to firm failure

This study examines the **anatomy of the Greek corporate landscape** and the **role of zombie firms** from the **economic recovery** to **Covid-19 crises**.

Our aim is to answer **4 questions**:

*The analysis took into consideration **previous PwC reports on Stars & Zombies** (published in 2015, 2019 & 2021).

01

What are the key characteristics of Greek firms, and what are the special **features that distinguish zombies from healthier firms**?

02

How has the **share of zombie firms** evolved **over time** in Greece?

03

How does the **share of zombie firms** differ by **company size** and across **sectors**?

04

What is the **relationship between zombie firms and firm failure**?

3

Introduction

Greek firms after the sovereign debt and pandemic crises

The following main themes regarding opportunities and challenges faced by Greek firms arise in recent reports from the OECD (2024), the European Commission (2024), and the Bank of Greece (2024).

Opportunities



- ▶ Reduced domestic economic and political uncertainty.
- ▶ Greece's return to investment grade status since 2023 (S&P, Fitch, Moody's).
- ▶ Reduction of Greek sovereign debt from 169% in 2015 to 154% in 2024 as % of GDP.
- ▶ Stronger export performance and record-breaking tourism sector.
- ▶ Access to RRF funds and resolution of NPLs.
- ▶ Increase in investments (gross fixed capital formation) by 81% in 2024 compared to 2015.
- ▶ Investments in digital transformation and green initiatives.

Challenges & external threats



- ▶ Low investment and productivity.
- ▶ High regulatory burden.
- ▶ Large share of micro-firms with limited access to external finance.
- ▶ Climate and geopolitical risk; demographic challenge; trade wars.

Government interventions during the pandemic stabilised the economy but may have delayed necessary restructuring

The **pandemic** demonstrated the **vulnerability of key industries**, such as tourism, to external shocks.

Government support measures helped to stabilise the economy and prevent a massive wave of defaults (IMF, 2021):

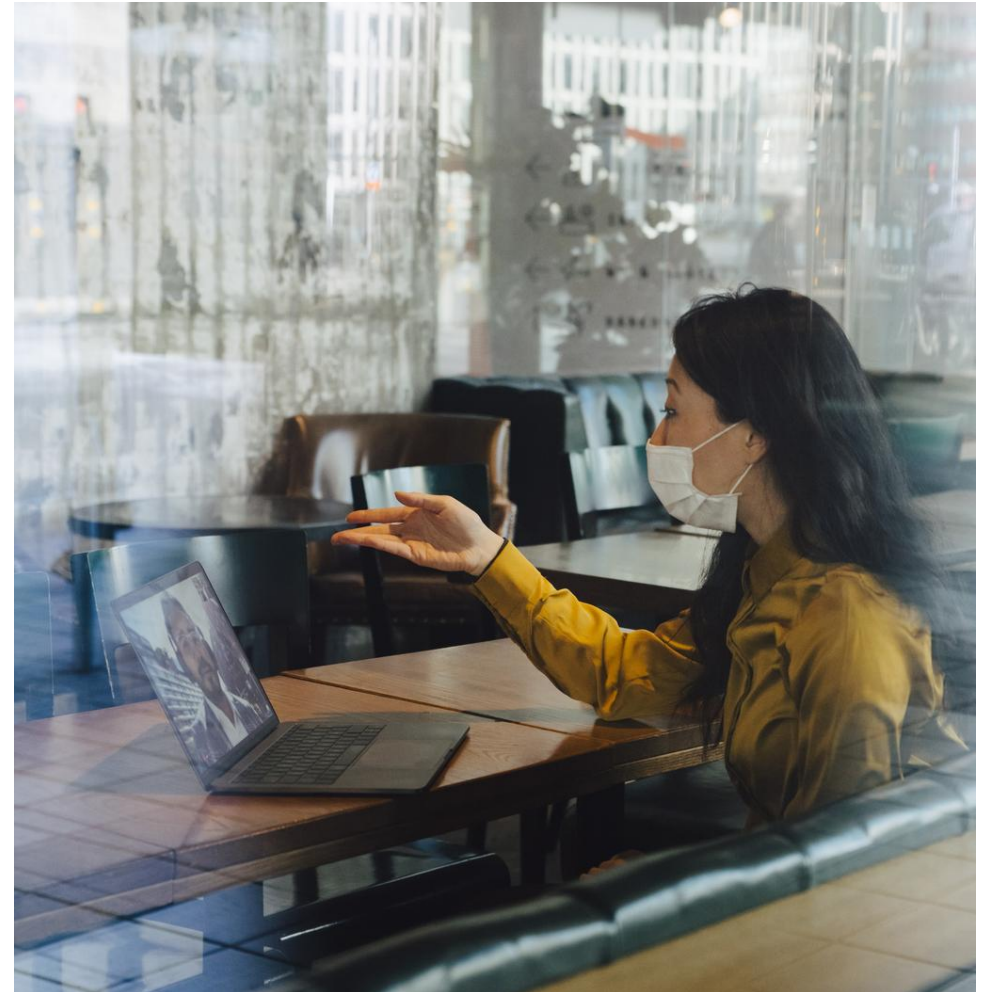


More than €10 bn, through fiscal stimulus and loan guarantees



Bankruptcy rate of Greek SMEs **would increase by 57%** in the absence of policy intervention during Covid-19 (Gourinchas et al., 2020)

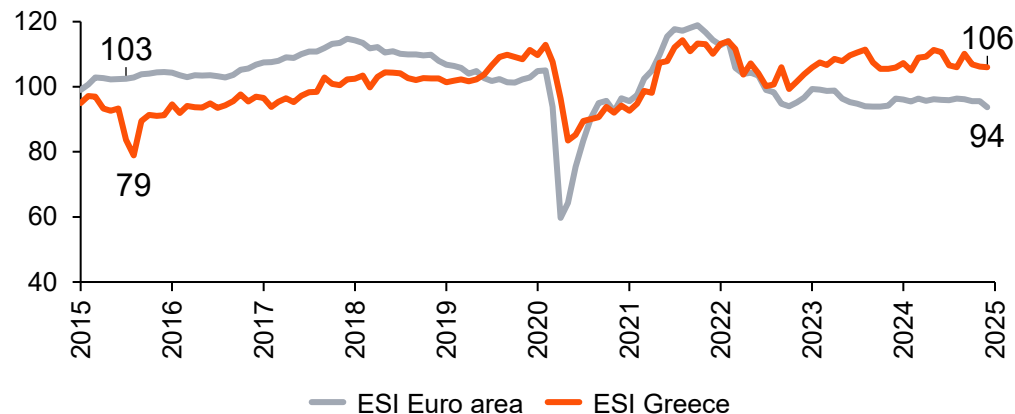
While necessary and successful, **these interventions may have delayed the restructuring of financially weak firms**, keeping fail rates artificially low (OECD, 2024).



Improved macro-finance environment and gradual business lending recovery

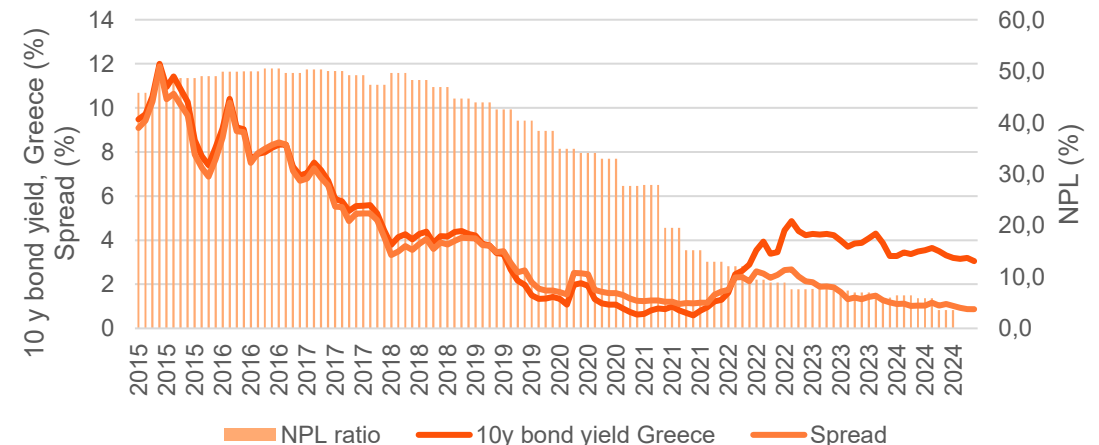
- ▶ **Greek firms have low leverage**, as business lending by Greek banks only improved later in the 2015–2023 period.
- ▶ Despite a **better economic climate and lower sovereign risk**, banks focused on reducing NPLs.
- ▶ This “creditless recovery” follows banking crises, where financial intermediation slows until banks’ balance sheets are cleaned.
- ▶ The efforts of Greek banks yielded significant results, with business **NPLs dropping below 10%** by April 2022.
- ▶ The **sharp decline in the NPL ratio** reflects the success of the “Hercules” government program, which guaranteed NPL securitizations.

Economic Sentiment Indicator



Source: Eurostat

Non-performing business loans ratio*, government bond yield and spread

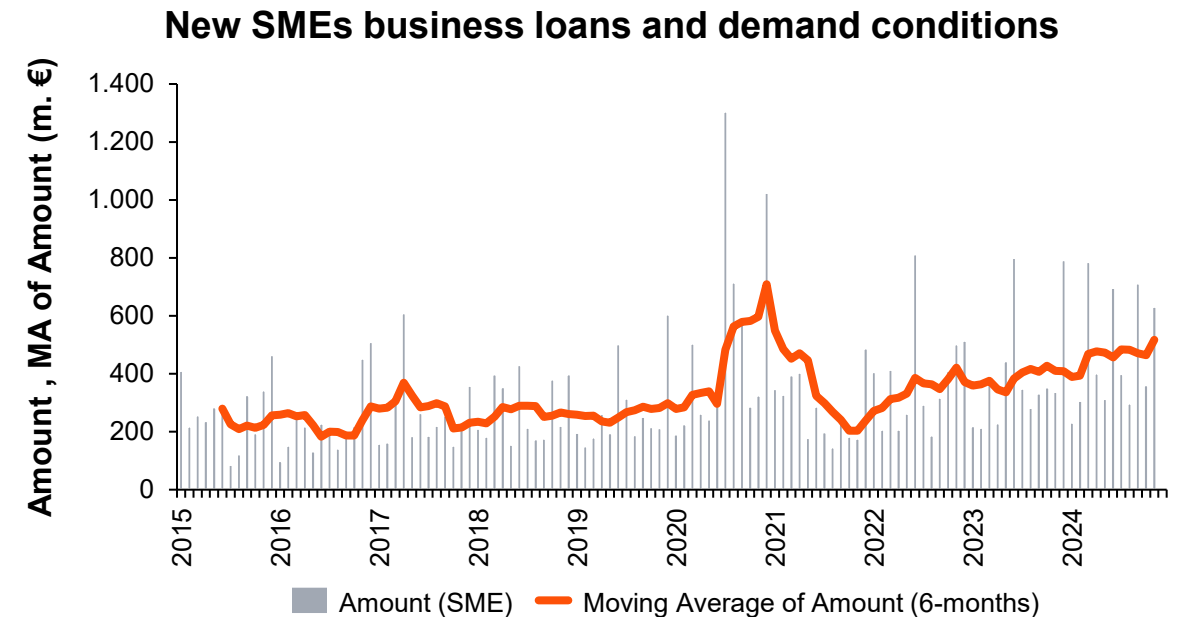
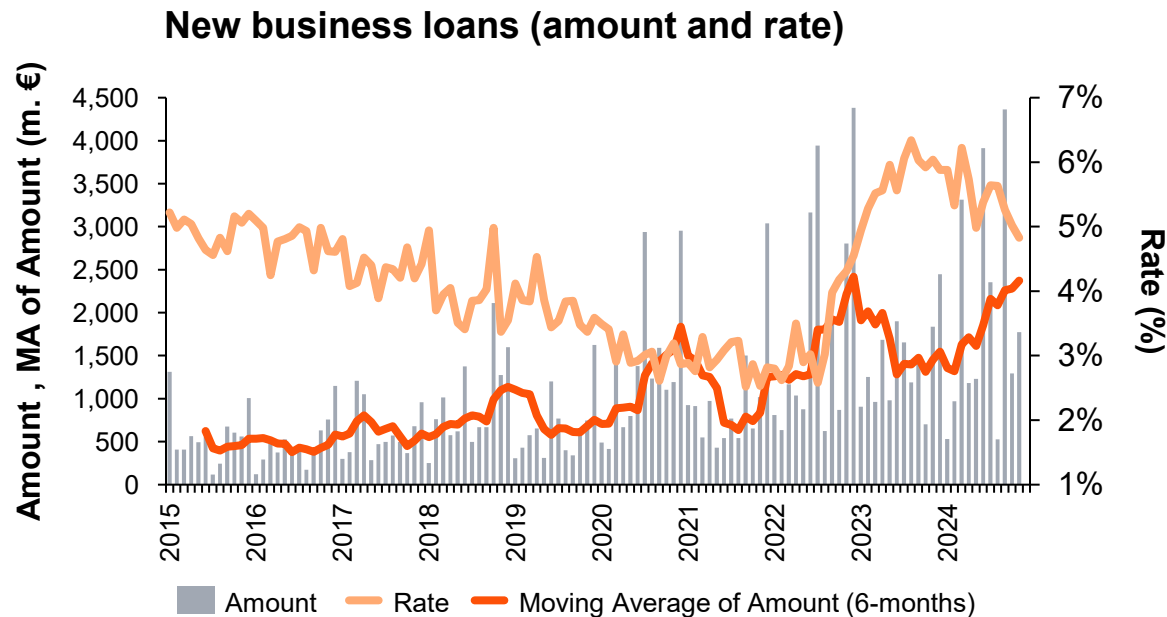


Source: Bank of Greece, Eurostat, Federal Reserve Bank of St. Louis

*NPLs retained by credit institutions.

Business lending to larger firms accelerates but SMEs lending remains relatively weak

- ▶ Since 2022, **business lending has increased**, despite the ECB's tighter monetary policy, which substantially increased borrowing costs.
- ▶ New monthly business lending flows averaged €1.7 bn between 2022 and 2024, compared to €0.8 bn between 2015 and 2021.
- ▶ At the same time, **growth in lending to SMEs was comparatively weaker**.



Source: Eurostat, ECB and Bank of Greece

4

Research Methodology

Our database

Representation of our sample to total economy

- Listed and private firms are included.
- Coverage is significantly higher for larger firms, given less stringent financial reporting requirements for smaller firms.
- The selected companies represent **75% of revenues** of the total Greek corporate economy (2019-2022).



Greek firm-level financial data extracted from Orbis database

To address those questions, we use firm-level data from Orbis (published financial statements), covering **FY2015–FY2023**, a period characterised by the recovery from two major crises.

Sample characteristics

- Fiscal Years examined: 2015-2023
- Initial sample: 31,561 firms
- Final sample: 13,981 firms (average 2015-2023)
- Reporting: Consolidated financial statements

Data cleaning

Excluded sectors: Financial & Insurance, Public Administration, Defense & Social Security

Excluded firms: Firms with a last recorded year before 2014, and those lacking zombie classification.

Methodology - Defining zombie firms

The aim of the study is to identify firms that exhibit persistent financial weakness

There are several alternative definitions in existing studies ranging from low profitability and high leverage to receiving subsidised credit. We built our analysis upon **PwC's previous report (2015) to develop a zombie classification** that differs from commonly used Interest Coverage Ratio (ICR)-based metrics. Zombie firms are identified through a PwC-based metric analysed below, with sensitivity checks using interest coverage ratio measures.

Effectively, the PwC methodology adopts a combination approach, with the key distinction that it does not rely on the ICR but instead on poor performance and either high debt or negative profits. This is particularly important given that the median Greek firm has relatively low leverage. **The PwC methodology appears better suited** to capture the idiosyncratic characteristics of the Greek corporate ecosystem.

Zombies meet all following conditions:

< -5%

CAGR of Turnover

(3-year window)

< 0%

ROCE

(3-year window mean)

> 5 or < 0

Net Debt/
EBITDA

EBITDA

(3-year window mean)

For sensitivity analysis, we also use two ICR-based measures.

Robustness checks with other models (ICR)

For robustness, and to benchmark our findings to the extant literature, **we use two ICR-based measures in addition to the PwC methodology.**

Baseline ICR metric

It follows De Jonghe et al. (2024) and assigns zombie status if all following conditions are met:

- 3-year Accumulated Recurring Cash Flows (EBITDA plus Financial Revenues) < 3-year Accumulated Interest Expenses
- Recurring Cash Flows fail to cover Interest Expenses in a minimum of two of the three individual years
- Age \geq 10 years

Alternative ICR metric

It classifies a firm as zombie when:

- $ICR < 1$ for 3 consecutive years, where $ICR = EBIT / \text{Financial Expenses}$;
- Age \geq 10 years

This measure, proposed by Adalet McGowan et al. (2018), is often used in the literature.



Overall, **similar insights** are obtained from the analysis of the ICR-based measures.

The **main difference** is that the **PwC measure highlights the impact of the Covid-19 crisis**, capturing a temporary increase in zombie classification due to pandemic-related financial distress.

5

Key characteristics of Greek firms, and the distinguishing features of zombie firms

Greek firms have successfully transitioned from crisis to growth

Greek firms have **overcome setbacks from the Covid-19 crisis**. In particular, they showed:

Strong aggregate sales

Total turnover more than doubled since 2015, signalling a robust post-crisis rebound after the Greek debt crisis.

Swift rebound from Covid-19 disruption

Turnover dropped significantly in 2020, reflecting the economic shock, but businesses rebounded swiftly, supported by policy measures and demand resurgence.

Improved profitability

Total EBIT tripled since 2015, and the median EBIT margin rose, highlighting firms' ability to increase efficiency.

Business growth

Total capital employed expanded.

Financial stabilisation

Total debt rose, but solvency deteriorated only during 2020, with a strong recovery in 2021-2022, reflecting financial stabilisation.

A typical Greek firm shows low leverage and adequate liquidity

12%

Leverage ratio (Total debt/Total assets)

145%

Liquidity ratio (Current assets/Current liabilities)

5%

Profitability ratio (EBIT/Turnover)

Source: Orbis, PwC analysis

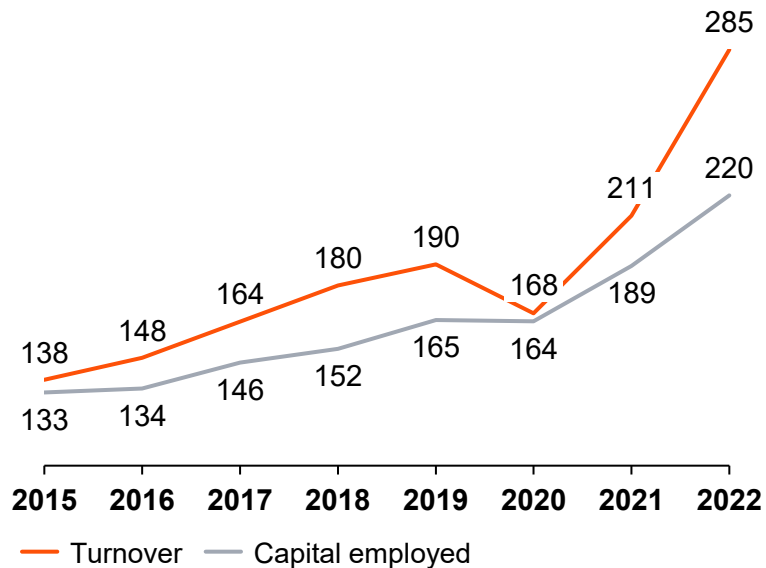
A representative (median) Greek firm has:

| Variable | Median |
|-----------------------------|--------|
| Assets | 2.942 |
| Turnover | 2.240 |
| EBIT | 0.127 |
| Net income | 0.063 |
| Profitability (EBIT margin) | 5% |
| Short-term debt | 0.040 |
| Long-term debt | 0.039 |
| Leverage (Debt/Assets) | 12% |
| Solvency (Equity/Assets) | 39% |
| Liquidity (Current ratio) | 145% |
| Age (years) | 19 |

Assets, Turnover, EBIT, Net Income and Debt are expressed in € mn.

In the post-pandemic era, Greek firms showed a strong rebound

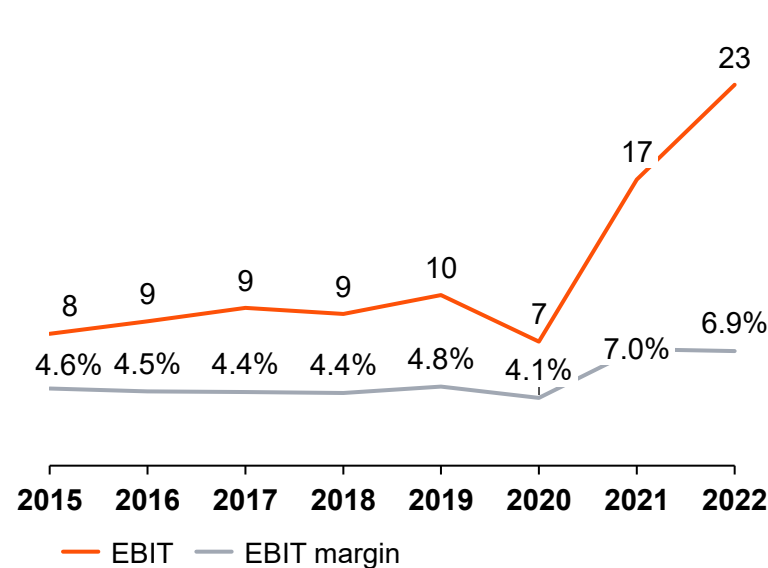
Turnover & Capital Employed (€ bn)



Between 2015 and 2022, **Greek firms marked significant business growth** as:

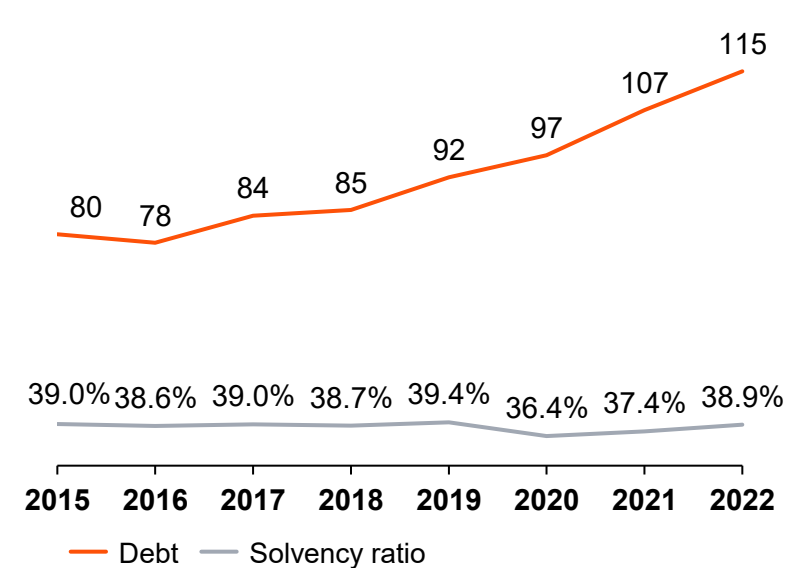
- Turnover increased by 107%
- Capital employed increased by 65%

EBIT (€ bn) & EBIT margin (%)



During the last 2 years their **profitability was remarkable** with total EBIT margin being around 7%.

Total Debt (€ bn) & Solvency ratio (%)



Their debt surpassed €100 bn, but they **stabilised their solvency ratio**, thus **improving their profitability**.

Zombies are more fragile, compared to non-zombie firms

Following the application of the “zombie” criteria, we separate zombie and non-zombie firms.

Zombie companies show **weaker business activity and liquidity**.

In particular, a **typical (median) zombie company**:

- is **smaller** in terms of revenue
- **relies more on debt**
- shows greater **difficulty in meeting short-term obligations**
- tends to be **older** than a non-zombie one

Note: Overall similar insights with ICR-based measures of zombie classification (refer to Appendix).

Source: Orbis, PwC analysis

| Variables | Non-zombie Median | Zombie Median |
|-----------------|-------------------|---------------|
| Assets | 3.391 | 3.727 |
| Turnover | 2.698 | 0.817 |
| EBIT | 0.165 | -0.130 |
| Net income | 0.084 | -0.180 |
| Profitability | 6% | -15% |
| Short-term debt | 0.053 | 0.102 |
| Long-term debt | 0.061 | 0.186 |
| Leverage | 13% | 27% |
| Solvency | 40% | 25% |
| Liquidity | 148% | 113% |
| Age (years) | 19 | 22 |

Assets, Turnover, EBIT, Net Income and Debt are expressed in € mn.

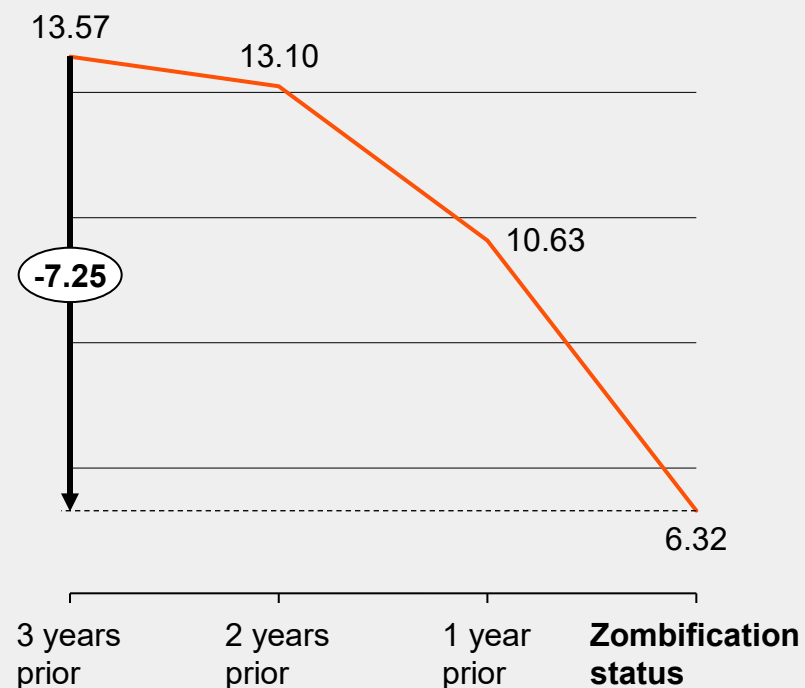
Prior to “zombification”, firm fundamentals worsen

Firm performance deteriorates ahead of a firm being classified as zombie, with falling average turnover and EBIT across zombie firms.

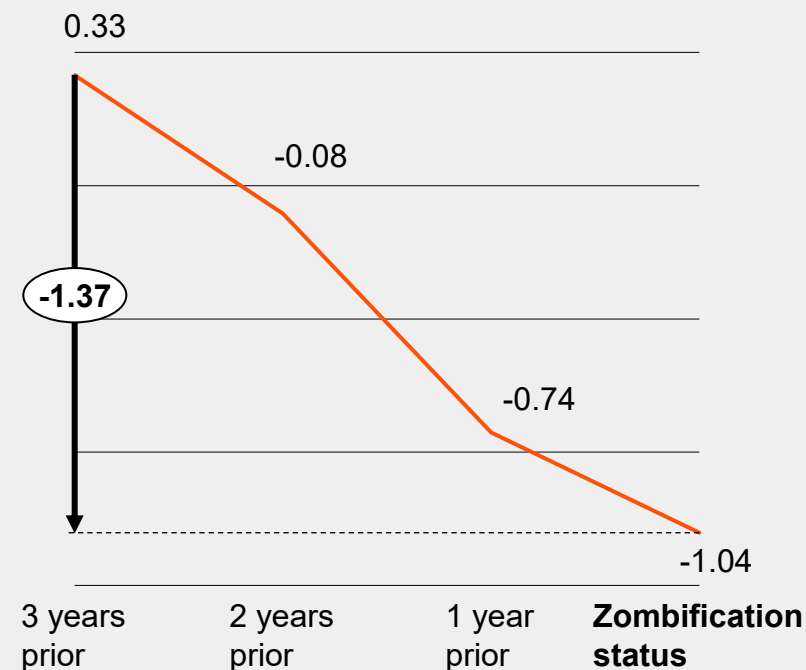
Declining Turnover and EBIT can be perceived as a **signal for zombification** strengthening the need for prevention.



Turnover prior to zombification status (€ mn)



EBIT prior to zombification status (€ mn)



Note: Figures present the annual average turnover and EBIT of zombie firms (expressed in € mn) over the three years that precede the zombification (first time that the firm is classified as zombie using PwC methodology).

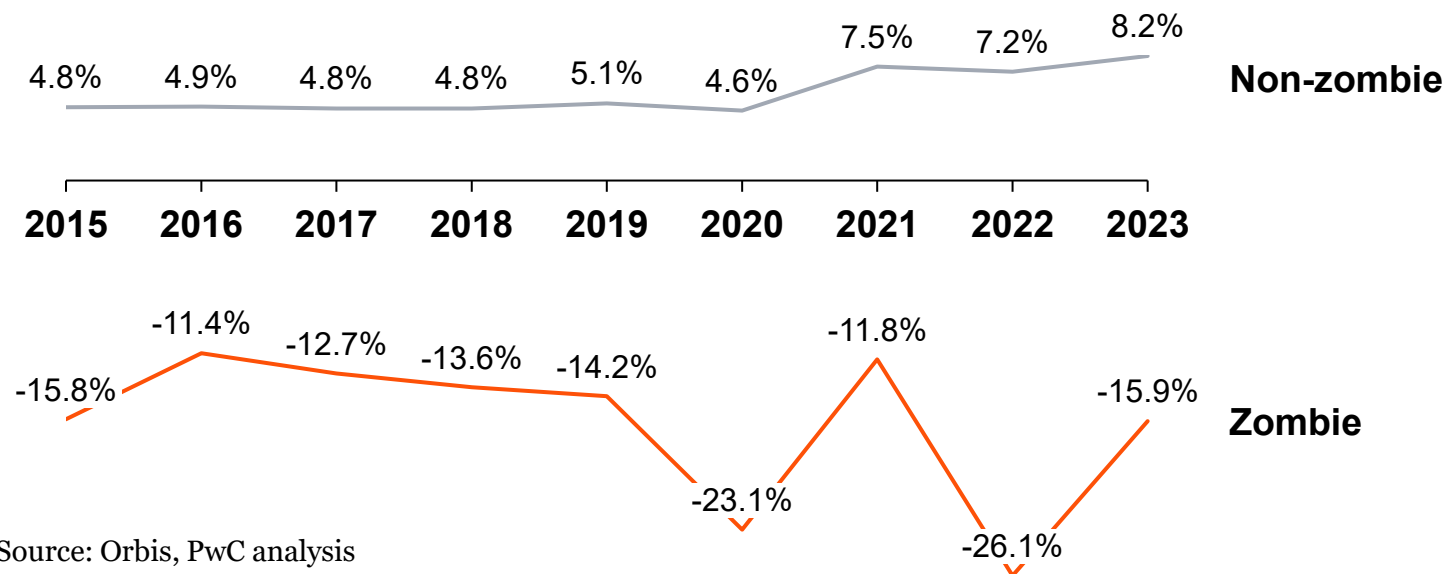
Source: Orbis, PwC analysis

In terms of profitability, the gap is large and persistent

The ever-widening gap

While healthy firms' profitability ratio is increasing through the years, zombie firms face significant challenges. Their profitability ratio is consistently negative and deteriorated significantly during the Covid-19 crisis.

Median profitability ratio of non-zombie and zombie firms 2015-2023



Source: Orbis, PwC analysis



26.1%
average gap for
the period
2020-2023

18.4%
average gap for
the period
2015-2019

As non-zombie firms are becoming healthier, the zombie ones still face challenges



In the post-Covid era, **Greek firms** have managed to **increase their profitability** reflecting **financial stabilisation**. They expanded their business activity leading to a significant rebound.



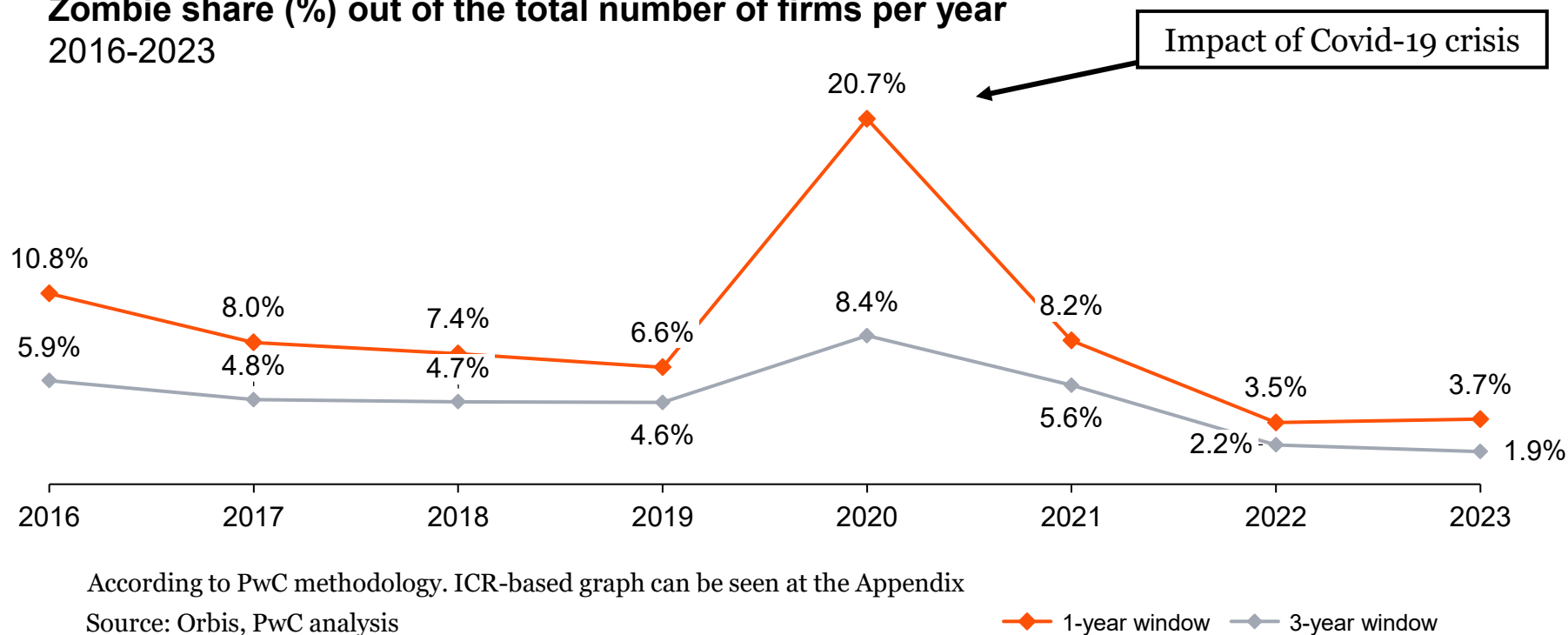
Nevertheless, zombie firms still lack on improving their profitability which shows significant fluctuations and remains negative. In fact, during the last 4 years **the gap between non-zombie and zombie firms' profitability has increased by 7.7 pps.**

6

The evolution of the
share of zombie firms
in Greece over time

Proportion of zombie firms has declined over time

Zombie share (%) out of the total number of firms per year
2016-2023



Around

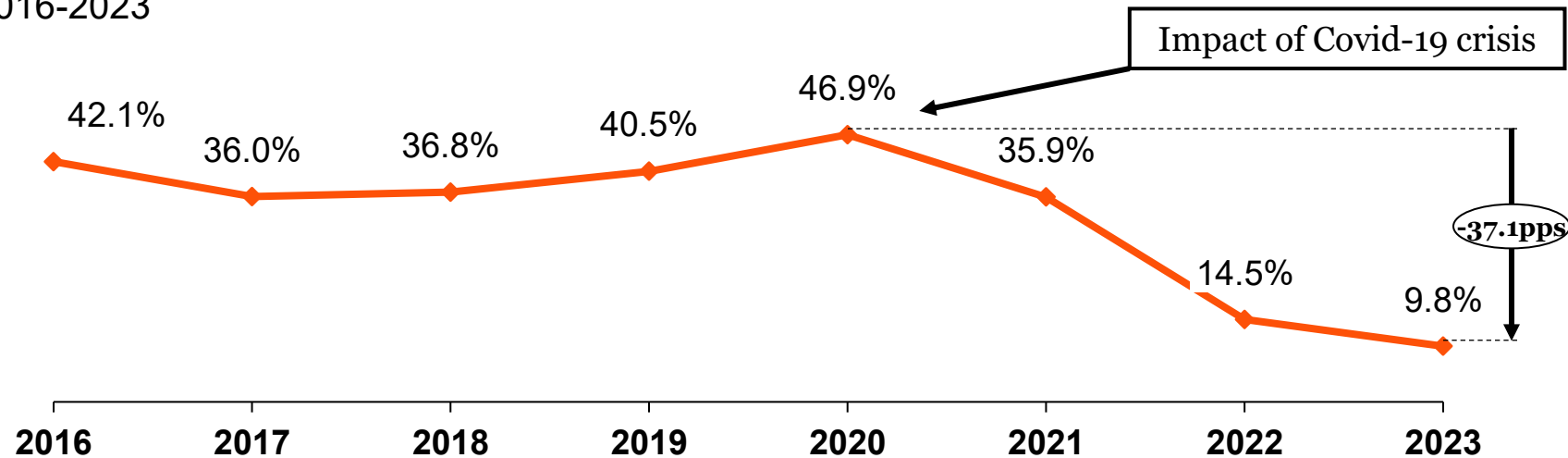
2-4%

the **proportion of zombie firms** has declined over time, reaching its lowest level in 2023.

- ▶ Using either the baseline zombie classification approach (based on conditions met over a 3-year window) or a less restrictive approach (using 1-year window), the **zombie share declines over time**. Higher overall zombie share with less strict criterion, e.g. 11% in 2016.
- ▶ The PwC methodology highlights the **impact of the Covid-19 crisis**, as evidenced by the strong increase in the zombie share between 2019 and 2020, which **could have been worse without the Greek government intervention** (Gourinchas et al., 2020; IMF, 2021).
- ▶ **ICR methodology shows a similar decline over time**. ICR-based zombie share reached its lowest level in 2023 (see Appendix).

Zombies that are persistent over time have been reduced by 2023

Persistent zombies in a given year as a share (%) of the number of zombies in previous year
2016-2023



Below

10%

the **zombie persistence** has declined over time, reaching its lowest level in 2023.

Note: Persistence is the proportion of firms that remain classified as zombies in current year using PwC methodology relative to the number of zombies in previous year. ICR-based graph can be seen at the Appendix

Source: Orbis, PwC analysis

- ▶ **Persistence** significantly declined after the Covid-19 crisis by 37pps.
- ▶ **ICR methodology shows a similar decline over time.** Zombie persistence decreased from 60% in 2016 to 20% in 2023 under both ICR measures (see Appendix).

Only few long-term zombies remain

Persistence rates of zombie firms by year-cohort (in percentage)

| Cohort | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|--------|------|------|------|------|------|------|------|------|------|
| 2015 | 100 | 42 | 20 | 10 | 13 | 14 | 8 | 5 | 1 |
| 2016 | | 100 | 34 | 13 | 13 | 19 | 13 | 3 | 1 |
| 2017 | | | 100 | 38 | 20 | 20 | 12 | 8 | 2 |
| 2018 | | | | 100 | 40 | 24 | 14 | 6 | 3 |
| 2019 | | | | | 100 | 52 | 21 | 6 | 2 |
| 2020 | | | | | | 100 | 37 | 5 | 1 |
| 2021 | | | | | | | 100 | 19 | 3 |
| 2022 | | | | | | | | 100 | 9 |
| 2023 | | | | | | | | | 100 |

1%

of firms first classified as zombies in 2015 remained in zombie status by 2023

Figures in each row (cohort) report how firms flagged as zombies in a certain year survive over time. They are computed as the ratio of the number of remaining zombie firms to the number of zombie firms in the year in which they became zombies. Zombie classification uses the PwC methodology.

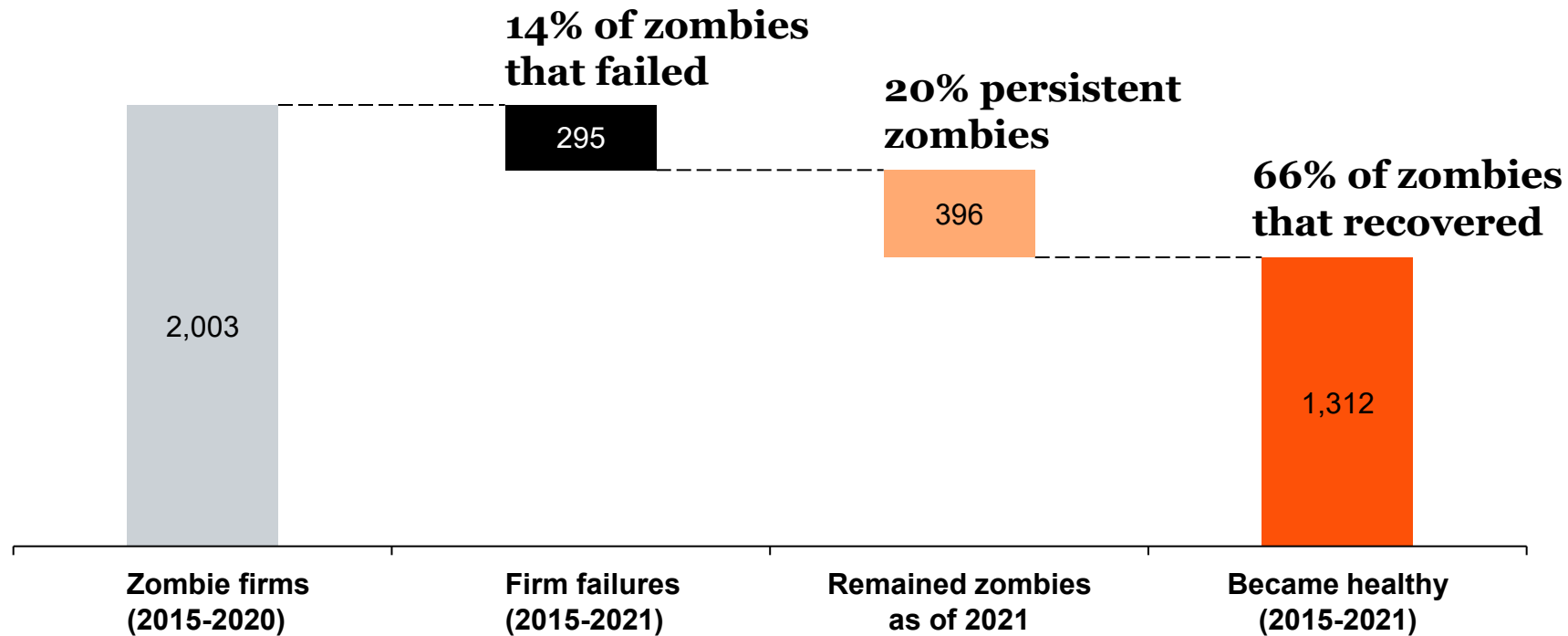
Source: Orbis, PwC analysis

- ▶ On average, **42% of 2015-cohort zombie firms remain in the same status one year after having been flagged as zombie**. However, this number decreases significantly to 10% after three years, meaning that only 10% of these firms continue to struggle three years later.
- ▶ Zombie persistence significantly declined over time. **Only 1% of firms classified as zombies in 2020, remain in that status by 2023.**

Two-thirds of zombie firms recovered within 2015 and 2021

Evolution of zombie firms (2015-2021)

New zombie firms per year (first classification)



Source: Orbis, PwC analysis



- Between 2015 and 2020, a total of **2,003 firms** were classified as **zombies**.
- By 2021, around **two-thirds (66%) of zombie firms had recovered**, showing that a significant share of Greek firms managed to return to financial health in the aftermath of the sovereign debt crisis and the pandemic.
- **One in five (20%) remained trapped in zombie status**, unable to recover or return to financial health. These businesses hinder the release of capital into the market, which could otherwise be utilised by healthier companies.
- At the same time, **14% of zombie firms failed** and exited the market.

Zombies outlook: persistence, exit and recovery

- ▶ The **proportion* of zombie firms has declined significantly**, reaching its lowest level in 2023 at around 2-4%, though the **Covid-19 crisis triggered a temporary increase** in the zombie share.
- ▶ On top of the drop in the share of zombie firms, the **persistence of firms remaining in zombie status** has also **declined to a minimum**, with only 1% of those first classified as zombies in 2015 remaining in zombie status by 2023.
- ▶ By 2021, **around two-thirds (66%) of zombie firms had recovered**, showing that a significant share of Greek firms managed to return to financial health in the aftermath of the sovereign debt crisis and the pandemic.
- ▶ At the same time, **14% of zombie firms failed** and exited the market.
- ▶ These developments are most likely to reflect an **improved economic climate post-2015**, along with **government support packages during Covid-19**, mitigating the overall financial fragility.

*Share of zombie firms and zombie persistence have similar decline over time both in ICR and PwC methodology.





The share of zombie firms by firm size and across sectors

How sector and size differentiate the “zombie” status?

We aim to identify whether a firm’s turnover/size exposes it to “zombification”. In addition, it is essential for our analysis to investigate the role of economic activity to a company’s “healthy” status.

Firm size

For our analysis we used the **European Commission’s classification** of firms by size based on their annual turnover.

In particular, the firms are classified as follows:

- **Micro firms:** < €2 mn (40% of sample)
- **SMEs:** €2-50 mn (55%)
- **Large firms:** > €50 mn (5%)

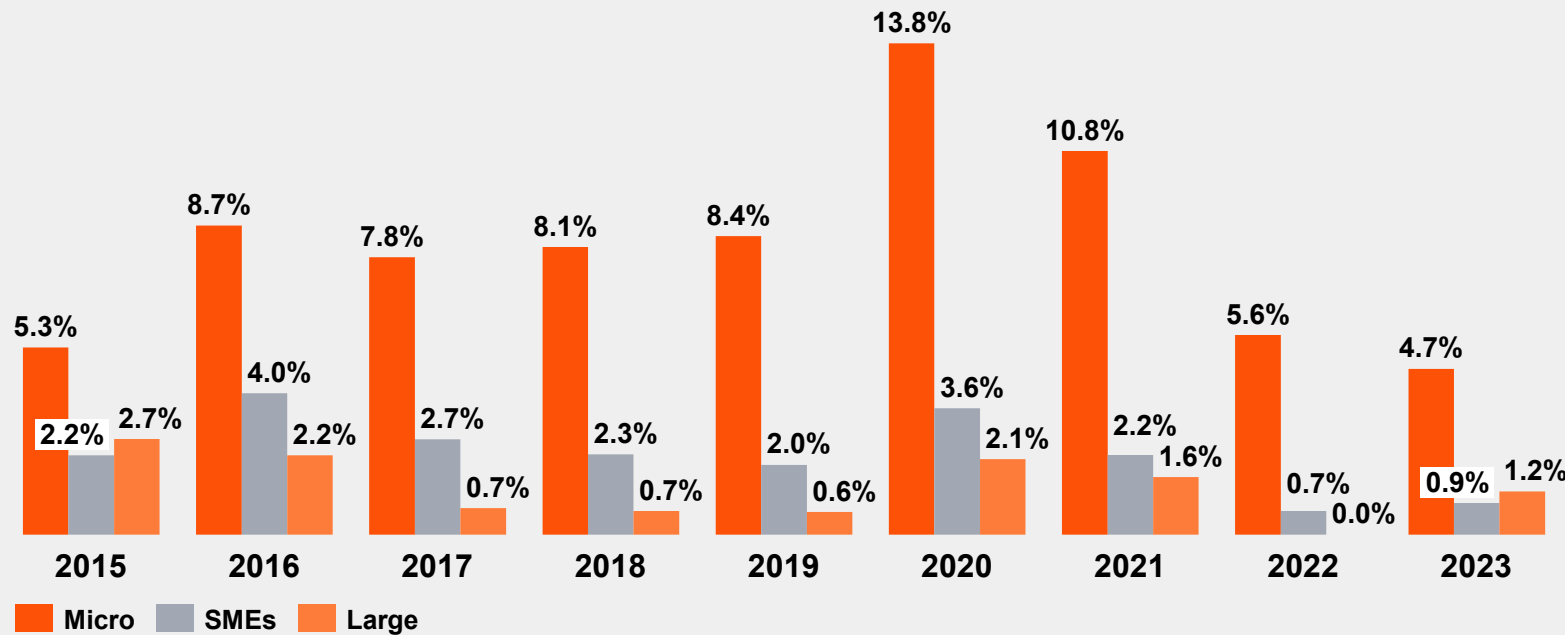
The sampled Greek companies are **classified in seven sectors** according to the type of economic activity (based on the **PwC classification**):

1. **Industry:** Comprised of companies that are part of heavy and light industry, food and beverage production, pharmaceutical companies, and energy companies (petroleum refining and renewable energy sources).
2. **Commerce:** Comprised of companies active in retail and wholesale commerce, fuel retail, and food and beverage commerce.
3. **Services:** Consist of enterprises that are active in providing services to other companies, as well as entertainment, IT and transportation companies.
4. **Investment companies:** Comprised of companies specialising in leasing and real estate-related services.
5. **Tourism:** Including hotel companies, travel agencies, car rental companies and cruise enterprises.
6. **Infrastructure:** Consists of telecommunication service providers and utility companies.
7. **Construction:** Comprised of companies engaging in building-related activities.

Sectors

Micro firms are the ones who are the most vulnerable, especially in times of crisis

Share of zombie firms by firm size
2015-2023



Source: Orbis, PwC analysis

- The **share of micro zombies** exhibits significant volatility, **sharply increasing during 2020**, but **then rapidly declining** following the pandemic.
- **Micro firms** are **more sensitive** to economic conditions.
- **SMEs and large** companies have a small zombie share in the economy overtime.
- By **2023**, **zombie shares** across all size groups reach their **lowest levels**.

Average zombie share
(2015-2023)

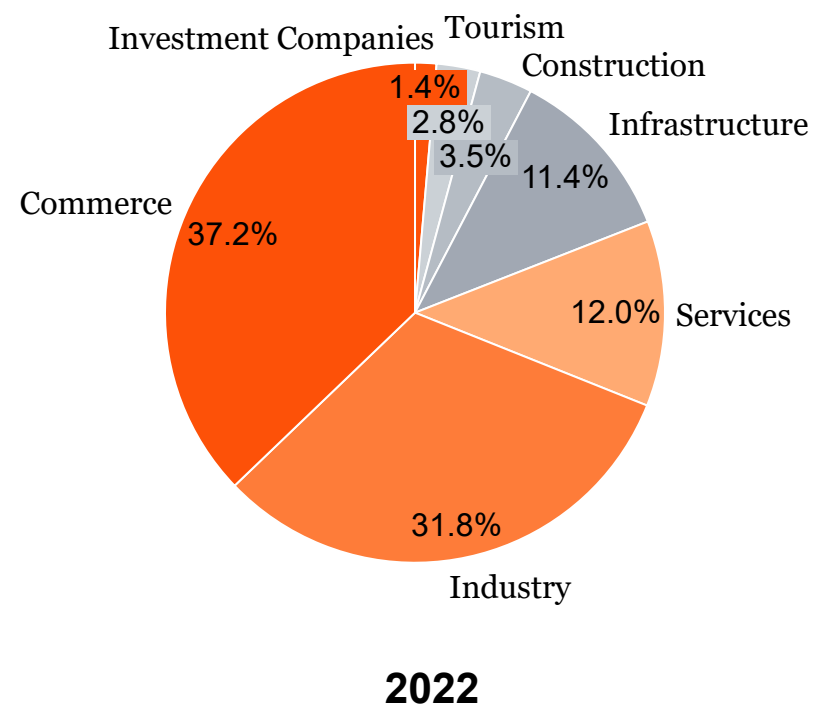
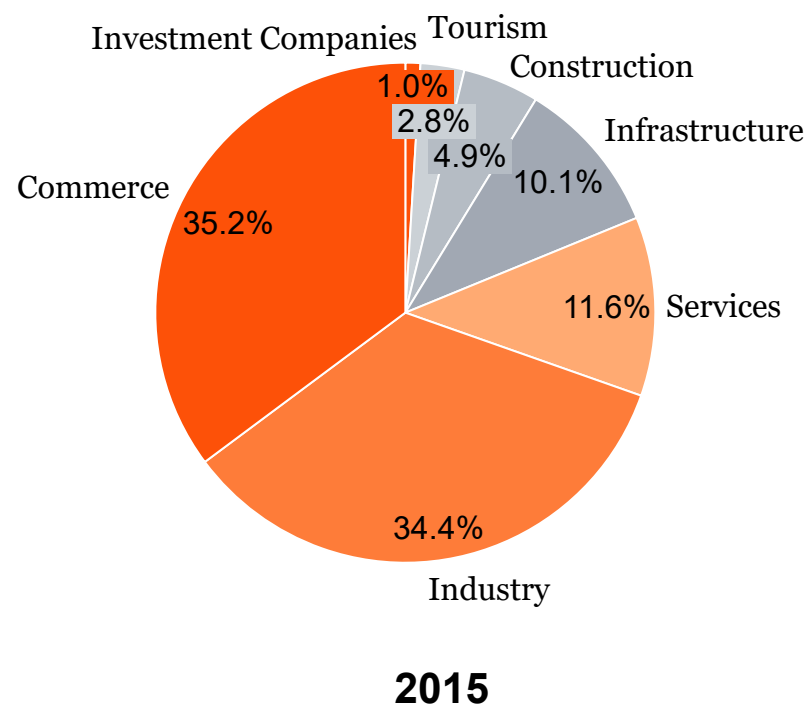
8.1%
Micro firms

2.3%
SMEs

1.3%
Large firms

The relative contribution of each sector to the total turnover remains stable over time

Sectoral share (%) of total turnover
2015 & 2022

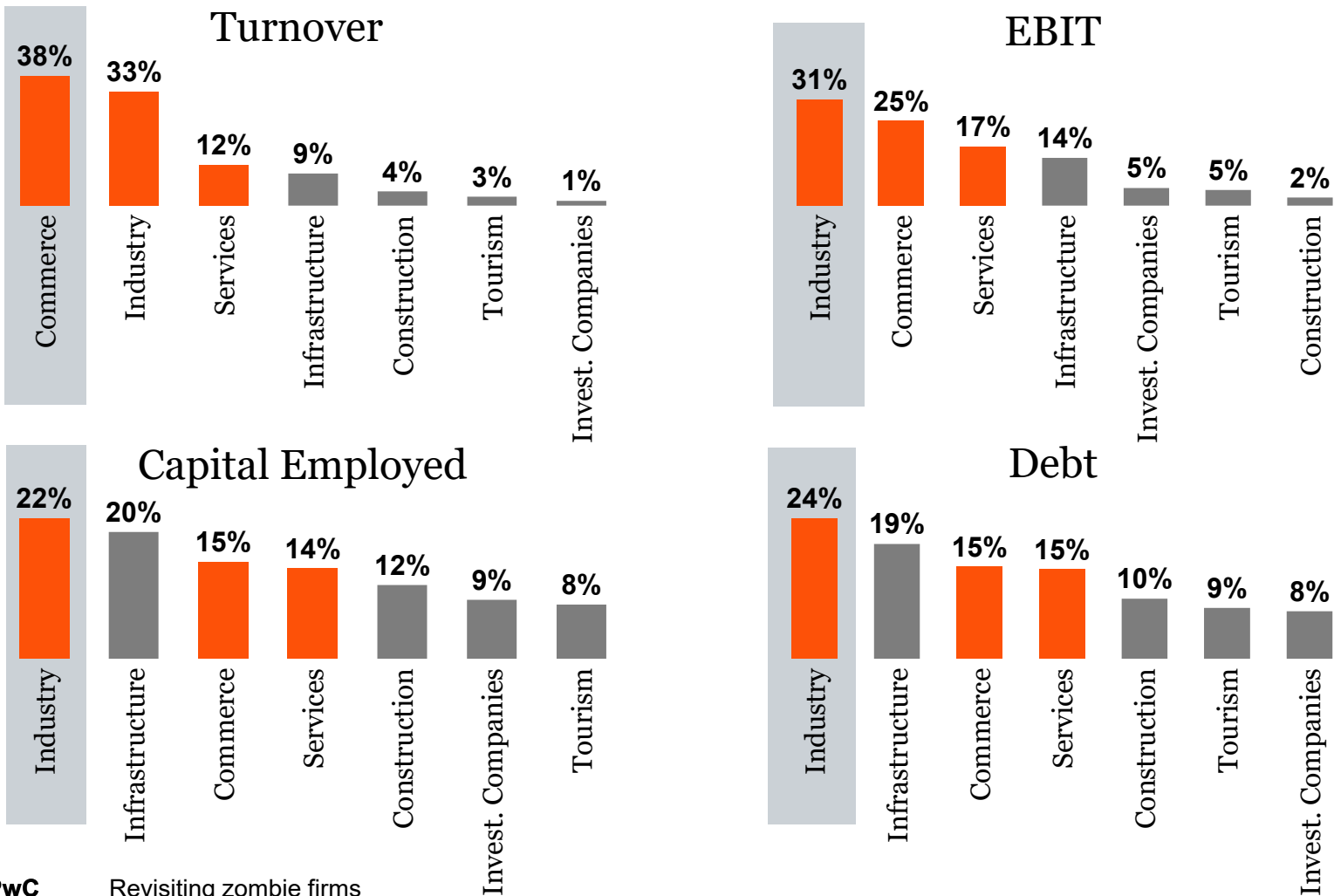


37.2%
(2022)
the highest share in the
firms' total turnover
observed in **Commerce**

Source: Orbis, PwC analysis

Industry, Commerce and Services are the top sectors in terms of financial performance

Sectors' share in the total value (cumulative value across 2015-2023)



Industry, Commerce and Services represent:

83% of total Turnover

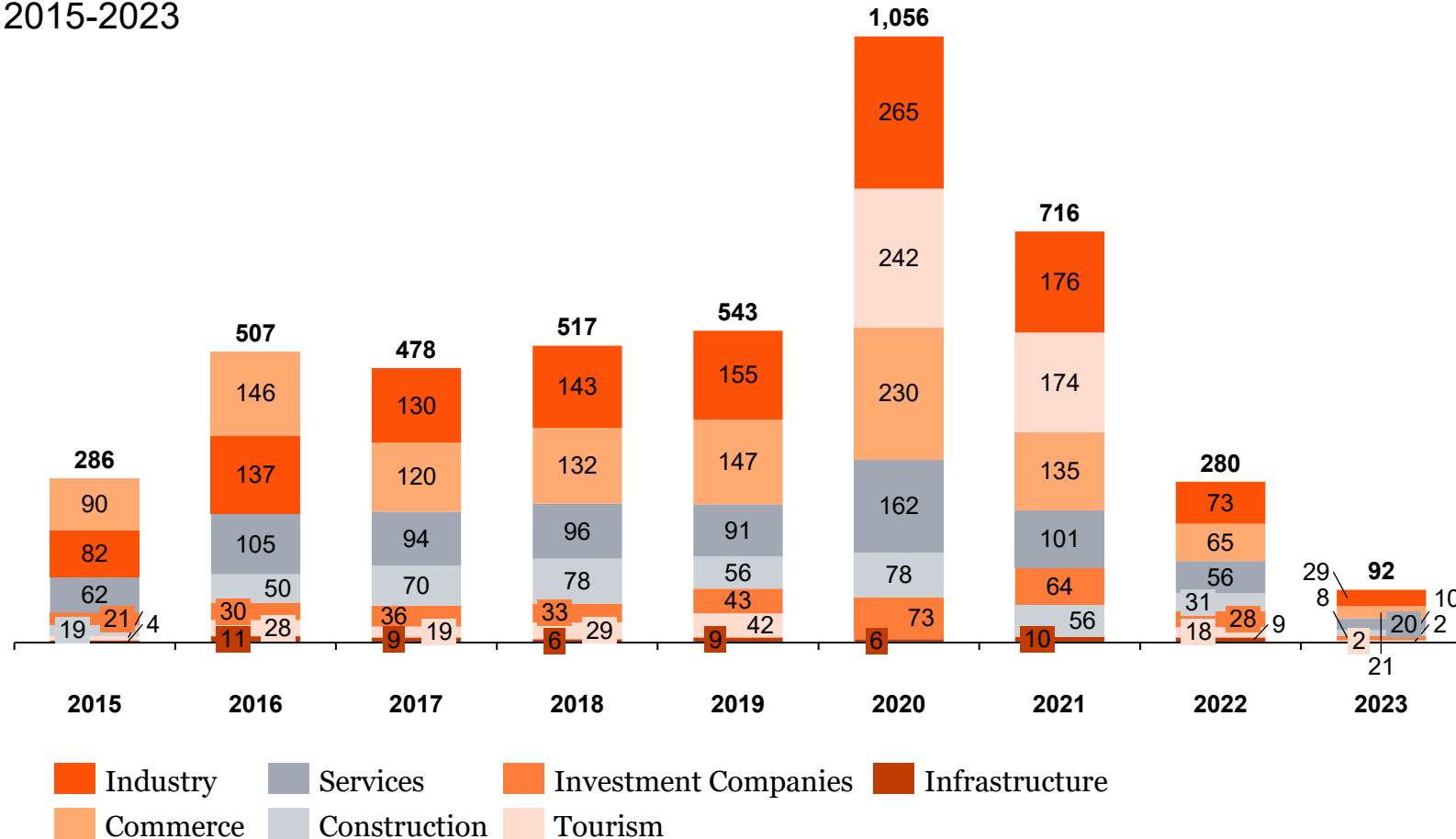
73% of total EBIT

51% of total Capital Employed

54% of total Debt

The total number of zombie firms declined by 68% in 2023

Total number of Zombie firms* per sector
2015-2023



Source: Orbis, PwC analysis

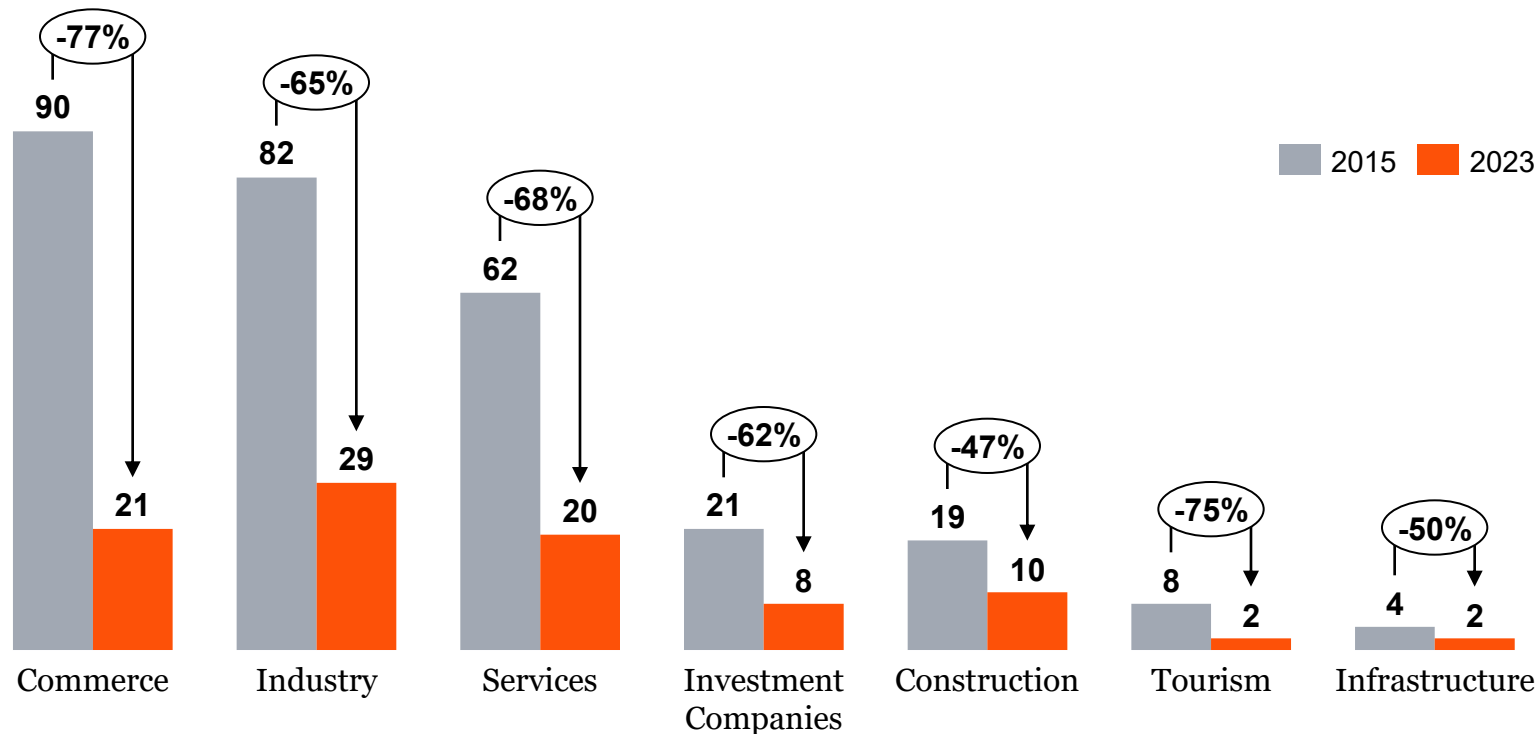
*Total number of firms classified as zombies each year



- The **total number** of zombie firms **declined by 68% in 2023**, despite the market's volatility following the economic crisis and the pandemic. The number of zombie firms peaked in 2020 as a result of the pandemic.
- **Industry, Commerce, and Services** recorded the **largest number of zombie firms** throughout the period – which is expected given the large number of firms in these sectors.
- **Tourism** experiences a significant increase during the pandemic, followed by a **rapid rebound** once restrictions were lifted.

Commerce and Tourism recorded the steepest reduction in zombie firms

Total number of Zombie firms* per sector
2015 vs 2023



*Total number of firms classified as zombies each year
Source: Orbis, PwC analysis



- Almost all sectors have **reduced** the zombie firms in absolute number by **more than 50%**, reflecting a **broad trend of recovery** and improved business sustainability across all sectors.
- **Commerce (-77%)** and **Tourism (-75%)** recorded the **steepest reductions** in zombie firms, while **Industry** and **Services** also recorded significant declines.
- **Tourism** and **Infrastructure** have small number of zombies over time.

Highest zombie concentration in micro, Industry and Commerce sectors

Micro firms are the most vulnerable

From 2015 to 2023, **zombie shares averaged 8.1% for micro firms, 2.3% for SMEs, and 1.3% for large firms**, showing that micro firms are the most vulnerable, especially in times of crisis.

The **share of micro zombies exhibits significant volatility**, peaking at 13.8% in 2020, before rapidly declining in around 5% the subsequent years.

Despite this decline, **micro firms** still present a **high sensitivity**.

In contrast, **large firms and SMEs** have managed to overcome their difficulties **reaching by 2023 their lowest zombie levels historically**.

Zombie firms have declined across all sectors

Zombie firms dropped significantly by 68% in 2023, despite the market's volatility following the economic crisis and the pandemic.

Industry, Commerce, and Services consistently had **the largest numbers of zombie firms in absolute terms** throughout the period, due to their large firm base.

Commerce (-77%) and Tourism (-75%) recorded the steepest reductions, while **Industry and Services** also **declined** notably.



The relationship between zombie firms and firm failure

Methodology

Aiming to understand **why some Greek companies survive while others fail**, focusing on the **impact of Zombie firms on fail rate**, we employ an econometric survival model to analyze the drivers of firm failure and make reliable conclusions.

Fail rate: The ratio of **failed firms to the total number of firms** in the given year.

Identifying

Identifying firm failure, we include:

- Firms that apply to the failure status based on Orbis: Active (insolvency proceedings); Bankruptcy; Dissolved; Dissolved (liquidation); In liquidation; Inactive (no precision)
- Firms that appear as “Active” but produced last financial statement until 2021 (based on “Last Available Year” in Orbis)

We **assume** that **firms fail in the last year they published financial statements**

We **exclude 2022 & 2023** since the **reliability of failure classification declines**

The determinants of firm failure we choose using the proportional hazard model (Cox, 1972):

$$h(t, X_i) = h_0(t) \exp(\beta X_i + \gamma Z_i)$$

- h is conditional hazard rate: probability of failure conditional on surviving up to year t and on the covariates; $h_0(t)$ is baseline hazard rate

Covariates include:

- Total assets (log), Leverage, Profitability, Liquidity, Age (log)
- A dummy variable reflecting firm’s zombie status ($Z_i = 1$ if zombie and 0 otherwise)

Year and Sector are **included** as **fixed effects**

Modelling

The smaller the firm, the higher the fail rate

Fail rate in micro firms triple relative to large firms

Over the period 2015-2021, the **average fail rate among all companies is 2.44%**, while the average fail rate **in zombie firms** is highest hovering at **3.97%**

Average fail rate ranges from:



Average fail rate is **3.26%** in **micro firms**



Average fail rate is **1.8%** in **SMEs firms**



Average fail rate is **0.91%** in **large firms**

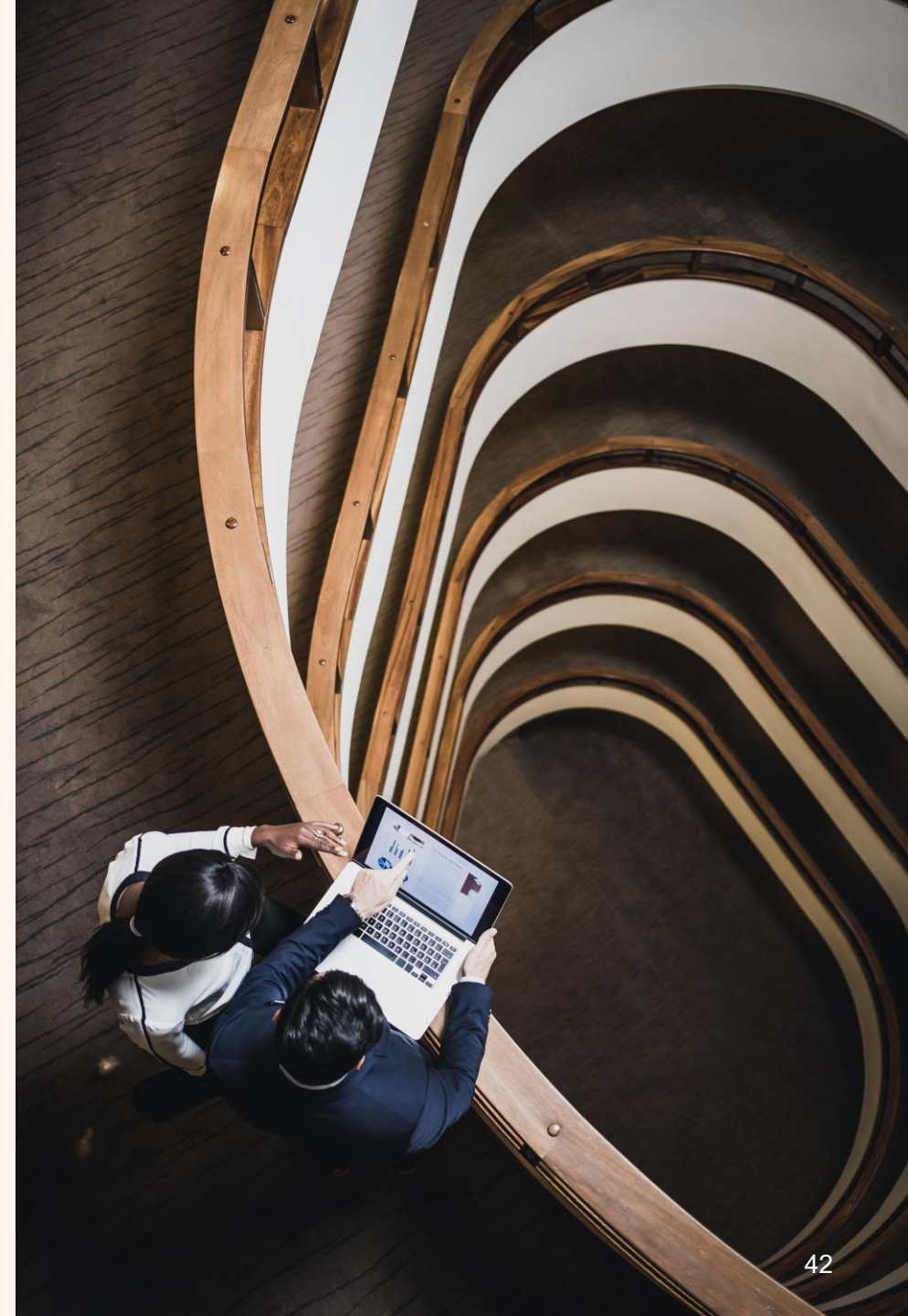


Government support packages blunted the impact of the pandemic

The **effect of the pandemic of average firm fail rate** would have been **significantly stronger in the absence of the Government interventions** (Gourinchas et al., 2020).

Econometric approach step-by-step

- ▶ We start by estimating **the effect of each of the covariates in turn on firm probability of failure.**
- ▶ Then, we include **all the covariates in a single model.**
- ▶ We also **winsorize** all continuous variables at the 1st and 99th percentiles.
- ▶ Main focus is on the **link between zombie status and probability of failure.**
- ▶ Finally, we turn our attention to the **sectoral fixed effects** to identify **which sectors exhibit significantly higher (or lower) probability of failure.**



Zombies face more than double risk of failure and smaller, newer and high leveraged firms are more likely to fail

- ▶ **Larger firms** face a **lower likelihood of failure**
- ▶ **Higher leverage** increases failure risk
- ▶ **More profitable firms** have a **lower** probability of failure
- ▶ **Older firms** exhibit **lower failure rates**

Zombies have **2.7** times higher risk of failure

Survival analysis 2015-2021

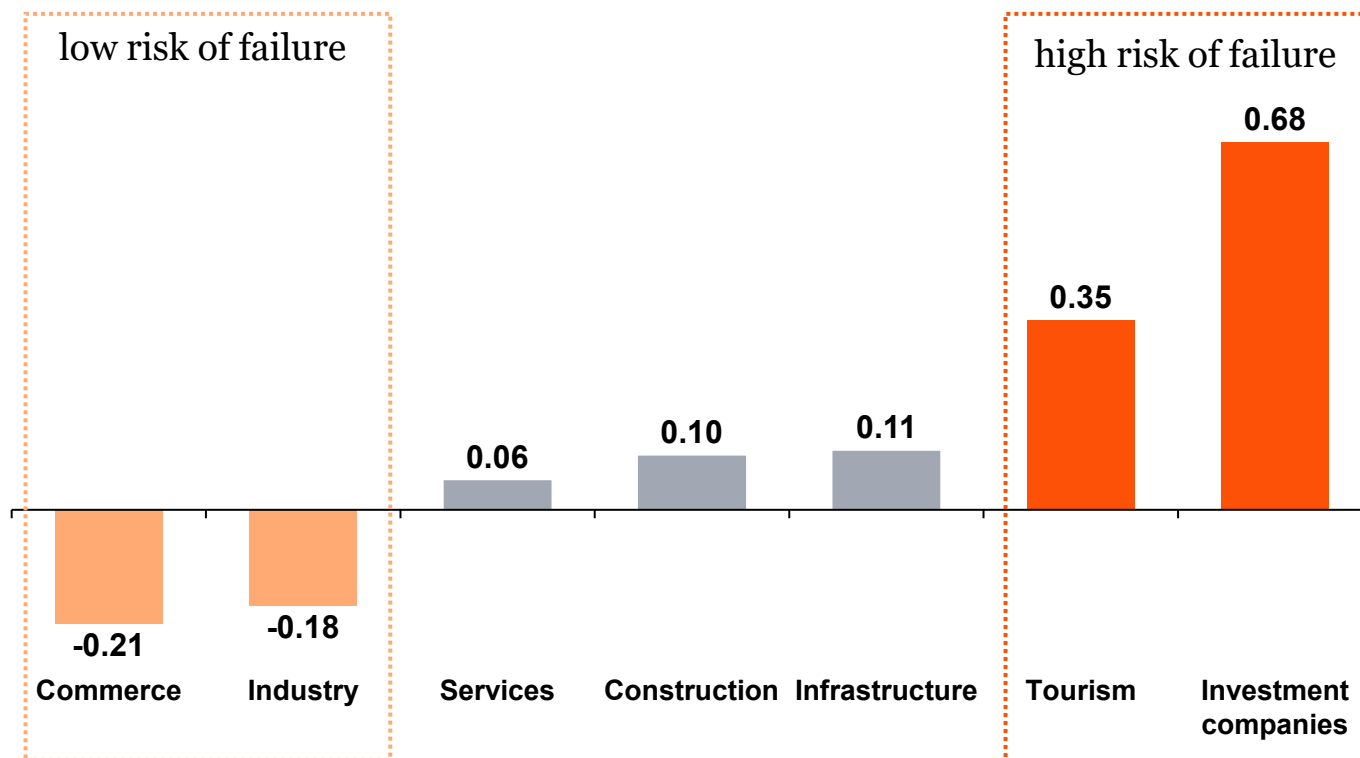
| | each of the five covariates | | | | | all five covariates | PwC-based zombie status | all continuous variables at the 1st and 99th percentiles |
|---------------------|-----------------------------|----------|---------|---------|-----------|---------------------|-------------------------|--|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Ln(Assets) | -0.162*** | | | | | -0.154*** | -0.153*** | -0.199*** |
| Leverage | | 0.188*** | | | | 0.194*** | 0.179*** | 0.688*** |
| Profitability | | | -0.000* | | | -0.000** | -0.000* | -0.176*** |
| Liquidity | | | | 0.000** | | -0.000 | -0.000 | -0.001 |
| Ln(Age) | | | | | -0.172*** | -0.087*** | -0.128*** | -0.117*** |
| Zombie (PwC) | | | | | | | 0.975*** | 0.815*** |
| Sector Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| No of observations | 98,990 | 98,990 | 96,814 | 98,970 | 97,694 | 95,527 | 75,419 | 75,419 |

Note: Table presents estimates from Cox proportional hazard model for Greek firms over the period 2015-2021. The dependent variable is the hazard of firm failure. A positive coefficient indicates that the risk of firm failing is increasing in that variable. To address the influence of extreme values, column 8 uses winsorized data at the 1st and 99th percentiles. N represents the number of firm-year observations. z-statistics (in parentheses) are based on standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Source: Orbis, PwC analysis

Significant differences in model-implied risk of failure across sectors

Estimates for risk of failure by sector
2015-2021



Note: Figure presents estimates from Cox proportional hazard model for Greek firms over the period 2015-2021. It shows the estimated coefficient for each sectoral fixed effect. In the cases highlighted under low and high risk of failure, the coefficient is statistically significant up to the 5% level.

Source: Orbis, PwC analysis

High risk of failure sectors

Investment companies as well as firms in **Tourism** sector have **significant higher probability of failure** on average compared to firms in other sectors

Neutral risk of failure sectors

Firms in the sectors of **Infrastructure**, **Construction** and **Services** have **not significant difference** in the probability of risk of failure compared on average compared to firms in other sectors

Low risk of failure sectors

Commerce and **Industry** firms have on average **smaller probability of failure** compared to firms in other sectors

Determinants and consequences of firm failure

We detect the common characteristics found in failed companies, as well as how they affect the economic scene and what actions should be taken from a policy standpoint.



Qualitative characteristics

Firm Characteristics & Survival Risk

Larger, more profitable, and older firms are **less likely to fail**, while highly leveraged firms face **greater risk**.

Zombie Firms & Failure

Zombie firms have a **2.7x higher risk of failure**, underscoring their economic fragility.

Proactiveness

Policy making

Understanding failure risk helps design **targeted support measures** and prevent misallocation of financial resources.

External impact

Economic aftermath

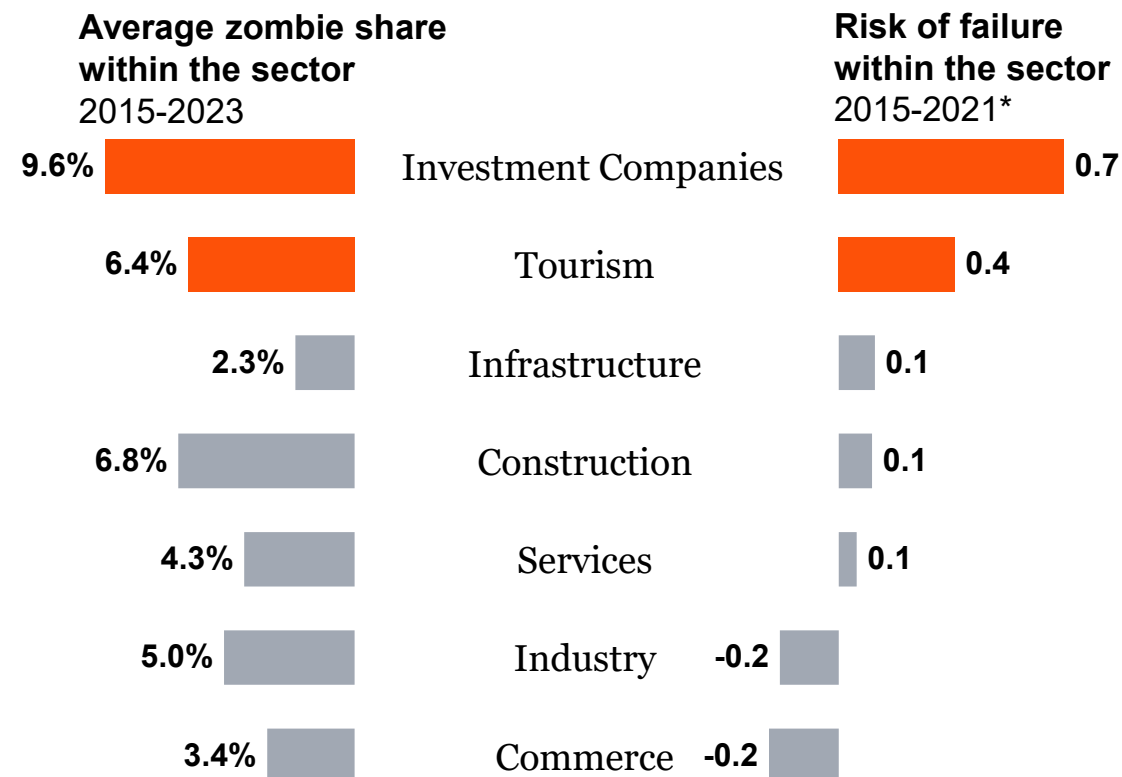
Reducing zombie firms can improve **resource allocation, productivity, and investment efficiency**.

The link between zombie status and fail rate is more than evident

The results indicate that the impact of zombie status is both **statistically** and **economically significant** as **risk of failure is 2.7x for zombie firms**.

Sectoral analysis reveals that the **Investment Companies** and **Tourism** sectors have the **highest average shares of zombie firms and risk of failure within their sector**.

The **Construction** sector has a significant proportion of "zombie" companies, yet the likelihood of failure appears to be minimal, likely because these construction firms tend to operate as zombies for extended period. In contrast, the **Industry** and **Commerce** sectors show a negative failure risk, reflecting robust sectoral characteristics, crucial for the Greek economy.



Source: Orbis, PwC analysis

* 2022 & 2023 are excluded since the reliability of failure classification declines



Areas for improvement

Areas for improvement

Although zombie share has declined significantly, challenges remain. The following areas highlight where firms and the economy need to improve to strengthen resilience and long-term sustainability.

Enhance restructuring and consolidation incentives

Firms need to adopt **more proactive restructuring and market-driven mindset**, which involve changing the company's structure or strategy in response to market conditions, customer needs, or competitiveness pressures.

- Cultivate a **culture of cooperation within the business ecosystem** by creating **synergies** that enable **micro businesses and SMEs** to access resources and expertise, helping them remain competitive.
- Encourage and support **consolidation during periods of financial strength** to avoid prolonged stagnation.

Accelerate business transformation and innovation

Many viable but struggling firms **continue to delay adopting sustainable business models**, while progress in innovation and digitalisation, remains limited.

- Offer **targeted investment incentives** for digitalisation and R&D, and promote the adoption of AI tools to improve operational efficiency and competitiveness.
- Support firms pivot toward higher-value activities through **operational restructuring**.

Monitor insolvency process efficiency

Current insolvency framework is often underutilised. More effective mechanisms are needed to ensure that non-viable firms exit the market smoothly or consolidate with minimal disruption. The **process must ensure fairness** by protecting creditors, employees and viable firms.

- **Streamline judicial decisions** and accelerate insolvency procedures to facilitate smooth market exit for non-viable firms.
- **Introduce incentives** such as tax deductions or favorable business loans for entities undergoing restructuring or liquidation.
- Develop a **private debt monitoring mechanism** to track micro-enterprises' debt exposure proactively and mitigate insolvency risks.

Targeted micro financing solutions

Smaller firms remain disproportionately **exposed to zombie risk**. They generally face higher failure rates and demonstrate weaker survival capacity, while access to finance for micro enterprises remains constrained.

- Establish an **effective mechanism to evaluate the performance of micro firms** in order to better assess the risks in funding solutions.
- Develop a **tailored framework** to support and coordinate all **the financing tools** for micro firms and SMEs.

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Appendix

List of variables

| Variable | Definition |
|---------------------------------|--|
| Zombie (PwC) | Zombie status based on PwC (2015). Dummy variable equal to 1 if (i) Compound Annual Growth Rate of Turnover < -5% (3-year window); (ii) Return on Capital Employed < 0% (3-year window mean); (iii) Net Debt/EBITDA > 5, or EBITDA < 0 (3-year window mean) |
| Zombie (ICR Baseline) | Zombie status based on De Jonghe et al. (2024). Dummy variable equal to 1 if (i) 3-year Accumulated Recurring Cash Flows (EBITDA plus Financial Revenues) < 3-year Accumulated Interest Expenses; (ii) Recurring Cash Flows fail to cover Interest Expenses in a minimum of two of the three individual years; (iii) Age ≥ 10 years |
| Zombie (ICR Alternative) | Zombie status based on Adalet McGowan et al. (2018). Dummy variable equal to 1 if (i) Interest Coverage Ratio (ICR) < 1 for 3 consecutive years, where $ICR = EBIT / \text{Financial Expenses}$; (ii) Age ≥ 10 years |
| Failed | Failed status based on Beaver et al. (2024) and Cathcart et al. (2020). Dummy variable equal to 1 if the firm has any of the following statuses in Orbis: Active (insolvency proceedings); Bankruptcy; Dissolved; Dissolved (liquidation); In liquidation; Inactive (no precision). We also assign failed status to firms that show as active in Orbis, when the data was retrieved (October 2024), but produced their last financial statement until 2021 based on the “Last Available Year” Orbis variable. We assume that firms failed in the last year that they published a financial statement |
| Assets | Total Assets = Fixed Assets + Current Assets, in € mn |
| Turnover | Sales, expressed in € mn |
| EBIT | Earnings Before Interest and Taxes, in € mn |
| Net income | P/L for period, in € mn |
| Profitability | EBIT margin = $EBIT / \text{Turnover}$ |
| Short-term debt | Short-term financial debts (e.g. to credit institutions + part of long-term financial debts payable within the year, bonds, etc.), in € mn |
| Long-term debt | Long-term financial debts (e.g. to credit institutions (loans and credits), bonds), in € mn |
| Leverage | Leverage ratio = $(\text{Short-term debt} + \text{Long-term debt}) / \text{Assets}$ |
| Solvency | Solvency ratio = $\text{Equity} / \text{Assets}$ |
| Liquidity | Current ratio = $\text{Current Assets} / \text{Current Liabilities}$ |
| Age | Current year - incorporation year |
| Listed | Listed status. A dummy variable that is equal to 1 if the firm is listed (and 0 otherwise) |

Anatomy of zombies: PwC vs. ICR methodology



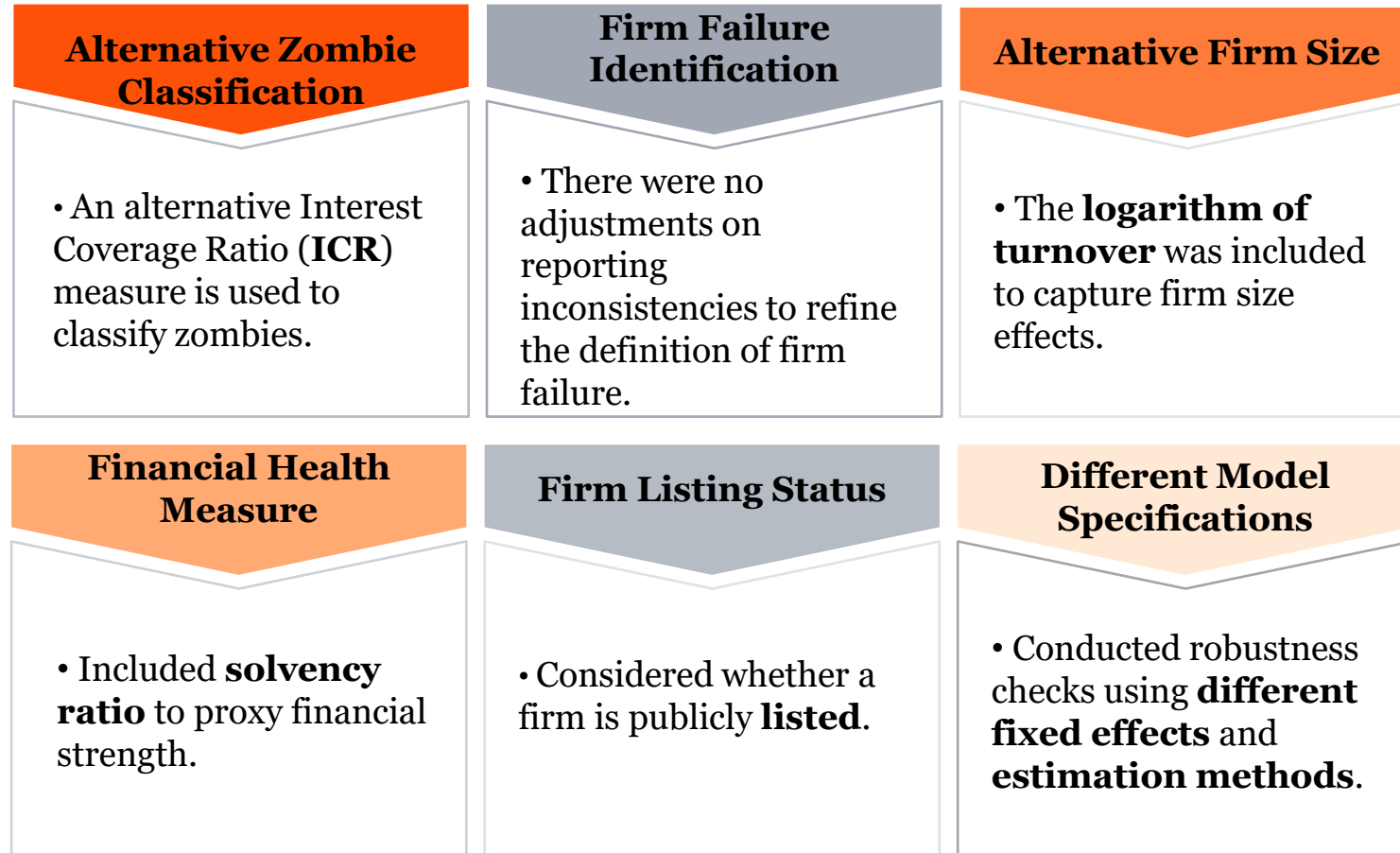
Overall **similar insights** across both methods:

- Zombies are more **financially fragile**.
- Their key financial figures **exhibit more volatility**.

| Group by: | PwC | | | | ICR | | | |
|------------------------|------------|-------|--------|-------|------------|-------|--------|-------|
| | Non-zombie | | Zombie | | Non-zombie | | Zombie | |
| | Median | MAD | Median | MAD | Median | MAD | Median | MAD |
| Assets | 3.391 | 2.106 | 3.727 | 2.067 | 4.056 | 2.156 | 5.308 | 2.707 |
| Turnover | 2.698 | 1.580 | 0.817 | 1.717 | 3.350 | 1.735 | 1.747 | 1.758 |
| EBIT | 0.165 | 0.171 | -0.130 | 0.265 | 0.229 | 0.199 | -0.139 | 0.300 |
| Net income | 0.084 | 0.133 | -0.180 | 0.253 | 0.125 | 0.151 | -0.250 | 0.338 |
| Profitability | 6% | 5% | -15% | 23% | 6% | 5% | -8% | 14% |
| Short-term debt | 0.053 | 0.040 | 0.102 | 0.062 | 0.092 | 0.052 | 0.322 | 0.282 |
| Long-term debt | 0.061 | 0.039 | 0.186 | 0.147 | 0.108 | 0.069 | 0.329 | 0.290 |
| Leverage | 13% | 12% | 27% | 14% | 14% | 12% | 36% | 23% |
| Solvency | 40% | 22% | 25% | 31% | 43% | 21% | 13% | 34% |
| Liquidity | 148% | 58% | 113% | 73% | 156% | 57% | 94% | 80% |
| Age | 19 | 10 | 22 | 9 | 21 | 9 | 24 | 7 |

Note: PwC methodology is based on the PwC (2015) study. Interest coverage (ICR) measure is based on the study by De Jonghe et al. (2024). MAD is the Median Absolute Deviation, a measure of volatility.

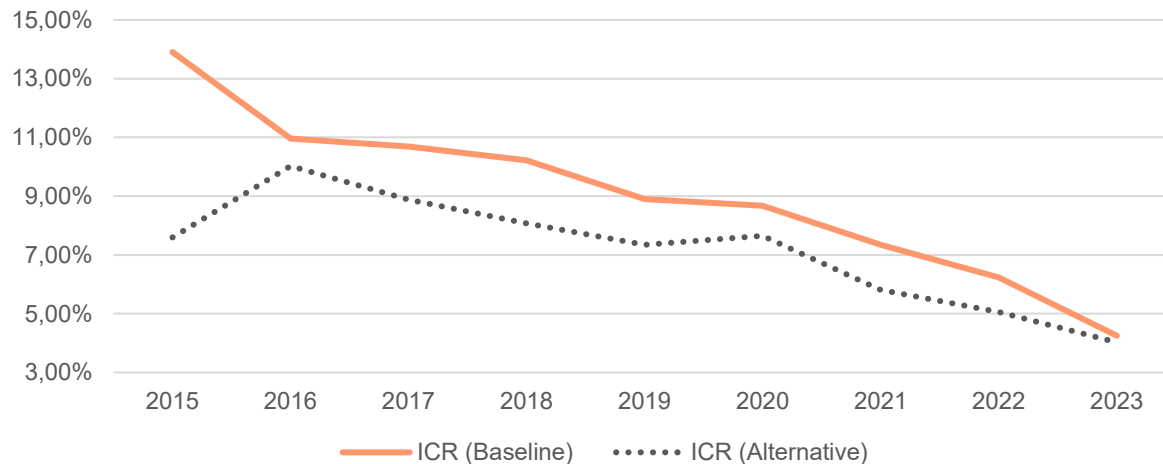
Sensitivity checks: the role of zombies remains robust across all checks



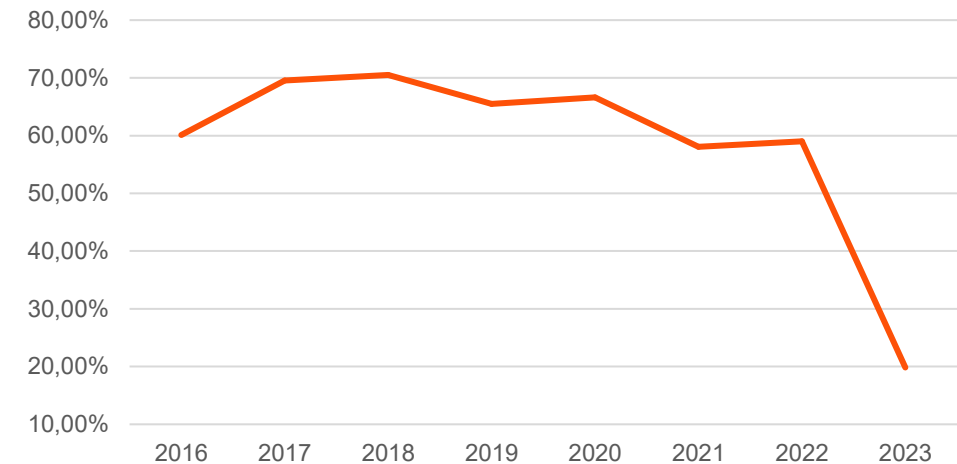
All approaches yield similar result:
Zombie firms face a significantly **higher failure risk**

Robustness check according to the ICR methodology (1)

**Zombies share out of the total number of firms per year
2015-2023**



**Persistent zombies in a given year as a share of
the number of zombies in previous year
2015-2023**

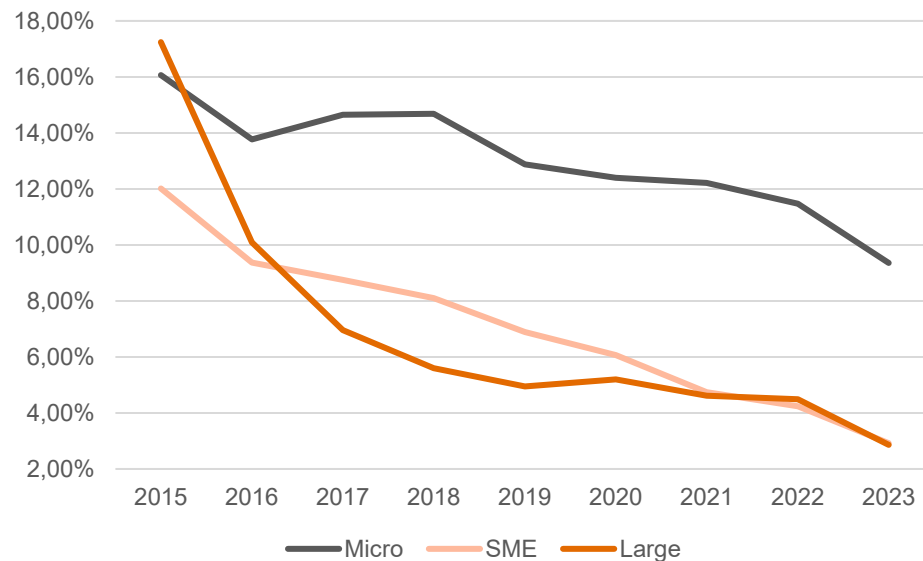


According to ICR method

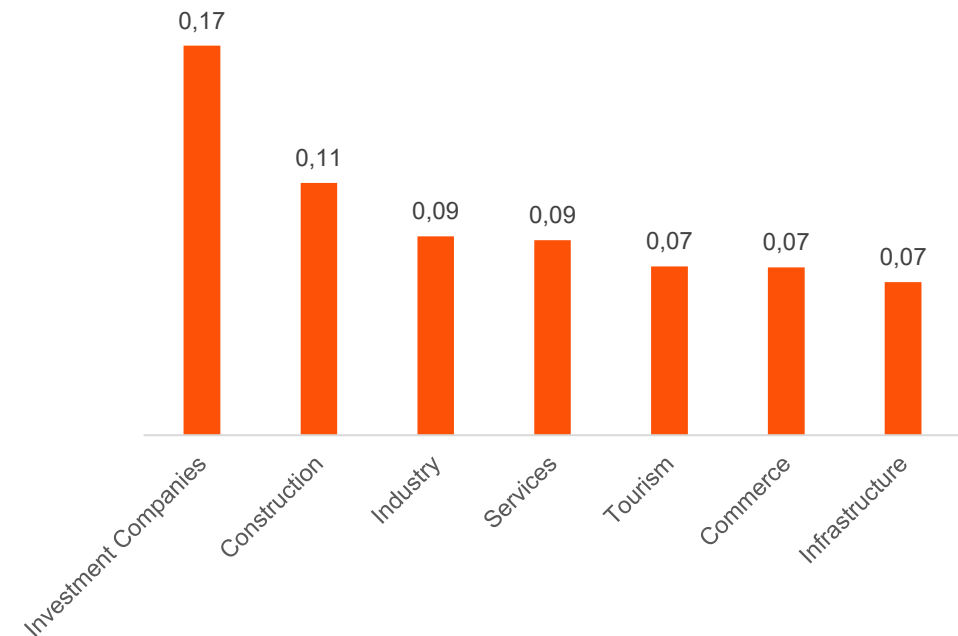
Under ICR measures, **proportion of zombie firms** as well as their **persistence** have declined to below **5%** and **20%** respectively in 2023.

Robustness check according to the ICR methodology (2)

Zombies share out of the total number of firms per year, across size categories 2015-2023



Average zombie share out of the total number of firms, across sectors over period 2015-2023



According to ICR method

Under ICR measure, **proportion of zombie firms** is larger at smaller firms, but generally decreases over time. The Investment Companies sector exhibit the higher average zombie share (17%).

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