Revista Galega de ECONOMÍA | Galician Journal of ECONOMICS

Revista Galega de Economía, 31(3) (2022). ISSN: 1132-2799
https://doi.org/10.15304/rge.31.3.8295

Articles

How zombie firms affect healthy firms: The case of Portuguese trade sector

Como afectan as empresas zombis ás empresas sas: O caso do sector comercial portugués

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Received: 01/03/2022; Accepted: 08/08/2022

Abstract

Zombie companies can be classified as being nonprofitable, having low productivity and being ten years old or over; these businesses continue to exist due to the support of banks and governments. This paper aims to understand the impact of these types of firms on the investment, employment growth and labour productivity of healthy companies from the wholesale and retail trade and the hospitality sector during the period 2011-2018.

The data obtained indicate that the prevalence of zombie companies in Portugal (in the sectors under study) is higher in periods of economic crisis and that most of them are old and large companies, especially in the hotel industry sector.

By using panel data models with fixed effects, our investigation concludes that zombie firms negatively affect how healthy companies are run, because they reduce the latter's investment expenditure and workforce productivity.

Keywords: Zombie Companies; Fixed Effects model; Investment expenditure; Productivity.

Resumo

As empresas zombis poden clasificarse como non rendibles, con baixa produtividade e con dez anos ou máis de antigüidade; estas empresas seguen existindo grazas ao apoio dos bancos e os gobernos. Este traballo pretende coñecer o impacto deste tipo de empresas no investimento, o crecemento do emprego e a produtividade laboral das empresas sas do comercio maiorista e minorista e do sector da hostalería durante o período 2011-2018.

Os datos obtidos indican que a prevalencia das empresas zombis en Portugal (nos sectores obxecto de estudo) é maior en períodos de crise económica e que a maioría delas son empresas antigas e de gran tamaño, especialmente no sector da hostalería.

Mediante o uso de modelos de datos de panel con efectos fixos, a nosa investigación conclúe que as empresas zombi afectan negativamente á xestión das empresas sas, xa que reducen o gasto de investimento e a produtividade da man de obra destas últimas.

Palabras clave: Empresas Zombie; Modelo de efectos fixos; Gastos de investimento; Produtividade.

JEL Codes: C23; D43; D61; G38.

1. INTRODUCTION

Zombie firms can be defined as businesses which have a poor financial record, are highly dependent on banks and governments and are unable to meet their financial obligations without help. The artificial extension to a zombie firm's life by bank and government intervention prevents funds from being allocated to more productive firms, causing their performance and a country's economy to stagnate. These situations aggravate the financial problems felt by many firms because the availability and cost of capital are factors that affect investment decisions (Vaz, 2021). In addition, zombie firms also create distortions in the economy by depressing the market prices of their products, raising wages in order to retain their employees and congesting markets (Caballero et al., 2008).

In the case of Portugal, after international financial crisis in 2007, markets began to distrust the country's ability to meet its commitments, given its high levels of public and private debt and weak economic growth, which called into question whether it would be able to accumulate enough wealth to avoid failure. Moreover, in 2010, Portuguese banks lost access to international financial markets, which were an important source of funding for the country (Karmakar, 2019). Consequently, its financial system reduced the supply of credit for businesses, which created growth constraints to the national economy. The difficulty of companies in accessing bank funding prevented them from investing and new ones from emerging (Leão et al., 2014; Barros et al., 2017). This is especially serious if, as Alexandre et al. (2017) have pointed out, the Portuguese banking system seems unable to direct resources to the most dynamic sectors and companies with the highest growth potential, reinforcing the idea that the financial sector has problems with credit allocation. In effect, Blanchard and Portugal (2017) have found that from 2008 to 2013, the proportion of non-productive credit was high, thus arousing suspicions that banks were continuing to provide credit to zombie firms, which was confirmed by several studies. Therefore, given the fact that Portugal has a large number of zombie companies, which have negative effects on the economy and undermine the performance of the more productive companies, it is a highly relevant matter of concern.

This work aims to identify the extent of the zombie firm phenomenon in Portugal, in the period from 2011 to 2018 and also to understand whether it had counterproductive effects on the investment, employment growth and labour productivity of healthy firms in that period. For this purpose, we will analyse Portuguese firms in the wholesale and retail trade sectors, included in section G, and the hotel industry, included in section I, in accordance with the Portuguese Classification of Economic Activities (CAE - Revision 3).

This paper is organised into five more sections after this introduction. The first section presents the literature review, which gives a brief history of the anomaly of zombie companies, how they can be defined, what criteria they have to meet to be classified as such, the reasons for their existence, a brief analysis on this phenomenon in Portugal and finally, the consequences of their presence. In the second part of the paper, we lay out the objectives of the paper and the associated starting hypotheses. In the third part we present the sample of firms chosen, the methodology applied for defining what zombie companies are and the econometric model used in the study; there is also a description of the variables used and their main descriptive statistics. The fourth section explains and interprets the results obtained from the regression models, as well as evaluating the initial hypotheses. Finally, the conclusions and limitations of the study are stated.

Revista Galega de Economía, 31(3) (2022). ISSN: 1132-2799
https://doi.org/10.15304/rge.31.3.8295

2. LITERATURE REVIEW

The curious case of zombie companies emerged in the early 1990s when Japan was experiencing macroeconomic stagnation, a period which became known as the "lost decade". Hoshi and Kashyap (2000) were the first to mention this phenomenon, which was the consequence of poor credit distribution by banks; in other words, Japanese banks were granting loans and restructuring companies' debts without checking their financial situation first. Thus, insolvent companies that should not have been operating continued to exist (Caballero et al., 2008; Barros et al., 2017).

According to Peek and Rosengren (2005), lax bank regulation and supervision policies in Japan discouraged banks from being strict towards distressed borrowers, leading to a policy of "evergreening loans", whereby they made additional credit available to an indebted firm in order to enable it to make interest payments on outstanding loans, thereby avoiding or postponing its bankruptcy. This made the bank's balance sheet look better, as it did not have to report non-performing loans (NPLs). As Peek and Rosengren (2005) and Alexandre et al. (2017) have declared, it is in the interest of banks (at least in the short term) to adopt a tolerance policy for distressed borrowers to avoid having to record impairments for uncollectible loans on their balance sheets or to increase their provisions. According to Caballero et al. (2008), the Japanese political and regulatory response was to turn a blind eye to any irregularities and to delay any reform or restructuring of banks.

This perverse logic determined that when companies underperformed, certain banks were more likely to grant them loans, especially if the money lenders had weak balance sheets or if there was a strategic alliance in place, which would allow both parties to benefit from better access to finance; in Japan, such cases were known as *Keiretsu* (Caballero et al., 2008; Barros et al., 2017).

The sheer ease with which some companies obtain credit and keep their interest rates low is why they were founded and remain in the market with no economic viability and low productivity (Barros et al., 2017). These so-called “zombie companies” have low operational efficiency, consuming funds and social resources unproductively, since they benefit from having unique access to financial markets. They usually pay lower taxes and although they should fold, they continue to operate due to support from governments and banks; therefore, they have no incentive to improve their management structures or implement technological advances (Jiang et al., 2017; Shen & Chen, 2017; Dai et al., 2019; Han et al., 2020).

As mentioned before, banks shouldn´t be the only ones to blame for the existence of zombie firms; according to Jiang et al. (2017), some governments choose to provide subsidies to firms, regardless of where they are located, as long as they are which are considered to be the main employers in that region; thus local authorities help them in order to create more jobs to maintain social stability. In fact, although zombie companies are inefficient, some of them can also supply jobs and improve employment figures. Due to this, authorities can maintain positive reputations with glowing performance assessments, and in return provide these companies with subsidies, guaranteeing their survival. The problem of such policies, as Tan et al. (2016) remarked, is that this type of government funding increases the purchasing power of zombie firms but reduces that of the competitors because of the “crowding out” phenomenon which affects non-zombie firms. Moreover, Tan et al. (2016) also stressed that although government investment leads to employment growth in all businesses, it is likely that even more jobs would arise if zombie firms did not exist, reinforcing the general idea of the abovementioned effect.

With all this in mind, if zombie companies provide more jobs, they receive more government subsidies as a consequence. Due to the high level of protection they obtain, they do not feel the need to innovate technologically, thus taking little initiative and demonstrating poor product standards and low internal control quality (Chang et al., 2020). In this context, it is not surprising that "zombie firms are more prone to opportunism and moral hazard after obtaining government subsidies, and will ignore long-term operational efficiency in favor of blindly expanding their investments" (Liu et al., 2019, p. 63). In fact, these types of subsidies impede the improvement of operating performance in such businesses while lowering their capacity utilization.

Several studies have sought to characterize zombie firms around the world. As an example of one of these studies, El Ghoul et al. (2021) have documented the prevalence of zombie firms by using a sample from seventy-nine countries over the period 2005–2016. They have found that zombie firms vary across industries and that country-level debt enforcement and creditor rights have an important effect on their emergence, while cultural factors do not appear to have any impact. They have also noticed that larger firms and those located in high-growth economies are less likely to become zombies.

Meanwhile, in order to identify zombie companies, there are several methodologies: Caballero et al. (2008) proposed an approach based on firms' loan interest rates, since zombie firms receive financial help from banks with these which are abnormally lower than those charged to healthier firms (Shen & Chen, 2017; Dai et al., 2019). This method, which has become known as CHK (Caballero, Hoshi and Kashyap), consists of a firm being considered a zombie if its interest payments are lower than the hypothetical "minimum" risk-free ones that are paid by the most creditworthy borrowers (Caballero et al., 2008; Fukuda & Nakamura, 2011; Urionabarrenetxea et al., 2018; Chang et al., 2020). The definition proposed by these authors has the advantage, on the one hand, of classifying firms as zombies on the assumption that they receive subsidised credit and, on the other hand, of not including profitability or productivity criteria (Caballero et al., 2008; Dai et al., 2019). However, this method generates errors of two types: the first occurs when unhealthy firms are not identified as zombie firms, since banks have incentives to grant evergreen loans to distressed firms for the purpose of hiding non-performing loans (NPLs), charging them standard interest rates (set at prevailing market rates); the second type happens when reputable businesses with low default risk are identified as zombies in the case that they make loan payments at interest rates lower than risk-free lending rates (Caballero et al., 2008; Fukuda & Nakamura, 2011; Shen & Chen, 2017; Urionabarrenetxea et al., 2018; Dai et al., 2019).

Fukuda and Nakamura (2011), in order to avoid these errors, refined the approach proposed by Caballero et al. (2008) introducing two criteria to classify a company as a zombie: the profitability criterion and the evergreen loan criterion. According to the former, firms whose earnings before interest and taxes (EBIT) exceed the hypothetical risk-free interest payments defined by Caballero et al. (2008) are not considered zombies. This criterion takes into account that EBIT should never be negative for healthy firms, thus restricting the probability of their being identified as zombies (type two error). The second criterion considers companies that have been unprofitable and heavily indebted as well as increasingly dependent on borrowing to be zombies. Hence, a company is defined as a zombie if its EBIT is lower than the hypothetical risk-free interest payments and if total external debt is more than half of the total value of assets in the previous period, borrowing more in the current period as a consequence. As this type of firm is unlikely to obtain a new loan, this criterion avoids classifying unhealthy firms as non-zombies (type one error [Fukuda & Nakamura, 2011; Barros et al., 2017; Dai et al., 2019]).

However, Imai (2016) stated that the method proposed by Fukuda and Nakamura (2011) is not the most appropriate, since in healthy firms, a temporary decrease in profits may also occur risking their being misidentified as zombies; likewise, zombie firms could see a temporary increase in profits and then be mislabelled as healthy firms. On the other hand, Barros et al. (2017) have expressed that banks and borrowers may be reluctant to provide information to verify the existence of subsidised credit, making it difficult to use the approach proposed by Caballero et al. (2008).

Accordingly, McGowan et al. (2017) have presented an alternative definition for zombie companies based on four criteria: i) interest coverage ratio (measured by the ratio between operating profit and interest expense) of less than one for three consecutive years; ii) losses; iii) negative added value; iv) 10 years old or over. However, in the course of their study, McGowan et al. (2017) only used two of the criteria, namely those concerned with the interest coverage ratio and the age of the firms. There were three reasons why they chose to focus on the former: firstly, it is the best option for making comparisons between countries; secondly, it is less endogenous for productivity than negative profits; thirdly, it includes alternatives other than subsidised credit that can allow zombie companies to keep afloat. The age of firms is also considered as an important criterion because it distinguishes zombie firms from early stage companies such as startups, given that in the beginning, they incur losses for long periods of time because they need to invest until they reach satisfactory levels of operational capabilities and have enough customers to realise profits (McGowan et al., 2017; Hallak et al., 2018).

Seen from a different angle, zombie firms limit the growth opportunities of their healthy counterparts from the same sector (McGowan et al., 2017; Hallak et al., 2018). Thus, according to Barros et al. (2017), Hallak et al. (2018) and Schivardi et al. (2020), there are three main reasons for this: firstly, zombie companies' easy access to bank credit at lower rates means that healthy companies could face unexpected constraints in obtaining bank funding, meaning that they may be forced to borrow at higher rates until they become so unaffordable that they have no choice but to seek internal financing by reducing dividends and reinvesting profits - in extreme situations, it can even lead to healthy companies abandoning the market; secondly, although zombie companies compete with healthy ones in the product market, the financial subsidies the former receive from banks or governments enable them to exert competitive pressure on the later for long periods; thirdly, zombie firms (unreasonably) raise wages in order to retain their workers and hence restrict job growth and expansion in healthy ones.

The distortions that zombie firms create due to lower market prices and higher wages limits the possibility for healthy firms to expand and also reduces their profits, which discourages them from making future investments (Caballero et al., 2008; McGowan et al., 2017). By investing little, there cannot be much innovation or many technological advances in the economy, thus reducing local and overall productivity growth (Gouveia & Osterhold, 2018).

Caballero et al. (2008) explained the effects of zombie firms by way of two concepts: Sclerosis and Scrambling. The first corresponds to firms who have low productivity and need to receive loans and adopt safeguards, but which are likely to close down if banks do not offer them the financial help required. The second refers to the retention of firms and projects that are less productive than those that would otherwise enter the market if zombie firms were not holding it up.

The studies of Caballero et al. (2008) and McGowan et al. (2017) have focused on investigating the effects that such congestion can cause when it comes to the performance of healthy firms. These authors conclude that an increase in the percentage of zombie firms operating in an industry, as measured by the resources they hold, is associated with the

average healthy firm investing less and being unable to generate employment growth. However, the productivity gap between zombie and healthy firms is still increasing because, on the one hand, it causes a reduction in the industry's productivity and, on the other hand, additional barriers to the entry of new and productive firms are put up. These new firms, to be able to compete with the most productive ones in their respective industries, need to reach higher productivity levels in order to offset the reduction in market profitability caused by the abovementioned congestion, thus increasing the productivity gap between zombie companies and healthy ones (Caballero et al., 2008; McGowan et al., 2017; Barros et al., 2017).

In a similar vein, Banerjee and Hofmann (2018) have investigated how zombie firms have an impact by using a sample of listed companies in 14 countries over three decades. They have confirmed that these companies harm overall economic performance as they are less productive and impede the growth of healthy ones at both the investment level and the employment level due to the aforementioned congestion effects.

McGowan et al. (2017) have also analysed how this overcrowding affects efficient resource allocation to the most productive firms within each sector, considering a model in which firms with higher total productivity grow faster than the rest (Barros et al., 2017; Gouveia & Osterhold, 2018). The authors have concluded that an increase in sunk resources in zombie firms hinders fair capital reallocation within each sector, measured as a decrease in the ability of more productive firms to attract revenue (McGowan et al., 2017). Similarly, Gouveia and Osterhold (2019) have stated that these results may be related to a reduction of funding available to healthy firms.

Andrews and Petroulakis (2019) have found that there is a link between zombie firms and weak banks and explored the consequences of this link through capital reallocation. Applying the methodology of McGowan et al. (2017), the authors have confirmed that as zombie firm congestion decreases, more capital is efficiently reallocated to more productive firms. Thus, they have concluded that the capital reallocation process is less efficient in industries exposed to weaker banks. Another focus of Andrews and Petroulakis's (2019) study is the channels through which zombie firm congestion may affect the growth opportunities of healthy, more productive firms, particularly their access to credit. Using data from the European Central Bank's Access to Enterprise Finance Survey, the authors have found a statistically significant negative relationship between the share of sunk capital in zombie firms and the availability of credit for healthy firms. This relationship may be associated with direct "crowding out" effects, as in when banks cannot extend credit to healthy firms because their balance sheets are impaired by zombie firms, reducing the profitability of the industry and consequently, the returns from projects devised by potentially healthy firms.

In a compelling study on the Japanese economy, Aherne and Shinada (2005) found evidence that productivity growth was lower in industries highly concentrated with zombie firms, made worse because the reallocation of market share was already in decline, adding to the weak productivity performance.

In a more recent study, Wang and Zhu (2021), using a database on Chinese listed firms in the period 2006–2016, have identified Chinese zombie firms and the characteristics of their distribution by introducing the factors of government overprotection and bank credit support, discovering that low-productivity zombie firms tie up abundant financial capital and have a significant "crowding out" effect on non-zombie firms. Yu et al. (2021) have noted that zombie firms significantly increase the debt financing costs of normal firms.

In summary, it can be seen that zombie companies cause several issues: firstly, they create solvency problems in the banking system; secondly, they decrease competitiveness in the market where they operate in; thirdly, they prevent the entry of new companies that are more

Revista Galega de Economía, 31(3) (2022). ISSN: 1132-2799
https://doi.org/10.15304/rge.31.3.8295

innovative and competitive; last of all, they affect the aggregate growth of the economy and constitute a factor of macroeconomic stagnation (Barros et al., 2017).

3. OBJECTIVES AND RESEARCH HYPOTHESES

Despite the growing literature on zombie firms, to our knowledge, no previous study has specifically investigated the consequences of the phenomenon in the commercial sector. In an attempt to close this gap, the main objective of this paper is to analyse the effects that zombie companies have on healthy companies in the trade sector, namely in investment, employment growth and labour productivity. At the same time, we seek to estimate the dimension of said phenomenon in Portugal in these sectors between 2011 and 2018 to see whether there is a relationship between its dimension and the economic environment during that period.

Based on the objectives of this study and on the literature review conducted, the following research hypotheses have been developed to be tested:

H1: a) An increase in resources (assets) used by zombie firms reduces investments by healthy firms.

b) An increase in resources (assets) used by zombie firms reduces employment growth in healthy firms.

c) An increase in resources (assets) used by zombie firms reduces the labour productivity of healthy firms.

These three hypotheses have been verified by several authors, such as Caballero et al. (2008) and McGowan et al. (2017).

H2: The phenomenon of zombie companies in the selected sectors increased in Portugal during the crisis period (2011-2014) and decreased after that cycle.

This hypothesis was validated in the studies conducted by Barros et al. (2017) and Gouveia and Osterhold (2018).

4. SAMPLE AND METHODOLOGY

To carry out this study, data on Portuguese companies has been collected from the SABI database (Sistema de Análise de Balanços Ibéricos [System of Analysis of Iberian Balance Sheets). The sample under analysis was restricted to firms belonging to section G (wholesale trade and retail trade) and section I (hotels, restaurants and similar) according to the Portuguese Classification of Economic Activities (CAE - Revision 3). Section G included divisions 46 (wholesale trade - including agents, except those of motor vehicles and motorbikes) and 47 (retail trade, except those of motor vehicles and motorbikes); and in section I divisions 55 (accommodation) and 56 (restaurants and similar) were chosen for a time period of 8 years, from 2011 to 2018.

The trade sector was selected because it is one of the drivers of the national economy. According to the Portuguese National Statistics Institute, INE (Instituto Nacional de Estatística, 2021), the wholesale and retail trade divisions comprise the largest part of the total turnover of the trade sector; moreover, wholesale and retail trade companies account for over 30% of the turnover of the Portuguese business domain in the time period analysed, 2011 to 2018. Meanwhile, according to the Portuguese Tourist Board (Turismo de Portugal [2020]), the tourism sector (which includes accommodation and restaurants) has the largest

export activity in the country and plays an important role in job creation (between 8% and 9% of the national employment figures).

In order to define the sample of firms to study, two other criteria were applied: incorporation date of companies until 31 December 2010; workforce of at least 10 employees throughout the period 2010 to 2018, thus excluding micro-enterprises. After applying these criteria, the first version of the sample consisted of 5,724 companies. Next, the companies that did not have values for all the variables or years were eliminated. Consequently, the sample was reduced to 5,365 companies. Finally, a winsorizing process was applied to treat the outliers of the dependent variables in all regressions.

The most representative sector of our sample is the wholesale trade with 40% of the total number of companies, the least being accommodation, at only 10%. The retail trade and restaurants represent 29% and 21%, respectively.

To define a zombie company, we have followed and adapted the approach presented by McGowan et al. (2017). More specifically, in the present study, a company is considered a zombie if, for three consecutive years, it has had both an interest coverage ratio of less than one and negative net income, while it must also be 10 years old or over.

Also based on the model of McGowan et al. (2017), the regression equations to be estimated using the panel data model with fixed effects are as follows:

$$TexInv = \beta_1 NonZ_{ist} + \beta_2 NonZ_{ist} \times Zashare_{st} + \beta_3 Employees_{ist} + \beta_4 Age_{ist} + \alpha_i + \alpha_t + \varepsilon_i \quad (1)$$

$$VarEmp_{ist} = \beta_1 NonZ_{ist} + \beta_2 NonZ_{ist} \times Zashare_{st} + \beta_3 Age_{ist} + \alpha_i + \alpha_t + \varepsilon_{ist} \quad (2)$$

$$ProdTrab_{ist} = \beta_1 NonZ_{ist} + \beta_2 NonZ_{ist} \times Zashare_{st} + \beta_3 Employees_{ist} + \beta_4 Age_{ist} + \alpha_i + \alpha_t + \varepsilon_{ist} \quad (3)$$

meaning that:

TxInv - investment rate; VarEmp - change in employment; ProdTrab - labour productivity; NonZ - dummy variable to identify healthy companies; Zashare - asset "trapped" in zombie companies in each sector; Employees - number of employees; Age - age of the company; i - companies = 1,..., 5365; s - sector (CAE 2 digits) = Wholesale trade, retail trade, accommodation and restaurants; t - years = 2011,..., 2018; α_i - the firm's individual fixed effects (i = 1,..., 5365); α_t - year fixed effects (t = 2011,..., 2018); ε_{ist} - error term.

According to the definition of McGowan et al. (2017), the variables Interest Coverage Ratio, Net Income and Age have been used as criteria to classify companies as zombies. Interest Coverage Ratio has been measured as the ratio between operating profit and interest expenses only if it is less than one and with negative net income, both for three consecutive years, as well as being 10 years old or over. As the variables Interest Coverage Ratio and Net Income have the condition of three consecutive years, the data for these variables were collected from 2009, so that it was possible to identify those companies as zombies in 2011, the year in which the study starts.

After identifying the zombie firms and with the main objective of analysing the effects that they cause on healthy firms, the independent variables to be studied are Rate of investment in tangible assets, Change in employment and Labour productivity, which are defined as follows:

Table 1. Description of dependent variables

Dependent variables	Calculation formula
Investment rate in tangible assets (Inv)	$\frac{\text{Tangible Fixed Assets}_t - \text{Tangible Fixed Assets}_{t-1} + \text{Depreciation}_t}{\text{Tangible Fixed Assets}_{t-1}}$
Variation in employment (VarEmp)	$\frac{\text{No. of Employees}_t - \text{No. of Employees}_{t-1}}{\text{No. of Employees}_{t-1}}$
Labour productivity (Prod)	$\frac{\text{Volume of Business}_t}{\text{No. of Employees}_t}$

Source: Own elaboration

Moreover, considering the research objectives and the hypotheses defined above, the independent variables of this study are as follows:

i) Healthy firms (NonZ:non−zombie): this is a dummy variable that identifies healthy firms, that is, those that are not considered zombies by the criteria defined for this designation, and are assigned the value of 1; those identified as zombies (which are characterised by firms with interest coverage ratio below one for three consecutive years, negative net income for three consecutive years and aged 10 years or more) are assigned the value of 0;

ii) "Stuck" assets (Zashare): this represents the assets of companies in each sector (2-digit CAE) that belong to companies considered zombies and measures how much burden zombie companies have in each activity sector;

iii) Number of employees (Employees): this represents the size of the company in order to verify the relationship between this variable and the dependent variables.

5. RESULTS

5.1. Descriptive statistics

Table 2 presents the descriptive statistics of the dependent and independent variables via the mean, median, standard deviation, minimum and maximum values of each variable for the period under analysis.

By examining the table, it can be seen that the companies in the sample for the period between 2011 and 2018 have, on average, a positive investment rate of 18.5% and a positive (but small) variation in employment, with a mean average value of 2.36%. Regarding labour productivity, these companies have a mean average value of €149,000 in turnover per worker. Regarding the "trapped" asset variable (Zashare), it shows that, on average, 5.13% of assets are "trapped" in zombie firms, i.e. they belong to those which are located in the sectors under study. Finally, it can be observed that the companies that make up the sample have had a mean average number of 23 years in business and employ 56 staff for this size of company.

Table 2. Descriptive statistics of variables

Variables	Mean	Median	Deviation standard	Minimum	Maximum
Inv (%)	18.50	6.1	30.53	-100	100
VarEmp (%)	2.36	0	15.65	-86.4	100
Prod (in thousands of euros)	149.02	98	140.38	0	550

Variables	Mean	Median	Deviation standard	Minimum	Maximum
***Zashare* (%)**	5.13	2.8	6.14	0.7	31.9
No. of employees	56.48	21	482.36	10	26,857
Age (in years)	22.74	19	16.99	2	111

Source: Own elaboration

Table 3 displays the descriptive statistics (mean, median, minimum and maximum) for just the 3 dependent variables under study (Investment rate, Employment change and Labour productivity) but divided into zombie and non-zombie firms.

Table 3. Descriptive statistics of zombie and non-zombie companies

Variables	Company	Mean	Median	Minimum	Maximum
Inv (%)	**Zombie**	7.93	1	-100	100
	Non-zombie	18.99	6.6	-100	100
VarEmp (%)	**Zombie**	-1.40	0	-63	100
	Non-zombie	2.53	0	-86.4	100
Prod (in thousands of euros)	**Zombie**	76.67	43	0	550
	Non-zombie	152.34	102	0	550

Source: Own elaboration

By analysing Table 3, we can observe that zombie companies have an average investment rate of 7.93%, while non-zombie companies have a higher average investment rate of 18.99%.

With regard to the variation in employment, zombie companies register a negative average value of 1.40% whereas for their non-zombie counterparts, it is a positive value of 2.53%. It can also be seen that zombie companies have an average value of 76 thousand euros in turnover per employee, while non-zombie companies have double the value, at 152 thousand euros. Thus, we have found that zombie firms in the sectors under study, on average, invest less, have lower employment growth and are less productive, namely at the labour level, compared to non-zombie firms.

Meanwhile, from the analysis of Table 4, we have seen that the percentage of zombie companies in Portugal in the sectors under study varied between 2.37% (in 2018) and 6.52% (in 2014), when it reached its minimum and maximum values, respectively. In the subperiod from 2011 to 2014, there was an increase of 2.36 percentage points (p.p.) for the percentage of zombie companies (from 4.16% in 2011 to 6.52% in 2014) and from 2015 the number of zombie companies began to decrease significantly, a reduction of 4.15 p.p.

Table 4. Number and weight of zombie companies per year

Year	2011	2012	2013	2014	2015	2016	2017	2018
Number of companies	223	275	346	350	256	170	136	127
Percentage of companies	4.16%	5.13%	6.45%	6.52%	4.77%	3.17%	2.53%	2.37%

Source: Own elaboration

Revista Galega de Economía, 31(3) (2022). ISSN: 1132-2799
https://doi.org/10.15304/rge.31.3.8295

These results seem to validate the second starting hypothesis, which states that the phenomenon of zombie companies was more notorious in Portugal during the crisis period (2011- 2014), and from 2015 onwards it lost popularity and evidence.

Table 5 shows that the lowest percentage of zombie companies is to be found in small companies (with 10 to 49 employees) throughout the time period analysed.

Table 5. Number of zombie companies by dimension

No. employees	10 - 49		50 - 249		250 or more	
No.	**%**	**No.**	**%**	**No.**	**%**	
2011	147	3.24%	67	9.19%	9	8.65%
2018	90	2.07%	32	3.59%	5	4.00%

Source: Own elaboration

By analysing Table 6, which covers the period between 2011 and 2018, it can be seen that the least representative sector of the sample, accommodation, has the highest percentage of zombie companies. On the other hand, the one with the lowest is wholesale trade, hence the most representative.

Table 6. Number of zombie companies in each CAE

CAE	Wholesale		Retail trade		Accommodation		Restaurants	
No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
Average 2011-2018	-	2.05%	-	3.12%	-	15.10%	-	5.43%

Source: Own elaboration

Note: No of zombie companies per sector out of the total number of companies in each sector

5.2. Regression analysis

Now we present the results of the panel data models with fixed effects (which omits the unknown variables that are constant for a given firm) for the dependent variables (Investment rate, Employment change and Labour productivity) and we analyse the effect that each independent variable has on the dependent ones.

Given that the main objective of this paper is to analyse how zombie companies affect their healthy counterparts, the most important coefficient is that of the interaction between non-zombie companies and the share of "trapped" assets (NonZ x Zashare). This interaction variable allows us to assess the main objective, taking into account that the number of zombie firms is measured by the "trapped" asset variable, which represents the importance of zombie firms in each sector via the fraction of assets held in these firms. The tables which appear below lay out the results obtained

According to the results presented in Table 7, the most relevant variable of the study, the interaction between non-zombie companies and the share of "trapped" assets in zombie companies (NonZ x Zashare), shows a negative relationship with investment rate and labour productivity. These results allow us to validate the first starting hypothesis, point a, and point

c, in which an increase in resources (assets) used by zombie firms reduces investment by healthy firms as well as their productivity.

Table 7. Regression Results

Variables	Inv	Emp	Prod
NonZ	4.786e-02*** (0.0124)	0.0254*** (0.0068)	12.1615*** (1.338)
Zashare	4.878e-02 (0.0862)	-0.0967* (0.0470)	-15.3659· (9.273)
Employees	6.611e-05* (3.15e-05)	-	-0.0244*** (0.0034)
NonZ x Zashare	-2.305e-01** (0.0866)	-0.0311 (0.0472)	-43.455*** (9.307)
R^2	0.077	0.012	0.066

Source: Own elaboration

Standard errors in parentheses. Note. *** 0.1 % Significance level; ** 1 % Significance level; * 5% Significance level; "·" 10 % Significance level.

More specifically, an increase of one percentage point in the "trapped" assets in zombie companies reduces the average investment rate of healthy companies in the sectors under study by 23.05 percentage points, keeping everything else constant. Similarly, on average, an increase of one percentage point in "trapped" assets in zombie firms leads to a decrease of about €43,000 in the labour productivity of healthy firms in the sectors under study, everything else remaining constant.

At the same time, regarding employment as the interaction variable, non-zombies with the share of "trapped" assets in zombie firms (NonZ x Zashare) is not statistically significant, which does not allow the validity of the first starting hypothesis, point b, stating that an increase in resources (assets) used by zombie firms reduces the employment growth of healthy firms, to be analysed. Regarding the variable Non-zombie (NonZ), it presents a positive coefficient for the three dependent variables. As far as investment is concerned, healthy firms spend on average, 4.79 percentage points more than zombie firms in the sectors under study, *ceteris paribus*.

Thus, healthy firms have higher investment rates than zombie firms do. McGowan et al. (2017) have pointed out that this coefficient is difficult to interpret since theoretically, it could be both positive (if zombie firms cannot afford to spend as much as healthy firms can) and negative (if zombie firms receive significant subsidies or subsidised credits that allow them to sustain levels of investment that apparently seem disproportionate). Indeed, as Caballero et al. (2008) mentioned, zombie firms may end up investing or hiring more than healthy firms do. When it comes to the positive relationship observed with the variation in employment, it actually indicates that on average, healthy companies have a variation in employment 2.54 percentage points higher than zombie companies in the sectors under analysis, ceteris paribus. Finally, it can be observed that, on average, healthy firms have labour productivity which is about twelve thousand euros higher than that of zombie firms in the sectors under study, *ceteris paribus*.

In contrast, the variable '"Trapped" assets' (Zashare) presents a negative coefficient for the dependent variable "Employment", suggesting that on average, a one percentage point increase in "trapped" assets in zombie firms causes a reduction of 9.67 percentage points for employment variation in companies in the sectors under analysis, *ceteris paribus*. Thus, the higher the percentage of resources held by zombie companies, the lower company employment growth is across the sectors analysed. By the same token, the variable '"Trapped"

assets' (Zashare) shows a negative sign for the dependent variable 'Labour productivity', which means that, on average, an increase of one percentage point in "trapped" assets in zombie companies reduces labour productivity by about €15,000 in firms in the sectors under analysis, ceteris paribus. Therefore, the higher the percentage of resources held by zombie firms, the lower the labour productivity of firms across all the sectors analysed.

In short, in the sectors examined, it is evident that the higher the percentage of resources (assets) held in zombie companies is, the lower the investment and labour productivity for healthy companies is. With regard to employment growth in healthy firms, as the coefficient on the interaction variable is not statistically significant, it cannot be analysed.

We can also conclude that healthy firms have higher investment rates and employment growth and are more productive at the labour level, relative to zombie firms. It should also be noted that the greater the percentage of resources held by zombie companies is, the lower the employment growth and labour productivity of all the companies in the sectors under study are. It should also be taken into account that as the size of companies increases, the higher their investment rate becomes, but labour productivity becomes lower.

At this point, a robustness analysis will be carried out in order to analyse the impact of zombie firms on healthy firms. Thus, the sample will be divided into 4 sub-samples corresponding to the four activity sectors (wholesale trade, retail trade, accommodation and restaurants).

Table 8. Regression results for dependent variable 'Investment rate' per sector

Variables	Wholesale	Retail Trade	Accommodation	Restaurant
NonZ	0.1048 * (0.0529)	-1.294e-02 (6.236e-02)	0.0049 (0.0398)	9.127e-02 ** (3.218e-02)
Employees	0.0004 * (0.0001)	2.591e-05 (3.382e-05)	0.0004 (0.0002)	1.611e-04 (9.505e-05)
NonZ x Zashare	-1.637 (1.284)	1.270 (2.487)	-0.0185 (0.148	-8.049e-01 * (3.940e-01)
R^2	0.08	0.02	0.07	0.14

Source: Own elaboration

Note. *** 0.1 % Significance Level; ** 1 % Significance Level; * 5% Significance Level; "." 10 % Significance Level; Values in parentheses correspond to the standard error.

With an analysis of Table 8 for the regression of the investment rate, it can be seen that in the restaurant sector, all independent variables are statistically significant. The interaction variable 'Non-zombie' with the fraction of '"Trapped" assets' in zombie firms (NonZ x Zashare) shows a negative relationship with the investment rate, indicating that a one percentage point increase in "trapped" assets in zombie firms reduces the investment rate of healthy firms in this sector by 80.5 percentage points, everything else being constant. For the same sector, the 'Non-zombie' variable (NonZ) shows a positive sign, which reveals that healthy firms have 9.13 percentage points more for investment rates than zombie firms in the restaurant sector, ceteris paribus.

In the wholesale sector, all independent variables are statistically significant, except for the interaction variable 'Non-zombie' with the fraction of '"Trapped" assets' in zombie firms (NonZ x Zashare). The 'Non-zombie' variable (NonZ) has a positive sign, indicating that healthy firms have 10.48 percentage points more for investment rates than zombie firms in this sector, ceteris paribus.

The retail trade and accommodation sectors do not present any statistically significant variables, which does not allow for an analysis of the effects of each independent variable on the investment rate of firms in these sectors.

An analysis of Table 9 for the dependent variable variation in employment shows that none of the independent variables is statistically significant for all sectors under study, so the effect of each of these variables on the dependent variable cannot be analysed.

Table 9. Regression results for dependent variable 'Employment variation' per sector

Variables	Wholesale	Retail trade	Accommodation	Restaurants
NonZ	0.0401 (0.025)	0.0129 (0.032)	0.0117 (0.026)	0.0032 (0.020)
NonZ x Zashare	-0.0751 (0.616)	1.1712 (1.285)	0.0138 (0.099)	-0.0280 (0.250)
R^2	0.010	0.016	0.005	3.292e-06

Source: Own elaboration

Note. *** 0.1 % Significance Level; ** 1 % Significance Level; * 5% Significance Level; "." 10 % Significance Level; Values in parentheses correspond to the standard error.

After analysing the results presented in Table 10, it can be observed that in the accommodation sector, all the independent variables are statistically significant. The interaction variable 'Non-zombie' with the share of '"Trapped" assets' in zombie firms (NonZ x Zashare) shows a negative relationship with 'Labour productivity', which reveals that an increase of one percentage point in the "trapped" assets in zombie firms results in a decrease of about €26,000 in the labour productivity of healthy firms in this sector, everything else being constant

Table 10. Regression results for dependent variable 'Productivity' per sector

Variables	Wholesale	Retail trade	Accommodation	Restaurants
NonZ	31.9654 *** (7.4637)	4.9917 (6.0885)	7.6372 ** (2.4074)	3.5012 *** (0.7700)
Employees	-0.2353 *** (0.0198)	-0.0058 (0.0033)	-0.1306 *** (0.0136)	-0.0254 *** (0.0023)
NonZ x Zashare	-211.9448 (181.0508)	73.1663 (242.8105)	-25.7098 ** (8.9755)	-12.9775 (9,4290)
R^2	0.0146	0.0015	0.0265	0.0205

Source: Own elaboration

Note. *** 0.1 % Significance Level; ** 1 % Significance Level; * 5% Significance Level; "." 10 % Significance Level; Values in parentheses correspond to the standard error.

In the wholesale trade sector, all independent variables are statistically significant, except for the interaction variable 'Non-zombie' with the share of '"Stuck" assets' in zombie firms (NonZ x Zashare). The variable 'Non-zombie' (NonZ) shows a positive sign, indicating that healthy firms have a labour productivity about €31,000 higher than zombie firms in this sector, ceteris paribus. In the restaurant sector, all independent variables are statistically significant, except for the interaction variable 'Non-zombie' with the fraction of '"Trapped" assets in zombie firms' (NonZ x Zashare).

In summary, when each activity sector is analysed separately, it can be seen that it is the restaurant and accommodation sectors which are most affected by the phenomenon of zombie companies. It should be noted that at the beginning of this chapter, when analysing the

Revista Galega de Economía, 31(3) (2022). ISSN: 1132-2799
https://doi.org/10.15304/rge.31.3.8295

number of zombie companies per sector, the aforementioned two had the highest percentage of zombie companies out of all four of them.

We can thus conclude that a higher percentage of resources (assets) retained in zombie firms negatively affects healthy firms in terms of investing in the restaurant sector and their labour productivity in the accommodation sector. Regarding employment growth in healthy firms, the interaction variable (NonZ x Zashare) was not found to be statistically significant in any of the sectors, as can be observed in the analysis of the sectors overall

We have also found that healthy firms have a higher investment rate in the restaurant and wholesale trade sectors and higher labour productivity in the restaurant, wholesale trade and accommodation sectors than zombie firms do. As for employment growth, although healthy firms show a positive sign in all sectors, it is not statistically significant, which does not allow us to analyse this variable in relation to zombie firms. Finally, it can be seen that the larger the firm, the higher its investment rate, so does its investment rate in the restaurant and wholesale trade sectors whereas the labour productivity of firms in all sectors under study is lower.

6. CONCLUSIONS

The phenomenon of zombie firms has been a major issue in recent economic and financial literature; in spite of having no financial conditions to survive, they are not eliminated from the market but remain there due to bank loans and government subsidies. On the one hand, such assistance and artificial aid damages overall economic growth and that of viable firms, but on the other hand, we cannot forget that they are responsible for a significant part of employment and capital.

In this study, we have used a sample of 5,365 Portuguese companies from the wholesale and retail trade, accommodation and restaurant sectors for the period between 2011 and 2018. The aim has been to estimate the extent of the anomaly in Portugal and understand the impact of these types of companies on their healthy counterparts. The methodology applied to define zombie companies has been that of McGowan et al. (2017).

In the first part of the empirical study, a descriptive analysis of the sample was carried out, in which it was found that the number of zombie firms in Portugal in the sectors under study reached its highest level between 2011 and 2014 (the period in which the Economic and Financial Assistance Programme was implemented), consequently decreasing after the economic downturns. We have also observed that 'zombie' status was given mostly to older enterprises (aged 41 years and over) and in larger ones (with 250 or more employees).

In the second part of the empirical study, panel data methodology was applied, using fixed effects models in all regressions. By analysing the results, it was verified that zombie companies have a negative impact on healthy firms, meaning that the more resources that are retained in zombie firms, the less investment and labour productivity there is in healthy firms. These results are in line with the previous studies of several authors. It was also possible to confirm that zombie firms have lower investment, employment growth and labour productivity rates compared to healthy firms.

When conducting this study, some limitations were encountered, including the lack of data for years prior to 2011, since it would have been interesting to study the period before the crisis to understand if the overall behaviour was similar to after it ended. In the same way, it would have also been useful to study the period between 2019 and 2021, due to it covering the dates of the pandemic. Furthermore, it would have been preferable to use additional classifications of zombie companies instead of just one.

Therefore, in future research, taking into account the limitations presented, it would be recommended to extend the time period of the analysis, including the period before 2011 and the period after 2018 and also to use other criteria for the identification of zombie companies. Another path for future investigation could be the inclusion of micro companies (less than 10 employees) because, according to the Bank of Portugal (2021), most accommodation facilities and catering companies are micro companies and these sectors were the most affected by the phenomenon studied in this work.

Gouveia and Osterhold (2019) have said that pushing for zombie companies to leave the market is important for the economy to function efficiently, although it should be noted that these companies are responsible for a significant part of employment and capital. Thus, they stress that a mixture of public policies should respond to the significant social costs associated with the exit of firms (even zombies).

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