

ZOMBIE FIRMS AND PRODUCTIVITY IN A  
TURBULENT ECONOMIC ENVIRONMENT:  
THE CASE OF UKRAINE

by

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## LIST OF ABBREVIATIONS

**DSCR** Debt service coverage ratio

**EBIT** Earning before interest and taxes

**ICR** Interest coverage ratio

**NBU** National Bank of Ukraine

**NPL** Non performing loan

**ROA** Return on assets

**SME** Small, medium and large enterprises

## CHAPTER 1. INTRODUCTION

Since the beginning of the 21st century, global economies have witnessed a succession of economic and financial crises that have impacted both developed and emerging market economies. Such shocks have a detrimental impact on companies, creating a riskier environment for them to operate. Furthermore, this environment also creates conditions for emergence of the so-called “zombie” firms - enterprises whose main problem is the inability to repay their debt obligations to creditors. This term was first defined by Kane (1987) and observed in Japan after the asset bubble burst in the late 1980s when corporate firms were unable to fully service their debts after a steep asset depreciation. The period after the bubble burst is known as “The Lost Decade”, where Japanese commercial banks continued to credit weak firms, thus helping them to avoid default and continue to operate. Such economic distortion, where companies, which in a competitive environment would exit the market, still do business, negatively affect healthy firms with good financial positions. This topic was not widely popular among academics in the mid-2000s, just when most central banks were pursuing low interest rate policies. However, this changed after the end of the US financial crisis, when not only academia but also the private sector joined the discussion, and a decade of low interest rates in the EU further increased the interest in research on the topic.

With the outbreak of the energy crisis in Europe and Russia's full-scale invasion of Ukraine, inflation in Europe and later in most of the Western world began to rise rapidly. This situation forced regulators to reconsider their policies to stimulate economies and start actively raising interest rates to combat rising prices and devaluation of domestic currencies. As a result of these developments, the attention of a wide range of economists and monetarists is once again focused on the problem of zombie companies, as rising interest rates increase the likelihood of default of such firms.

Ukraine is no exception in this situation, and the main objective of this study is to find evidence of the presence of zombie firms and their effect on the industries, in which they operate during the period from 2012 to 2019. At that time, the Ukrainian economy was undergoing a crisis resulting from the annexation of Crimea and the war in eastern Ukraine. Concurrently, significant reforms were being implemented in the banking sector. The National Bank of Ukraine, through regulatory measures, aimed to diminish the presence of banks with dubious reputations, affiliations with the oligarchy, and questionable lending practices. Finally, equally interesting for the study is to observe what share of SMEs handled their operational activities successfully during the crisis and managed to stay in the market.



## CHAPTER 2. RELATED STUDIES

Numerous research papers have delved into the intricacies of zombie companies. For example, Caballero et al (2008) uncovered that between 1991 and 1997, the proportion of Japanese companies benefiting from subsidized loans surged from 6,5% to approximately 35%. Their analysis delves into how zombie companies lead to crowding and the resulting impact on healthy businesses. Their findings indicate that industries with a high proportion of zombie firms tend to be more downcast, exhibiting diminished investment flows, productivity, and stagnant employment growth. Imai (2016) also found that not only big companies had bad financial conditions but also smaller companies, where the share of Japanese zombie SMEs increased from 4% to 14% during the 1999-2008 period.

Similar trends unfolded in Europe, where in response to the sovereign debt crisis, the ECB adopted a monetary policy featuring low interest rates and quantitative easing to invigorate the European economy. While this policy encouraged lending by commercial banks, it inadvertently exacerbated the "zombie" problem with the EU facing low inflation, productivity, and growth – mirroring Japan's "Lost Decade." Acharya et al (2019) unveiled that industries characterized by a significant presence of zombie firms faced reduced markups compared to sectors with fewer zombies. Moreover, as funding costs decreased, struggling companies survived longer, thereby expanding the aggregate supply. This stood in contrast to the regular competitive environment, where non-viable businesses exit the market. These factors cast a disinflationary shadow over the economy, leading to suppressed inflation growth.

The adverse influence of zombie firms extended to OECD economies as well, where industries characterized by high levels of zombification tend to be less productive, hampering productivity growth (McGowan, 2018). Furthermore, Banerjee and Hoffman (2021), utilizing financial data of listed non-financial companies since 1980, portrayed the life cycle of weak firms and estimated their likelihood of remaining in a zombie state. The prevalence of zombie firms across advanced economies climbed from 2% in 1980 to 15% in 2017. Among them, Australia and Canada harbored the highest share of such firms at 30%, while the UK and the United States were around 20%. Furthermore, the probability of zombie firms to stay in this classification increased from around 70% to 85%.

The connection between bank credit and weak firms also has been a focus of much academic study. Such a link should not be a surprise since unscrupulous credit provided by commercial banks and lax bank regulations are the primary reason for letting unprofitable firms to operate in the market. However, after the economic and financial disturbance in the US and Europe during 2008-2012, banking regulations became stricter. Capital requirements for commercial banks had been raised to make the banking system more resistant to economic shocks. However, there was still an issue with weak banks. For example, undercapitalized banks in Italy were unwilling to cut credit to weak firms. Such behavior was justified to mitigate the reputational risk by being requested by the supervisory to meet capital requirements (Schivardi et al, 2017). Additionally, weak banks have incentives to evergreen loans to weak firms because they do not want to declare them as NPLs, thus making zombie firms even more indebted (Storz et al, 2017). Finally, Andrews and Petroulakis (2019) estimate a high likelihood of zombie firms having credit connections with weak banks and emphasize the crowd-out effect of zombie companies on bank credit for healthy firms.

Probably one of the most recent and detailed studies on the issue of zombie companies was conducted by Albuquerque and Iyer (2023). Using financial data of private and listed non-financial companies in advanced economies and emerging markets over the past two decades, the researchers concluded that the share of zombie firms has only increased, especially after the US financial crisis and the COVID-19 pandemic. Moreover, there was a rather low percentage of zombies among private companies, which is mainly due to the low probability of "survival" of such entities. Another equally important finding is that healthy companies operating in industries with a high share of zombie firms are characterized by low productivity, low employment dynamics and low investments. Furthermore, in such an environment healthy companies also compete for access to bank credits, which theoretically has a deterrent effect on growth. Ukrainian zombie companies have also not been ignored by economists and researchers. Moreover, Ukrainian zombie companies are particularly distinguished, where Pardal et al (2021) showed an interesting point of view on such firms. They found that domestic companies can bypass financial standards and operate in informal markets due to ineffective government policy. Such ineffectiveness of government policies creates an environment where small enterprises are unprofitable if they operate officially, thus incentivizing manipulative behavior and zombie lending by weak commercial banks. Another study conducted by Hurnyak and Kordonska (2019) shows another interesting insight: using data on zombie banking performance for the 2008-2017 period, as well as a small sample of financial statements of Ukrainian companies, they observed that firms can exist and experience negative financial results in the long-term and operate mostly in the shadow economy as a result of having no consequences, such as bankruptcy. This is reinforced by the fact that in 2013 only 14% of Ukrainian companies used bank loans, thus these companies got their financial resources through increasing their accounts payable (accounts payable, salaries payable etc.) and could be considered as zombies. Researchers consider that the Ukrainian zombie problem is not only based on banking lending but also by the search for other sources of capital.

This paper aims to investigate the presence and describe the dynamics of zombie firms in the Ukrainian economy. It will help to take a glance at the results of the NBU's regulatory policy in retrospect and will be an additional useful study for a better understanding of this topic by the regulator.

## CHAPTER 3. DATA

Our analysis is based on the financial statement's dataset provided by the National Bank of Ukraine, which consists of financial statements of Ukrainian small, medium, and large enterprises. The data also includes the industries, to which enterprises belong and specified by KVED-2010 and the regions, including the occupied Donetsk and Luhansk region and the Crimean Peninsula, represented by the state classifier of administrative and territorial units of Ukraine. The financial indicators were taken from two reporting forms, which are designed to be filled out by different sizes of companies. According to the legislation, small enterprises are not required to report details of their operating expenses, which include interest payments, whereas in the case of medium and large companies, reporting of this type of expenses is mandatory. Thus, in this study we will focus on enterprises that filled out financial statements for medium and large enterprises, based on the available information on their financial expenses, which directly include interest payments.

**Table 1. Number of firm-year observations in the dataset**

	2012	2013	2014	2015	2016	2017	2018	2019
Number of observations	21,735	21,934	23,671	24,602	24,307	24,238	24,127	23,078

The dataset contains 187,692 firm-year observations for 27,100 non-financial firms, where we excluded firms that had less than 2 year of observations and left the non-available values in observations for firms that had for the longer timespan positive values as an indicator of exiting them from the market. The number of observations is changing from year to year in the timespan, as seen in Table 1. The main reasons for the different number of observations each year may be the entry of new firms into the market or their exit due to unprofitability or bankruptcy. The main variables in the dataset are described in Table 2.

**Table 2. Variables description**

<b>Variable</b>	<b>Description</b>
ID	Unique identification code for each company
Sales	The number of sales made by the company per year in monetary terms
Assets	Total assets of the company
Investment	Amount of funds allocated for investments
EBIT	Earnings before interest and taxes
Net Income	Net income of the company
Financial Costs	Interest and other expenses related to borrowings (including interest payments)
Employment	Number of employees in the company
Industry	Field of economic activities that a specific company belongs and indicated by KVED-2010
Region	Region of Ukraine
Zombie	Dummy variable that indicates if the company is considered as zombie
Return on Assets (ROA)	Financial ratio calculated as net income divided by total assets
Net investments	The difference between investments relatively to the prior period
Interest Coverage Ratio (ICR)	Debt servicing ratio calculated as EBIT over financial costs
Entry/Exit	Dummy variables that show the entry or the exit of a specific firm in the market
Sales to Employment Ratio	Measurement of productivity

Table 3 contains the descriptive statistics of main financial variables. The number of variable observations deviates from the total number of firm-year observations, however, as it was already mentioned, this occurred as a result of the presence of non-available values for some companies in some years. Despite that, such values can still be utilized for indication of an entry or, mostly, an exit of a specific firm from the market.

**Table 3. Descriptive statistics**

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
Sales	140,562	260,812	2,194,179	0	204,938,128
Assets	140,562	291,044	4,648,360	0	638,970,688
Investment	140,562	96,114	2,473,151	0	411,309,664
EBIT	140,562	11,918	454,956	-60,262,096	73,692,528
Net income	140,562	3,146	432,336	-80,055,376	50,658,212
Financial costs	140,562	7,872	101,605	0	12,551,586
Employment	140,562	238	1,907	0	271,770

The companies are grouped by their industry, which is represented by the KVED-2010 identification system and consists of 20 types of industries, excluding financial and insurance services. As seen in the Table 4, the biggest shares in the dataset belong to “Manufacturing”, “Wholesale and retail trade; repair of motor vehicles and motorcycles” and “Agriculture, forestry and fisheries” which together make up nearly 60% of all firms in the sample.

**Table 4. The average share of firms by industry**

<b>Industry</b>	<b>Share, in %</b>
Wholesale and retail trade; repair of motor vehicles and motorcycles	21,4
Manufacturing	20,3
Agriculture, forestry and fisheries	14,9
Real estate	8,2
Construction	6,4

Finally, in regards to regionality, the largest number of firms can be observed in Kyiv city (22,9%), Dnipro (8,7%), Kharkiv (7,6%), Kyiv (5,2%), and Odesa (5,1%) regions, where up to a third of all firms are located in Kyiv and Dnipro.



## CHAPTER 4. METHODOLOGY

### 4.1 Identification of zombie firms

The first step to approach the issue raised in this study is to define zombie companies among our sample of medium and large enterprises. A company is called a zombie if it is unable to service its interest payments on its debt obligations, where at the same time it still operates, despite the fact that in a traditional understanding it should declare bankruptcy. We use a modified version of the identification methodology used by Storz et al. (2017), where a firm is considered as a zombie if it meets the following conditions for two consecutive years: (i) return on assets (ROA) is negative, (ii) net investments are negative, and (iii) the ICR is less than 1. If these conditions are met for the  $t-1$  and  $t$  periods, then our dummy variable takes a value of 1 in the  $t$  period. Conditions (i) and (ii) indicate that firms are identified as zombies if they are unprofitable and have suspended their investment growth. Condition (iii) ensures that the operating profit of the company does not cover the interest payments for a selected year.

In the literature, quite a few methods and indicators are used to determine whether a company is a zombie. It is also important to mention that in literature, the so-called binary identification is the most common. In this method, a company falls or does not fall under the definition of a zombie firm if its financial indicators have specific values that are used in the identification. The use of indicators also varies among papers, which is generally caused by different capabilities and access to data by researchers, which does not always allow for standardization of the use of indicators. Thus, identifications can include both debt structure, leverage, age and capitalization for listed companies (Banerjee and Hoffman, 2021; Adalet McGowan et al., 2018; Acharya et al., 2020) as well as financial ratios, profitability, investment dynamics and debt service capacity (Schivardi et al., 2017; Storz et al., 2017). Regarding the latter, in many academic papers, the most common way to determine a firm's ability to pay interest payments on its debts is through the interest coverage ratio (ICR), however it holds a major caveat. In the traditional understanding zombie companies exist due to subsidized bank credit, however the ICR

shifts the definition towards “weak or vulnerable firms”, which does not show whether the company receives a loan on favorable terms and thus low values of ICR can sometimes be associated with high interest payments. For example, Mingarelli et al. (2022) call such a phenomenon “IC critique”. However, it should be noted that data do not always allow to follow the traditional definition, so researchers often have to adapt through shifting the definition towards vulnerability.

We arrived at our decision to employ zombie company identification by carefully considering the financial indicators that are both accessible within the financial statements of reporting companies and relevant to the context of the Ukrainian economy. We employ the aforementioned method with some additional modifications, replacing the debt service coverage ratio (DSCR) with the previously mentioned ICR. This change is justified by the lack of detailed indicators for the former, without, however, eliminating the IC critique.

#### 4.2 Regression

One of the main issues that arise in the study of zombie firms is productivity. It is believed that this type of companies are characterized by relatively lower levels of productivity, which directly affects the overall rational use of available resources in the country's economy. Our methodology takes inspiration from Caballero et al (2006), where the regression model takes the following structure:

$$\text{Sales/Employment}_{ijt} = \beta_1 \cdot D_t + \beta_2 \cdot D_j + \beta_3 \cdot \text{zombie}_{ijt} + \beta_4 \cdot Z_{jt} + \epsilon_{ijt}$$

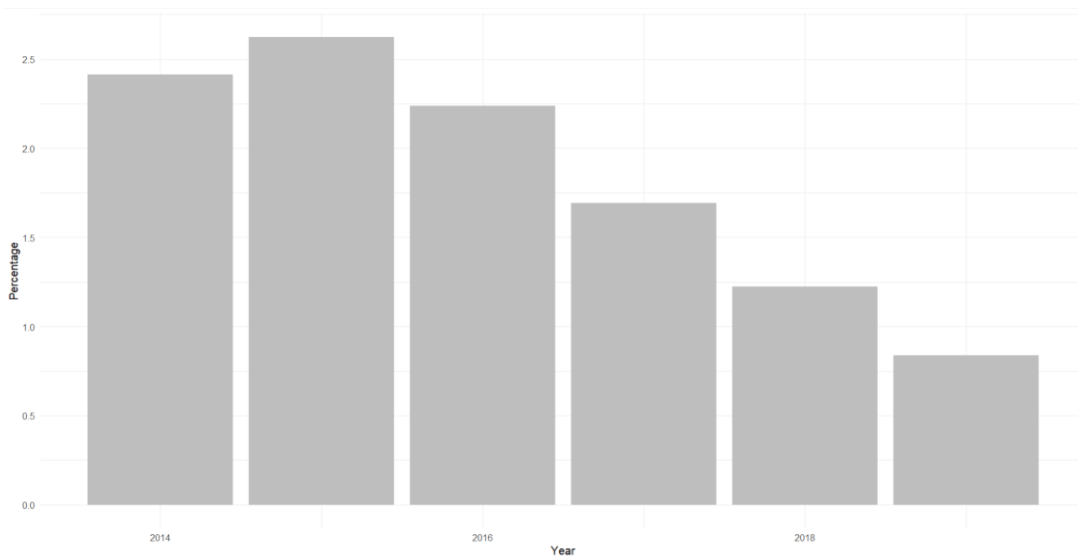
where our dependent variable is a productivity proxy represented by sales over employment ratio for  $i$ -th firm,  $t$ -th year and  $j$ -th industry, the  $D_t$  is an annual dummy variables set,  $D_j$  set of dummy variables of various industries,  $\text{zombie}_{ijt}$  is a dummy variable for indicating if a company is a zombie, and  $Z_{jt}$  is the percentage of assets of zombie firms residing in an industry. We also modify our model to take the log-linear form to indicate the average percentage changes and effects of independent variables.

In the process of selecting a suitable model, we were guided by the idea of simplicity, since there is a wide variety of econometric models used to determine the level of productivity in zombie firms. This model was chosen due to the limited availability of other variables that would help to better and more extensively model our research question. It is also well suited for understanding the impact of zombie firms on the industry, where the variable  $Z_{jt}$  indicates how these firms can affect the level of productivity in the industry as a whole.

## CHAPTER 5. RESULTS

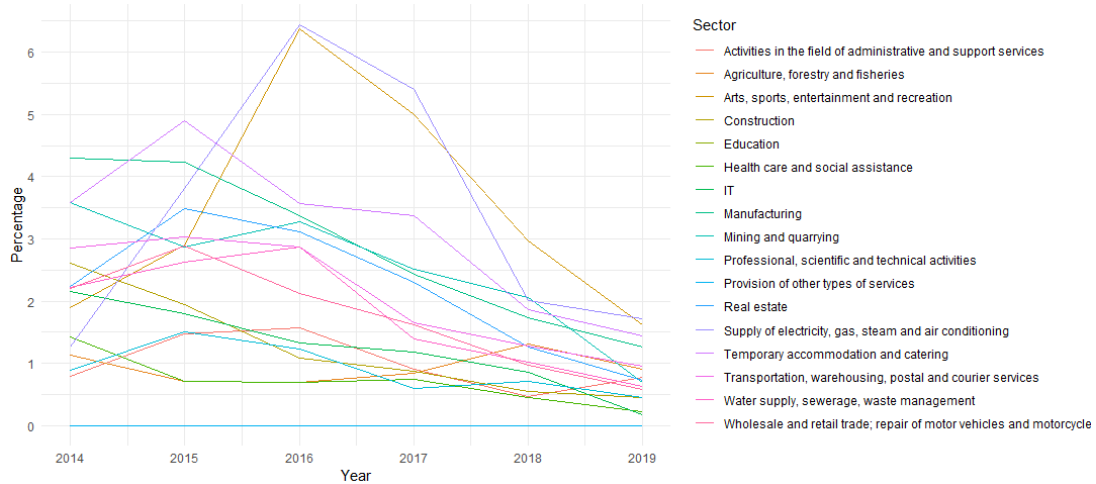
Using our proposed methodology for zombie identification, we conducted a statistical analysis of the number of zombie firms in the data sample each year. Figure 1 shows the dynamics of the share of zombie firms, where in 2014 and 2015 this percentage reached approximately 2,5% followed by a further decline in the following years, where in 2019 this figure was less than 1%. These shares should be considered as a lower bound on the true number of zombie firms in the Ukrainian economy.

**Figure 1. Percentage share of zombie firms, 2014-2019**



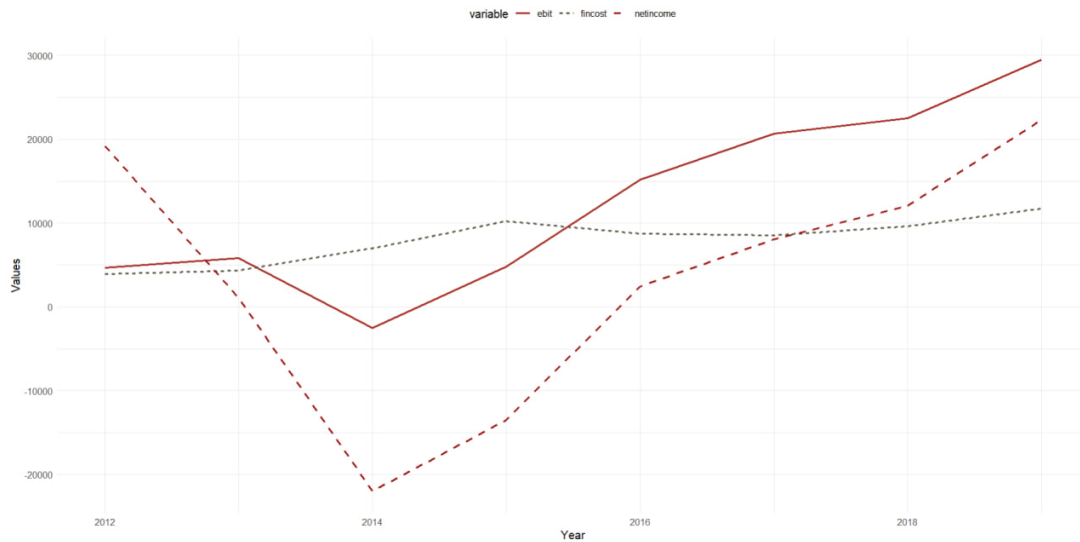
In terms of industry, the largest number of zombie firms over the entire time period is observed in such areas as "Manufacturing" and "Wholesale and retail trade; repair of motor vehicles and motorcycles", while in relation to the total number of firms in these fields these shares range from 1% to 4%. At the same time, Figure 2 shows that in 2016-2017 the largest shares of zombie firms relative to the total number of enterprises in a particular field of activity are observed in "Arts, sports, entertainment and recreation" and "Supply of electricity, gas, steam and air conditioning", where the shares of such firms amounted to less than 6,5% in both fields.

**Figure 2. Zombie companies share by industry**



Another interesting statistic is represented in Figure 3, which shows the average values of financial expenses, EBIT and net income of firms. Since the beginning of 2013, most companies have been experiencing a decline in net income, and in 2014, operating profit has also started to decline. At the same time, this period also saw a slight increase in financial expenses. Such a financial position of companies with insufficient operating profit to pay off their debt obligations creates risks for an increase in the number of zombie firms according to our methodology. Thus, Figure 3 confirms the fact that the period of 2014-2015 saw the highest number of zombie firms in our data sample. However, over time, most companies were able to improve their financial positions, thus reducing the number of zombie firms.

**Figure 3. Average dynamics of financial costs, EBIT and net income**



As already mentioned, our database contains companies that filled out financial reporting forms for medium and large enterprises, which reflect the companies' financial expenses, namely interest payments. At the same time, a small share of firms, 5188 companies or 20%, did not indicate annual interest payments, which suggests that these firms did not take on any debt obligations. Some of these entities have similar dynamics in their financial positions as zombie firms, namely, return on assets and net investments are negative for two consecutive years. In this case, we call them "vulnerable firms", with an emphasis on their low profitability, and such are indicated using the same methodology as for zombie firms, excluding ICR. Table 6 presents the comparable dynamics of the total number of zombies and vulnerable firms in 2014-2019.

**Table 5. Number of zombie firms and vulnerable firms**

	2014	2015	2016	2017	2018	2019
Zombies	571	645	544	410	295	193
Vulnerable firms	457	616	544	471	417	377

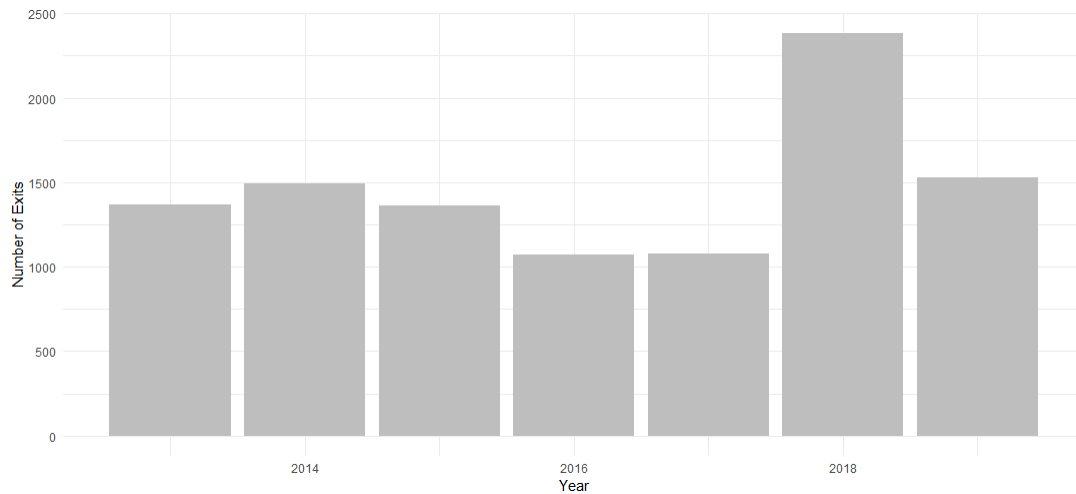
As for rough productivity measurement, Table 6 represents the average of employment to sales ratio for zombie and non-zombie firms. The values of the average number of employees to sales are quite clear indications of the low productivity of zombies, where such entities require 4,5 times more employees than healthy firms. An interesting insight in productivity gaps of zombie and non-zombie firms can be seen in those industries that experience the biggest number of zombie firms. For example, a remarkable difference can be observed in manufacturing, where the average employment to sales ratio for healthy firms equals 2,4 whereas for the zombies this ratio equals 21,4. Similar picture, however with a lower contrast, can be seen in wholesale and retail trade, and agriculture fields, where productivity gaps for non-zombies and zombies are 1,3-5,5 and 0,7-1,8 respectively.

**Table 6. Average employment to sales ratio for zombies and non-zombie firms**

Zombie	9,3
Non-zombie	2,0

Figure 4 represents the dynamics of the total number of firms that exited the market. During 2013-2017 the number of firms fluctuated with the highest value of nearly 1500 in 2014. At the same time, a great spike occurred in 2018, where 2384 entities exited the market. Relatively smaller firms were more prone to end their operations. Most of the companies that exited the market, were related to such industries as “Manufacturing”, “Wholesale and retail trade; repair of motor vehicles and motorcycles” and “Agriculture, forestry and fisheries”, where the share of those firms on average was around 50%. As a matter of fact, companies, prior to the exit, were experiencing an overall downtrend in employment and financial costs, whereas no distinct trend was observed in assets and net income. In the context of firms exiting after being considered as zombies, the average percentage share in 2015-2019 was around 3% out of total firms that exited the market in a specific year.

**Figure 4. Number of firms that exited the market**



Regarding the results of our model, Table 7 provides a clear picture of the productivity level of zombie firms. Thus, on average, zombie firms experience a lower sales to employment ratio of about UAH 120,000. At the same time, with the increase in the percentage of industry assets residing in zombie firms (indicated by  $Z_{jt}$ ), the lower values of sales to employment firms of that industry experience (on average less than UAH 6,682). In terms of logarithms, only the zombie dummy variable experiences any significance, where on average our productivity proxy for zombies decreases by 0,016 percentage. We do not report our fixed effects for years and industries, however those variables experience a high significance.



**Table 7. Regression output**

Variable	Sales/Employment	log (Sales/Employment)
Zombie <sub>ijt</sub>	-119,624* (71,952)	-0,017*** (0,003)
Z <sub>ijt</sub>	-6,682** (2,722)	-0,001 (0,0001)
Industry dummies included	Yes	Yes
Year dummies included	Yes	Yes
Observations	101,036	97,451
R <sup>2</sup>	0,018	0,256
Adjusted R <sup>2</sup>	0,017	0,256
Residual Std. Error	3,641,529.000 (df = 100989)	0,145 (df = 97404)
F Statistic	39,443*** (df = 46; 100989)	729,429*** (df = 46; 97404)
Note:	*p<0,1; **p<0,05; ***p<0,01	

**Table 8. Regression output with industry-zombie interaction**

Variable	Sales/Employment	log (Sales/Employment)
Zombie <sub>ijt</sub>	129,947 (115,465)	0,032*** (0,005)
Z <sub>ijt</sub>	-6,890*** (2,106)	-0,001*** (0,0001)
Manufacturing	-109,969*** (30,772.440)	0.051*** (0.001)
Wholesale retail	864,379*** (32,780)	0,182*** (0,001)
Agriculture	-155,578*** (32,447)	0,066*** (0,001)
Manufacturing*zombie	-124,329 (170,404)	-0,069*** (0,007)
Wholesale retail*zombie	-793,162*** (200,847)	-0,078*** (0,009)
Agriculture*zombie	52,498 (266,847)	-0,029** (0,011)
Year dummies included	Yes	Yes
Observations	101,126	97,531
R <sup>2</sup>	0,011	0,190
Adjusted R <sup>2</sup>	0,011	0,190
Residual Std. Error	3,655,235 (df = 101,112)	0,152 (df = 97,517)
F Statistic	88,121*** (df = 13; 101,112)	1,761*** (df = 13; 97,517)
Note:	*p<0,1; **p<0,05; ***p<0,01	

Additionally to our original model formulation, we add to our regression interaction terms to take a look at the productivity levels in industries with the highest number of zombie firms. In Table 8 we can clearly see that zombie firms in manufacturing, wholesale trade and agriculture have lower values of productivity with high significance in almost all of the three industries. The log-linear model coefficients of interaction terms experience high significance, which in turn repeatedly confirms that zombie firms tend to have lower productivity levels. Additionally, industries with a significant presence of zombie firms also tend to exhibit lower productivity as well. This suggests that the presence of zombie firms can have a negative impact on other healthy companies in the same market. The intense competition created by zombie firms can stifle the growth of healthy businesses and even deter new startups from thriving. Moreover, zombie firms can "take away" healthy firms' access to economic resources, such as bank credit, thus stifling growth opportunities.

Given the fact that our methodology considers the lower bound of the number of zombie firms in the Ukrainian economy, the true picture may indicate a higher number of such companies. Imperfect reporting standards and a high level of shadow economy impede a complete and qualitative analysis of the financial position of Ukrainian firms, not only in the time period used in the data sample, but also in the present. Considering our analysis and results, as well as the peculiarities of the Ukrainian environment, we can conclude that the presence of zombie firms did indeed affect the economy in the past decade and can have a significant impact on the Ukrainian economy and its growth in the future.

## CHAPTER 6. CONCLUSIONS AND RECOMMENDATIONS

Our study aimed to examine the situation of Ukrainian zombie companies in the time-period from 2012 to 2019. This period was characterized by great turbulence in the political and economic aspect of Ukraine's history. The value of reviewing these years was also in the abrupt change in the country's political leadership, the annexation of the Crimean Peninsula, and the aggressive invasion of the Donetsk and Luhansk regions, which had a profound impact not only on the operations of companies in these regions, but also on the export-oriented nature of the Ukrainian economy. Equally important was the introduction of reforms in the banking system, which reduced the number of insolvent banks and strengthened the financial system.

Using an academic approach to define zombie firms, we conclude that the total share of such firms in the data sample did not exceed 2,5%, keeping in mind that this is considered to be the lower bound. Moreover, there has been a decline in the number of zombie firms, which was mainly caused by companies improving their financial position rather than exiting the market. Also, using proxy productivity indicators, the fact of relatively lower productivity of zombie firms was determined. Zombies experienced on average lower values of sales to employment ratio, at the same time, industries with higher share of assets residing in zombie firms, also experienced on average lower productivity.

The main purpose of this study is to understand the prevalence of zombie firms in the Ukrainian economy and their effects on various industries. This subject needs more thorough research and leads to a call for further attempts to address this issue in the context of Ukraine. An understanding of the relationship between banks and firms could help to better determine the state of not only the banking sector, but also which banks could theoretically support the activities of zombie companies. Finally, zombie firms do indeed have a detrimental effect on the economy, thus the regulator should be notified of the importance of dealing with such an economic phenomenon.

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## APPENDIX

**Table 9. Average employment**



**Table 10. Average percentage change in employment**

