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The Impact of Interest Rate Changes on the Evolution of Zombie Firms in Europe.

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Abstract

This study analyses the relationship between interest rate changes and the prevalence of zombie firms in eight European countries between 2012 and 2023. Using firm-level data and a regression analysis, no significant relationship is found between short-term interest rates and the survival of zombie firms. Instead, fiscal interventions during the COVID-19 pandemic, borrowing costs, and credit demand were found to be key factors. The results emphasise the complexity of zombie firm dynamics and highlight the importance of targeted structural reforms, efficient credit allocation, and balanced policy measures to eliminate inefficiencies, improve resource allocation, and promote long-term productivity.

Keywords: Zombie Firms, Interest Rates, European Economy, Monetary Policy

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1 Introduction

Zombie firms, usually defined as companies that are unable to cover their debt servicing costs through operating profits, have become an important topic of economic research due to their impact on productivity, innovation and resource allocation. The question of whether prolonged periods of low interest rates - as seen in the era of generous monetary policy following the global financial crisis - contribute to the persistence of these inefficient firms is of great concern to policy makers and academics alike. Looking at Figure 1 shows that there is a growing trend in zombie firms that began in the era of '0 interest rates' in Europe, when the European Central Bank (ECB) set the policy rate to near zero in March 2016. The trend in zombie firms accelerated around the COVID-19 period in 2020 and experienced a downward trend almost simultaneously with the rise in interest rates. While previous studies have found evidence of this relationship, my analysis shows that while the relationship is consistent with theoretical expectations, it is not statistically significant in the European context. However, this does not diminish the importance of the topic. Using firm-level financial data in eight European countries, this paper analyses whether lower short-term interest rates are associated with an increase in the proportion of zombie firms. In particular, a regression analysis was conducted to examine how interest rates, alongside macroeconomic indicators such as borrowing costs, credit demand and government support, influence the prevalence of zombie firms. In contrast to the results of previous studies, such as those of Banerjee and Hofmann (2018), the results suggest that the observed trends may be more robust to statistical tests. While the coefficients are consistent with the hypothesis that lower interest rates might support unprofitable firms, the lack of statistical significance suggests that other factors, such as institutional differences, government interventions or data limitations, might play a more important role. It is generally assumed in the literature that zombie firms suppress productivity and innovation by tying up capital and labour for unproductive purposes, thereby crowding out more efficient firms. The ECB's prolonged period of ultra-low interest rates and the extensive fiscal measures introduced during the COVID-19 pandemic provide a unique context to investigate this issue (see Figure 1, rise in Zombie firms during the 0 interest

rate period). For instance, European governments have introduced extensive support programmes, including loan guarantees and subsidies, to stabilise the economy during the crisis. While these measures were necessary to maintain employment and economic activity, they may have inadvertently delayed the exit of unproductive firms, raising concerns about their long-term economic impact. Preliminary visual evidence in Figure 2 illustrates that the zombie count peaked in 2020 and Figure 4 suggests that countries with higher government intervention during the COVID-19 period, such as Germany and France exhibit higher prevalence rates of zombie firms compared to weaker economies like Italy or Greece. However, these patterns require further investigation in order to understand the interplay between institutional factors and economic policy. Although the results do not show a statistically significant relationship between interest rates and the prevalence of zombie firms, they do contribute to a more nuanced understanding of the issue and they suggest that the mechanisms influencing the survival of zombie companies are complex and multi-layered and go beyond monetary policy. By integrating firm-level data, macroeconomic indicators and government support measures, this paper highlights the importance of considering broader structural and institutional factors when analysing the persistence of inefficient firms.

In addition, this research raises critical questions about the factors that sustain zombie firms in advanced economies and provides insights into the consequences of monetary and fiscal policy on resource allocation and economic efficiency. The results form the basis for future research to explore alternative explanations and refine the analysis.

2 Literature Review

The concept of 'zombie firms' has become a key focus of economic research, particularly because of its role in productivity stagnation and misallocation of resources. Zombie firms are usually defined as unproductive firms that are unable to cover their debts through operating profits but remain in operation due to external financial support, such as bank loans or government intervention. The term gained prominence in studies of Japan's economic stagnation in the 1990s when Caballero, Hoshi and Kashyap (2008) introduced the concept of 'zombie loans'. They showed how banks lent to insolvent firms to avoid recognising losses, leading to a misallocation of resources and hindering the growth of healthier firms. Subsequent research has expanded the scope of this phenomenon. McGowan, Andrews and Millot (2018) document the rise of zombie firms in OECD countries and link their prevalence to declining productivity and innovation. Similarly, Schivardi, Sette and Tabellini (2021) highlight the role of undercapitalised banks in perpetuating zombie firms through the 'weak banking channel', creating a feedback loop that perpetuates economic distortions. These findings emphasise the systemic risks that zombie firms pose to macroeconomic efficiency. Monetary policy is often cited as a key factor in the survival of zombie firms. Banerjee and Hofmann (2018) provide empirical evidence of the link between low interest rates and the persistence of unproductive firms and show how accommodative monetary policy reduces the financial pressure to restructure. Borio (2018) confirms this view and argues that persistently low borrowing costs delay necessary market corrections and promote inefficiencies in the economy. The 'risk-taking channel' of monetary policy studied by Jimenez et al. (2014) and Dell'Ariccia et al. (2013) suggests that low interest rates incentivise banks to lend to riskier, less productive firms, exacerbating the survival of zombie firms. Government intervention in times of crisis further complicates the dynamics of zombie companies. During the COVID-19 pandemic, fiscal measures such as loan guarantees and subsidies have been crucial in mitigating economic dislocation. However, Acharya, Eisert and colleagues (2019) warn that without structural reforms, such interventions risk perpetuating inefficiencies. Giannetti and Simonov (2013) also point out that while bank bailouts can encourage lending under certain conditions, they often

allow unprofitable firms to survive, thereby misallocating resources and delaying market adjustments. Empirical studies have looked at the prevalence and consequences of zombie firms, emphasising their impact on economic efficiency and productivity. Caballero et al. (2008) first linked zombie lending in Japan to the suppressed growth of healthy firms, while Peek and Rosengren (1995) showed how poor lending practices entrenched inefficiencies. McGowan et al. (2018) highlight how zombie firms in OECD economies reduce productivity growth and distort capital allocation, while Andrews and Petroulakis (2017) and Schivardi et al. (2021) emphasise the role of weak and undercapitalised banks in sustaining these firms, with monetary policy playing a key role in the survival of zombie firms. Banerjee and Hofmann (2018) argue that low interest rates incentivise lending to riskier firms, supported by Jimenez et al. (2014) and Borio (2018), who show that persistently low interest rates increase banks' risk tolerance. These studies highlight the unintended consequences of monetary easing, which stabilises financial systems but can support unproductive businesses. Aghion et al. (2018) add that while credit access encourages investment, it can harm productivity by disproportionately favouring inefficient firms, highlighting the need to strike a balance between short-term stabilisation and long-term efficiency. Existing studies offer a global perspective on this phenomenon. Banerjee and Hofmann (2018) document an increase in zombie firms in 14 advanced economies, with their share rising from 2% in the 1980s to 12% in 2016. They find that economic downturns increase the prevalence of zombie firms, with their numbers remaining elevated even during recoveries. This trend emphasises the need for a deeper examination of the structural and political factors that enable their survival.

This study expands on the existing literature by providing a comprehensive analysis of zombie firms in European economies (2012–2023). By integrating firm-level data with macroeconomic indicators, it examines the interplay between monetary policy, credit conditions and government interventions, particularly during the COVID-19 pandemic. In contrast to previous work, this study highlights the nuanced dynamics that keep zombie firms alive and offers new insights for policy discussions on productivity and resource allocation.

3 Methodology

The study examines the prevalence and dynamics of zombie firms in Europe between 2012 and 2023 and analyses the macroeconomic and sectoral factors that influence their persistence. It covers the periods before COVID-19 (2012-2019), during COVID-19 (2020-2021), and after COVID-19 (2022-2023), and focuses on the policies of central banks, conditions in credit markets, and government intervention. Zombie firms lack a universally accepted definition. Early studies such as that by Kane (1989) identified zombies as companies whose corporate capital had been completely consumed, while Hoshi (2006) described them as insolvent companies dependent on external financial support. Banerjee and Hofmann (2018) defined them as companies that are unable to service their debts from current earnings over an extended period of time. Despite differing definitions, zombie companies have one thing in common: their survival depends on continued external support. The nature of this support varies. Caballero, Hoshi and Kashyap (2008) emphasised subsidised bank lending as a key factor, while more recent studies such as Vanhala and Verín (2020) highlight the role of government subsidies. Such interventions often delay insolvency but undermine market efficiency and economic growth. A major challenge in researching zombie companies lies in their identification. The metrics vary from subsidised credit (Caballero et al., 2008) to profitability and debt servicing capacity (Banerjee & Hofmann, 2018). However, a disciplined and universally accepted measurement approach is still difficult to find. This study takes a focused and pragmatic approach to identifying zombie companies, building on the widely used interest coverage ratio (ICR) methodology. Firms are classified as zombies if:

$$\text{Coverage Ratio (CR)} = \frac{\text{Earnings Before Interest and Taxes (EBIT)}}{\text{Interest Expense}} < 1 \qquad (1)$$

Firms with a $CR < 1$ are classified as 'zombies', indicating that they are unable to generate sufficient operationg profits to cover their interest obligations. This definition provides a consistent and objective framework for identifying zombie companies in different countries and sectors. To address missing financial data, *EBIT* (Earnings Before Interest and

Taxes) and interest expenses were set to zero where necessary. This approach preserves the integrity of the dataset by avoiding the exclusion of companies with incomplete data, thus ensuring analytical robustness. Zombie firms were then aggregated by country and year to examine temporal and geographical trends. Sectoral patterns were analysed using the Global Industry Classification Standard (GICS), which also facilitated the exclusion of financial firms to avoid distortions due to their regulatory and structural peculiarities. Annual aggregate zombie measures are calculated for each country (Austria, Belgium, Germany, Spain, France, Greece, Italy and the Netherlands) to allow for a macroeconomic comparison. The analysis uses ordinary least squares (OLS) regression models to quantify the relationship between macroeconomic conditions and the prevalence of zombie firms. The dependent variable,$\text{Zombie}_{i,t}$, represents the number of zombie firms in country i at time t for all regressions.

An important independent variable is the *short-term interest rate*, which reflects the cost of debt, the availability of credit and the general liquidity conditions in the economy. This variable is particularly relevant for zombie firms, as it affects their ability to service debt, obtain liquidity and survive despite low productivity. By examining short-term interest rates, the model assesses the monetary conditions under which zombie firms persist or exit the market. The model is specified as follows:

$$\text{Zombie}_{it}{}^{1} = \beta_0 + \beta_1 \times \text{Short-Term Interest Rates}_{i,t} + \epsilon_{it} \tag{2}$$

For further analysis, this study explores the relationship between the *cost of borrowing* and the prevalence of zombie firms. The cost of borrowing is a crucial factor influencing the survival, profitability, and resource accessibility of zombie firms. It offers insights into the financial conditions under which these firms operate, shaping their lifecycle and ability to compete in the market. The relationship is examined using an OLS regression,

[1]Where the dependent variable, $\text{Zombie}_{i,t}$ is modeled as a function of short-term interest rates to examine their relationship.

specified as:

$$\text{Zombie}_{i,t} = \beta_0 + \beta_1 \text{Cost of Borrowing}_{i,t}{}^2 + \beta_2 \, \text{Short-Term Interest Rates}_{i,t} + \epsilon_{i,t}, \quad (3)$$

In addition, *credit standards* are included in the study to provide insights into the financial systems and conditions in which companies operate, as well as into the ease or difficulty of obtaining credit. The independent variable, credit standards, reflects changes in lending conditions. To account for the influence of monetary policy, *Short-Term Interest Rates* are included as a control variable. The model is specified as follows:

$$\text{Zombie}_{i,t} = \beta_0 + \beta_1 \, \text{Credit Standards}_{i,t}{}^3 + \beta_2 \, \text{Short-Term Interest Rates}_{i,t} + \epsilon_{i,t}, \quad (4)$$

Another variable that is important to examine the dynamics of zombie firms is the *loan demand general* as it reflects the overall economic environment, credit availability, and business health. High loan demand would further push the survival of zombie firms by providing access to cheap credit, while low loan demand could force them to restructure or exit the market. It helps to understand what makes zombie firms thrive or fail. In the model the loan demand general, measures general changes in loan demand. To control for the effects of monetary policy, *Short-Term Interest Rates* are included as a control variable and result as:

$$\text{Zombie}_{i,t} = \beta_0 + \beta_1 \, \text{Loan Demand General}_t{}^4 + \beta_2 \, \text{Short-Term Interest Rates}_t + \epsilon_{i,t}, \quad (5)$$

In order to capture specific liquidity issues related to short-term borrowing, the study

[2]Where $\text{Cost of Borrowing}_{i,t}$ captures borrowing costs in country i at time t, β_0 is the intercept term, β_1 quantifies the effect of borrowing costs on zombie firms, β_2 helps to isolate the impact of short-term interest rates on zombie firms by controlling for other factors, such as borrowing costs and $\epsilon_{i,t}$ is the error term.

[3]Where $\text{Credit Standards}_{i,t}$ represents changes in lending conditions, $\text{Short-Term Interest Rates}_{i,t}$ accounts for short-term interest rates, β_0 is the intercept, β_1 and β_2 are the coefficients for the explanatory variables, and $\epsilon_{i,t}$ is the error term.

[4]Where $\text{Loan Demand General}_t$ indicates general loan demand at time t, and $\text{Short-Term Interest Rates}_t$ accounts for short-term interest rates at time t. β_0 is the intercept term, β_1 and β_2 are coefficients estimating the effect of loan demand and short-term interest rates, respectively, on the prevalence of zombie firms, and $\epsilon_{i,t}$ is the error term.

includes short-term loan demand as variable which could help provide more insight. The variable *Loan Demand Short Term*, aims to capture variations in short-term credit demand. To control for the influence of monetary policy, short-Term interest Rates are included as a control variable. The relationship is modeled linearly as follows:

$$\text{Zombie}_{i,t} = \beta_0 + \beta_1 \,\text{Loan Demand Short Term}_t{}^{5} + \beta_2 \,\text{Short-Term Interest Rates}_t + \epsilon_{i,t}, \quad (6)$$

Incorporating both general and short-term loan demand is essential to fully capture the dynamics of credit markets and their impact on zombie firms. General loan demand provides a broad overview of overall credit needs across all maturities, offering insights into macroeconomic conditions such as investment activity, business expansion, and liquidity availability. In contrast, short-term loan demand focuses on immediate liquidity requirements, which are critical for firms that may be experiencing difficulties and rely on short-term borrowing to manage debt or other expenses. By incorporating both variables, the analysis provides a comprehensive framework to assess how long-term credit trends and short-term financial pressures may influence the survival and persistence of such firms. For zombie firms, government support plays a critical role in their survival, and this was especially evident during the COVID-19 pandemic. Recognising the significant economic interventions undertaken in 2021, the analysis incorporates two key independent variables: *Additional Spending*, which reflects fiscal measures such as subsidies and direct financial assistance, and *Equity Loans Guarantees*, representing state-backed loan programmes. These are examined as follows:

$$\text{Zombie}_{i,21} = \beta_0 + \beta_1 \,\text{Additional Spending}_{i,21}{}^{6} + \beta_2 \,\text{Equity Loans Guarantees}_{i,21} + \epsilon_{i,21}, \quad (7)$$

With this diverse set of variables, the study aims to provide a framework for evaluating

[5]Where Loan Demand Short Term$_t$ represents demand at time t, Short-term Interest Rates$_t$ reflect the prevailing interest rates, β_0 is the intercept, β_1 and β_2 are coefficients, and $\epsilon_{i,t}$ is the error term.

[6]where Zombie$_{i,21}$ denotes the number of zombie firms in country i in 2021, Additional Spending$_{i,21}$ represents fiscal expenditures in country i, and Equity Loans Guarantees$_{i,21}$ captures the value of guaranteed loans. β_0 is the intercept, β_1 and β_2 are coefficients that quantify the effects of these variables, and $\epsilon_{i,21}$ represents the error term.

the extent to which government interventions, particularly fiscal measures and loan guarantees, supported the survival of zombie firms during a period of exceptional economic disruption.

4 Data

Firm-level data were sourced from Standard & Poor's (S&P) Compustat Global Annual Fundamentals, which covers 33,000 active and inactive companies from over 80 countries and is mapped to the GICS to obtain sector-level information (see Table 23). Figure 3 shows that zombie firms are concentrated in industrials, health care, and consumer discretionary. The total count of zombie firms per sector is listed in Table 24. The dataset provides extensive financial and market information, representing more than 96% of European market capitalisation. Furthermore, public companies from Austria, Belgium, Germany, Greece, France, Spain, Italy, and the Netherlands were selected for the time frame from 2012 to 2023. Firms in the utilities, financial, insurance, and banking sectors were excluded to align with the methodology established by Acharya, Crosignani, et al. (2020) and Acharya, Eisert, et al. (2019). This selection provides an 11-year time frame for examining zombie firm dynamics across varying economic conditions. In total, there are 6,405 zombie firms in the dataset. The evolution shows a rising trend, peaking in 2020 with a total of 704 zombie firms across selected countries and declining in the following years (see Table 25). The macroeconomic variables were gathered from different sources. The Gross Domestic Product (GDP) growth rates were collected from Eurostat, including provisional numbers for 2022 and 2023, ensuring the dataset encompasses the entire study period. The short-term interest rates, representing annual rates in percentages, were obtained from the OECD database. These rates provide essential macroeconomic context, particularly for understanding the role of monetary policy in shaping firm behaviour during periods of low interest rates. The cost of borrowing for corporations was further analysed using monthly data from the ECB, which was aggregated into annual averages expressed as percentages per annum. This aggregation method simplifies the data while preserving overall trends in borrowing conditions, ensuring compatibility with

the annual frequency of other datasets. For simplicity, euro area-level data were used rather than country-specific figures. As shown in Figure 5, the visuals indicate an inverse relationship: the count of zombie firms peaks, particularly in 2020–2021, when the cost of borrowing is low. Additionally, the fiscal measures implemented during the COVID-19 pandemic were examined using data from the International Monetary Fund's Fiscal Monitor. These estimates, as of 27 September 2021, are expressed in U.S. dollars and as a percentage of gross GDP, weighted by purchasing power parity to ensure comparability across countries. Fiscal data covered Austria, Belgium, Germany, Greece, France, Spain, Italy, and the Netherlands, capturing the role of government interventions such as fiscal support and loan guarantees during a period of extraordinary economic disruption (see Figure 2). The bar charts in Figure 2 demonstrate that in the dataset, Italy, alongside Germany and France, had strong fiscal responses during the COVID-19 crisis, which might have contributed to the survival of some zombie firms. However, as shown in Table 25, the count of zombie firms in 2021 is close to or less than in 2019. Therefore, there is no significant link when analysing the numerical data. Lending conditions and credit demand were analysed using data from the ECB's Bank Lending Survey (BLS). Three key indicators were considered: credit standards for enterprises (Figure 6), overall loan demand (Figure 7), and short-term loan demand (Figure 8). The count of zombie firms peaks alongside increases in short-term loan demand, suggesting a potential relationship between these variables. Quarterly data were averaged into annual rates to align with other datasets, smoothing intra-year fluctuations while preserving meaningful variation. These methodological adjustments ensure consistency and clarity, providing a robust foundation to analyse the interplay between government interventions and zombie firm dynamics during significant economic and policy shifts.

5 Results

The results of the regression analysis are presented, focusing on the short-term interest rate as the primary variable of interest, alongside other key indicators, to examine their impact on the prevalence of zombie firms. The analysis is divided into detailed subsections

addressing the role of each indicator and its interaction with the short-term interest rate. The study aims to determine whether these factors contributed to the survival of inefficient firms during the pre-COVID-19 (2012–2019), COVID-19 (2020–2021), and post-COVID-19 (2022–2023) periods.

5.1 Short-Term Interest Rates

Table 1: OLS Regression – Short-Term Interest Rates and Zombie firms – (2012–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	68.3148	6.001	11.383	0.000
Short Term Interest Rates	-0.4093	5.722	-0.072	0.943

Notes: This table presents OLS regression results based on 96 observations. R-squared = 0.000, Adjusted R-squared = -0.011, F-statistic = 0.005116, p-value = 0.943. Standard errors assume the covariance matrix is correctly specified.

The results demonstrate that short-term interest rates exhibit no statistically significant relationship with the prevalence of zombie firms across the periods studied. For the full sample period (2012–2023), the coefficient for short-term interest rates is -0.4093 ($p = 0.943$), and the model explains none of the variation in zombie firm prevalence ($R^2 = 0.000$). These findings suggest that short-term interest rates alone do not have a significant influence on the survival of zombie firms.

Table 2: OLS Regression – Short-Term and Zombie Firms – Pre-COVID Period (2012–2019)

Variable	Coefficient	Std. Error	t-Statistic	P-value
Constant	62.6011	6.525	9.595	0.000
Short-Term Interest Rates	-8.9505	20.254	-0.442	0.660

Notes: This table presents OLS regression results based on 64 observations. R-squared = 0.003, Adjusted R-squared = -0.013. The dependent variable is the proportion of zombie firms. Standard errors assume the covariance matrix is correctly specified.

When examining the pre-COVID period, which is characterised by prolonged low interest rates and relative macroeconomic stability, the regression results indicate a negligible negative relationship between short-term interest rates and zombie firms. The negative coefficient suggests that the stable financial environment and low borrowing costs had only a minimal negative effect on the prevalence of zombie firms.

Table 3: OLS Regression – Short-Term Interest Rates and Zombie firms – COVID Period (2020–2021)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	136.3286	146.261	0.932	0.367
Short-Term Interest Rates	107.2035	297.966	0.360	0.724

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.009, Adjusted R-squared = -0.062. The dependent variable is *Is Zombie*. Standard errors assume the covariance matrix is correctly specified.

The regression analysis for the pandemic period shows a weak positive coefficient, with the model explaining less than 1% of the variation in zombie firm prevalence ($R^2 = 0.009$). This negligible relationship is likely due to the dominant role of fiscal stimulus measures and government interventions, including subsidised loans and equity guarantees, which overshadowed the effects of interest rates on firm survival.

Table 4: OLS Regression – Short-Term Interest Rates and Zombie Firms – Post-COVID Period (2022–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	75.4705	26.201	2.880	0.012
Short-Term Interest Rates	-1.0116	10.747	-0.094	0.926

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.001, Adjusted R-squared = -0.071. Standard errors assume the covariance matrix is correctly specified.

In the post-pandemic recovery phase, as central banks raised interest rates to counter inflationary pressures, the regression results reveal a negligible negative relationship. Despite rising interest rates, their influence on zombie firm prevalence remained statistically insignificant, possibly due to the lingering effects of government support and structural adjustments still unfolding in the economy.

5.2 Cost of borrowing

The regression analysis examining the relationship between borrowing costs and zombie firm prevalence reveals limited explanatory power, particularly over the full sample period. The coefficient for borrowing costs is not statistically significant, and the model accounts for only 0.3% (see table 5) of the variation in the dependent variable, indicating a weak relationship. This aligns with expectations that borrowing costs, while relevant for firm-level financing, do not independently determine zombie firm survival.

Table 5: OLS Regression – Cost of Borrowing and Zombie Firms – (2012–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Constant	53.1946	16.036	3.316	0.001
Cost of Borrowing	-3.1907	6.427	-0.496	0.621
Short-Term Interest Rates	-11.0402	9.542	-1.157	0.252

Notes: This table presents OLS regression results for the full sample period (2012–2023) with 96 observations. The dependent variable is the prevalence of zombie firms. R-squared = 0.003, Adjusted R-squared = -0.008, and F-statistic = 0.2464 (p-value = 0.621). Standard errors assume the covariance matrix is correctly specified.

To explore the temporal variation further, Table 6 focuses on the pre-COVID-19 period, characterised by monetary easing and economic stability, to assess the role of borrowing costs in zombie firm prevalence.

Table 6: OLS Regression – Cost of Borrowing and Zombie Firms – Pre-COVID Period (2012–2019)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	89.67	127.20	0.705	0.484
Cost of Borrowing	-11.59	54.38	-0.213	0.832
Short-Term Interest Rates	12.43	102.41	0.121	0.905

Notes: This table presents OLS regression results based on 64 observations. R-squared = 0.004, Adjusted R-squared = -0.029, F-statistic = 0.043, p-value = 0.888.
Standard errors assume the covariance matrix is correctly specified.

Further analysis reveals no significant relationship between borrowing costs and zombie firm prevalence, indicating that the availability of inexpensive credit exerted minimal direct influence.

Table 7: OLS Regression – Cost of Borrowing and Zombie Firms – COVID Period (2020–2021)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	21.46	10.05	2.135	0.048
Cost of Borrowing	68.29	91.64	0.745	0.460
Short-Term Interest Rates	79.58	261.05	0.305	0.763

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.009, Adjusted R-squared = -0.062, F-statistic = 0.135, p-value = 0.724.
Standard errors assume the covariance matrix is correctly specified.

During the pandemic, extensive fiscal and monetary measures, such as subsidised loans and equity guarantees, were implemented to support businesses. While the regression results for this period show a positive coefficient for borrowing costs, it remains statistically insignificant.

Table 8: OLS Regression – Cost of Borrowing and Zombie Firms – Post-COVID Period (2022–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	27.68	12.29	2.252	0.034
Cost of Borrowing	27.36	8.16	3.352	0.002
Short-Term Interest Rates	-24.48	16.29	-1.503	0.139

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.001, Adjusted R-squared = -0.071, F-statistic = 0.090, p-value = 0.926.Standard errors assume the covariance matrix is correctly specified.

In the post-pandemic recovery phase, as central banks raised interest rates to combat inflation, borrowing costs became a significant factor. The coefficient in Table 8 indicates a positive relationship between higher borrowing costs and zombie firm prevalence, suggesting that tighter financing conditions posed greater challenges for inefficient firms reliant on cheap credit. The model for this period demonstrates improved explanatory power, with $R^2 = 0.031$.

5.3 Credit Standards

Table 9: OLS Regression – Credit Standards and Zombie Firms – (2012–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	66.9341	6.981	9.591	0.000
Credit Standards	0.4293	1.095	0.392	0.696
Short-Term Interest Rates	-2.7861	8.354	-0.333	0.741

Notes: This table presents OLS regression results based on 96 observations. R-squared = 0.002, Adjusted R-squared = -0.020, F-statistic = 0.079, p-value = 0.924.
Standard errors assume the covariance matrix is correctly specified.

For the full sample period, the coefficient indicates no statistically significant relationship between credit standards and zombie firm prevalence. Similarly, short-term interest rates exhibit no significant effect, with a coefficient of -2.7861 ($p = 0.741$). The model explains minimal variation in the dependent variable ($R^2 = 0.002$), suggesting that credit standards alone do not significantly influence zombie firm dynamics during this period. These results reflect the broader complexity of factors sustaining zombie firms, extending beyond lending conditions.

Table 10: OLS Regression – Credit Standards and Zombie Firms – Pre-COVID Period (2012–2019)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	62.3197	7.324	8.509	0.000
Credit Standards	0.1297	1.486	0.087	0.931
Short-Term Interest Rates	-11.1444	32.377	-0.344	0.732

Notes: This table presents OLS regression results based on 64 observations. R-squared = 0.003, Adjusted R-squared = -0.029, F-statistic = 0.099, p-value = 0.905.
Standard errors assume the covariance matrix is correctly specified.

Similarly, during the pre-pandemic years, the credit standards variable shows no meaningful relationship with zombie firms. These findings imply that variations in credit standards during this period did not significantly impact the prevalence of zombie firms, likely due to the persistent availability of credit across the financial system.

Table 11: OLS Regression – Credit Standards and Zombie Firms – COVID Period (2020–2021)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	153.7175	210.188	0.731	0.477
Credit Standards	-10.4120	38.563	-0.270	0.791
Short-Term Interest Rates	44.0222	64.174	0.686	0.504

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.009, Adjusted R-squared = -0.062, F-statistic = 0.129, p-value = 0.724.
Standard errors assume the covariance matrix is correctly specified.

The analysis during the pandemic period reveals a negative coefficient for credit standards (-10.4120), suggesting a potential inverse relationship. However, this effect is not statistically significant ($p = 0.791$), and the model explains only a small fraction of the variation in zombie firm prevalence ($R^2 = 0.009$). These findings highlight the dominant role of government interventions and fiscal support during the pandemic, overshadowing the effects of credit standards on firm survival.

Table 12: OLS Regression – Credit Standards and Zombie Firms – Post-COVID Period (2022–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	7.4730	5.172	1.445	0.171
Credit Standards	6.9904	2.207	3.167	0.007
Short-Term Interest Rates	-21.9426	16.147	-1.359	0.196

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.001, Adjusted R-squared = -0.071, F-statistic = 0.009, p-value = 0.926.
Standard errors assume the covariance matrix is correctly specified.

In the post-pandemic recovery phase, as economic conditions tightened and monetary policies shifted, credit standards emerge as a significant factor. The coefficient for credit standards is 6.9904 ($p = 0.007$), indicating a positive and statistically significant relationship with zombie firm prevalence. This result suggests that stricter credit standards during the recovery period may have limited access to financing for inefficient firms, contributing to their continued classification as zombies. The model for this period explains slightly more variation ($R^2 = 0.001$), reflecting the interplay between lending conditions and broader economic adjustments. The results demonstrate that credit standards play a limited role in influencing zombie firm prevalence during stable or crisis periods. However, their significance during the post-pandemic phase underscores the importance of lending conditions in shaping firm dynamics during economic transitions. The credit standard findings align with existing literature emphasizing the role of credit allocation practices in determining firm survival, particularly in the context of structural adjustments and tightening monetary conditions.

5.4 Loan Demand

Table 13: OLS Regression – General Loan Demand and Zombie Firms – (2012–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	73.7787	8.934	8.258	0.000
Loan Demand General	-0.7351	0.889	-0.827	0.411
Short-Term Interest Rates	-9.6123	12.521	-0.768	0.445

Notes: This table presents OLS regression results based on 96 observations. R-squared = 0.001, Adjusted R-squared = -0.071, F-statistic = 0.009, p-value = 0.926. Standard errors assume the covariance matrix is correctly specified.

For the loan demand variable, there is a weak and generally statistically insignificant association across the examined periods. For the full sample period (2012–2023), the results suggest that changes in loan demand have little direct influence on the prevalence of zombie firms. The model explains only 0.3% of the variation in zombie firm prevalence, as indicated by $R^2 = 0.003$.

Table 14: OLS Regression – General Loan Demand and Zombie Firms – Pre-COVID Period (2012–2019)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	65.2270	12.713	5.131	0.000
Loan Demand General	-0.2753	1.141	-0.241	0.810
Short-Term Interest Rates	-14.4111	30.471	-0.473	0.638

Notes: This table presents OLS regression results based on 64 observations. R-squared = 0.004, Adjusted R-squared = -0.029, F-statistic = 0.1253, p-value = 0.882. Standard errors assume the covariance matrix is correctly specified.

Also, for the pre-COVID period, there is no significant relationship between general loan demand and zombie firms, suggesting that loan demand changes during this period had minimal impact on zombie firm prevalence, likely due to the prolonged availability of credit and the lack of significant economic shocks. In the post-pandemic recovery, as governments scaled back fiscal interventions and central banks raised interest rates, loan demand emerges as a more significant factor. In Table 16, the coefficient is estimated at 2.6417 ($p = 0.086$), with $R^2 = 0.043$. Although only marginally significant, this result suggests that changes in loan demand may have played a role in influencing zombie firm prevalence in post-pandemic times. Additionally, short-term interest rates exhibit a statistically significant and positive relationship (32.7661, $p = 0.004$), highlighting the interplay between tighter monetary conditions and borrowing dynamics.

Table 15: OLS Regression – General Loan Demand and Zombie Firms – COVID Period (2020–2021)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	38.3642	47.997	0.799	0.437
Loan Demand General	7.3993	14.476	0.511	0.617
Short-Term Interest Rates	-27.4953	35.671	-0.771	0.454

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.002, Adjusted R-squared = -0.038, F-statistic = 0.285, p-value = 0.753. Standard errors assume the covariance matrix is correctly specified. This regression

The results for the COVID-19 period show a positive but not significant coefficient of 7.3993 ($p = 0.617$). The model explains less than 1% of the variation in zombie firm prevalence ($R^2 = 0.009$). These results highlight the limited role of loan demand in influencing zombie firm dynamics during a period when government subsidies and support measures largely dictated firm survival.

Table 16: OLS Regression – General Loan Demand and Zombie Firms – Post-COVID Period (2022–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	55.3480	16.009	3.457	0.004
Loan Demand General	2.6417	1.429	1.848	0.086
Short-Term Interest Rates	32.7661	9.437	3.472	0.004

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.089, Adjusted R-squared = 0.067, F-statistic = 4.123, p-value = 0.015.
Standard errors assume the covariance matrix is correctly specified.

5.5 Short-Term Loan Demand

Table 17: OLS Regression – Short-Term Loan Demand and Zombie Firms – (2012–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	23.7304	40.645	0.584	0.561
Loan Demand Short Term	73.9323	66.663	1.109	0.273
Short-Term Interest Rates	-0.9530	5.736	-0.166	0.869

Notes: This table presents OLS regression results based on 96 observations. R-squared = 0.013, Adjusted R-squared = -0.008, F-statistic = 0.618, p-value = 0.541.
Log-Likelihood = -523.74, AIC = 1053.0, BIC = 1061.0. Standard errors assume the covariance matrix is correctly specified.

Similarly to the other variables, short-term loan demand in the full sample analysis shows a positive but statistically insignificant relationship, suggesting that short-term loan demand alone is not a strong determinant of zombie firm persistence over time. The analysis of short-term loan demand for the full sample reveals a positive but statistically insignificant relationship, indicating that short-term loan demand alone is not a strong determinant of zombie firm persistence over time.

Table 18: OLS Regression – Short-Term Loan Demand and Zombie Firms – Pre-COVID Period (2012–2019)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	53.1946	133.363	0.399	0.692
Loan Demand Short Term	16.5161	233.876	0.071	0.944
Short-Term Interest Rates	-11.0402	35.952	-0.307	0.760

Notes: This table presents OLS regression results based on 64 observations. R-squared = 0.003, Adjusted R-squared = -0.029, F-statistic = 0.099, p-value = 0.906.
Log-Likelihood = -342.52, AIC = 691.0, BIC = 697.5. Standard errors assume the covariance matrix is correctly specified.

During the pre-pandemic period, the results show no significant relationship between short-term loan demand and zombie firm prevalence, suggesting that the consistent availability of credit and the absence of major economic disruptions limited its influence on

zombie firm dynamics. While, during the pandemic, widespread fiscal and monetary interventions aimed at stabilising the economy likely overshadowed the effects of short-term loan demand (see Table 19). The regression results remain statistically insignificant, suggesting that government support measures, such as subsidised loans and direct fiscal aid, played a more prominent role in sustaining firms during this period than short-term borrowing patterns.

Table 19: OLS Regression – Short-Term Loan Demand and Zombie Firms – COVID Period (2020–2021)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	38.8874	38.397	1.013	0.323
Loan Demand Short Term	60.3210	112.604	0.536	0.597
Short-Term Interest Rates	-1.3870	95.725	-0.014	0.989

Notes: This table presents OLS regression results based on 16 observations. R-squared = 0.009, Adjusted R-squared = -0.062, F-statistic = 0.129, p-value = 0.724.
Log-Likelihood = -90.425, AIC = 184.9, BIC = 186.4. Standard errors assume the covariance matrix is correctly specified.

Table 20: OLS Regression – Short-Term Loan Demand and Zombie Firms – Post-COVID Period (2022–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	54.1629	18.807	2.880	0.008
Loan Demand Short Term	33.9714	11.789	2.882	0.008
Short-Term Interest Rates	-1.0391	10.755	-0.097	0.923

Notes: This table presents OLS regression results based on 16 observations.R-squared = 0.001, Adjusted R-squared = -0.071, F-statistic = 0.009, p-value = 0.926.
Log-Likelihood = -88.766, AIC = 181.5, BIC = 183.1. Standard errors assume the covariance matrix is correctly specified.

On the contrary, in the post-pandemic recovery phase, the results are statistically significant. The coefficient is 33.9714 ($p = 0.008$), suggesting a positive relationship. The model for this period explains a slightly larger share of the variation ($R^2 = 0.043$). Hence, with increasing short-term loan demand, firms might have easier access to financing, thereby improving their liquidity and continuing inefficiencies, as they are able to keep operating without addressing fundamental problems.

5.6 Government Support (2020 - 2021)

The analysis of the relationship between zombie firms and government support, as presented in Table 21, reveals no statistically significant effects.

Table 21: OLS Regression – Government Support and Zombie Firms – COVID Period (2020–2021)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	71.0000	6.087	11.663	0.000
Additional Spending	-0.6760	2.019	-0.335	0.739
Equity Loans Guarantees	-3.1541	3.121	-1.011	0.315

Notes: This table presents OLS regression results based on 96 observations. R-squared = 0.028, Adjusted R-squared = 0.008, F-statistic = 1.360, p-value = 0.262. Standard errors assume the covariance matrix is correctly specified.

The model, incorporating additional government spending and equity loans or guarantees as independent variables, accounts for only 2.8% of the variation in zombie firm prevalence, highlighting its limited explanatory power. For the sample period from 2020 to 2021, both coefficients are statistically insignificant, suggesting that these measures did not meaningfully affect the persistence of zombie firms. During the COVID-19 pandemic, fiscal measures such as direct spending, equity injections, and loan guarantees were introduced to stabilise economies and prevent firm closures. While these interventions were essential in mitigating the economic impact of the pandemic, their influence on sustaining inefficient firms remains uncertain. The results in Table 19 suggest that government support measures were not specifically targeted at zombie firms but instead aimed at broader economic stabilisation. Consequently, fiscal policies may have helped avert firm closures but were not decisive in altering the prevalence of zombie firms. Further analysis is needed to assess whether other factors, such as the overall economic environment or the characteristics of firms receiving aid, contributed to these findings.

5.7 Classification of the results in the literature context

The findings of this study align with existing literature on zombie firms while offering nuanced insights into their persistence across European economies from 2012 to 2023. The results reinforce prior research on the limited role of monetary policy in addressing zombie firm prevalence. The absence of a statistically significant relationship between short-term interest rates and zombie firms supports conclusions by Borio (2018) and Banerjee and Hofmann (2018), who argue that low interest rates alleviate financial pressures but do not drive the structural adjustments required to eliminate inefficiencies. Similarly, bor-

rowing costs were not found to be a decisive factor in zombie firm survival, consistent with McGowan, Andrews, and Millot (2018). The findings on loan demand reveal further complexity. While general loan demand had little impact overall, its significance during the post-pandemic period aligns with Andrews and Petroulakis (2017), highlighting the importance of credit conditions during economic recovery. The reliance on short-term borrowing by inefficient firms during periods of financial tightening reflects the 'weak bank channel' identified by Schivardi, Sette, and Tabellini (2021), wherein credit allocation sustains unproductive firms rather than fostering productivity-enhancing investments. The analysis of government support during the pandemic reveals no significant relationship between fiscal measures and zombie firm prevalence (see Table 21). This suggests that interventions such as loan guarantees and direct spending primarily acted as economic stabilisers rather than restructuring tools, consistent with Acharya, Eisert, et al. (2019) and Giannetti and Simonov (2013). While these measures mitigated immediate disruptions, their broad application likely sustained both efficient and inefficient firms, delaying structural adjustments. These findings align with broader research on zombie firms in Japan and OECD economies. The post-pandemic reliance on credit mirrors trends observed by Caballero, Hoshi, and Kashyap (2008) during Japan's banking crisis, where zombie lending suppressed the growth of healthier firms. Similarly, the persistence of zombie firms despite recovery efforts echoes Banerjee and Hofmann's (2018) global findings that zombie firms tend to rise during downturns and remain elevated during recoveries.

5.8 Economic Interpretation of the Results

This study's findings emphasise the complex interplay between monetary policy, credit conditions, and fiscal interventions in shaping zombie firm dynamics. Across all periods, short-term interest rates were not statistically significant, consistent with prior literature. Borrowing costs, while largely insignificant, showed a positive association with zombie firm prevalence in the post-pandemic period, suggesting that tightening financial conditions exposed structural inefficiencies. Loan demand, both general and short-term, was insignificant during the pre-pandemic and pandemic periods, likely due to abundant liq-

uidity and fiscal support. However, its growing significance in the post-pandemic period indicates that inefficient firms increasingly relied on borrowing to sustain operations under tighter economic conditions. Similarly, government support measures during the pandemic, while essential for stabilising the economy, had limited direct influence on zombie firm prevalence, echoing broader concerns about untargeted fiscal interventions delaying necessary market corrections. Overall, the results suggest that zombie firm persistence is driven by a combination of monetary policy, fiscal measures, and firm-level dynamics, none of which independently determine their survival. Addressing this issue requires a multifaceted approach, including targeted fiscal policies, improved credit allocation, and structural reforms to enhance productivity. Future research should explore these interactions further to provide a deeper understanding of zombie firm dynamics in modern economies.

6 Robustness

To test the robustness of the findings, Gross Domestic Product (GDP) growth ($\text{GDP}_{i,t}$) was introduced as an additional explanatory variable in the regression model. GDP growth, a key indicator of macroeconomic health, reflects a country's economic performance and its influence on firm survival. Higher GDP growth is generally linked to improved corporate performance, potentially mitigating the prevalence of zombie firms. The regression model was extended as follows:

$$\text{Zombie}_{i,t} = \beta_0 + \beta_1 \text{Short-Term Interest Rates}_{i,t}{}^{7} + \beta_2 \text{GDP}_{i,t} + \epsilon_{i,t}$$

The results, presented in Table 22, indicate no statistically significant relationship between GDP growth and zombie firm prevalence or between short-term interest rates and zombie firms. The low explanatory power ($R^2 = 0.007$) suggests that these variables alone are

[7] In this specification, $\text{Zombie}_{i,t}$ represents the number of zombie firms in country i in year t. The variable $\text{ShortTermInterestRates}_{i,t}$ captures the short-term interest rates in country i for the year t, while $\text{GDP}_{i,t}$ denotes the GDP growth rate of country i for the same period. The model includes an intercept, β_0, and an error term, $\epsilon_{i,t}$, to account for unobserved heterogeneity.

Table 22: OLS Regression – GDP and Zombie Firms – (2012–2023)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Intercept	69.8277	6.297	11.087	0.000
Short-Term Interest Rates	-0.6461	5.740	-0.113	0.911
GDP Growth	-1.3785	1.707	-0.807	0.421

Notes: R-squared = 0.007, Adjusted R-squared = -0.014, F-statistic = 0.329, p-value = 0.721. Standard errors assume the covariance matrix is correctly specified. Number of observations = 96.

insufficient to explain the variation in zombie firm prevalence. GDP growth plays a limited role in this model, and other factors—such as institutional settings, sectoral differences, or fiscal policies—might be more critical. The findings confirm that the relationship between short-term interest rates and zombie firms remains trivial even after accounting for GDP growth.

7 Conclusion

This study investigates the relationship between interest rate changes and the prevalence of zombie firms in Europe, with a particular focus on the role of short-term interest rates, borrowing costs, loan demand, credit standards, and government support measures. By analysing firm-level and macroeconomic data across eight European countries from 2012 to 2023, the study provides a nuanced understanding of the factors that influence zombie firm dynamics. The findings reveal that short-term interest rates, while theoretically important, do not exhibit a statistically significant relationship with zombie firm prevalence. This aligns with the broader literature suggesting that monetary policy alone is insufficient to address inefficiencies. Borrowing costs, while generally insignificant, show a notable positive association with zombie firm prevalence during the post-pandemic recovery, suggesting that tightening financial conditions may have exacerbated the survival of inefficient firms. Similarly, general and short-term loan demand gain importance during the post-pandemic period, indicating that economic adjustments and liquidity constraints play a role in shaping zombie firm dynamics during recovery phases. Government support measures during the COVID-19 pandemic also show limited direct effects on zombie firm prevalence. Overall, zombie firm dynamics appear to be of a multifaceted nature, driven

by the interplay of monetary policy, fiscal interventions, and firm-level characteristics. The study further contributes to the ongoing discussions on resource allocation and productivity by emphasising the limitations of relying solely on monetary or fiscal policies to address inefficiencies.

8 Limitations, recommendation for further research

As already discussed throughout, the study faces several limitations that merit consideration. One primary constraint lies in the availability and quality of data. The reliance on aggregated macroeconomic data and firm-level financial information introduces potential measurement errors and may overlook important nuances, such as country-specific institutional factors and industry-level dynamics. A more granular dataset could enable a deeper exploration of these regional and sectoral variations, providing richer insights into the factors shaping zombie firm dynamics. Another limitation stems from the definition of zombie firms. This study uses the widely accepted interest coverage ratio (ICR < 1) to classify zombie firms, yet this metric may oversimplify the complexities of financial distress. Firms facing temporary liquidity issues or operating in capital-intensive industries might be misclassified as zombies, while genuinely distressed firms with alternative financing arrangements might be excluded. Employing additional indicators, such as profitability or liquidity measures, could offer a more comprehensive perspective on the prevalence and characteristics of zombie firms. The analysis primarily employs linear regression models, which may overlook non-linear relationships and the lagged effects of monetary policy and government interventions on zombie firm dynamics. Greater consideration of institutional and sectoral heterogeneity, including differences in banking systems, regulatory frameworks, and market structures across Europe, would add further depth. While the study provides valuable insights into the immediate impacts of COVID-19 support measures, the long-term effects remain uncertain as fiscal interventions are withdrawn. Future research utilising advanced econometric methods and examining post-pandemic trends could offer a more comprehensive understanding of the persistence and determinants of zombie firms.

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Appendix

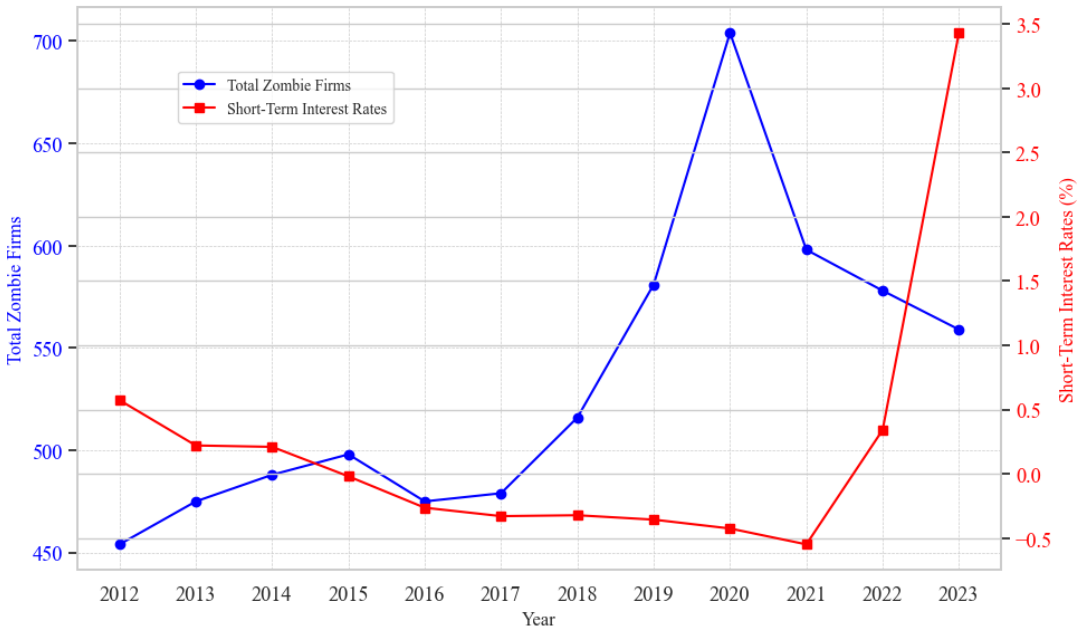

Figure 1: Total Zombie Firms and Short-Term Interest Rates (2012–2023)

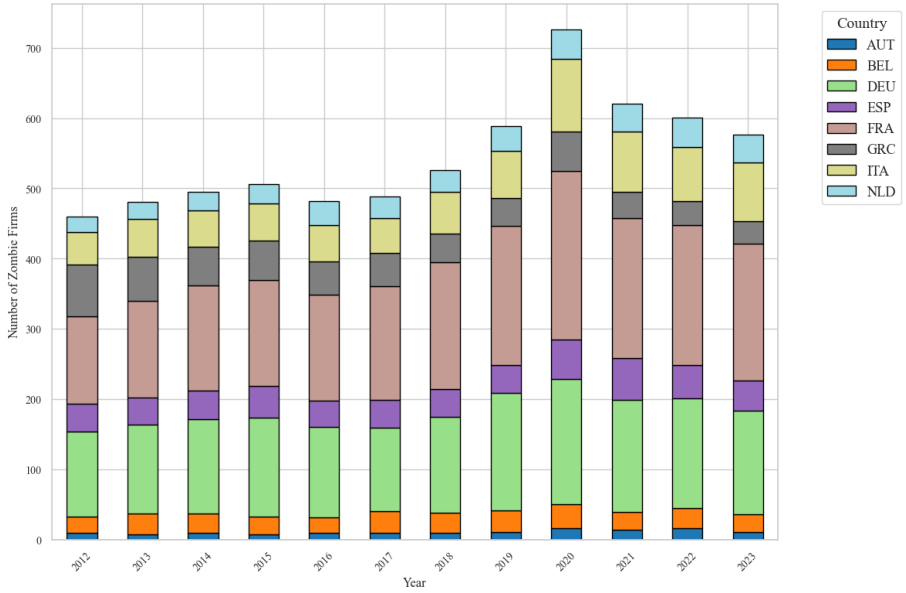

Figure 2: Number of Zombie Firms by Country (2012-2023)

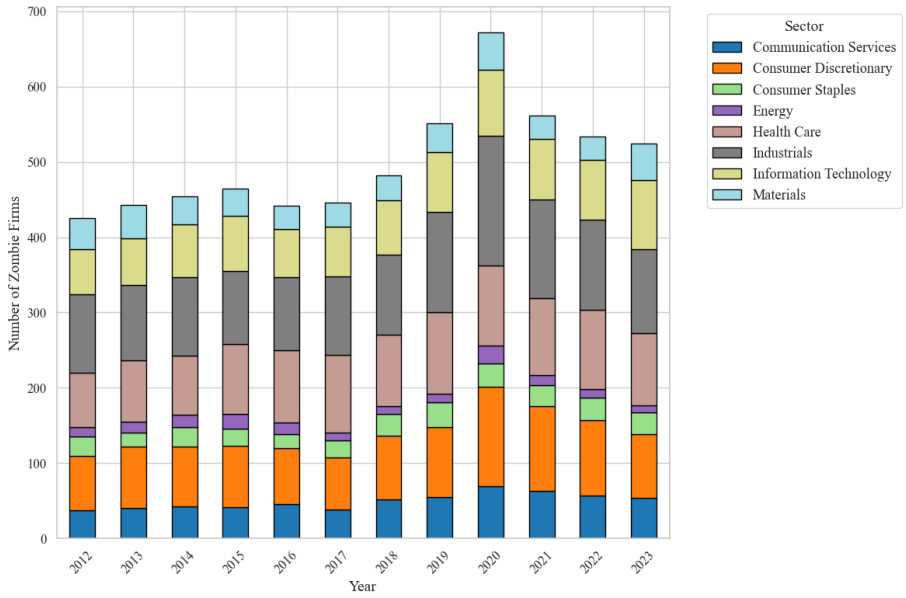

Figure 3: Number of Zombie firms by Sector (2012-2023)

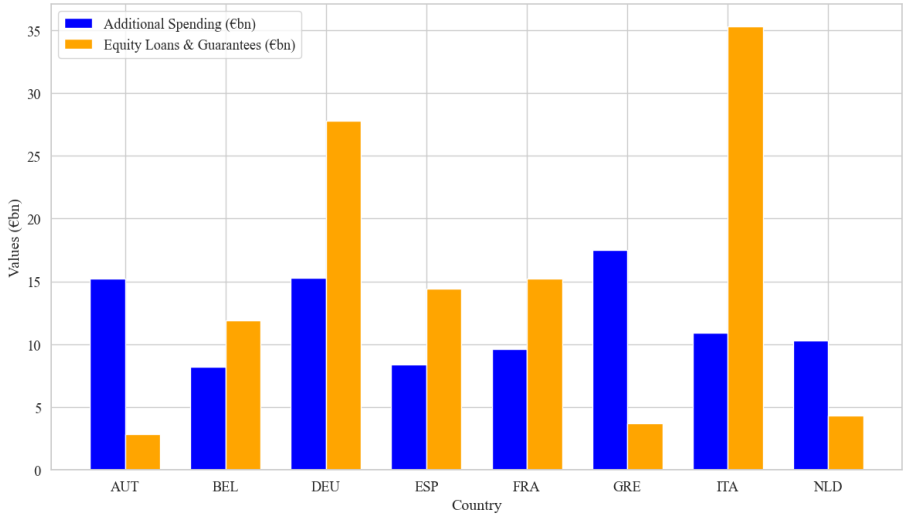

Figure 4: Discretionary Fiscal Response to the COVID-19 Crisis in Selected Economies (2021)

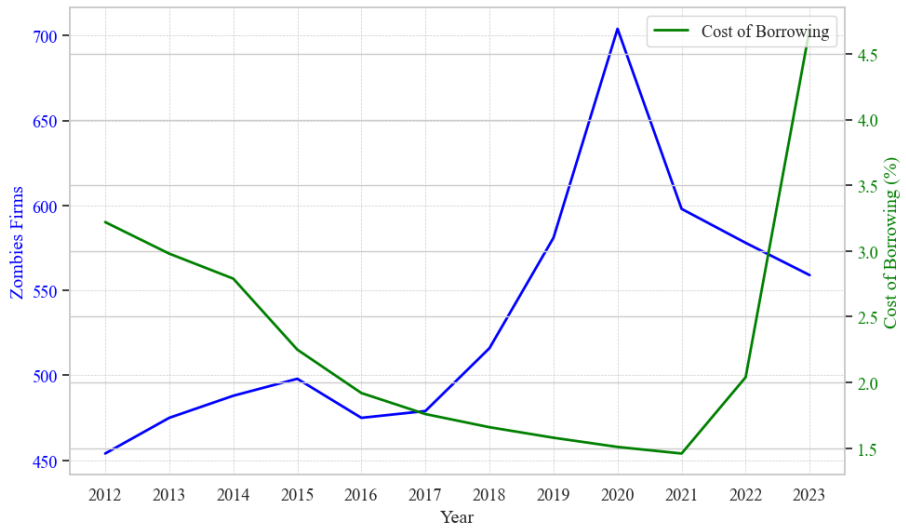

Figure 5: Relationship Between Zombie firms and Cost of Borrowing (2012–2023)

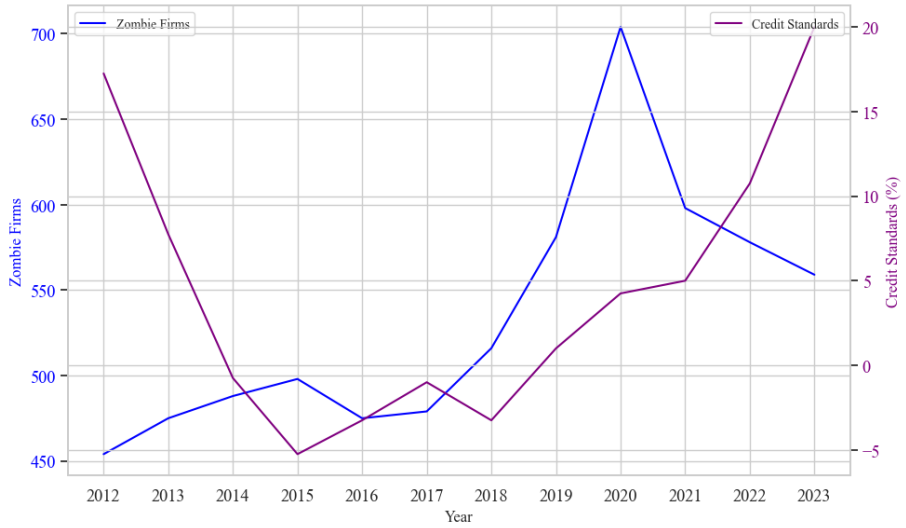

Figure 6: Relationship Between Zombie firms and Credit Standards (2012–2023)

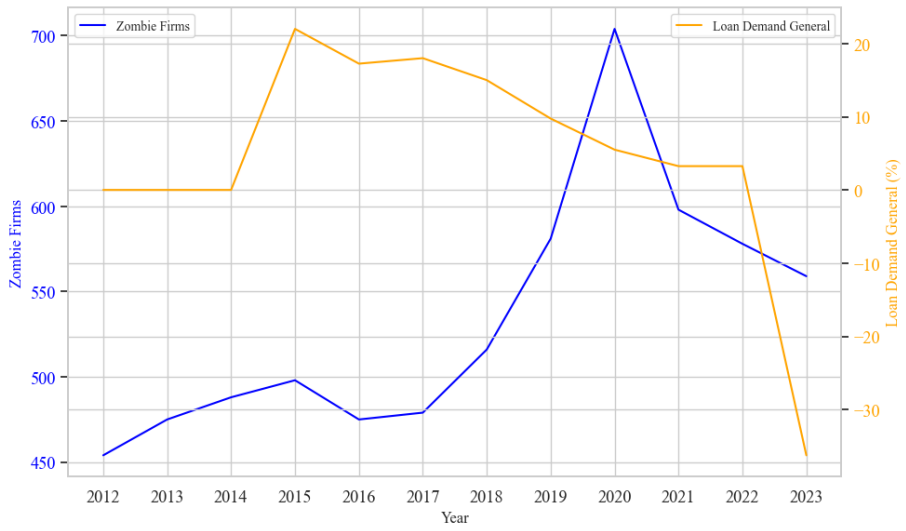

Figure 7: Relationship Between Zombie firms and General Loan Demand (2012–2023)

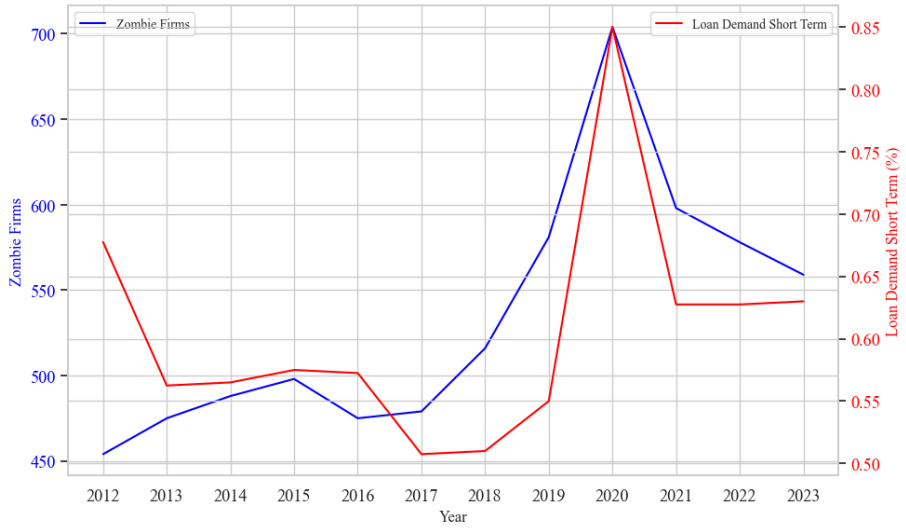

Figure 8: Relationship Between Zombie firms and Short-Term Loan Demand (2012–2023)

Sub-Industry	Sector
Chemicals	Materials
Oil & Gas	Energy
Machinery	Industrials
Construction Materials	Materials
Building Products	Industrials
Textiles, Apparel & Luxury Goods	Consumer Discretionary
Construction & Engineering	Industrials
Trading Companies & Distributors	Industrials
Food Products	Consumer Staples
Containers & Packaging	Materials
Energy Equipment & Services	Energy
Transportation Infrastructure	Industrials
Metals & Mining	Materials
Commercial Services & Supplies	Industrials
Electronic Equipment & Instruments	Information Technology
Automobiles	Consumer Discretionary
Software	Information Technology
IT Consulting & Services	Information Technology
Internet & Direct Marketing Retail	Consumer Discretionary
Auto Components	Consumer Discretionary
Electrical Equipment	Industrials
Air Freight & Logistics	Industrials
Beverages	Consumer Staples
Aerospace & Defense	Industrials
Pharmaceuticals	Health Care
Computers & Peripherals	Information Technology
Food & Drug Retailing	Consumer Staples
Distributors	Industrials
Health Care Equipment & Supplies	Health Care
Wireless Telecommunication Services	Communication Services
Communications Equipment	Information Technology
Entertainment	Communication Services
Media	Communication Services
Health Care Providers & Services	Health Care
Biotechnology	Health Care
Personal Products	Consumer Staples
Household Durables	Consumer Discretionary
Industrial Conglomerates	Industrials
Airlines	Industrials
Marine	Industrials
Hotels Restaurants & Leisure	Consumer Discretionary
Specialty Retail	Consumer Discretionary
Household Products	Consumer Staples
Road & Rail	Industrials
Paper & Forest Products	Materials
Tobacco	Consumer Staples

Table 23: GICS Sub-Industry to Sector Mapping (Excluding Utilities and Financials)

Sector	Total Zombies
Industrials	1381
Health Care	1137
Consumer Discretionary	1065
Information Technology	885
Communication Services	597
Materials	453
Consumer Staples	312
Energy	169

Table 24: Total Zombie firms per Sector (2012–2023)

Year	Number of Zombies
2012	454
2013	475
2014	488
2015	498
2016	475
2017	479
2018	516
2019	581
2020	704
2021	598
2022	578
2023	559
Total	**6405**

Table 25: Annual Number of Zombie firms (2012–2023)

Country	**Total Zombies**
Austria (AUT)	142
Belgium (BEL)	343
Germany (DEU)	1768
Spain (ESP)	525
France (FRA)	2091
Greece (GRC)	616
Italy (ITA)	716
Netherlands (NLD)	395

Table 26: Total Number of Zombie firms per Country (2012–2023)

Country Code	**2019**	**2020**	**2021**
AUT	10	16	14
BEL	31	34	25
DEU	168	179	160
ESP	39	56	59
FRA	199	240	200
GRC	39	56	37
ITA	67	103	86
NLD	36	42	39

Table 27: Number of Zombie Firms in 2019, 2020, and 2021.