

The Role of Different Types of Creditors on Zombie Firm Creation

O Papel de Diferentes Tipos de Credores na Criação de Empresas Zombies

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ABSTRACT

Despite the key role of trade creditors as sources of finance, the literature on their impact on the proliferation of zombie firms is rare. This study examines whether suppliers, such as banks, engage in “evergreen” lending to zombie firms and whether their behavior differs from that of banks. We found that highly productive, larger and younger firms are less likely to become zombie firms. The behavior of suppliers is, in fact, different from that of banks; they are indeed more cautious in lending to zombie firms. Unlike suppliers, banks seem to have contributed to the rise of resource misallocation, a key explanation for the productivity slowdown in the new century.

Keywords: Zombie firms; Trade credit; Financial constraints; Bank credit; Portugal.

JEL Classification: G21, G32, G33, L25, L60, L80

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1. INTRODUCTION¹

Zombie firms, that is, incumbent firms that are insolvent and kept alive only with the help of creditors, crowd out investment opportunities for more productive firms and discourage innovative firms from entering the market. Aggregate productivity is therefore harmed, not only by the existence of zombie firms, but also by the negative externalities they generate on the entry and growth of healthy firms (Caballero et al., 2008). Portugal is one of the European countries most affected by the proliferation of zombies (McGowan et al., 2018).

Why are there zombie firms? Several studies have identified the “forbearance” of banks as the main reason for their survival. Of course, banks have the incentive to continue lending to their troubled borrowers to avoid reporting nonperforming loans, which in turn allows these borrowers to avoid (or delay) bankruptcy (Peek and Rosengren, 2005; Caballero et al., 2008; Andrews and Petroulakis, 2017; Storz et al., 2017). However, these studies only consider the role of banks as lenders, ignoring other creditors. Most input suppliers give credit to their customers. Since we define zombies as those firms that are supported by creditors, the probability of becoming a zombie is likely to be influenced by the financial structure of the firm. Trade credit constitutes a major source of short-term financing and, facing bank credit constraints, firms postpone payments to their suppliers to avoid the risk of insolvency (Cuñat and García-Appendini, 2012; Casey and O’Toole, 2014).

The objective of this study is to analyze whether trade creditors engage in evergreen lending to zombie firms and whether their behavior differs from that of banks. Despite the key role of trade creditors as sources of financing, studies on their impact on zombie prevalence are scarce, which distinguishes our contribution from that of previous studies.

To analyze the relationship between trade creditors and zombie firms, we use a panel of the Portuguese population of firms in the manufacturing and services industries over the period 2010–2017. Our results show that zombie firms are very widespread in Portugal. However, suppliers did not contribute to increase the weight of zombies in the economy. Apparently, suppliers were more cautious in lending and artificially supporting firms.

2. RELATED LITERATURE

2.1. THE PREVALENCE OF ZOMBIE FIRMS

Industry productivity growth is expected to be enhanced by the Schumpeterian process of “creative destruction”, wherein innovations introduced by new and incumbent firms can be taken as business experiments subject to the market test and the shrink and exit of firms as a necessary selection mechanism through which non-competitive technologies (and products) are excluded. How does this process change when there are zombies? When there are zombies, new and healthy firms have to compete with zombies in the markets for finished products, labor, and funds. This may congest product markets and make it difficult to

¹ A previous version of this work was presented by Joana Lopes as a Master’s Thesis, with the title “The walking dead: An analysis of the role of different creditors in zombie firms in Portugal”, under supervision of Prof. Carlos Carreira, at the University of Coimbra, Faculty of Economics.

access workers and financial resources for non-zombie firms (e.g., depressed product prices and higher wages). As a consequence, innovative investments by new entrants and healthy firms may be depressed. Moreover, the congestion caused by the zombies can drive healthy incumbents into trouble, forcing them to exit. Aggregate productivity is therefore harmed, not only by the existence of zombie firms per se, but also by the negative externalities they generate on the entry of new firms and on the growth and exit of healthy incumbents, as well (Caballero et al., 2008).

McGowan et al. (2018) showed a high prevalence of resources sunk in zombie firms in several European countries over the period 2003–2013. In 2013, the highest share (in the sample) of zombies in terms of the number of firms was found in Spain at 10%, while the highest share of the capital stock and employment sunk in zombie firms was observed in Italy at 19% and in Belgium at 14%, respectively. From 2007 to 2013, the prevalence of zombies has increased in general (the exceptions were the United Kingdom and France). The previous shares are broadly confirmed by other studies using different methodologies to identify zombie firms—e.g. Andrews and Petroulakis (2017) for 11 European countries (2001–2014); Storz et al. (2017) for 7 European countries (2010–2014); Gouveia and Osterhold (2018) for Portugal (2006–2015); Hallak et al. (2018) for 19 UE countries (2008–2013); Acharya et al. (2019) for 5 European countries (2010–2014); Carreira et al. (2022) and Nieto-Carrillo et al. (2022) for Portugal (2004–2017); and Schivardi et al. (2022) for Italy (2004–2013).

The zombie problem is severe in the periphery of Europe – Greece, Italy Spain, and Portugal – countries that were particularly affected by the global financial crisis and the subsequent European sovereign debt crisis (Storz et al., 2017; Hallak et al., 2018; Acharya et al., 2019). In the case of Portugal, in fact, Carreira et al. (2022) and Nieto-Carrillo et al. (2022) found that, on average, about 11% of firms were classified as zombies between 2005 and 2016, with a peak in 2012, at 12.7% (see also Storz et al., 2017; Gouveia and Osterhold, 2018; Hallak et al., 2018).

2.2. CREDITORS AND ZOMBIE FIRMS

Why do creditors of zombie firms continue supporting them instead of claiming their debts? One would expect that lenders dealing with troubled borrowers would stop granting new loans, hastening their death. However, Peek and Rosengren (2005) showed that Japanese banks, especially the undercapitalized ones, misallocated loans in the 1990s. This was due to regulatory forbearance and perverse incentives that led them to make additional loans to severely impaired borrowers (the so called “evergreening” loans) to avoid having to declare the loans as nonperforming and record losses on their own balance sheets.

This seminal study from Japan seems to provide insights into the proximate causes of zombie prevalence in Europe. Using data on bank lending to individual enterprises in Croatia during the global financial crisis and the subsequent sovereign debt crisis, for example, Broz and Ridzak (2017) concluded that banks grant loans to zombie firms only when this is in their self-interest. Likewise, Acharya et al. (2019) and Schivardi et al. (2022) provide some evidence that banks undercapitalized during the crisis period directed loans to zombie firms to avoid the recognition of loan losses. Similarly, Andrews and Petroulakis (2017) and Storz

et al. (2017) found that zombie firms tend to be associated with weak banks, suggesting that the zombie problem is at least partly due to bank forbearance.

Blattner et al. (2019) observed that, following an unexpected increase in capital requirement imposed by the European Banking Authority in 2011, affected Portuguese banks significantly decreased lending. However, consistent with the evergreen lending to zombie firms, they also found that these banks reallocated credit to borrowers with previously underreported loan loss. A related study by Bonfim et al. (2022) found that Portuguese banks were less likely to refinance firms with negative equity after bank inspections of the credit portfolio, implying a significant reduction in the unconditional probability of refinancing.

When considering sources of financing, it is important to also consider other funding options besides bank credit, trade credit being a point in particular. It is a fact that trade credit is widely used and represents an important funding source for various firms (Cuñat and García-Appendini, 2012). However, to our knowledge, the behavior of suppliers as creditors of zombie firms has not yet been addressed in the literature for developed countries. Lu et al. (2020), using a sample of listed firms in China over the period 2005-2015, found that equity markets and suppliers provide substantial financing support to zombie firms, while banks are less important. In turn, Shiraishi and Yano (2021) found that zombie (private) firms in China from 2002 to 2009 avoided exiting the market by accessing trade credit.

A common explanation for trade credit is that suppliers may have a monitoring advantage over banks. In the course of their business, suppliers obtain information about the borrower that other lenders can only obtain at a cost (Biais and Gollier, 1997; Jain, 2001). They can also better control the actions of buyers, reducing moral hazard (Burkart & Ellingsen, 2004; Cuñat, 2007; Fabbri and Menichini, 2010). Moreover, Burkart and Ellingsen's (2004) model suggests that trade credit and bank credit can be either complements or substitutes. Actually, empirical evidence shows that trade credit is an important source of financing for firms facing bank credit constraints and that trade credit becomes even more important in a financial crisis (Danielson and Scott, 2004; Garcia-Appendini and Montoriol-Garriga, 2013; Casey and O'Toole, 2014; Carbó-Valverde, 2016). Furthermore, credit-constrained firms that face liquidity shocks are more likely to delay payments to suppliers (Boissay and Gropp, 2013). Suppliers reduce their business ties with distressed customers as they approach bankruptcy (Garcia-Appendini and Montoriol-Garriga, 2020).

We can therefore assume that trade creditors, unlike banks, will no longer grant new loans when confronted with zombie debtors. Even so, late and non-payments are a major problem for Portuguese suppliers, with financial difficulties cited as one of the main causes (Intrum, 2018). Thus, it is important to know whether trade creditors are actually issuing zombie loans.

3. DATA AND METHODOLOGY

3.1. THE DATASET

The database used in this study was originally compiled by Carreira et al. (2022), who used raw data from the Integrated Business Accounts System (SCIE, Portuguese acronym),

administered by the Portuguese Statistical Office (INE). It covers the population of Portuguese firms with at least three employees operating in the manufacturing and services sectors, except utilities, financial sector, and education, health and cultural services, from 2010 to 2017. Our final sample comprises a panel of 225,567 firms, making up 1,216,768 firm-year observations.

Several strategies have been proposed in the literature to identify whether a firm can be classified as a zombie (see Carreira et al., 2022 for a survey). In this paper, we use the method proposed by Carreira et al. (2022). Specifically, a firm is flagged as a zombie whenever: (i) its return-on-assets is lower than the low-risk interest rate for at least three consecutive years; (ii) its leverage ratio is higher than the industry-median of the low return-on-assets exiting group; and (iii) it is older than 5 years. The first two criteria aim to fulfil the “profitability” and “evergreen lending” requirements (Fukuda and Nakamura, 2011). The three-consecutive years criterion ensures that the zombie status is not due to temporary difficulties in profitability, while the age criterion makes it possible to distinguish ‘true’ zombie firms from young (or emerging) firms (McGowan et al., 2018). (In the Appendix, we provide a robustness analysis of the findings using the alternative methods of Shen and Chen (2017) and Schivardi et al. (2022) to identify zombie firms.)

3.2. EMPIRICAL STRATEGY

To investigate whether banks and suppliers are at the root of zombie firms, we estimate the probability of being a zombie as a function of both bank debt and supplier debt. Specifically, this paper estimates the following model:

$$Zombie_{it} = \alpha + \beta_1 BANK_{it} + \beta_2 SUPP_{it} + \beta_3 X_{it} + \varepsilon_{it}, \quad (1)$$

where subscripts i and t denote firm and year, respectively. The dependent variable $Zombie$ is a dichotomous variable equal to 1 if the firm is a zombie and 0 otherwise. $BANK$ and $SUPP$, our main explanatory variables, are the variables that capture a firm’s indebtedness to banks and suppliers, respectively. X is a vector of control variables for business characteristics and environment, and includes productivity, size and firm age, as well as a business cycle variable (annual growth rate of GDP) and industry-dummies. Finally, ε is the usual error term.

3.3. EXPLANATORY VARIABLES AND DESCRIPTIVE STATISTICS

Because we define zombies as those firms that are highly indebted, which is measured using the leverage ratio (*i.e.* total debt to total assets), we consider here the natural logarithm of book value of bank debt and supplier debt as measures of the $BANK$ and $SUPP$ variables, respectively. Firm-level productivity is measured by revenue total factor productivity (TFP) obtained as the residual of a production function in log form (*i.e.* the difference between a firm’s output and the weighted sum of inputs). The three-input Cobb-Douglas production

function was estimated using the method of Levinsohn and Petrin (2003). As proxies of firm size, we consider (natural logarithms of) the number of employees.

On average, about 9.1% of the firms in the sample were classified as zombies over the period 2010-2017. Table 1 shows the statistics of the main variables for the whole sample and for zombies versus non-zombies. Notice that the average zombie is less productive, smaller (labor size), older and has relatively more bank debt but less supplier (trade) debt than its non-zombie counterpart. The correlation between bank debt and zombie dummy is positive, while in the case of supplier debt the correlation is negative (Table 2). However, the correlation between supplier and bank debt is positive, suggesting that firms use both sources of financing.

Table 1: Descriptive statistics of zombie and non-zombie firms

<i>Variable</i>	<i>Full sample</i>		<i>Non-zombies</i>		<i>Zombies</i>	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
<i>Bank debt</i>	7.700	5.503	7.706	5.508	7.888	5.506
<i>Supplier debt</i>	9.665	3.471	9.705	3.464	9.357	3.597
<i>TFP</i>	1.968	1.046	1.988	1.039	1.492	1.088
<i>Labor</i>	1.983	0.902	2.001	0.908	1.717	0.749
<i>Age</i>	2.323	0.942	2.289	0.954	2.683	0.530

Note: All variables are in logarithms.

Table 2. Correlation across covariates

<i>Variable</i>	[1]	[2]	[3]	[4]	[5]
[1] <i>Zombie dummy</i>	1				
[2] <i>Bank debt</i>	0,006	1			
[3] <i>Supplier debt</i>	-0,035	0,344	1		
[4] <i>TFP</i>	-0,160	-0,160	-0,237	1	
[5] <i>Labor</i>	-0,130	0,273	0,401	0,037	1
[6] <i>Age</i>	0,113	0,162	0,127	-0,121	0,113

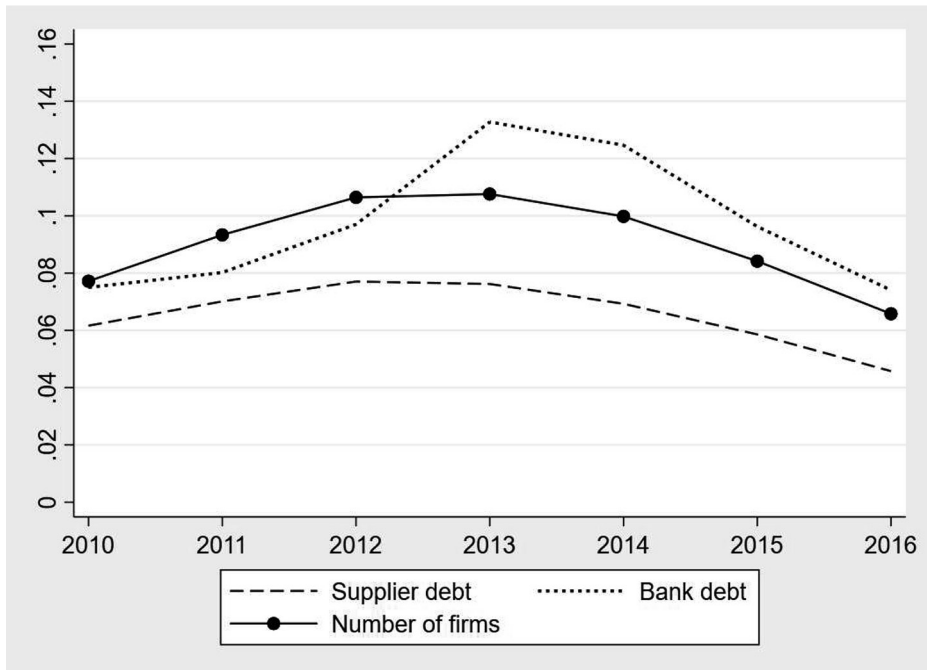
Notes: All variables are in log form, except the Zombie dummy. Pooled yearly values, 2010-2017. All coefficients are statistically significant at the 0.01 level.

4. EMPIRICAL ANALYSIS

Figure 1 shows the share of zombies in terms of the number of firms and financial resources sunk into zombies. On average, about 9.1% of the firms in the sample were classified as zombies. The share of zombies in total bank corporate loans is larger than the

share in terms of number of firms, at 9.7%, on average, while the share in total debts to suppliers is clearly lower, at 6.6%. Moreover, the bank debt share rises from 7.5% in 2010 to 13.3% in 2013; after that it declines, probably due to the implementation of measures by the European Central Bank to strengthen the prudential supervision of credit institutions (Nieto-Carrillo et al., 2022).

Figure 1: Proportion of zombie firms



Notes: Share of zombie firms. Supplier and bank debt refer to the share pertaining to zombie firms.

The regression results of equation (1) are provided in Table 3—each column reports the coefficient estimates and their standard errors (in parentheses) for a *probit* model.² All regressions use Huber-White robust standard errors. Since all variables are expressed in logarithms, except GDP growth rate, the estimated coefficients can be interpreted as elasticity parameters. For all specifications considered, the results suggest that, as expected, highly productive firms are less likely to be zombies. Larger and younger firms are also less likely to be zombies. The likelihood of a firm being a zombie is also reduced in expansion periods.

² We also estimated equation (1) using a logit model. The results confirm those in Table 3, that is, the corresponding coefficients have a similar magnitude.

Models (1) and (2) of Table 3 show the probability of being a zombie in the current and following year, respectively. As can be seen, the coefficient on bank debt is positively signed in both specifications and statistically significant at the 1% level, confirming that higher bank debt increases the likelihood of being a zombie. In contrast, the coefficient on supplier debt is negative, but statistically significant only in model (2), suggesting that suppliers are somewhat more cautious in lending to zombie firms.

Table 3: Determinants of zombie firms

<i>Variable</i>	<i>Zombie in year t</i>	<i>Zombie in year $(t+1)$</i>	<i>Continuing as a zombie</i>	<i>Become a zombie</i>
	(1)	(2)	(3)	(4)
<i>Bank debt</i>	0.013*** (0.001)	0.006*** (0.001)	0.018*** (0.001)	0.004*** (0.001)
<i>Supplier debt</i>	-0.003 (0.002)	-0.010*** (0.002)	-0.005** (0.002)	-0.019*** (0.001)
<i>TFP</i>	-0.535*** (0.007)	-0.452*** (0.007)	-0.516*** (0.009)	-0.169*** (0.004)
<i>Labor</i>	-0.383*** (0.008)	-0.280*** (0.008)	-0.582*** (0.011)	-0.164*** (0.005)
<i>Age</i>	1.119*** (0.010)	0.753*** (0.008)	1.137*** (0.012)	0.161*** (0.005)
<i>Growth</i>	-0.044*** (0.002)	-0.053*** (0.002)	0.007** (0.003)	-0.047*** (0.002)
No. of observations	1,060,811	843,107	807,699	767,535
Wald chi-square	17278.60	13922.26	10176.47	3545.15
Log pseudolikelihood	-189426.25	-164751.75	-116910.16	-94662.11
Pseudo- R^2	0.350	0.345	0.404	0.011

Notes: All variables are in log form, except GDP growth rate. The regression also includes industry dummies as well as a constant term. Models (1) and (2) show the probability of being a zombie in the current and following year, respectively. Model (3) shows the probability of a zombie firm remaining as a zombie in the current year vis-à-vis a non-zombie (control group), while model (4) shows the probability of becoming a zombie in t , given that in $t-1$ is not a zombie. Robustness check of results using alternative definitions of zombie firms in Appendix, Table A.1. Firm-cluster robust standard errors are given in parentheses. ***, ** and * statistical significance at the 0.01, 0.05 and 0.10 levels, respectively

Model (3) shows the probability of a zombie firm remaining as a zombie in the current year. Information asymmetry between creditors and debtors is expected to decrease over time. However, the behavior of banks and suppliers is not similar, with no change in the sign of the coefficients.

Finally, model (4) examines whether joining the zombie statute is associated with trade credit. The main result seems to be that, unlike banks, suppliers seem to have reduced their business relationships with distressed customers prior to firms actually becoming zombies.

We conduct sensitivity analysis by using alternative zombie identification methods and the main results, which are given in Table A1 in the Appendix, hold.

5. CONCLUSION

Zombie firms are those firms that are insolvent and have little hope of recovery but avoid exiting the market thanks to the financial support of their creditors. In this study, we

empirically investigated whether banks and trade creditors engage in “evergreen lending behavior” to zombie firms.

We found that the behavior of suppliers differs from that of banks. Unlike banks, suppliers seem to be more cautious in lending and artificially supporting zombies. Highly productive firms, larger firms and younger firms are less likely to be zombie firms.

The findings of this study contribute to the literature on zombie firms, providing new insights into the behavior of different types of creditors. It raises some concerns about the functioning and management of banks, an issue that remains open for future research. The main conjecture is that banks do not allow firms in fragile situations to exit the market, and as such, there will be a rise in resource misallocation in the economy, thus generating a slowdown in productivity growth.

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APPENDIX

Table A1. Analysis of the robustness of the determinants of zombie firms using alternative definitions

<i>Variable</i>	<i>Zombie in year t</i>	<i>Zombie in year $(t+1)$</i>	<i>Continuing as a zombie</i>	<i>Become a zombie</i>
	(1)	(2)	(3)	(4)
Schivardi et al. (2022) zombie definition				
<i>Bank debt</i>	0.016 ^{***} (0,001)	0.010 ^{***} (0,001)	0.022 ^{***} (0,004)	0.009 ^{***} (0,001)
<i>Supplier debt</i>	-0.006 ^{***} (0,002)	-0.003 ^{**} (0,002)	0.000 (0,006)	-0.008 ^{***} (0,001)
Shen and Chen (2017) zombie definition				
<i>Bank debt</i>	0.015 ^{***} (0,001)	0.001 (0,001)	0.021 ^{***} (0,002)	0.003 ^{***} (0,001)
<i>Supplier debt</i>	0.015 ^{***} (0,001)	-0.035 ^{***} (0,001)	0.003 (0,002)	-0.030 ^{***} (0,001)

Notes: *Probit* estimations of equation (1). The regression also includes control variables and constant term, the coefficient estimates of which are not reported. See notes to Table 3. ***, ** and * statistical significance at the 0.01, 0.05 and 0.10 levels, respectively.

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