IMPACT OF ZOMBIE COMPANIES ON GOVERNANCE AND FINANCIAL PERFORMANCE OF THE MANUFACTURING INDUSTRY DURING COVID-19

Thi Khanh Phuong Nguyen [*], Thi Le Thanh Nguyen [**], Dieu Linh Nguyen [*]

_____

* Banking Academy of Vietnam, Hanoi, Vietnam
** *Corresponding author,* Banking Academy of Vietnam, Hanoi, Vietnam
Contact details: Banking Academy of Vietnam, 12 Chua Boc Street, Dong Da District, Hanoi, Vietnam

Abstract

In Vietnam, after the COVID-19 period, zombie companies increased and negatively affected the economy, making it difficult for the state to make appropriate policies (Caballero et al., 2008). The purpose of this research is to find out the factors that affect the possibility of becoming a zombie company and how the manufacturing enterprises themselves affect the performance of enterprises in the industry. The research sample includes 41 zombie companies and 479 other normal companies in the manufacturing industry listed on the Vietnamese stock market from 2017–2021. Analysis results show that factors that reflect financial performance including liquidity, capital efficiency, and profitability of zombie companies are lower than healthy companies and the differences are all significant. Regression analysis using Stata shows that zombie companies have a negative impact on the financial performance of manufacturing companies on the stock market. From the results of empirical research, the study has made a number of policy recommendations to minimize the negative impact of zombie companies on the overall performance of the industry and the economy.

Keywords: Listed Companies, Manufacturing Industry, Zombie Companies

Authors' individual contribution: Conceptualization — T.K.P.N.; Methodology — T.L.T.N.; Validation — T.K.P.N.; Writing — Review & Editing — T.K.P.N., T.L.T.N., and D.L.N.; Visualization — T.K.P.N.; Supervision — T.L.T.N.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

1. INTRODUCTION

Zombie companies are companies that have made losses for three consecutive years or made profits, but not enough to repay debt, have fallen into financial difficulties, but are still supported by the government to survive. These companies have taken away the opportunities of many large businesses that are always trying to expand their markets and develop their economies. Besides, these companies are also barriers for new companies entering the market, reducing investment capital

and creating a burden on the economy. This is a big problem facing not only Japan, the United States (US), and China, but also the world economy. In Vietnam, zombie companies exist in the form of state-owned companies that operate with the state budget, but operate stagnantly, and have been at a loss for many years, or foreign-invested companies that exist when interest rates are low and supported by the government.

"Zombie companies" first appeared in the 1990s, is a term used to refer to companies with weak business situations, unable to be financially independent, but dependent on bailouts and other incentives. Low interest rate loans from Japanese banks following the collapse of the Japanese asset price bubble.

Kane (1987) suggested that credit institutions and zombie banks are organizations that have the ability to mobilize finance to maintain their existence and create negative impacts on the entire economy in many aspects. Hoshi (2006) believes that zombie companies are companies that are gradually losing their ability to pay debts and are unlikely to recover, but are not bankrupt thanks to capital support from banks. Caballero et al. (2008) pointed out that zombie companies are companies that have fallen into financial distress and are eliminated by the market, but provide financial support to prolong their existence. They have no ability to innovate, cannot change to adapt to new environments and especially do not contribute anything to the development of the economy nor create added value for themselves. Thomas (2009), on zombie companies in the United Kingdom (UK) and the US, commented that zombie companies are companies that only have enough cash to pay interest, but cannot pay off the entire debt sets (evergreen loans). Zombie companies are still able to earn revenue, but cannot attract enough investment money to pay debts. After paying all costs for production and business, zombie companies are left with only enough to pay the interest on those debts, but not the principal. Nguyen (2016) and Binh et al. (2020) said that, in Vietnam, zombie companies are inefficient businesses, with huge debt, but extremely low debt repayment ability, unprofitable business, stagnant, and possibly going bankrupt. However, those businesses still exist because they receive support from banks with low-interest-rate loans. Those businesses increase the market entry costs of new companies and thereby create pressure on the whole economy.

Zombie companies not only negatively affect the production and business efficiency of the entire industry, but also cause many negative impacts on all aspects of the social economy. Therefore, it is important to check the actual business purpose of the enterprise to determine whether the enterprise really cannot escape the zombie situation or is intentionally becoming a zombie to take advantage of preferential interest rates and subsidy packages level of the government, whether listing on the stock market to expand capital sources, issue bonds, or gain illegal profits is extremely necessary. Along with that, the manufacturing industry group accounts for a large proportion of the economy. At the same time, this industry group is also greatly affected by the macro environment, so the COVID-19 pandemic has caused manufacturing businesses to suffer heavily. Therefore, researching zombie companies in the manufacturing industry in Vietnam is an urgent issue in the current period.

The overall goal of the research is to understand the impact of zombie businesses on the performance of manufacturing enterprises in Vietnam in the period 2017–2021. To answer the above research objective, the research questions are as follows:

RQ1: What are the signs of zombie companies?

RQ2: What is the current status of zombie companies in Vietnam?

RQ3: What is the impact of zombie companies on the performance of manufacturing enterprises?

The study uses quantitative research methods with fixed-effect (FEM) and random-effect (REM) models and the support of Stata software to evaluate business performance through return on assets (ROA) spending. The study points out an existing problem related to zombie companies: a zombie business last year will impact the ROA financial performance of healthy businesses the following year, and also provides recommendations. Proposals to policymakers and businesses themselves to reduce the rate of zombie businesses in the economy.

The structure of this paper is as follows. Section 2 reviews the relevant literature, displaying studies related to identifying factors affecting the ability to become zombie companies and how manufacturing industry enterprises themselves affect the performance of enterprises in such industries. Section 3 outlines the theoretical framework and describes the collection of data samples and the research methodology. Section 4 shows the research results of ordinary least squares (OLS), FEM, REM, and Hausman tests, and checks the model for defects, while Section 5 provides the result discussion. Section 6 shows some main conclusions and policy implications of the study practice and recommendations.

2. LITERATURE REVIEW

After the COVID-19 pandemic, many companies have a weak business situation and cannot be financially independent, but must depend on relief and low-interest loans from banks. These are zombie companies. There have been studies around the world about zombie companies and especially their effects.

In the early 21st century, empirical studies focused on the phenomenon of zombie companies emerging in Japan, revealing the stagnation of the Japanese economy in the 1990s and the inadequacies in the economic system of Japan. Japanese financial system (Hoshi & Kashyap, 2004; Ahearne & Shinada, 2005; Peek & Rosengren, 2005). Mostly, original research related to bank actions (Caballero et al., 2008; Broz & Ridzak, 2017; Kwon et al., 2015) pointed to the behavior of Japanese banks that caused companies to go bankrupt and lose their ability to operate. Their research results show that the existence of these indebted and insolvent companies has prevented economic recovery in Japan, by hindering the development of these companies themselves. and thus reduces the productivity of the entire economy, as shown by Ahearne and Shinada (2005), De Veirman and Levin (2012), Asanuma (2015), and Kwon et al. (2015).

Ahearne and Shinada (2005) suggested that one factor affecting the weakness of Japan's economic performance over the past decade is that Japanese banks have continued to provide financial support to indebted financial support to indebted, inefficient companies, commonly known as zombie companies. Such inefficient practices will prevent companies

with higher growth potential from gaining market share, stifling potentially important productivity gains for the economy as a whole. To better understand zombie companies, the study used Japanese data from industries with a large number of zombie companies (construction, retail industries, and wholesale) to provide evidence that productivity growth in these industries is very low. They argued that an important role in the formation of zombie companies was the inappropriate allocation of bank credit, and financial support packages from Japanese banks contributed to maintaining the disparity between bank companies in the same market share.

Peek and Rosengren (2005) argued that lending has been encouraged by banks' national obligation to support troubled businesses (to avoid rising bankruptcies and unemployment) and in case of financially weak banks trying to maintain required capital. Growth cap pass-through rates for problem loans are reported on their statements of financial position. The results show that the misallocation of bank credit has hindered the long-term recovery and growth of the Japanese economy.

Hoshi and Kashyap (2004) showed that the problem of low profits of Japanese banks due to lack of profits from lending activities. Studies have found a number of possible causes such as the large increase in bank loans specifically for underperforming sectors due to more zombie companies receiving loans with additional interest rates low (Peek & Rosengren, 2005) and an increase in the number of businesses receiving loans at very low interest rates (Caballero et al., 2008). According to Hoshi and Kashyap (2004), Peek and Rosengren (2005) explained the behavior of Japanese banks as due to pressure from the government to not allow companies to go bankrupt, leading to the risk of job loss.

Fukuada and Nakamura (2011) identified zombie companies in a group of listed companies in Japan between 1995 and 2004 to find out why zombie companies recovered. The author defines zombie companies based on the criteria obtained from the results of Caballero et al. (2008) and focuses on the element of zombie companies that are believed to help zombie companies recover. However, research shows that cutting staff or selling fixed assets, without paying executives, is not a positive solution to zombie companies' resilience. On the other hand, support to reduce debt and reduce capital is the solution to help restore zombie companies.

Andrews et al. (2017) showed that average productivity is reduced due to the existence of weak firms, which in turn strongly affects economic growth. Such firms use scarce resources, so their persistence can reduce market prices, increase productivity-related wages, and weaken investment, hindering expansion.

Jiang et al. (2017) showed that the long-term existence of zombie companies not only takes up valuable resources, but also causes financial problems for other enterprises, reducing the production efficiency of the whole world branch. Research on zombie companies in China in the period 2009–2016 has shown that enterprises are alive, but not dead because they are supported by the government in the form of government subsidies and zombie companies that take on large positions will receive more support.

Lam et al. (2017) conducted a survey in China with survey data of enterprises in the period 1998–2013 to evaluate the factors that determine whether a business is vegetative or the factors that identify zombie companies using the Probit model. Research results show that zombie companies are more popular among state-owned enterprises and are concentrated in redundant industries in North and Northeast China. At the same time, zombie companies tend to underperform shown by higher financial leverage and lower profitability.

Banerjee and Hofmann (2018) used 32,000 listed non-financial companies data from 14 developed countries (from the Worldscope database) to show the average labor productivity and the composite factor productivity of zombie firms are lower than that of their peers, and the productivity distribution of zombie firms shifts to the left. The results of empirical research also show that when the proportion of fixed capital of manufacturing enterprises compared to the whole industry in a country increases, the financial efficiency decreases significantly. Specifically, the estimates show that when other factors remain unchanged if the average fixed capital ratio of zombie businesses in the economy increases by 1%, financial performance will decrease by about 0.3%.

Dai et al. (2019) showed that, in China, the main cause of the emergence of zombie companies is due to ineffective interventions from the government and continuous financial support from the government and banks did not contribute to the recovery of zombie companies. While cutting labor costs, changing ownership, and removing leverage can help effectively deal with zombie companies, the transfer of ownership or sale of assets does not have a clear recovery for these businesses.

Huong et al. (2020) used data from 533 companies on the Vietnamese stock market from 2008 to 2016 to study the factors that help determine zombie companies. Above all, zombie companies are companies with negative profits and interest payment ratios below one for three consecutive years. The results from the model show that:

1) a zombie company this year is more likely to be a zombie company next year;

2) small companies are more likely to become zombie companies;

3) abuse of financial leverage, increasing debt to total assets increases the risk of becoming a zombie company;

4) reduced return on total assets increases the risk of becoming a zombie company;

5) as the current rate decreases, the risk of becoming zombie companies increases;

6) decrease in total asset turnover increases the risk of becoming a zombie company.

Binh et al. (2020) reviewed the criteria for identifying food sector zombie companies based on their financial factors and how food sector zombie companies affect their financial performance enterprises in the same field in Vietnam. This study uses secondary data, collected from the financial statements of 55 listed food companies for the period 2017–2019. The statistical results show the proportion of listed zombie companies in the food industry. The food processing industry accounted for 30% of the study period. Binh et al. (2020) pointed out that the zombie companies' group was inefficient, suffered long-term losses and had many potential financial risks. Both the economic policy from the government and the actual actions of businesses must be changed to help overcome and improve the situation of zombie businesses that still exist.

Yu et al. (2021) conducted a study of non-financial companies listed on Class A shares on the Chinese stock market from the year of 2008 to the year of 2018 on the impact of zombie companies on costs. Debt financing of non-zombie firms via FEM. Research on robustness testing and endogeneity testing shows that zombie companies significantly increase the debt financing costs of other companies and the impact of zombie companies on the debt financing costs of non-zombie companies has a significant difference depending on different levels of external financial dependence, different ownership forms and different company sizes. The negative impact of zombie firms on the debt financing costs of non-zombie firms is more significant in industries with high external financial dependence, non-state-owned firms and non-zombie firms (small and medium companies). Reasonable handling of zombie companies helps reduce and improve resource allocation efficiency across the entire industry and promotes the optimization and upgrading of industrial structure as well as the sustainable development of the economy.

Liu and Zhou (2022) pointed out that zombie companies have a strong negative impact on society. Specifically, the authors conducted empirical research on the impact of zombie companies on the financial information transparency of normal companies and found that zombie companies significantly reduce the transparency of financial information of these ordinary companies, thus also reducing their operating efficiency. Further analysis showed that zombie companies have a more obvious negative impact on the financial information transparency of companies without political connections, companies with a poor regulatory environment, and companies within highly competitive industries.

Rashid et al. (2022) studied publicly traded companies on the Pakistan Stock Exchange from 2009–2019. The results showed the presence of zombie companies in the Pakistani context with high liquidity, low liquidity, non-profit, inefficient and negative relationships between zombie companies and industry growth. The study is useful for policymakers when developing bankruptcy policies to ensure a stable environment for industrial growth.

Feng et al. (2022) concluded that zombie companies can have significant financial consequences. In a simple theoretical model, they showed that zombie companies can increase the borrowing costs of healthy firms and make them more dependent on internal funding in the future. Empirical evidence of research on Chinese manufacturing companies from 1998 to 2007 has proven that the appearance of zombie companies will cause non-plant enterprises (strong financial health enterprises) to cut spending more and this impact is especially high if the non-plant enterprises are financially constrained and if the financial market condition is tight.

Logarušić and Raguž Krištić (2022) analyzed the impact of zombie companies on the performance of companies, the economy and economic sentiment (ESI) health in selected countries in Central and Eastern Europe from 2008 to 2016. The results of the study show that: using panel data with a fixed effects model, market congestion caused by zombie companies has a negative impact on productivity and profits per employee, investment positive, and negative for employment growth of healthy companies, with no significant impact on the gross domestic product (GDP) of selected countries in Central and Eastern Europe where there is a positive relationship with ESI.

Ren et al. (2023) studied the relationship between zombie companies and fixed asset investments of normal companies. The study uses the Chinese Industrial Enterprise Database (CIED) for the period 1998–2013. The results show that zombie companies have crowded out fixed asset investment by increasing financial costs, destroying the industry's competitive environment, while improving the regional institutional environment can reduce the zombie crowding effect

In summary, the current research on zombie companies in Vietnam is still new, with a small number of studies, especially the manufacturing industry that have not been studied deeply, especially during the COVID-19 period. According to the forecasts of experts Globally, the wave of zombie companies will become a dilemma for any government during this time including countries with the most developed economies in the world such as the US, China, and Germany. Therefore, studying the effect of zombie companies on ROA is a necessary issue.

With the model assessing the impact of zombie companies on ROA we propose the following hypotheses:

H1: Zombie companies negatively impact the operational performance of a company.

H2: Companies in a state of financial distress in the previous year negatively affected their operational performance in the following year.

H3: Company size is positively related to the return on assets.

H4: Financial leverage has a negative effect on return on assets.

H5: The use of financial leverage by zombie companies has a positive impact on their profitability.

H6: Revenue growth rate has a positive effect on the company's profitability.

H7: The revenue growth rate of zombie companies has a positive effect on the company's profitability.

H8: The current ratio of short-term debt obligations has a positive effect on return on assets.

H9: The current ratio of zombie companies positively impacts return on assets.

H10: The gross domestic product growth rate has a positive effect on the return on assets of companies.

H11: The inflation rate negatively impacts the return on assets of companies.

3. RESEARCH METHODOLOGY

3.1. Method

The main method used in this research is the quantitative research method, using the logit model to regress the zombie-dependent variable to determine the factors that identify actual zombie companies in Vietnam. At the same time, use panel data regression to test the OLS least squares regression model, the FEM model and the REM model and conduct the Hausman test with the support of Stata software and found that the FEM model is the optimal model chosen. Then, test for heteroskedasticity with the Wald test, test for autocorrelation with the Wooldridge test, and fix the defects of the model.

3.2. Data collection

The study uses secondary data from manufacturing companies listed on the Vietnamese stock exchanges (Ho Chi Minh Stock Exchange [HOSE], Hanoi Stock

Exchange [HNX], UPCOM), for the period 2017–2021, data is collected from the financial statements of the companies, enterprises aggregated and publicly announced on the VietstockFinance (https://finance.vietstock.vn/). After aggregating, concatenating, and cleaning data, the research team has a balanced dataset of 520 listed companies in the manufacturing industry that operated continuously for the whole period of 2017–2021 on the Vietnamese stock exchanges. The research sample includes: 41 zombie companies and 479 other healthy enterprises in the same manufacturing industry. The empirical study will use the data of these enterprises in the period 2019–2021, because the data from 2017 and 2018 will be used to determine zombie companies in 2019 according to the criteria used in the study.

The study uses criteria to identify companies in the zombie companies group in year *t* according to Huong et al. (2020):
- interest coverage ratio (measured by profit before tax and interest divided by interest payable) is less than 1 in three consecutive years *t - 2*, *t - 1*, and *t*;
- profit from negative business activities in year *t*.

3.3. Research models

This study used the following variables in the research model to evaluate the influence of zombie companies in the manufacturing industry on the performance of other businesses in the same industry proposed as follows:

Table 1. Variables in the research model

Variable	Symbol	Formula
Financial performance	ROA	A company's net income / Total assets
Zombie companies	Zombie	A dummy variable that takes the value of 1 if the zombie company and takes the value of 0 in all other cases
Firm size	SIZE	Logarithm of total assets
Financial structure	DTL	Total debt / Total equity
Revenue growth rate	GR	Percentage increase or decrease in revenue from period to period
Current ratio	CR	Total current assets / Total current liabilities
Gross domestic product growth	GDP	Aggregated data from the World Bank
Inflation rate	CPI	Aggregated data from the World Bank

Source: Authors' compilation.

Specifically, the model to evaluate the influence of the manufacturing industry's zombie companies on the performance of other enterprises in the same industry is proposed as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 Zombie_{i,t-1} + \beta_2 Zombie_{i,t} + \beta_3 Zombie_{i,t} * CR_{i,t} + \beta_4 Zombie_{i,t} * GR_{i,t} + \beta_5 Zombie_{i,t} * DTL_{i,t}$$
$$+ \beta_6 GR_{i,t} + \beta_7 CR_{i,t} + \beta_8 DTL_{i,t} + \beta_9 SIZE_{i,t} + \beta_{10} GDP_{i,t} + \beta_{11} CPI_{i,t} + \varepsilon_{i,t} \quad (1)$$

where, *i* subscript refers to a zombie company, *t* subscript refers to a sample year, *SIZE* — firm size, *DTL* — financial structure, *GR* — revenue growth rate, *CR* — current ratio, *GDP* — gross domestic product growth, *CPI* — inflation rate and interaction variables between zombies and *DTL, GR, CR*.

4. RESEARCH RESULTS

4.1. Factors identifying zombie companies in Vietnam

The authors use the logit model to regress the zombie-dependent variable to determine the factors that identify actual zombie companies in Vietnam.

First, the *DTL* variable has a positive and statistically significant coefficient of 1%, indicating that when increasing debt over total assets, the company operates inefficiently, and the profits earned are not enough to pay interest, leading to the risk of Becoming a higher zombie. This result is similar to Hoshi (2006), Fukuda and Nakamura (2011), Nakamura and Fukuda (2013), and Binh et al. (2020).

Second, the *GR* variable has a negative coefficient with a statistical significance of 1%, indicating that when the revenue growth rate decreases, the likelihood of becoming zombie companies will increase. This means that the business's production and business capabilities decline, causing revenue to decrease.

Third, the variable *CR* has a negative coefficient with a statistical significance of 1%, showing that when the current ability to pay decreases, the probability of becoming a zombie increases. In other words, increasing current liquidity means increasing the ability to handle payment of due debts, demonstrating the company's financial capacity to deal with debts, thus the company's ability to be a zombie will decrease. This result supports previous research by Binh et al. (2020).

Fourth, the *SIZE* variable has a negative and statistically significant coefficient of 1%, which shows that when the company's scale (capital scale) is small, the enterprise is more likely to become a zombie company, but when the company's size grows large enough, it is less likely to become a zombie. The results are similar to the study of Binh et al. (2020).

Table 2. Variables in the research model

Iteration 0: Log-likelihood = -314.79878			Logistic regression:			
Iteration 1: Log-likelihood = -278.89403			Number of obs. = 1,502			
Iteration 2: Log-likelihood = -273.27425			Wald chi² (4) = 43.99			
Iteration 3: Log-likelihood = -272.83202			Log-likelihood = -272.83037			
Iteration 4: Log-likelihood = -272.83037			Prob > chi² = 0.0000			
Iteration 5: Log-likelihood = -272.83037						
Zombie	Coef.	Std. error	z	P > |z|	[95% conf. interval]	
DTL	0.0062957	0.0032149	1.96	0.050	-5.32e-06	0.0125968
GR	-0.2924257	0.1566178	-1.87	0.062	-0.599391	0.0145396
CR	-0.4927942	0.1845816	-2.67	0.008	-0.8545675	-0.1310209
SIZE	-0.1750241	0.0546899	-3.20	0.001	-0.2822145	-0.0678338
_cons	2.181944	1.524155	1.43	0.152	-0.8053454	5.169234

Source: Authors' elaboration using Stata software.

4.2. Research results on the influence of vegetal businesses on profitability (*ROA*)

Regression of panel data by least squares method and test for multicollinearity of the model are presented below (see Table 3).

The result Prob > F = 0.0000 shows that the OLS model is suitable.

Next, the authors conduct a multicollinearity test to check the suitability of the variables and the size of the sample. The coefficients of variance inflation factor (VIF) < 5 show that the sample is large enough and the model is suitable for building variables (see Table 4). Then, carry out the regression according to the fixed effects and random effects methods (see Tables 5 and 6) and choose the optimal model between FEM and REM.

Table 3. Ordinary least squares regression model (*ROA*)

Number of obs. = 1,502					R-squared = 0.2237	
F (11, 1490) = 39.03					Adj. R-squared = 0.2179	
Prob > F = 0.0000					Root mean square error (MSE) = 0.18629	
Panel A: Regression by least squares method						
Source	*SS*		*df*		*MS*	
Model	14.8991481		11		1.35446801	
Residual	51.709946		1.490		0.034704662	
Total	66.6090941		1.501		0.044376478	
Panel B: Multicollinearity test						
ROA	*Coef.*	*Std. error*	*t*	*P > |t|*	*[95% conf. interval]*	
Zombie	-0.5538192	0.0463756	-11.94	0.000	-0.6447875	-0.4628508
Zombie_1	-0.0984321	0.0410596	-2.40	0.017	-0.1789728	-0.0178914
Zombie × GR	0.0365933	0.0256649	1.43	0.154	-0.0137499	0.0869366
Zombie × CR	0.0639425	0.0102655	6.23	0.000	0.0438061	0.0840789
Zombie × DTL	0.0031794	0.0003368	9.44	0.000	0.0025189	0.00384
GR	-0.0002546	0.0027803	-0.09	0.927	-0.0057083	0.0051991
CR	0.0028214	0.0022326	1.26	0.207	-0.001558	0.0072008
DTL	-0.0007934	0.0002226	-3.56	0.000	-0.00123	-0.0003568
SIZE	0.0126806	0.0028264	4.49	0.000	0.0071365	0.0182248
GDP	0.0002812	0.0024888	0.11	0.910	-0.0046007	0.0051632
CPI	-0.0029048	0.0086532	-0.34	0.737	-0.0198785	0.014069
_cons	-0.2485061	0.0818814	-3.03	0.002	-0.4091212	-0.087891

Note: SS — sum of squares, MS — mean square.
Source: Authors' elaboration using Stata software.

Table 4. Multicollinearity test (*ROA*)

Variable	*VIF*	*1/VIF*
Zombie	4.42	0.226461
Zombie_1	3.02	0.331024
Zombie × DTL	2.93	0.341639
DTL	2.01	0.497623
CR	1.95	0.513575
GR	1.71	0.585080
Zombie × CR	1.41	0.706886
GDP	1.09	0.915883
SIZE	1.09	0.915259
CPI	1.09	0.918263
Zombie × GR	1.07	0.937790
Mean VIF	1.98	

Source: Authors' elaboration using Stata software.

Table 5. Fixed effects (*ROA*) regression model

Fixed-effects (within) regression					Number of groups = 501	
R-squared:					Obs per group:	
Within = 0.0625					Min. = 2	
Between = 0.0169					Avg. = 3.0	
Overall = 0.0197					Max. = 3	
corr(u_i, Xb) = -0.2615 (assumed)					F (11,990) = 6.00	
Number of obs. = 1.502					Prob > F = 0.0000	
ROA	*Coef.*	*Std. error*	*t*	*P > |t|*	*[95% conf. interval]*	
Zombie	-0.385187	0.0482562	-2.87	0.004	-0.2332149	-0.0438226
Zombie_1	0.1527611	0.0355442	4.30	0.000	0.0830105	0.2225117
Zombie × GR	0.0480212	0.0171127	2.81	0.005	0.0144399	0.0816024
Zombie × CR	0.0083364	0.0141353	0.59	0.555	-0.0194022	0.036075
Zombie × DTL	0.0001938	0.0005315	0.36	0.715	-0.0008492	0.0012368
GR	0.0091577	0.0042258	2.17	0.030	0.0008651	0.0174503
CR	0.0014653	0.0021906	0.67	0.504	-0.0028335	0.0057641
DTL	-0.0006926	0.000406	-1.71	0.088	-0.0014893	0.0001041
SIZE	0.0408029	0.0125922	3.24	0.001	0.0160924	0.0655133
GDP	0.0012049	0.0013002	0.93	0.354	-0.0013466	0.0037563
CPI	-0.0011113	0.0045301	-0.25	0.806	-0.0100011	0.0077784
_cons	-1.041177	0.337975	-3.00	0.002	-1.704407	-0.3779475
sigma_u	0.20057277					
sigma_e	0.0960969					
rho	0.81330656	(fraction of variance due to u_i)				
F-test that all u_i = 0: F (500, 990) = 9.22						

Source: Authors' elaboration using Stata software.

Table 6. Random effects (*ROA*) regression model

Random-effects GLS regression			Number of groups = 501			
R-squared:			Obs per group:			
Within = 0.0293			Min. = 2			
Between = 0.2440			Avg. = 3.0			
Overall = 0.2027			Max. = 3			
corr(u_i, X) = 0 (assumed)			Wald chi² (11) = 153.78			
Number of obs. = 1.502			Prob > chi² = 0.0000			
ROA	*Coef.*	*Std. error*	*t*	*P > |z|*	*[95% conf. interval]*	
Zombie	-0.3703096	0.0386533	-9.58	0.000	-0.4460687	-0.2945505
Zombie_1	-0.0021351	0.0292832	-0.07	0.942	-0.0595291	0.0552588
Zombie × GR	0.0322594	0.0166026	1.94	0.052	-0.0002811	0.0647999
Zombie × CR	0.0324353	0.0109938	2.95	0.003	0.0108879	0.0539827
Zombie × DTL	0.0018109	0.0003891	4.65	0.000	0.0010483	0.0025734
GR	0.0043107	0.0029927	1.44	0.150	-0.0015548	0.0101762
CR	0.0018209	0.0019563	0.93	0.352	-0.0020134	0.0056552
DTL	-0.0006732	0.0002697	-2.50	0.013	-0.0012018	-0.0001446
SIZE	0.0157284	0.0041989	3.75	0.000	0.0074988	0.023958
GDP	0.0005967	0.0013234	0.45	0.652	-0.0019971	0.0031904
CPI	-0.0027244	0.004601	-0.59	0.552	-0.0117421	0.0062933
_cons	-0.3456439	0.1153219	-3.00	0.003	-0.5716707	-0.1196171
sigma_u	0.1576513					
sigma_e	0.0960969					
rho	0.72909922	(fraction of variance due to u_i)				

Source: Authors' elaboration using Stata software.

After conducting the regression modeled by two methods — REM and FEM — the results obtained are that almost all variables included in the model have a small p-value, so the variables are statistically significant. The Hausman test was used to test the difference between the two models.

Table 7. Hausman test (*ROA*)

Variables	Coefficients			
	(b)	*(B)*	*(b - B)*	*sqrt(diag(V_b - V_B))*
	FEM	*REM*	*Difference*	*Std. error*
Zombie	-0.1385187	-0.3703096	0.2317909	0.0288891
Zomebie_1	0.1527611	-0.0021351	0.1548962	0.0201466
Zombie × GR	0.0480212	0.0322594	0.0157618	0.0041469
Zombie × CR	0.0083364	0.0324353	-0.0240989	0.008885
Zombie × DTL	0.0001938	0.0018109	-0.0016171	0.0003621
GR	0.0091577	0.0043107	0.004847	0.0029835
CR	0.0014653	0.0018209	-0.0003556	0.0009858
DTL	-0.0006926	-0.0006732	-0.0000194	0.0003035
SIZE	0.0408029	0.0157284	0.0250745	0.0118715
GDP	0.0012049	0.0005967	0.0006082	
CPI	-0.0011113	-0.0027244	0.0016131	
H_0: Difference in coefficients not systematic				
Chi² (11) = (b - B)' [(V_b - V_B)$^{(-1)}$](b - B)				
Chi² (11) = 132.62				
Prob > chi² = 0.0000				
(V_b - V_B is not positive definite)				

Note: b — consistent under H_0 and Ha; obtained from xtreg. B — inconsistent under Ha, efficient under H_0; obtained from xtreg.
Source: Authors' elaboration using Stata software.

The results p-value = 0.0000 < 0.05 with 95% confidence can be said that the REM and FEM are significantly different, the estimates according to the REM are biased estimates. Therefore, using the FEM is the chosen optimal model.

Conduct tests for the selected FEM as the optimal model.

1. Change the heteroskedasticity test with a hypothesis pair (test of variation of error):

Modified Wald test for groupwise heteroskedasticity in fixed effect regression model
H_0: sigma (i)² = sigma² for all *i*
Chi² (501) = 1.5e+10
Prob > chi² = 0.0000

The test results for p-value = 0.000 < 0.05 show that the model has a variable variance phenomenon.

2. Test for autocorrelation with hypothesis pair:

Wooldridge test for autocorrelation in panel data
H_0: No first-order autocorrelation
F (1, 499) = 6.063
Prob > F = 0.0141

P-value = 0.0141 < 0.05, so the model has an autocorrelation residual phenomenon. So, the model has two problems: variable variance and autocorrelation residual. The final result is the model after overcoming the model's defects.

Table 8. Regression results of the effect of zombie companies on profitability (*ROA*)

Cross-sectional time series feasible generalized least squares (FGLS) regression
Coefficients: Generalized least squares
Pannels: Heteroskedastic
Correlation: Common AR(1) coefficients for all panels (0.5836)

				Obs per group:		
Estimated covariances = 501				Min. = 2		
Number of obs. = 1,502				Avg. = 2.998004		
Estimated autocorrelations = 1				Max. = 3		
Number of groups = 501				Wald chi² (11) = 850.42		
Estimated coefficients = 12				Prob > chi² = 0.0000		

ROA	*Coef.*	*Std. error*	*t*	*P > |z|*	*[95% conf. interval]*	
Zombie	-0.1972861	0.0439954	-4.48	0.000	-0.2835154	-0.1110567
Zombie_1	-0.0398219	0.0306227	-1.30	0.193	-0.0998413	0.0201975
Zombie × GR	0.0151306	0.0169478	0.89	0.372	-0.0180864	0.0483476
Zombie × CR	0.0103971	0.0095256	1.09	0.275	-0.0082728	0.029067
Zombie × DTL	0.0010743	0.0002893	3.71	0.000	0.0005074	0.0016413
GR	0.0026914	0.0008062	3.34	0.001	0.0011112	0.0042716
CR	0.0006971	0.0003942	1.77	0.077	-0.0000754	0.0014697
DTL	-0.0007773	0.0000328	-23.68	0.000	-0.0008417	-0.000713
SIZE	0.0104299	0.0007233	14.42	0.000	0.0090121	0.0118476
GDP	0.0003413	0.0001717	1.99	0.047	4.73e-06	0.0006778
CPI	-0.0011333	0.0005307	-2.14	0.033	-0.0021735	-0.000093
_cons	-0.1962478	0.0191509	-10.25	0.000	-0.2337829	-0.1587127

Source: Authors' elaboration using Stata software.

5. DISCUSSION

Firstly, the zombie variable has a negative sign, indicating that zombie companies have a negative effect on the performance of enterprises.

This can be explained when zombie companies consume more resources such as raising capital and using government subsidy packages to maintain business operations. Most of these enterprises fell into debt, reducing profits, and leading to reduced operational efficiency.

Second, the interaction variable between zombies with financial leverage (*Zombie × DTL*) has a positive coefficient with statistical significance below 5%.

That is, when zombie companies use financial leverage, it will positively affect the *ROA* of manufacturing enterprises. This is explained by the fact that financial leverage is seen as a tool to promote profit after tax from equity and also a tax shield, which zombie companies live mainly on debt. Therefore, zombie companies using financial leverage will help increase profits and improve the ROA of the whole industry.

Third, the revenue growth rate (*GR*) variable has a positive coefficient with statistical significance below 1%, showing that it has a positive impact on *ROA* as expected.

Other things being equal, a 1% increase in revenue growth will increase *ROA* by 0.26914%. The revenue growth rate will reflect the production and business capacity of the enterprise, the higher this rate is, the more efficient the enterprise is in production and business. This result is consistent with the results of Agiomirgianakis et al. (2006) and Yazdanfar (2013).

Fourth, the current solvency variable (*CR*) has a positive coefficient with statistical significance below 1%, showing a positive effect on *ROA*. Therefore, when the current ratio increases, it means that the company's ability to pay its short-term debts increases. This shows that the financial capacity of the enterprise is sufficient to meet the debt and the operating efficiency of the enterprise is increased. This result is similar to the study of Binh et al. (2020).

Fifth, financial structure, i.e., total debt to total capital, negatively affects the financial performance of enterprises at the significance level of less than 1%.

In other words, hypothesis *H3* that the use of increased financial leverage can cause a decrease in the operating efficiency of enterprises has been confirmed. Financial leverage is the extent to which borrowed capital is used in the total capital of an enterprise in the hope of increasing profit margin (Nguyen et al., 2019). For listed companies, the abuse of financial leverage can have negative impacts on the financial health of enterprises and increase the risk of becoming a zombie company. Because when businesses grow, their capital needs also increase, businesses will tend to mobilize external capital through debt. However, if enterprises borrow at too high a rate, beyond their ability to pay, financial leverage will not be effective, on the contrary, it will also harm businesses. This result supports the view of Shen and Chen (2017) that zombie companies tend to use more financial leverage than other firms, and financial leverage over 50% is one of the two criteria used to classify whether a business is living in a plant or not.

Sixth, the size of the enterprise has a positive impact on the financial performance of the enterprise at a significance level of less than 1%.

This means that the larger the enterprise, the higher the financial efficiency of the enterprise, which means the smaller the probability of becoming zombie companies. The research results agree with Binh et al. (2020) regarding the conclusion that assessing the probability of becoming a zombie of an enterprise based on their size. Besides, the study by Urionabarrenetxea et al. (2018) also explains that size is positively related to debt, due to enterprises. Larger firms tend to diversify their capital sources, so their probability of bankruptcy is relatively smaller and they have a higher level of access to loans. This result also supports the study of Hallak et al. (2018), which suggests that a large enterprise will have more complete track records, providing financial reports, more reliable, information asymmetry would be less severe, coupled with a high credit rating and possibly established long-term lending relationships with banks, at the same time, large enterprises have may

have built a reputation for being able to cope with periods of temporary unprofitability, which may justify refinancing from the bank's point of view. For these reasons, they can have more access to capital while it is difficult for smaller businesses to access. Thanks to mobilizing large capital, enterprises, if they make good use of the opportunities, will expand their production and business, and increase their financial efficiency.

Seventh, the *GDP* growth variable results in a positive impact on the performance of enterprises at the statistical significance level of 5%.

GDP is a measure reflecting the economic development of a country, when GDP growth is a sign that the economy is operating efficiently, businesses are more confident to invest. When production activities are improved, the operating efficiency of enterprises will increase. This result is similar to the study of Nguyen et al. (2021).

Eighth, the variable inflation index (*CPI*) results in a negative impact on the performance of enterprises at statistical significance below 5%.

When a country's inflation increases, the average price level of goods increases. It will limit the ability of people to consume goods and products and directly affect the production and business activities of enterprises, especially those in the manufacturing industry.

Finally, the research results show that there are similarities between the industrial manufacturing industry and other industries such as construction materials as researched by Huong et al. (2020). Specifically, the criteria reflect that the financial performance of zombies is lower than that of healthy companies and the differences are statistically significant. This confirms that zombie groups generate lower performance with long-term losses and some potential financial risks, and zombie companies have a negative impact on financial performance.

6. CONCLUSION

Firstly, according to the regression results, zombie companies use more human resources in business survival and development, use more support from investors, and government subsidies to maintain business action. In fact, banks have policies for businesses with bad finance to continue to borrow capital for production and business activities. The wrong incentives of banks to cover bad debt losses, along with supportive policies of the state have led to the emergence of zombie companies.

The introduction of inappropriate support packages creates a delay in the development of Vietnam's economic growth.

Second, businesses need to build development strategies and operational plans, specifically paying attention to factors that help businesses avoid the risk of becoming zombies, and promote business activities such as increasing capital and increasing revenue, total asset turnover, improving payment capacity, and reducing financial leverage.

Third, for management agencies and policymakers, it is necessary to invest in in-depth research projects on zombies in Vietnam to have a deeper insight into the zombie situation. Experimental research results are the basis for policymakers to propose solutions to solve the zombie situation in the economy.

Fourth, in addition to the responsibilities of business owners, banks, and the government, investors also need to understand the financial situation of the businesses they wish to invest in. Moreover, it is essential to be aware of global economic changes and fluctuations to make informed investment decisions. By doing so, investments can be directed to the right places, thereby affirming the position and improving the competitiveness of enterprises compared to others in the same industry, and contributing to the development of Vietnam's economy.

Although this research has significant theoretical and practical contributions, such as demonstrating that a zombie company from the previous year can impact the financial performance (ROA) of healthy companies in the following year, the authors have proposed several recommendations for policymakers and businesses. These recommendations aim to minimize the rate of businesses becoming zombies in the future and to address the challenges posed by zombie companies, thereby creating greater opportunities for healthy or new businesses entering the market.

However, there are still some limitations. In particular, the sample size is limited in both time and the number of businesses, focusing only on listed manufacturing enterprises on the Vietnam stock market. Additionally, the study has not analyzed the impact of differences between various types of businesses. Therefore, future research should increase the number of survey samples, expand to include all types of businesses and analyze and compare the differences between these businesses to broaden the scope of the research.

REFERENCES

Agiomirgianakis, G., Voulgaris, F., & Papadogonas, T. (2006). Financial factors affecting profitability and employment growth: The case of Greek manufacturing. *International Journal of Financial Services Management, 1*(2–3), 232–242. https://doi.org/10.1504/IJFSM.2006.009628

Ahearne, A. G., & Shinada, N. (2005). Zombie firms and economic stagnation in Japan. *International Economics and Economic Policy, 2*(4), 363–381. https://doi.org/10.1007/s10368-005-0041-1

Andrews, D., McGowan, M. A., & Millot, V. (2017). *Confronting the zombies: Policies for productivity revival* (OECD Economic Policy Paper No. 21). OECD Publishing. https://doi.org/10.1787/f14fd801-en

Asanuma, D. (2015). An examination on the zombie theory: An agent-based-approach. *International Business Management, 9*(5), 719–725. https://www.makhillpublications.co/index.php/view-article/1993-5250/ibm.2015.719.725

Banerjee, R. N., & Hofmann, B. (2018). The rise of zombie firms: Causes and consequences. *BIS Quarterly Review*, 67–78. https://www.bis.org/publ/qtrpdf/r_qt1809g.htm

Binh, T. Q., Huong, V. T. T., & Loan, N. T. B. (2020). Zombie companies: Experimental research from real estate listed sectors. *Revista Argentina de Clínica Psicológica, 29*(5), 1360–1369. https://www.revistaclinicapsicologica.com/archivesarticle.php?id=250

Broz, T., & Ridzak, T. (2017). Lending activity and credit supply in Croatia during the crisis. *Journal of Policy Modeling, 39*(6), 1102–1116. https://doi.org/10.1016/j.jpolmod.2017.08.004

Caballero, R. J., Hoshi, T., & Kashyap, A. K. (2008). Zombie lending and depression restructuring in Japan. *American Economic Review, 98*(5), 1943–1977. https://doi.org/10.1257/aer.98.5.1943

Dai, X., Qiao, X., & Song, L. (2019). Zombie firms in China's coal mining sector: Identification, transition determinants and policy implications. *Resources Policy, 62*, 664–673. https://doi.org/10.1016/j.resourpol.2018.11.016

De Veirman, E., & Levin, A. T. (2012). When did firms become more different? Time-varying firm-specific volatility in Japan. *Journal of the Japanese and International Economies, 26*(4), 578–601. https://doi.org/10.1016/j.jjie.2012.09.001

Feng, L., Lang, H., & Pei, T. (2022). Zombie firms and corporate savings: Evidence from Chinese manufacturing firms. *International Review of Economics & Finance, 79*, 551–564. https://doi.org/10.1016/j.iref.2022.02.008

Fukuda, S.-I., & Nakamura, J.-I. (2011). Why did 'zombie' firms recover in Japan? *The World Economy, 34*(7), 1124–1137. https://doi.org/10.1111/j.1467-9701.2011.01368.x

Hallak, I., Harasztosi, P., & Schich, S. (2018). Fear the walking dead? Incidence and effects of zombie firms in Europe. *Journal of Economic Science Research, 1*(1), 24–40. https://doi.org/10.30564/jesr.v1i1.393

Hoshi, T. (2006). Economics of the living dead. *The Japanese Economic Review, 57*(1), 30–49. https://doi.org/10.1111/j.1468-5876.2006.00354.x

Hoshi, T., & Kashyap, A. K. (2004). Japan's financial crisis and economic stagnation. *Journal of Economic Perspectives, 18*(1), 3–26. https://doi.org/10.1111/j.1468-5876.2006.00354.x

Huong, V. T. T., Binh, T. Q., Suong, H. T. M., & Ngan, L. T. (2020). Ảnh hưởng của các công ty zombie đến hiệu quả hoạt động tài chính: Kết quả nghiên cứu thực nghiệm trên các công ty niêm yết nhóm ngành vật liệu xây dựng tại Việt Nam [The impact of zombie companies on financial performance: Results of experimental research at listed construction material companies in Vietnam]. *Journal of Trade Science, 137–138*, 100–108. https://surl.li/fsazih

Jiang, X., Li, S., & Song, X. (2017). The mystery of zombie enterprises — "Stiff but deathless". *China Journal of Accounting Research, 10*(4), 341–357. https://doi.org/10.1016/j.cjar.2017.08.001

Kane, E. J. (1987). Dangers of capital forbearance: The case of the FSLIC and "Zombie" S&Ls. *Contemporary Economic Policy, 5*(1), 77–83. https://doi.org/10.1111/j.1465-7287.1987.tb00247.x

Kwon, H. U., Narita, F., & Narita, M. (2015). Resource reallocation and zombie lending in Japan in the 1990s. *Review of Economic Dynamics, 18*(4), 709–732. https://doi.org/10.1016/j.red.2015.07.001

Lam, R., Schipke, A., Tan, Y., & Tan, S. (2017). *Resolving China's zombies: Tackling debt and raising productivity* (IMF Working Paper No. WP/17/266). International Monetary Fund (IMF). https://doi.org/10.5089/9781484330722.001

Logarušić, M., & Raguž Krištić, I. (2022). Utjecaj zombi poduzeća na performanse zdravih poduzeća i gospodarstava odabranih zemalja Srednje i Istočne Europe [The impact of zombie companies on the performance of healthy companies and economies in selected countries of Central and Eastern Europe]. *Ekonomski Pregled, 73*(2), 157–185. https://doi.org/10.32910/ep.73.2.1

Nakamura, J.-I., & Fukuda, S.-I. (2013). What happened to "zombie" firms in Japan? Reexamination for the lost two decades. *Global Journal of Economics, 2*(2), Article 1350007. https://doi.org/10.1142/S2251361213500079

Nguyen, T. T. A. (2016). Enterprise "plant life" in the economy of Vietnam: The status, causes and some policy implications. *Nghiên cứu Kinh tế số, 456*(5), 11–20. https://vjol.info.vn/index.php/econst/article/view/29257

Nguyen, T. V., Loc, T. B., & Liem, N. T. (2021). The impact of stock market on enterprise capital structure in ASEAN developing countries. *Science & Technology Development Journal: Economics – Law & Management, 5*(1), 1359–1367. https://doi.org/10.32508/stdjelm.v5i1.729

Nguyen, V. C., Nguyen, T. N. L., Tran, T. T. P., Nghiem, T. T. (2019). The impact of financial leverage on the profitability of real estate companies: A study from Vietnam stock exchange. *Management Science Letters, 9*, 2315–2326. https://doi.org/10.5267/j.msl.2019.7.023

Peek, J., & Rosengren, E. S. (2005). Unnatural selection: Perverse incentives and the misallocation of credit in Japan. *American Economic Review, 95*(4), 1144–1166. https://doi.org/10.1257/0002828054825691

Rashid, S., Khan, K. I., Nasir, A., & Rashid, T. (2022). Unveiling living dead: Characteristics and consequences of zombie firms. *Cogent Business & Management, 9*(1), Article 2121240. https://doi.org/10.1080/23311975.2022.2121240

Ren, M., Zhao, J., & Zhao, J. (2023) The crowding-out effect of zombie companies on fixed asset investment: Evidence from China. *Research in International Business and Finance, 65*, Article 101979. https://doi.org/10.1016/j.ribaf.2023.101979

Shen, G., & Chen, B. (2017). Zombie firms and over-capacity in Chinese manufacturing. *China Economic Review, 44*, 327–342. https://doi.org/10.1016/j.chieco.2017.05.008

Thomas, M. E. (2009). *The zombie economy: Leadership in times of uncertainty.* PA Consulting.

Urionabarrenetxea, S., Garcia-Merino, J. D., San-Jose, L., & Retolaza, J. L. (2018). Living with zombie companies: Do we know where the threat lies? *European Management Journal, 36*(3), 408–420. https://doi.org/10.1016/j.emj.2017.05.005

Yazdanfar, D. (2013). Profitability determinants among micro firms: Evidence from Swedish data. *International Journal of Managerial Finance, 9*(2), 150–160. https://doi.org/10.1108/17439131311307565

Yu, H., Liu, X., & Zhou, Y. (2022). The effects of zombie firms on the financial information transparency of other firms. *Emerging Markets Finance and Trade, 58*(9), 2474–2492. https://doi.org/10.1080/1540496X.2021.1995350

Yu, M., Guo, Y. M., Wang, D., & Gao, X. (2021). How do zombie firms affect debt financing costs of others: From spillover effects views. *Pacific-Basin Finance Journal, 65*, Article 101471. https://doi.org/10.1016/j.pacfin.2020.101471