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Zombie Companies in Portugal - The non-tradable sectors of Construction and Services

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Abstract

The phenomenon of zombie companies has already been deeply analyzed, particularly in the case of Japan. Several authors relate the economic crisis experienced in the 1990s and the stagnation that Japan has been witnessing to the deterioration of the Japanese banking system, while continuously attributing credit to weaker companies, many of which were in a situation of insolvency, preventing them from closing or restructuring on one hand and credit to from being channeled to more productive sectors.

Considering that the phenomenon of zombie companies in the case of Japan jeopardized the growth of that country in the twentieth century, it is relevant to identify the weight of this type of entities in the Portuguese enterprise sector and its evolution over time.

The present study shows that between 2008 and 2015, in the Portuguese non-tradable sectors of Construction and Services, between 5.2% (2008) and 12.5% (2013) of companies in the market were zombies.

We also confirm the theoretical predictions and previous empirical results that a greater zombie presence in Construction and Services has significant negative implications on healthy companies operating in the same sector, namely reducing investment and employment and increasing the productivity gap between companies more and less productive in each sector.

JEL Classification: E22, E24, G32, L25, O47

Keywords: *Zombie Companies, Construction, Services, Non-Tradable Sectors, Resource Allocation, Financing, Investment, Employment*

Note: This article is sole responsibility of the authors and do not necessarily reflect the positions of GEE or the Portuguese Ministry of Economy.

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1. Introduction

The ease of obtaining credit, allied to a long period of very low interest rates, created conditions for the appearance, fixation and permanence of companies in the market, which otherwise would not be possible. If there are no significant barriers for companies to obtain credit and if interest rates are particularly low, there are conditions that allow companies without economic viability and with very low productivity (especially of the labor factor) to remain on the market¹.

These companies, which have been called zombies, are on the market for at least 10 years, survive with credit granted by the banking system because they are unable to generate enough revenue to carry out their normal activities, pay wages above the productivity of their sector and are not very innovative.

The main consequences of remaining in the market of companies with these characteristics are, among others, that they (i) create solvency problems in the banking system, (ii) reduce competitiveness in the market where they operate, (iii) prevent new, more innovative and more competitive companies from entering (iv) affect the aggregate growth of the economy and (v) constitute a factor of macroeconomic stagnation (Caballero, 2008).

Based on the bibliographical review, our objective was to identify the factors that allow characterizing the situation in Portugal regarding the existence of zombie companies. In this sense, this work intends, essentially, to analyze the existence and persistence of zombie companies in the national economy. To do so, we used the information contained in the annual statements of corporate income, as reported to the Ministry of Finance, worked through a statistical tool (STATA).

Taking into account that identifying zombie companies is not an easy task since, although its well-defined characteristics, there are some factors that can contribute to lead to erroneous conclusions, we followed the strategy used by Caballero et al (2008) and McGowan et al. (2017), and we intend to observe the following parameters:

- Its extent and its effects;
- The model used is a standard variant of the ones studied in the literature on creative destruction, where one can understand to what extent and under what conditions the theory underlying the definition of the perfect market is present (companies are born and die, of course, according to market conditions);
- The modeling of the presence of zombies presents itself as a constraint to the "destruction" of companies (as would normally happen to companies that do not have the economic and financial conditions to continue in the market), demand or credit;
- We expect to find what Caballero and Hammour (1998, 2000) called "sclerosis", situation in which companies would not survive without the loans granted by the banks, and "scrambling", which is the congestion of inefficient companies that prevent the entry of young, innovative and more productive companies.

Thus, the work will provide a frame to the problem, referring to the characteristics intrinsic to zombie companies, based on the typology referred in the literature on the subject. Finally, the results of the

¹ Segundo o BPstat do Banco de Portugal, o aumento dos custos unitários do trabalho em Portugal em grande parte do período entre 1996 e 2016 (com exceção para os anos de 2004, 2010, 2011, 2012 e 2014) decorre de um aumento mais do que proporcional das remunerações em relação à produtividade. De facto, os salários pagos, mesmo sendo baixos, estão acima da produtividade das empresas o que cria problemas de competitividade nos sectores onde estas se inserem.

econometric study performed on the basis of the existing data and the final considerations will be presented.

2. Literature review

There is a large set of bibliography describing the constraints related to the impact of active zombie companies, consuming financing that could be directed to more productive companies, especially those of the tradable sectors and, among them, of companies with an export vocation.

As reported by McGowan et al. (2017), various approaches have been used to define zombie companies, characterizing them as companies with more than a decade of existence that do not generate sufficient revenues in their regular activity, persistently dependent on bank credit and that usually pay high wages considering the productivity of the sectors in which they operate.

The productivity of these companies is much lower, contributing to decrease productivity in the different sectors where they are installed. This performance causes congestion and inefficiency in the market, among other factors, because²:

- Encourages inefficient companies to remain in the market, since easy access to bank credit gives them the possibility to continue their activity;
- Attracting financial resources through the banking system reduces available credit and makes it impossible for viable companies to stay and progress; and
- Prevent the entry of new companies, willing to innovate and to be more productive.

The awakening to this problem arose from the stagnation in Japan since the beginning of the 1990s, known as the "lost decade" (Hoshi, 2000), in which the particularities of the Japanese banking system helped establish a large-scale crisis, provided by the close relationship between companies and the banking system, which reflected in the stagnation of the economy. The negligent banking regulation allowed for years the successive default of solvency ratios by the banking system. In order to continue to maintain credit flow, Japanese banks continued to lend and restructure corporate debt without meeting their financial conditions, thereby incurring substantial non-performing loans.

In this way, insolvent companies, which otherwise would leave the market, ended up perpetuating its existence, even without the conditions to do so. The congestion of the market with companies with these characteristics caused a generalized decrease of its profits, including of the companies considered healthy, and the discouragement of the entry of young and innovative companies (Caballero, 2008; Know, 2015; McGowan et al, 2017).

According to Peek and Rosegren (2005), the situation in Japan was due in part to banking regulation and supervision policies that lead banks with high bad debt and depreciated capital to have little incentive to be strict with debtors, ie a policy of "evergreening loans" from banks where a bank assigns additional credit to a company in difficulty to enable the company to pay interest on the outstanding loans, avoiding or postponing its bankruptcy/restructuring. In this way, they avoid overloading their balance sheets by avoiding non-performing loans.

² Caballero, 2008; Know, 2015; McGowan et al, 2017

In particular, Hoshi's (2000) study considers that there was no immediate political and regulatory response, and it was found that the actions occurred at more advanced stages of the problem in which it was necessary to recognize the bankruptcy of banking institutions and their nationalization.

Although banks were meeting international standards for minimal capital requirements (Basel), many began to face large volumes of non-performing loans, which would oblige them to amortize existing capital, reducing capital levels. While facing this situation, banks chose to continue to finance insolvent companies. The study by Hoshi (2000) argues that by making the roll over of debt, banks increased recession by failing to finance more productive firms, creating a distortion in the economy.

The definition considered by Caballero et al. (2008), precursors of the approach of zombie companies, faces a common difficulty: obtaining the necessary information. In fact, banks and debtors will hardly be available to provide information to verify the existence of subsidized credit. Bruche & Llobet (2013) raise the hypothesis that the banking regulator may offer a "reward" to banks that are willing to provide information about zombie companies, expecting that they are able to exploit this informational advantage to maximize the transfers they receive, obtaining income from the information they hold.

Caballero et al. (2008) emphasize the banks' incentive to restructure the debt of companies presenting non-performing loans, since they only have to make reservations, usually 15%, while, by recognizing the existence of credit at risk, that percentage rises to 70%.

Their study sought to establish an approximation to the definition of zombie company considering them as companies that receive sufficient financial support from their creditors to survive despite their poor profitability and explored strategies to identify the zombie business set from the calculation of interest difference between companies.

They concluded conclude that, in the Japanese case, regulators failed to identify the high cost of allowing zombie companies to remain active and that capital injected into bank recapitalization in the late 1990s was not enough to discourage funding to those companies. Peek and Rosengren (2005) found that bank credit extended to low-income enterprises increased sharply between 1993 and 1999.

During times of underperformance by firms, banks have become more likely to lend to zombie companies, especially where there are strategic alliances between companies and banks, facilitating access to finance. There is evidence that this is the typical case of Japan, since there were differences between the situations where the companies and banks were affiliated with keiretsu³, and in the situations where this was not the case.

The study by McGowan et al. (2017) uses as a definition, within the scope of his work, a classification of zombie company based on the interest coverage ratio, introducing as criterion the age of the company.

In this sense, companies with 10 or more years of age, with an interest coverage ratio of less than 1 for at least 3 consecutive years, with large turnover of debt service and successive losses (negative profits) and with low multi-factor productivity (especially regarding the labor factor).

The criterion of age is important in distinguishing zombie companies from innovative start-up companies. The study by McGowan et al. (2017) also identifies a relationship between the size of companies and the prevalence of zombies, considering that the percentage of zombie companies is higher among larger companies. It will be interesting to assess this information for the Portuguese reality based on the available sample.

³ *Keiretsu* é uma expressão utilizada no Japão que dá nome às alianças estratégicas que ligam vários agentes económicos, incluindo as entidades bancárias, que são parceiros estratégicos na medida que o acesso ao financiamento é facilitado.

The empirical study by McGowan et al. (2017) adopts a model, based on the model presented by Caballero et al. (2008), which uses available information on 9 countries between 2003 and 2013, in order to measure the activity of a company using the data as follows:

$$Y_{isct}^k = \beta_1 nonZ_{isct} + \beta_2 nonZ_{isct} \times Z_{sct} + \beta_3 Firmcontrols_{isct-1} + \delta_{sct} + \varepsilon_{isct}$$

where Y refers to the measure of activity (the investment rate, the percentage change in employment or the multifactorial productivity level, $k = 3$) in firm i , in industry s , in country c , at time t , where Z is the share of the capital of the industry sunk in zombie companies and company controls include dummy variables for firm age (young = 1 if age <6) and for company size in terms of number of workers (1-10, 11-19, 20-49, 50-99, 100-249 and 250+).

Taking into account the heterogeneity in the productivity of firms between sectors, McGowan et al. (2017) use a model to test the potential for the distortion effect of excess of zombie companies on resource allocation, taking into account a model in which firms with higher productivity (MFP) grow faster than the rest (Doster et al. Decker et al., 2016), also using information about nine countries, in the period between 2003 and 2013. The model is as follows:

$$Kgrowth_{isct} = \alpha + \beta_1 MFP_{isct-1} + \beta_2 MFP_{isct-1} \times Z_{sct} + \beta_3 Formcontrols_{isct-1} + \delta_{sct} + \varepsilon_{isct}$$

in which $Kgrowth$ is the change in the real capital stock for firm i , in industry s , in country c , at time t ; MFP is a multi-factor productivity measure at company level that is a deviation from the country-industry-year average to control MFP differences between industries and countries; Z is the non recoverable part of the industrial (labor or capital) resources of zombie companies; company controls are dummies for age and size.

The study by McGowan et al. (2017) concludes that the survival of zombie companies that remain in limbo with financial weaknesses, while consuming financing, reduces the productivity growth of the labor factor, since this trend is associated with low investment and low employment growth in these companies.

It also concludes that the probability of a company being zombie tends to increase with the size of the company, with age (in older companies the probability increases), and that over time there has been an increase in both the prevalence of zombie companies limiting the expansion of viable companies and the entry of young and innovative companies into the market, making it difficult to efficiently relocate capital and increase productivity.

In the identification of a zombie phenomenon, what one hopes to find is what Caballero and Hammour (1998, 2000) called "sclerosis", situation in which companies would not be saved without the loans granted by the banks, and "scrambling", which is a congestion of companies that prevent the entry of young, innovative and more productive companies.

Experience in Japan is important in helping to understand the evolution of contemporary productivity in Europe in general and in Portugal in particular, and is even more important because the financial system is, by excellence, the main financier of companies. The European tradition lies in free market theory, where companies enter and exit the market, the unviable "die" and leave and the most efficient remain. However, there are studies that indicate that this mechanism may be "failing".

There are at least two reasons that may be leading to this:

- On one hand, the banking system with the need to grant credit imposed by the management objectives, granted on the basis of overvalued guarantees and
- On the other hand, the political constraints imposed by the need to avoid the growth of unemployment rates.

In Portugal, to this reality was added the economic and financial crisis that began in 2008, which resulted on the request for financial rescue and the consequent Financial Assistance Program in 2011, which eventually led to severe credit restrictions with consequences for people and businesses.

Following these seminal analyzes, it is intended to apply the existing models to the reality of companies in Portugal, seeking to characterize the business fabric of SMEs so that the size and prevalence of the phenomenon of zombie companies in Portugal can be gauged. As with other countries that have undergone adjustment programs, it is important to gauge the impact of the financial crisis on the phenomenon of zombie companies.

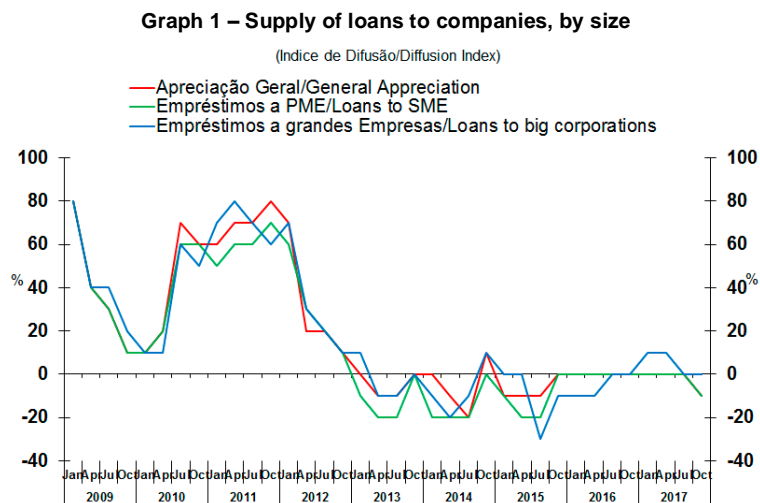
At the beginning of 2017, a study - McGowman et al. (2017) - was published by the OECD - whose objective was to explore the possibility of a productivity slowdown over the last decade in the economies of countries that are part of the institution motivated by the existence and prevalence of zombie companies. Although the working paper by McGowman et al (2017) includes Portugal, it does so only for the year 2013, which is manifestly insufficient to characterize the reality of the national economy in relation to the problem, taking into account the characteristics used for detect the presence of zombie companies.

3. Macroeconomic Environment of Portugal

For a better framing of the question, it is necessary to make a macroeconomic framework of Portugal.

After the global financial crisis of 2008, Portuguese companies have faced difficulties in obtaining financing under favorable conditions, particularly when compared to companies in other Member States, due to the contraction of credit offered by the Portuguese financial system.

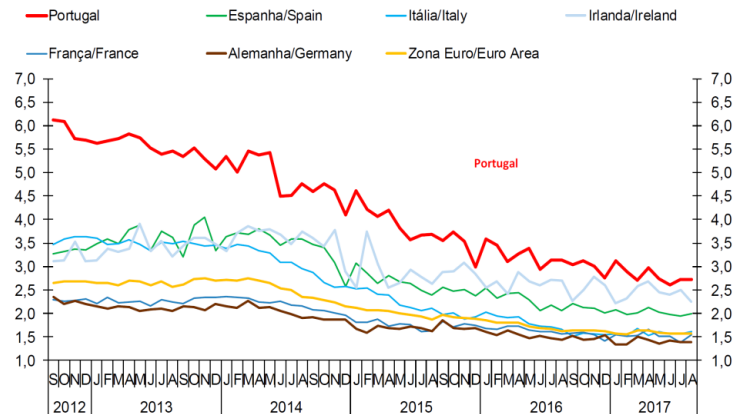
Since that year, there has been an increase in the tightening of credit supply conditions, although there is evidence of a slight decrease in the tightening of lending to SMEs since 2013.



Source: Banco de Portugal / Gabinete de Estratégia e Estudos

Indeed, despite the accommodative monetary policy of the ECB, with interest rates at historically low levels, the financial fragmentation of the Euro Zone has prevented the transmission of the policy to the countries of southern Europe, in particular Portugal, where companies continue to face higher interest rates (Leão et al., 2012).

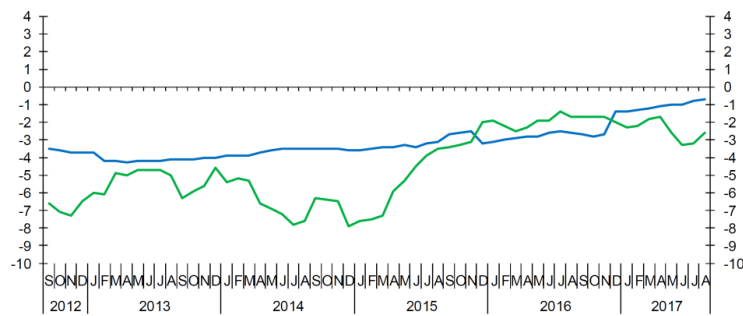
Graph 2 - Interest rates on new loans to non-financial corporations (%)



Source: Banco Central Europeu / Gabinete de Estratégia e Estudos

This factor, on one hand, and the high level of indebtedness and decapitalization of many companies, on the other hand, have made access to bank financing for investment difficult, creating constraints to the growth of the Portuguese economy.

Graph 3 - Annual rate of change of Bank Loans Stock

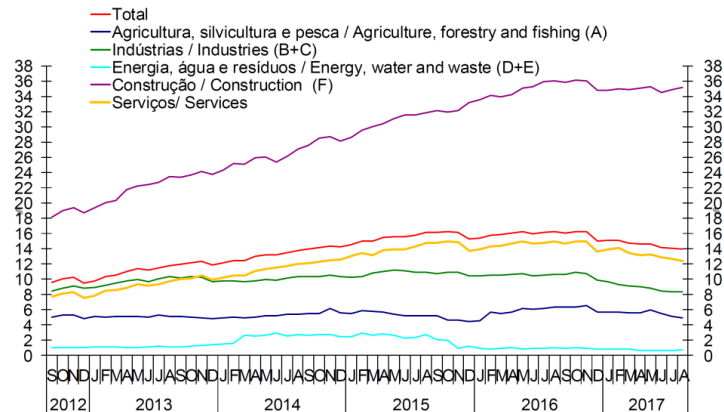


Source: Banco de Portugal / Gabinete de Estratégia e Estudos

Companies are the engine of the economy, creating jobs and generating value, so it is essential to guarantee the necessary financing. Without it, many companies will not be able to invest and there will be no room for the emergence of new businesses, damaging the growth potential of the economy.

In addition, there has been an increase in overdue credit, burdening the banks' balance sheet and preventing financing other companies.

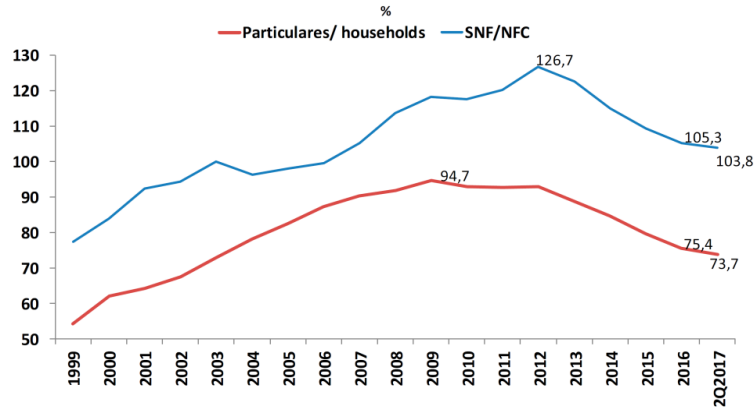
Graph 4 - Loans overdue by sector (% of loans granted)



Source: Banco de Portugal / Gabinete de Estratégia e Estudos

It is also essential to ensure the financial deleveraging of companies by freeing up resources for the financing of productive activities, as has happened in recent years, without undermining economic growth.

Graph 5 – Debt of non-financial corporations (% of GDP)



Source: Banco de Portugal / Gabinete de Estratégia e Estudos

The difficulty of obtaining credit varies, according to Matthew (2004), according to the size and age of the company. According to the author, smaller firms use commercial credit more often than bank credit, not for preference but for ease of acquisition. On the other hand, younger companies, because they do not have a history with banking institutions, will also find it more difficult to obtain bank credit.

The study by OECD (2009), considers that "these firms are more vulnerable now for many reasons: not only has the traditional challenge of accessing finance continued to apply, but new, particularly supply-side, difficulties are currently apparent".

Farinha and Félix (2015) estimated "the likelihood of a company facing financing constraints in the years 2010-2012" and consider that the data analyzed indicate that "a significant fraction of Portuguese SMEs were affected by financing constraints in this period."

Bernardo (2015) points out that access to bank credit is "closer to returning to normal", although there remain "doubts about the possibility of these companies financing themselves in the same way they have done in the past, namely in terms of maturities and amounts, and these doubts led to the search for financing alternatives for these companies."

In a scenario of scarce financial resources, with a strong presence of low productivity companies that consume financing, and with overdue credit increasing, this study is of particular importance in order to assess the situation in Portugal regarding the prevalence of that type of companies and the impact of funding allocated to zombie companies in reducing funding to most companies, looking to take into account companies with:

- Great turnover of the debt service (and with negative profits);
- Interest coverage ratio <1 (for at least 3 consecutive years);
- Low multifactorial productivity, but especially of the labor factor;
- Negative added value.

4. Companies and sectors to consider

The various studies on zombie companies have considered sectors based on different criteria.

Some authors chose to restrict their analysis to the manufacturing industry (Fukao & Kwon (2006), Kwon et al. (2015)), to listed companies (Peek & Rosengren (2005)) or excluding larger firms, of capital or the number of employees - Imai (2016); Stortz et al (2017)). McGowan et al. (2017) consider the entire universe of non-agricultural and non-financial private enterprises.

Schivardi et al. (2017) consider only those that exceed a minimum amount of loans contracted. Caballero et al. (2008) and Fukuda & Nakamura (2011) consider only listed companies in the "Manufacturing, construction, real estate, retail, wholesail (...) and service sector" sectors.

In this study, the objective is to analyze the problem of zombie companies in the context of small and medium enterprises in non-tradable sectors. The focus on small and medium-sized enterprises is that they are the ones that rely more heavily on bank loans to finance themselves. The analysis of the non-tradable sectors is justified with the intention of understanding the real relevance of the zombie prevalence in this group of companies, and to verify how the inefficient allocation of resources in these sectors is undermining its application to more productive companies that export and the improvement of the balance of the national current account.

For the definition of small and medium-sized enterprises (SMEs), we follow the definition given by the European Commission Recommendation 2003/361/EC of 6 May 2003 on the definition of micro, small and medium-sized enterprises. Such a definition is summarized in Table 1.

Table 1 – Micro, Small, Medium and Large Companies

	Number of Employees		Annual turnover		Annual balance sheet total
Micro	<10	and	≤2M	or	≤2M
Small	<50	and	≤10M	or	≤10M
Medium	<250	and	≤50M	or	≤43M
Large	≥250	or	>50M	and	>43M

In its theoretical characterization, tradable sector are those whose final products:

- i) Compete in the international market,
- ii) May be consumed in a country other than that in which they are produced or
- iii) Can be consumed in national territory by foreigners.

This characterization is nonetheless subjective, and it is therefore necessary for a practical approach to define concrete criteria.

International institutions have used the manufacturing and extractive industries as an approximation for tradable sectors, for simplicity. However, the finding that several non-processing sectors have tradable potential (notably a significant part of the exported product) has led to the adoption of new criteria.

Amador and Soares (2012a, 2012b), in addition to the aforementioned sectors, consider tradable, the entire sector whose export / sales ratio exceeds 15%. The choice of gross value added over sales (exports / gross value added) is justified by the relative insensitivity to business cycles when compared to sales, for example. Gouveia and Canas (2016) update the above definitions by accounting not only for exports but also for imports by type of final product in a given sector⁴. Thus, they believe to fully account for the tradable potential of a given sector. They consider tradable all sectors for which the ratio

$$\frac{\text{Exports + Imports by type of final product}}{\text{Gross Value Added}}$$

is higher than 10%.

The European Commission (2016) states that the non-tradable sector includes: construction, financial and insurance activities, real estate activities, professional and scientific activities, administrative and support activities, public administration, defense, education, health and social activities, artistic, entertainment and recreational activities, as well as other services.

This study follows the criteria defined by Gouveia and Canas (2016) and will focus on SMEs for the Construction and Services sectors while not tradable⁵.

5. Definition of zombie companies

In the different empirical studies, several criteria have been used to define zombie companies, from the least restrictive ones that consider as criterion only the existence of losses in successive years, to the more restrictive ones that consider as zombies companies in which the type of financing is tendentially subsidized. In order to be able to select the definition used in the light of the information available, we briefly analyze the criteria previously used in this definition.

The generality of the current literature on zombie companies characterizes them, as already mentioned, as companies with more than a decade of existence that do not generate sufficient revenues in their regular activity, persistently dependent on bank credit and who normally pay wages taking into account the productivity of the sector in which they work.

Caballero et al. (2008) classify a company as being zombie based on the relation of such company with access to subsidized credit, setting aside criteria of profitability and productivity. Being unprofitable, such companies rely on the benefit of special conditions given by the lenders to survive. These conditions include the postponement of payment periods and interest relief to be paid, among others.

In particular, they consider as zombie a company whose interest expenditure is less than a hypothetical measure of interest payable, which serves as the lower border and which is constructed according to the following formula:

$$R_{i,t}^* = rs_{t-1}BS_{i,t-1} + \left(\frac{1}{5} \sum_{j=1}^5 rl_{t-j} \right) BL_{i,t-j} + rcb_{min \text{ over last } 5 \text{ years}, t} \times Bonds_{i,t-1}$$

⁴ A lógica é a de que se um produto final está a ser importado por uma economia, a mesma economia terá eventualmente a capacidade de o exportar quando atingir suficiente eficiência e escala.

⁵ Os sectores descritos correspondem às secções E - Serviços de distribuição de água, Saneamento, Gestão de resíduos e despoluição; F - Construção; G - Comércio por grosso e a retalho, Reparação de automóveis e motocicletas; e L - Atividades Imobiliárias; o que corresponde às divisões 36 a 47 e 68 da Classificação Portuguesa das Atividades Económicas, Revisão 3. (e do NACE-Rev. 2)

Above, $BS_{i,t-1}$, $BL_{i,t-1}$ e $Bonds_{i,t-1}$ respectively represent short-term bank loans, long-term bank loans and debt securities in circulation; rs_{t-1} , rl_{t-j} e $rcb_{\min.\text{over last 5 years},t}$ respectively represent the average short-term prime rates in year t, long-term at year t zero minimum coupon paid to any convertible bond issued in the last 5 years⁶.

Fukuda and Nakamura (2011) start from the definition of Caballero et al. (2008), trying to mitigate errors of type one and type two⁷. Thus, they add two criteria for the decision to classify a company as a zombie.

The first, a profitability criterion, immediately excludes an enterprise from being classified as a zombie if the pre-tax result and financing expenses (EBIT) is higher than the hypothetical lower boundary defined by Caballero et al. (2008).

The second, a criterion to control for evergreen loans⁸, defines a company as zombie whenever:

- i) EBIT exceeds this measure,
- ii) The total external debt is more than half the value of total assets in the previous period and
- iii) whose loans have increased during the current period.

Kwon et al. (2015) consider two criteria in the definition of zombie companies. One of them, of financial support, following the definition of Caballero et al. (2008) and also defines as zombie companies whose total debt level at the end of the current period is higher than the level of long-term debt at the end of the previous period. The second, of insolvency, classifies as zombie companies that present for three consecutive years a sum of operating result and non-operating income or a lower EBIT than the hypothetical measure.

Imai (2016) further explores the measurement of Fukuda and Nakamura (2011) (FN), creating the criterion which he calls "modified FN". This dynamic measure classifies as zombie a company whose sum of the differences between EBIT and the hypothetical measure such as constructed by Caballero et al. (2018) over the last m periods is negative, as demonstrated by the formula below. It does so in order to isolate cyclical or temporary effects on companies' EBIT.

$$\sum_{m=0}^T (EBIT_{i,t-m} - R_{i,t-m}^*) < 0$$

Schivardi et al. (2017) consider, for their definition of zombie companies, two measures of profitability that in turn combine a measure of leverage. First, if the return on assets of the company is lower than the prime rate (the lowest rate at which the firm is able to borrow) and if its level of leverage is greater than a threshold L, the firm is classified as a zombie. In the second definition, this same measure of leverage is complemented by an alternative profitability measure in which the company is considered a zombie if the EBITDA ratio for interest expenses is less than one for three consecutive years.

⁶ Para informação detalhada consultar Anexo 1 de Caballero et al (2008).

⁷ Como risco de tipo um entende-se a probabilidade de identificar uma empresa saudável como sendo *zombie*. Risco do tipo dois refere-se à probabilidade de não identificar uma empresa *zombie* como sendo *zombie*.

⁸ Por *evergreen lending* entende-se empréstimos concedidos por bancos com o objetivo de permitir às empresas pagar juros referentes a empréstimos anteriores, prolongando assim o ciclo de dívida e evitando realizar as perdas referentes.

Common to all of the definitions mentioned is their requirement regarding the abundance and detail of information on the distribution of debt of each company in the sample. In this sense, we will seek an alternative definition that is referred to by McGowan et al. (2017), with contributions from Bank of Korea (2013) and Bank of England (2013), consisting of framing zombie companies according to three criteria:

- i) Companies with an interest coverage ratio (the ratio between operating income and bank interest expense) of less than one for three consecutive years (Bank of Korea, 2013) - in our analysis we use EBITDA for reasons of availability of data,
- ii) Companies with negative profits (Bank of England, 2013),
- iii) Companies with negative added value - this factor was not considered in our analysis.

The study by McGowan et al. (2017) uses as a definition, within the scope of their work, a zombie company classification based on the definition of interest coverage ratio, introducing as criterion the age of the company - companies older than 10 years - important to distinguish zombie companies from startup companies. So that we can also make this distinction in the Portuguese case, we add the criterion of age so we will only consider as zombies companies aged 10 years or more.

In this study, we intend to assign the zombie classification to companies that have remained in the market for more than 10 years, and that present an interest coverage ratio of less than 1 for at least 3 consecutive years.

6. Available information and variable construction

In order to assess the extent of the problem and characterize the behavior of SMEs in relation to credit and investment options, and then to select companies considered as zombies, we use panel data on companies. This information, drawn from annual income statements as reported to the Ministry of Finance, and included in the Simplified Business Information (IES), is provided by the Bank of Portugal through its Microdata Laboratory (BPLim) and relates to the period of 2006 to 2015.

In order to be able to analyze with relative precision the credit relationships of the companies, we would need to isolate the interest expense referring exclusively to banking relations or financial companies. Detailed information on the nature of corporate interest expenses exists only as of 2010 and has appeared with the amendments to Annex A of the IES Annual Statement. Thus, there is a temporal limitation in the availability of data that justifies the consideration of a less strict zombie measure - which includes consideration of the total amount of interest incurred.

In addition, the period in question largely coincides with the Economic and Financial Assistance Program (PAEF) that was in force in Portugal between 2011 and 2014, following the financial crisis. Thus, in addition to a short period of time, it is an atypical period, in which economic activity is extraordinarily withdrawn. Although it is a time of interest to analyze the impact of the PAEF in the context of zombie companies, a longer time period would also be necessary.

One measure that considers the effect of zombie prevalence in the economy is the productivity of the labor factor, measured as Gross Value Added (GVA) per full-time paid employee. The database does not include GVA measurement but includes a GVA indicator as a percentage of turnover. To obtain the GVA, we multiplied this indicator by the turnover of each company. For the productivity of the labor factor, for computational reasons, we considered only companies with one or more employees paid full time (avoiding division by 0).

Since measuring the zombie impact on investment is another of the main goals of this study, choosing and building a variable investment is essential. Investment is understood as the change in the logarithm of tangible and intangible fixed assets (real and intangible capital, hereinafter "capital").

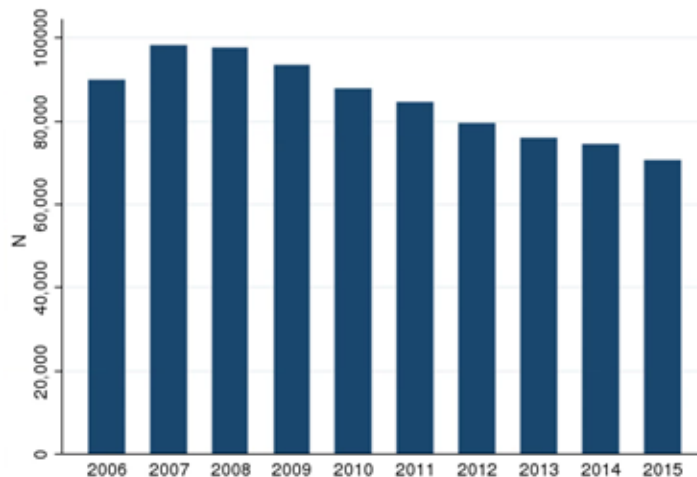
7. Empirical study

This section starts by presenting a brief characterization of the business fabric under study, particularly as to its composition both in terms of number of companies and in terms of their size. Next, we identify the zombie prevalence in the selected sample and time period, exploring its various dimensions. In the penultimate subsection a description of the econometric procedure is elaborated and in the last subsection the main empirical results are presented.

7.1 The business fabric

In this study, we considered a final sample of 179,512 companies over 10 years. We only consider companies that declare activity in consecutive years and with available information about the key variables (such as number of employees, value of their assets or turnover) and that operate in the sectors of interest (see subsection "Companies and Sectors to Consider").

Graph 6 - Number of companies considered per year

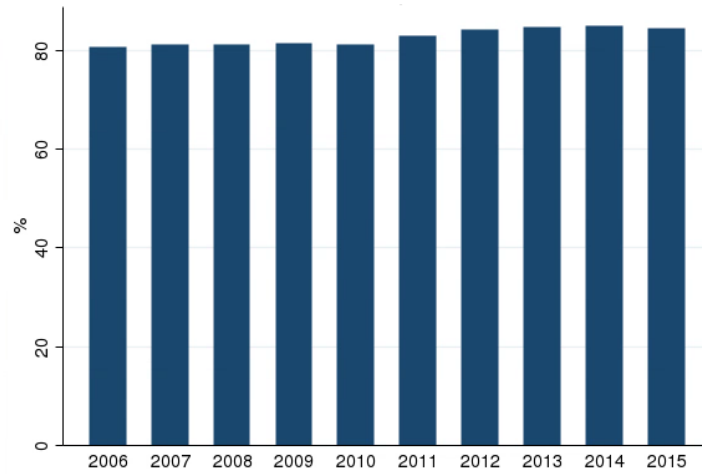


Graph 6 shows the number of companies considered per year. Although there is a slight increase in the number of companies between 2006 and 2007, there has been a sharp decline in the number of companies in the remaining years. This effect is not unexpected, as this was the period of economic and financial crisis as well as the Economic and Financial Assistance Program period.

The business fabric in Portugal differs from that observed in other works on zombie companies in multiple factors, one of the most important being its composition with regard to the size of companies. The Portuguese business fabric is clearly dominated by micro-enterprises.

As can be seen in Graph 7, over the entire period under review the fraction of microenterprises in the sectors considered remains close and slightly above 80%. Thus, the criteria used by some studies that restrict the zombie definition to companies with a relatively high number of employees are not justified in the Portuguese context, since we would be considering a sample that is not representative of the national economy.

Graph 7 - Percentage of microenterprises

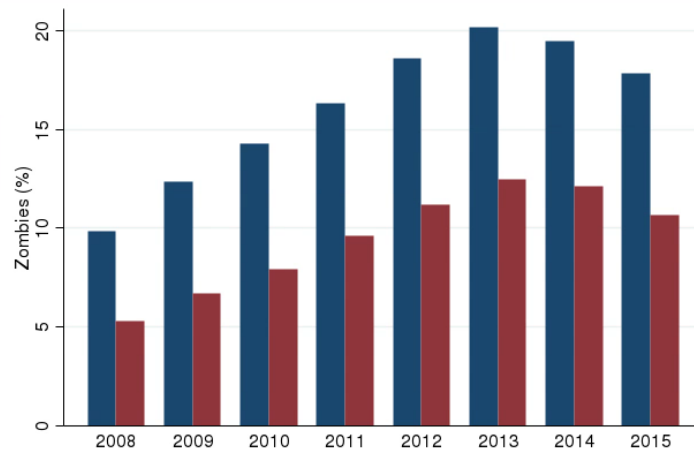


7.2 Prevalence of zombie companies in the Portuguese economy

In this section we analyze the real zombie prevalence in the economy according to the previously defined criteria - interest coverage ratio (ICR) of less than 1 for three consecutive years and age of 10 years or more.

In graph 8 we can see the real prevalence of the zombie phenomenon in the economy as a percentage of the universe of companies, either considering only the ICR criterion (blue bars) or considering age as well (red bars).

Graph 8 - Prevalence of zombie companies



It is immediately apparent that by adding the age criterion, the percentage of zombie companies in the economy drops considerably compared to when we consider only the ICR criterion. In the case where the complete criterion is considered, a prevalence of zombie is observed between approximately 5.2 and 12.5%, quite significant values.

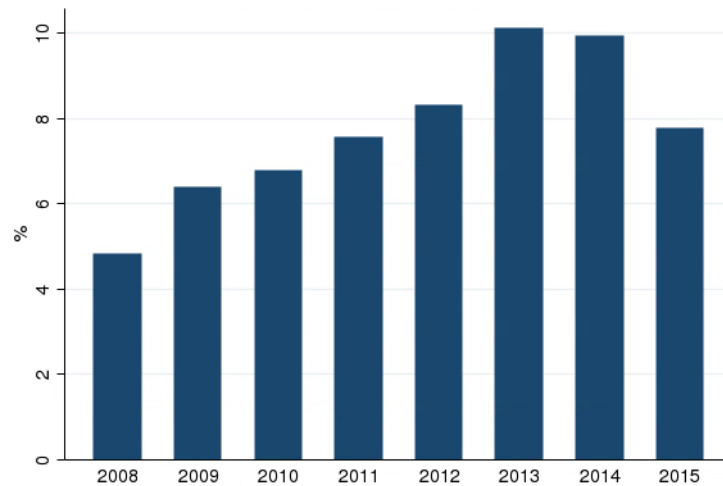
There is also a clear worsening of the zombie problem over the period that coincides with the sovereign debt crisis and PAEF, a period of extraordinary difficulties for companies. There is also a slight improvement in the years 2014 and 2015 but it would be premature to comment on the sustainability of this improvement without examining the most recent years.

Although the zombie prevalence alone reveals the extent of the problem in the Portuguese economy, the phenomenon is relatively more worrying when coupled with the fact that the total number of companies is decreasing in the same period in which the proportion of zombie companies is increase. This phenomenon can mean both a more than proportionate increase in the number of companies that become zombie or those that have already been considered and that are still active, revealing in this case an extraordinary inefficiency of the "market clearing mechanism" - an increase in barriers to exit zombie companies from companies that cease activity but that do not include the definition of zombie.

Important for measuring the zombie impact on the economy is not only the prevalence of this type of companies but also the resources they capture. This is the measure used to quantify the zombie presence when estimating its impact on healthy companies. Thus, in graph 9 we can see the percentage of asset "stuck" in zombie companies over the period. The value of each year represents the average percentage of assets stuck in zombie companies in each sector.

Asset values "trapped" in zombie companies track the movement of zombie prevalence over the period, increasing consistently until 2013 and declining in subsequent years, ranging from about 5 to 10 percent. The value is lower than that relative to the prevalence, but still very significant, evidencing the zombie phenomenon as a real problem in the Portuguese economy in the period under analysis.

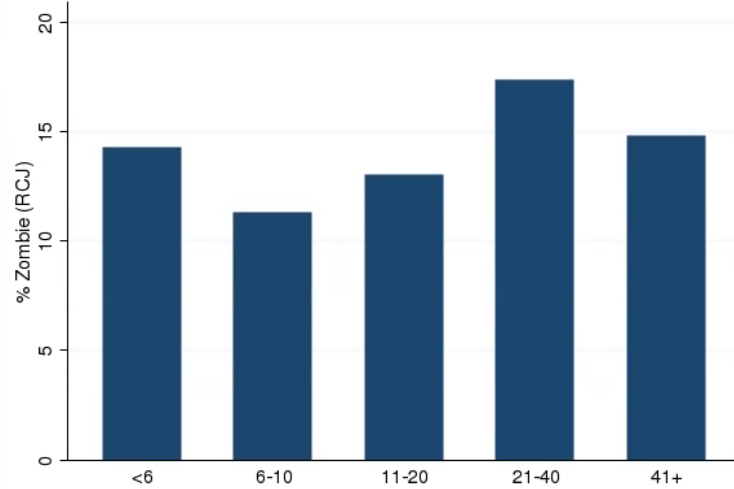
Graph 9 - Average asset "stuck" in zombie companies by sector



Contrary to what is observed in the work of McGowan et al. (2017), the relationship between zombie prevalence and both age and firm size is not monotonic. In the graphs below it is possible to observe this relation, corresponding the first to the size groups and the second to the age groups.

In the first, the zombie criterion used is only that of the interest coverage ratio - for obvious reasons it is not justified here to include the criterion of age. It is observed a higher prevalence with age up to 40 years, and a reduction in the group with 41 or more years of age. The relatively high prevalence among companies younger than 5 years may reflect the presence of startup companies growing or settling in the market.

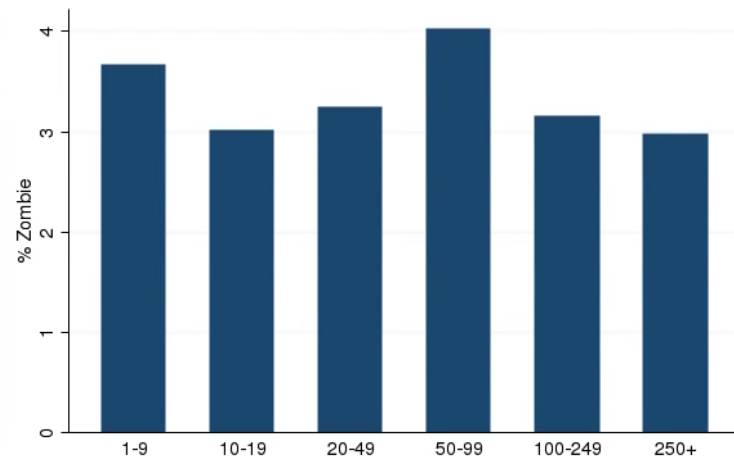
Graph 10 - Interest coverage ratio in zombie companies by age



The behavior is similar when we analyze the zombie prevalence by size of the companies. There is a higher presence among the smaller companies (less than 10 employees) and companies with between 50 and 99 employees.

The differences between the realities of Portugal and other comparable studies lie not only in the different development of the zombie phenomenon in the different contexts but also in the different natures of the business structures themselves, and in Portugal there is an unequivocal prevalence of smaller and relatively younger companies.

Graph 11 - Percentage of zombie companies by size (number of employees)



7.3 Econometric Models and Forecasts

The econometric study focuses on pooled microdata analysis and aims to identify adverse effects of zombie prevalence on "healthy" companies, particularly in terms of investment and employment. The specifications are applied for the period between 2008 and 2015, unless otherwise indicated.

The basic specification of the study follows Caballero et al. (2008), and can be represented as follows:

$$Y_{imt} = \beta_1 NonZ_{imt} + \beta_2 NonZ_{imt} * Zashare_{mt} + Zashare_{mt} + \gamma_t' + \delta_m' + \varepsilon_{imt} \quad (E - 5.1)$$

In the above equation, Y_{imt} represents the explained variable - investment, employment or labor factor productivity. Investment (I/K) is calculated as the annual change in the natural log of capital. Employment (E) is calculated as the annual percentage change in employment, measured by the number of full-time paid employees. $NonZ_{imt}$ is a dummy that identifies healthy companies ($= 1$). $Zashare_{mt}$ represents the fraction of sector assets (2 digits) "trapped" in zombie companies in each period. γ'_t and δ'_m respectively represent year and sector dummy vectors.

Labor factor productivity is calculated as gross value added on the number of full-time paid employees. The choice of gross value added as well as the number of full-time paid employees is intended to avoid cyclical effects which could be manifested in either outcome measures or turnover or in more volatile employment measures such as the total number of persons employed.

The main objective of the model is to test the harmful effects of an increase in zombie prevalence in the activity of healthy companies. Thus, the main coefficient of interest is β_2 . The prediction is that the coefficient shows a negative sign for both investment and employment - a higher zombie prevalence (measured by the fraction of assets held in these companies) presupposes a greater retention of resources linked to the sector in non-productive companies, reducing ability of healthy companies to thrive.

As for the productivity of the work factor, the model predicts that β_2 is positive, meaning that those sectors where there is a higher prevalence of zombie are those where the productivity gap between zombie and healthy companies widens. The congestion that the presence of less productive zombie companies causes in the market creates additional barriers to the entry of new and more productive enterprises (scrambling effect), so that, in order to be competitive, new companies must be capable of achieving a higher level of productivity *a priori*. Thus, differences in productivity are accentuated.

There is no concrete prediction for the coefficient β_1 . While on the one hand it is reasonable to assume that healthy companies have greater ability to invest, develop their business and expand, including the number of people they employ, it is also possible to elaborate the opposite argument that zombie companies, by receiving sufficient "aids" to remain active, do not feel the need to constrain their investment actions or employment variation. The exception appears in the productivity regression, where it is clearly predicted that the average productivity will be higher for healthy companies than for zombie companies, thus expecting a positive β_1 . Moreover, the discussion focuses mainly on the coefficient β_2 .

The sector and year dummies vectors are included to control shocks, cyclical effects or characteristics not observable both at the sector specific level and at the aggregate level of the economy.

For reasons of robustness, we tested two alternatives to the base specification defined by E-5.1. In the first alternative, the E-5.2 specification based on McGowan et al. (2017), we include in the equation characteristics of the company, namely a vector of dummies of size (micro, small, medium or large company) and dummy $young_{imt}$, equal to 1 if the company is less than 6 years. We also included unobservable fixed effects at the sector-year level, and we removed the $Zashare_{mt}$ variable because, because of the alternative fixed-effects structure, it was not possible to identify its coefficient. The inclusion of unobservable sector-year effects is intended to confirm that the negative effect found is not explained by some unobservable factor that makes a sector particularly harmful in a given year, thus controlling for all factors affecting sector m in year t . Equation E-5.2 is represented as follows:

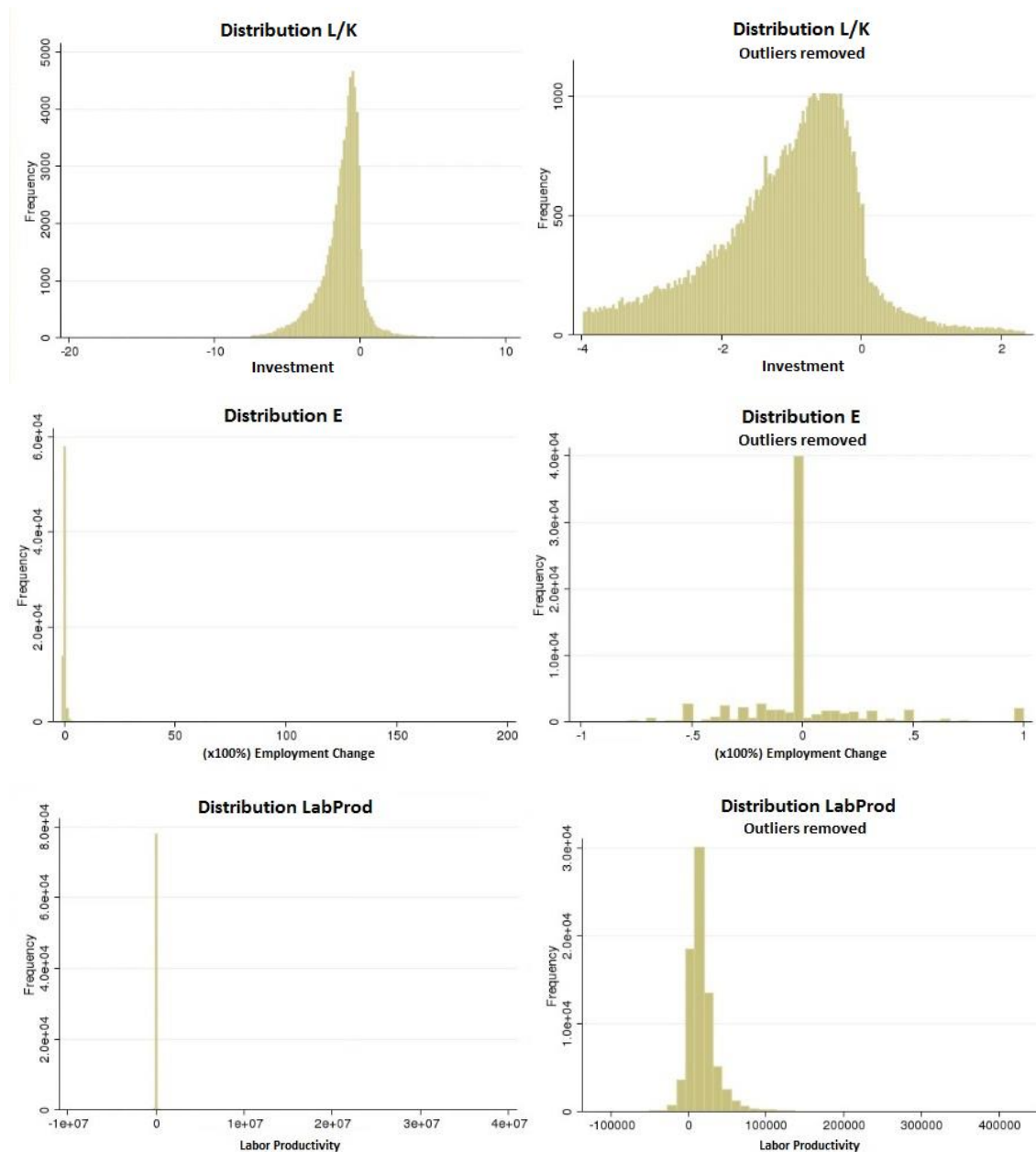
$$Y_{imt} = \beta_1 NonZ_{imt} + \beta_2 NonZ_{imt} * Zashare_{mt} + \gamma' size_{imt} + \delta' young_{imt} + \varphi'_{mt} + \varepsilon_{imt} \quad (E - 5.2)$$

The second alternative is to study investment and employment in the cross-section of 2015. We do it for being the most recent year and for being a year of economic recovery. The impossibility of studying a pre-crisis period makes it an appealing alternative.

7.4 Investment, Employment and Productivity

The following figure shows the distribution of each of the explanatory variables for the year 2010. The annual distributions of each variable are identical, so we choose to show only one.

Graph 12 - Distribution of explained variables (total and corrected for outliers)



The presence of outliers affects the different variables explained in a heterogeneous way. Of all, the investment variable is the least sensitive to the presence of outliers, with a stable distribution relatively centered around the mean. The distribution of the variation of employment variable is extremely affected by the presence of high and positive outliers and the distribution of the labor productivity variable also reveals the presence of some values too high (in absolute value) that can disproportionately affect the results.

Given these characteristics, we have chosen, in all regressions, to restrict the sample to observations above the percentile 1 and below the 99th percentile for the case of investment and labor factor productivity and below the 97.5th percentile for employment. The corrected distributions for the outliers are also represented in the figure above. For homogenization of procedures we have equated the correction of outliers for investment and productivity, and the unique characteristics of the distribution of employment have motivated a different approach.

Not correcting for outliers never affects the direction of the effects found and may impact the statistical significance of the coefficients. Stricter constraints, that is, restricting the sample to more central values of the distribution of each explained variable, has a monotonic impact in the sense of increasing the statistical significance of the coefficients and the explanatory capacity of the models (R^2).

7.5 Main Empirical Results and Concluding Remarks

The results of the base specifications (equations E-5.1 and E-5.2) for the panel can be analyzed in Table 2.

Quadro 2 - Presença *Zombie* e Efeito em Não-*Zombies*

Variables	(E-5.1)			(E-5.2)		
	(1) Log(I/K)	(2) ΔE	(3) LabProd	(4) Log(I/K)	(5) ΔE	(6) LabProd
<i>NonZ_{int}</i>	0.1647*** (0.0121)	0.0812*** (0.0105)	10588.74*** (2541.33)	0.1061*** (0.0136)	0.0576*** (0.0094)	11718.25*** (2241.26)
<i>NonZ_{int} * Zashare_{mt}</i>	-0.5869*** (0.0758)	-0.1386* (0.0604)	35981.82** (16927.23)	-0.5359*** (0.0732)	-0.1160* (0.0596)	35546.94* (17916.25)
<i>Zashare_{mt}</i>	0.5058*** (0.0950)	0.1218* (0.0635)	-55285.12*** (16900.35)	-	-	-
Company characteristics	NO	NO	NO	YES	YES	YES
Dummies year	YES	YES	YES	YES	YES	YES
Dummies sector	YES	YES	YES	YES	YES	YES
Dummies sector-year	NO	NO	NO	YES	YES	YES
Observations	529,781	548,161	409,437	529,781	448,161	409,437
R^2	0.2650	0.0176	0.0814	0.2810	0.0305	0.1266

Note: Log (I / K) refers to the annual change in the natural logarithm of the capital stock (tangible + intangible). ΔE refers to the annual percentage change in employment, measured by the number of full-time paid employees. Standard errors clustered at sector level. Sector always refers to 2-digit CAE. CAEs-Rev3 selected: 36 to 47 and 68. Zashare refers to the fraction of the sector's assets held in zombie companies, defined as companies over the age of 10 years and the ratio of interest coverage lower than the unit for three consecutive years. Panel under review: 2008-2015. To avoid outcomes disproportionately influenced by outliers, observations below the percentile 1 and above the 99th percentile of the investment distribution and labor factor productivity were eliminated, and below the 97.5 percentile for employment. *** p-value <0.01 ** p-value <0.05 * p-value <0.10

The estimated coefficients are, as expected, negative and significant in both specifications for both investment (columns 1 and 4) and employment (columns 2 and 5). The sign of the coefficient of non-zombie interaction with the share of assets “trapped” in zombies in a given sector-year shows that increases in the relative amount of resources “stuck” in zombie companies are related to reductions in investment and job creation by the average healthy companies.

These results indicate not only that the presence of zombies in these sectors of the Portuguese economy may have amplified the negative consequences of the crisis but also that they may be slowing the recovery of the economy, distorting the capture and application of resources by healthy companies. Taking into account all the companies studied, the implications for product growth and job creation (not destruction) are especially relevant at the aggregate level. The cross-sectional analysis of 2015, the most recent in the available sample and the year in which there is some improvement in economic conditions and even a reduction in the zombie presence in the economy, confirms that the zombie prevalence in the economy continues to have statistically significant negative effects both on investment as in employment, which seems to support this hypothesis⁹.

The coefficients for labor factor productivity are positive and significant for both specifications (columns 3 and 6), confirming that an increase in the fraction of assets “trapped” in zombie companies is related to an increase in the productivity gap between zombie companies and healthy companies .

This result highlights two important issues. On one hand, the prevalence and persistence of zombie companies that, in normal conditions, would terminate activity causes a reduction in the level of productivity of the sectors and consequently in the economy, undermining their growth. On the other hand, new companies wanting to enter the market need to achieve higher levels of productivity to compensate for the reduction in market profitability caused by zombie congestion and to be able to compete with the most productive companies in their sector. This process perpetuates the productivity gap between zombies and non-zombies, while the former continue to be able to survive.

Finally, we verified that neither in the working paper of McGowan et al. (2017) nor in any others were analyzed the public policies implemented in Portugal, in order to allow to gauge how they could have contributed to the existence of zombie companies and to identify the need for implement policy measures to prevent companies from remaining in business, so as to allow the channeling of investment to more productive companies. These may be research lines for a more in-depth study on this topic.

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⁹ Os resultados para o emprego não são significativos para o universo das empresas, embora os efeitos mantenham o seu sentido. No entanto, se retirarmos da amostra as empresas mais pequenas (empresas que empregam apenas 1 pessoa), onde a variação no emprego é naturalmente mais rígida, o coeficiente volta a ser estatisticamente significativo.

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