



Article

# Determinants of Zombie Firms: The Impact of Corporate Insolvency Efficiency and Cultural Factors

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**Abstract:** By examining a broad range of companies from both developed and developing nations from 2015 to 2021, we gather evidence on the occurrence and factors contributing to the existence of zombie firms. Approximately 10% of our observations are identified as zombie firms, and there is significant variability in the proportion of zombie firms across different countries. We find that countries with more efficient corporate insolvency rules tend to have a lower incidence of zombie firms. We also establish that a nation's culture plays a vital role in determining the prevalence of zombie firms. More specifically, our findings indicate that countries with higher levels of individualism culture tend to have lower numbers of zombie firms.

**Keywords:** zombie firms; insolvency regimes; culture



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## 1. Introduction

Zombie firms are insolvent but continue to operate due to unusual market conditions and support from financial institutions and governments (Altman et al. 2024, as cited in this study). The COVID-19 pandemic has led many governments and central banks to implement extensive corporate support programs to help businesses survive the economic shock without terminating many workers. However, concerns have arisen regarding the proliferation of zombie firms. The Group of Thirty (Group of Thirty 2020) and the Bank for International Settlements (BIS 2021) warn that economic stagnation may persist if the number of zombie firms increases due to prolonged corporate support measures, and discussions on zombie firms have gained renewed international attention.

Caballero et al. (2008), a pioneer in this field of research, argued that the presence of zombie firms hinders macroeconomic activity and causes misallocations of resources. According to many studies, if zombie firms persist and continue to hold onto resources such as labor and capital, these resources will not be available for other healthy firms or for firms entering the market, leading to distortions in the macro-level allocation of resources (Acharya et al. 2019; Adalet McGowan et al. 2018; Banerjee and Hofmann 2018). However, despite the potential negative consequences for the economy, the number of zombie firms continues to grow worldwide (Banerjee and Hofmann 2018). Recently, a growing body of cross-country analyses on the topic revealed a considerable disparity in the prevalence of zombie firms among different countries (Adalet McGowan et al. 2018; Banerjee and Hofmann 2018). Therefore, the aim of this study is to address the question of why there is a disparity in the prevalence of zombie firms. By using a large sample of firms from 43 countries, we examine the prevalence of zombie firms and investigate the country-level characteristics that explain these disparities. Specifically, we focus on the influence of corporate insolvency regimes and cultural factors on the incidence of zombie firms.

While zombie firms in various countries are receiving increased scrutiny from both academics and practitioners, few studies have explored the role of legal systems (Becker and Ivashina 2023). Existing discussions and empirical evidence primarily focus on the creation of zombies within specific countries or through particular economic channels, such as banks'

easy credit and government support (Acharya et al. 2024; Begenau et al. 2023; Blattner et al. 2023; Bonfim et al. 2023). However, the zombie phenomenon seemingly cannot be solely explained by bad banks (Hu and Varas 2021; Nakamura 2023). In this study, we argue that weak corporate insolvency regimes may hinder lenders' incentives to liquidate or restructure zombie firms. This hindrance could arise if the liquidation process is costly and thus less attractive to creditors. Weak corporate insolvency regimes can lead to delays, increased costs, and uncertainty for creditors, discouraging them from liquidating zombie firms (Becker and Ivashina 2023). Therefore, we suggest that an inefficient insolvency framework may lead to a higher prevalence of zombie firms. In addition, prior research has indicated that national culture can shape preferences for financial intermediation and debt contracting (Aggarwal and Goodell 2009; Zheng et al. 2013; El Ghouli et al. 2018, 2019). Building on these studies, we argue that culture shapes creditors' incentives to liquidate zombie firms.

Our paper contributes to the literature in several ways. Firstly, in our research, we explore the impact of the inefficiency of bankruptcy law and national culture on the determinants of zombie firms. We find that both corporate insolvency regimes and cultural factors drive the existence of zombie firms. Specifically, countries with more efficient corporate insolvency regimes are more likely to have a lower emergence of zombie firms. Additionally, countries with higher levels of individualistic culture tend to have a lower prevalence of zombie firms. By doing so, we extend the strand of research investigating the determinants of zombie firms, which places banks and government assistance administered through banks at the heart of the problem (Schivardi et al. 2022; Blattner et al. 2023; Acharya et al. 2024; Begenau et al. 2023; Blattner et al. 2023). Moreover, to the best of our knowledge, this study is the first to provide evidence that national culture has a significant impact on the prevalence of zombie firms. There are two papers that are most related to our study: Becker and Ivashina (2023) and El Ghouli et al. (2021). Becker and Ivashina (2023) also focused on the role of effective insolvency resolution in the creation of zombie firms. They found that, in countries without efficient bankruptcy regimes, cheap lending is more prevalent during periods of economic stress. However, there are two key differences between their study and ours. First, following Caballero et al. (2008), they define a zombie solely based on whether the interest rate is lower than that of the most creditworthy borrowers. The criticism against this definition is that it might be biased regarding long-term credit relationships (Mingarelli et al. 2022). Moreover, they specifically focus on periods of economic distress, which exacerbates the issue by identifying firms facing temporary financial distress due to a negative shock rather than zombies that are economically unviable. In our study, to alleviate the concern of misidentifying zombies rather than low-quality firms, we define zombie firms as those unable to generate sufficient earnings or cash flows to meet their interest payments for at least a conservative period of three years but still able to survive. We also adopt the Altman et al. (2024) definition, using a two-step filtering process to determine zombie firms with an accounting-based measure and a default predictor. Additionally, we expand their research by examining not only periods of distress but also normal times. El Ghouli et al. (2021) explored the role of formal (legal) and informal (cultural) institutions in explaining the prevalence of zombie firms using a dataset of firms from seventy-nine countries from 2005 through 2016. They found that countries with more efficient debt enforcement<sup>1</sup> environments tend to have fewer zombie firms. Although El Ghouli et al. (2021) found no evidence that the prevalence of zombie firms is related to national culture, the differing results may be attributed to differences in sample coverage. Despite their broader coverage of countries and longer study periods, our sample is twice as large. This suggests that their analysis may have overlooked certain zombie firms, while our wider scope allows us to provide a more comprehensive picture of the prevalence of zombie firms in different countries.

Secondly, using a large sample of firms from developed and developing countries, we provide new evidence on the prevalence of the zombie firms phenomenon throughout the

world. We extended recent research that focused on more advanced economies (Banerjee and Hofmann 2018; Adalet McGowan et al. 2018; Altman et al. 2024; Acharya et al. 2024).

The rest of this paper is structured as follows: Section 2 reviews the literature and develops the hypotheses. Section 3 presents an overview of our sample and variables and provides summary statistics, including the distribution of zombie firms across the world. Section 4 outlines the empirical strategy of our analysis. Our robustness tests are detailed in Section 5. Finally, we conclude our study in Section 6.

## 2. Literature Review and Development of Hypothesis

The literature started with evidence from Japan in the 1990s. Peek and Rosengren (2005) documented that the evergreening behavior of under-capitalized banks is the main cause of zombie firms, and the existence of these zombie firms contributed to Japan's prolonged economic stagnation (Caballero et al. 2008; Fukuda and Nakamura 2011). The discussion of zombie firms has intensified in the wake of the global financial crisis of the late 2000s and the European debt crisis. Research shows that weak economic recovery in European countries may mirror Japan's experience in the 1990s, where weakly capitalized banks led to a rise in zombie firms (Acharya et al. 2024; Blattner et al. 2023; El Ghouli et al. 2021; Bonfim et al. 2023; Begenau et al. 2023). This evidence highlights the twisted incentives of banks: extending subsidized loans to nonviable firms to avoid regulatory repercussions and "gamble" for resurrection (Acharya et al. 2024). Nakamura (2023) demonstrated that the problem of zombie firms in Japan occurred not only during the "lost decade" but also in the 1970s when banks were stable and main bank relationships were functioning well. During this time, the existence of a main bank increased the likelihood of corporate bailouts. However, it was found that the main banks did not necessarily choose to bail out firms that were better off than those that were not rescued. This aligns with the evidence from Álvarez-Román et al. (2023), who document that being distressed is negatively correlated with the probability of receiving new credit. However, the primary bank of a distressed firm is more reluctant to restrict the credit supply to this firm than a bank with no previous exposure to the company. This reluctance may reflect the incentives of the primary bank to engage in loan evergreening, thereby sustaining zombie firms. In recent years, a growing body of cross-country studies on zombie firms has found that these firms exist worldwide, with significant disparities in their prevalence across countries (Adalet McGowan et al. 2018; Banerjee and Hofmann 2018). This suggests a potentially important role for structural policies. Consequently, the literature has begun to examine the role of the institutional environment in shaping this disparity in zombie firm prevalence. Banerjee and Hofmann (2018) showed that in a low-interest-rate environment, factors on both the corporate side and the banking side interact to lead to the occurrence and increase in zombie firms. On the corporate side, they analyze that a prolonged low-interest-rate environment reduces interest payments, making it difficult for firms to have incentives to reduce their debt. On the banking side, they indicate that a prolonged low-interest-rate environment makes banks' risk-taking stance more aggressive, leading them to lend to relatively fewer creditworthy borrowers. However, Obstfeld and Duval (2018), Laeven et al. (2020), and Schularick (2021) argue that attributing the cause of zombie firms to monetary policy (the low-interest-rate environment) is mistaken, as the ratio of zombie firms in the Eurozone, where policy interest rates are the same, varies significantly between countries.

Beyond these views on the determinants of zombie firms, El Ghouli et al. (2021) and Altman et al. (2024) found that the strength of creditor rights is positively related to the incidence of zombie firms. Strong creditor rights provide creditors with legal and institutional tools that not only allow them to gain possession of collateral but also enable them to influence the bankruptcy restructuring or liquidation process, thereby improving their recovery rates. In addition to rights granted to creditors, the efficiency of resolving insolvency is important for creditors to exercise their rights to recover debt at low costs. Therefore, we expect a negative relationship between the efficiency of bankruptcy law and the prevalence of zombie firms.

**H1:** *Higher corporate insolvency efficiency is negatively related to the prevalence of zombie firms.*

As shown above, the literature on investigating zombie firms has evolved from focusing on bad bank incentives to examining the institutional environment driving the prevalence of zombie firms. However, there is a lack of attention paid to the role of informal institutions, namely, culture. In our discussion, we mainly focus on the individualism/collectivism dimension of culture, which emphasizes the relationship between “I” and “we” (Hofstede 1983; Boubakri et al. 2023). Individualism refers to cultural values that emphasize personal responsibility and self-reliance. In contrast, collectivist cultures place greater emphasis on maintaining social harmony and group cohesion. Liquidating and recognizing zombie firms often result in the layoff of managers and employees. In countries with higher collectivist cultures, there may be a reluctance to take action, which could cause widespread job losses. Higher collectivist cultures may be more tolerant of zombie firms to preserve the jobs of managers and employees, while higher individualist cultures may be less tolerant of such firms.

**H2:** *National culture influences the prevalence of zombie firms.*

**H2-1:** *Individualist cultures are associated with a lower prevalence of zombie firms.*

**H2-2:** *Collectivist cultures are associated with a higher prevalence of zombie firms.*

Although our analysis primarily emphasizes individualism, we also consider the other three cultural dimensions identified by Hofstede (2001): uncertainty avoidance, masculinity, and power distance. It is important to note that these dimensions are correlated with the individualism dimension (Gorodnichenko and Roland 2011). In high-uncertainty avoidance cultures, there is a low tolerance for change and ambiguity, causing creditors to hesitate in liquidating failing firms. This reluctance allows inefficient zombie firms to persist, resulting in a higher prevalence of such firms in these environments. In high-power-distance countries, where power and wealth inequalities are generally tolerated, there may be a tendency to terminate zombie firms even if it involves laying off managers and employees. Finally, high-masculinity (femininity) countries may be more hostile (friendly) to zombie firms because they value achievement (caring for others, including managers and stakeholders).

### 3. Data

#### 3.1. Data and Sample

To conduct our comparative analysis, we use firm-level data from Bureau van Dijk’s Orbis database. As most studies on zombie firms do, we limit our analysis to nonfinancial corporations<sup>2</sup>. To determine if a company is a zombie, we examine firms that have no missing data on interest coverage and incorporation date. Our final sample has 185,601 unique firm-year observations from 2015 to 2021 in 43 countries. We use Djankov et al.’s (2008) Creditor Rights Index, which aggregates secured creditors’ scores on four types of legal rights in bankruptcy. A higher index value indicates stronger creditor rights. We also use country-level data on corporate insolvency rules from the World Bank’s Doing Business Database, Hofstede’s (2001) national culture dimensions, and data on banking sector health from the World Bank’s Global Financial Development Database. We winsorize firm-level variables at the 1% level to eliminate outliers.

#### 3.2. Variables Definitions

##### 3.2.1. Zombie Firms

Following Adalet McGowan et al. (2018) and El Ghouli et al. (2021), the identification of zombie firms in this study is based on two conditions: firstly, the firm must have been in operation for more than ten years, and secondly, its ICR (EBITDA/interest expenses) should have been lower than 1 for the past three years.

### 3.2.2. Corporate Insolvency Rules

Our explanatory variables measure the effectiveness of the corporate insolvency framework at the country level. We utilize the World Bank's annual "Doing Business" report, which provides a comparative analysis of business regulations across various countries. Our focus centers on the indicators related to the resolution of business insolvency.<sup>3</sup> The methodology employed in this section is based on the research conducted by Djankov et al. (2008). We examine four variables: the resolving insolvency score (the primary score), the recovery rate score (estimation of senior creditors' recovery), the strength of the insolvency framework (qualitative aspect of the primary score), and the resolution time. The scores range from 0 to 100, with higher values indicating a stronger insolvency system. Conversely, the resolution time is assessed in the opposite manner, where higher values indicate lengthier or slower resolution times. We find that there is significant heterogeneity in the efficiency of insolvency procedures.

### 3.2.3. National Culture

As a measure of culture, we use the individualism<sup>4</sup> score from Hofstede's work, initially constructed based on responses from an employee value survey gathered from more than 117,000 IBM employees between 1967 and 1973 in 40 countries. This score is provided on a scale of 1–100, where a higher score represents a more individualist culture. Geert Hofstede, in his book *Culture's Consequences: International Differences in Work-Related Values*, explains how cultures evolve under the influence of factors such as climate, economic development, and history. Individualism, a key construct in the Hofstede framework, reflects the extent to which a society reinforces individual achievement as opposed to collectivism, which stresses collective action by individuals<sup>5</sup>.

### 3.2.4. Other Controls

In our study, we conduct regressions to analyze the prevalence of zombie firms while considering various firm- and country-level variables. To align with existing research on zombie firms (e.g., El Ghouli et al. 2021; Adalet McGowan et al. 2018), we specifically control for firm size, represented by the natural logarithm of total assets, and sales growth, which measures the increase in sales compared to the previous year.

At the country level, we include GDP per capita, which is defined as the natural logarithm of GDP per capita to control for aggregate economic environment. It is analyzed that banks' evergreening behavior contributes to the proliferation of zombie firms. To capture bank health, we use a country's bank Z-scores estimated as  $(ROA + \text{equity}/\text{assets})/\text{SD}(\text{ROA})$ , where ROA is bank ROA, equity is bank equity, assets are bank assets, and SD(ROA) is the standard deviation of ROA. Previous research has shown that the legal protection of creditors affects the incentives of lenders to liquidate zombie firms (El Ghouli et al. 2021; Altman et al. 2024). Therefore, we control for this factor in our analysis.

### 3.3. Summary Statistics

Table 1 presents summary statistics for firm-level variables (Panel A) and country-level variables (Panel B). We observed 185,601 observations, of which 10% are zombie firms.

**Table 1.** Summary statistics.

Variable	N	p25	p50	p75	Mean	SD
Panel A: Firm-level variables						
zombie	185,601	0	0	0	0.101	0.302
altman_zb	148,432	0	0	0	0.0364	0.1875
lnasset	166,770	9.737	11.49	13.26	11.56	2.482
l1salegrowth	179,718	−0.0870	0.0420	0.209	0.138	0.565

**Table 1.** Cont.

Variable	N	p25	p50	p75	Mean	SD
Panel B: Country-level variables						
l1GDP	301	9.431	9.917	10.67	9.953	0.830
l1real GDP growth	301	−1.760	0.433	1.834	−1.211	7.640
l1bankzscore	299	9.150	13.97	19.00	15.72	9.300
l1resolving insolvency score	258	54.70	70.65	80.60	66.36	19.05
l1recover rate score	258	36.90	64.10	82.60	58.63	24.89
l1frame work score	258	65.63	71.88	81.25	69.61	17.34
l1resolution time	252	1.100	1.900	3	2.020	1.065
Creditor right individualism	39	1	2	3	1.974	0.959
uncertainty avoidance	40	36	58.50	71	54.50	21.33
power distance	40	51	74.5	86	69.675	22.731
masculinity	40	39.5	56.5	69.5	55.425	20.814
Collectivism (institutional)	40	37.5	49.5	65	49.6	22.965
Collectivism (in-group)	27	3.850	4.285	4.627	4.263	0.524
Adjusted individualism	27	4.254	5.246	5.536	4.954	0.805
	22	19.14	31.84	40.66	30.11	12.98

### 3.4. Zombie Firms Around the World

To demonstrate whether the COVID-19 support programs of various countries have led to an increase in zombie firms and to examine the variation in the prevalence of zombie firms across countries, we present a time-series pattern in Table 2 and the zombie share across countries in Table 3 using our sample firms. From Table 2, we find that the overall change in the global zombie rate from 2019 to 2020 is relatively small. However, because our sample period extends only until 2021, it is necessary to use a longer period to accurately assess the impact of COVID-19 on zombie firms. Table 3 provides a sample and zombie firm distribution by country level, revealing a noteworthy disparity in the zombie ratio across countries. Out of all the countries that were sampled, Canada has the largest proportion of zombie firms, with 36.97% of all observations being accounted for by zombie firms. Following Canada are Australia, Sweden, and the United States, all of which have over 20% of their observations being zombie firms, with percentages of 28.45%, 26.64%, and 22.48%, respectively. The question then arises as to what factors bring about cross-country differences in the proportion of zombies present and what kind of environment contributes to the occurrence and increase in zombies. The following section aims to address the factors that lead to variations in the proportion of zombie firms across different countries and understand the specific environment that fosters the emergence and growth of these firms.

**Table 2.** Time-series patterns.

Year	All Firms	Percent	Zombie	Percent
2015	20,343	10.96	2056	10.11
2016	25,994	14.01	2316	8.91
2017	27,590	14.87	2483	9.00
2018	27,880	15.02	2665	9.56
2019	27,884	15.02	2845	10.20
2020	27,689	14.92	3120	11.27
2021	28,221	15.21	3312	11.74
Total	185,601	100	18,797	10.13

**Table 3.** Zombie firms around the world.

Country	All Firms	Percent	Zombies	Percent	Country	All Firms	Percent	Zombies	Percent
	N		N			N		N	
Argentina	360	0.19	28	7.78	Japan	17,086	9.21	216	1.26
Australia	4000	2.16	1138	28.45	Latvia	100	0.05	13	13.00
Austria	285	0.15	16	5.61	Lithuania	82	0.04		0.00
Belgium	589	0.32	76	12.90	Luxembourg	216	0.12	14	6.48
Brazil	1524	0.82	190	12.47	Malta	126	0.07	1	0.79
Bulgaria	924	0.5	103	11.15	Mexico	416	0.22	16	3.85
Canada	4541	2.45	1679	36.97	Netherlands	659	0.36	55	8.35
China	71,122	38.32	2998	4.22	Poland	2964	1.6	230	7.76
Croatia	474	0.26	42	8.86	Portugal	248	0.13	29	11.69
Cyprus	311	0.17	43	13.83	Romania	1478	0.8	163	11.03
Czech Republic	164	0.09	2	1.22	Russia	2004	1.08	164	8.18
Denmark	656	0.35	71	10.82	Saudi Arabia	644	0.35	19	2.95
Estonia	89	0.05	0	0.00	Slovakia	388	0.21	44	11.34
Finland	855	0.46	70	8.19	Slovenia	194	0.1	3	1.55
France	3378	1.82	460	13.62	South Africa	1047	0.56	36	3.44
Germany	2852	1.54	217	7.61	South Korea	11,255	6.06	1355	12.04
Greece	1007	0.54	157	15.59	Spain	969	0.52	129	13.31
Hungary	122	0.07	10	8.20	Sweden	3300	1.78	879	26.64
India	22,031	11.87	3501	15.89	Turkey	1199	0.65	147	12.26
Indonesia	2843	1.53	197	6.93	United Kingdom	4872	2.62	500	10.26
Ireland	343	0.18	33	9.62	United States	16,227	8.74	3648	22.48
Italy	1657	0.89	105	6.34	Total	185,601	100	18,797	10.13

#### 4. Empirical Strategy

In this section, following [El Ghouli et al. \(2021\)](#), we examine the determinants of the prevalence of zombie firms. We estimate several specifications of the following logit model. In all specifications, we use weighted regressions with weights equal to the inverse of the number of firm observations in each country to account for the heterogeneity in the number of observations across countries ([El Ghouli et al. 2018](#)):

$$Zombie_{i,k,c,t} = \alpha_0 + \alpha_1 FLV_{i,t-1} + \alpha_2 CLV_{c,t-1} + YearFE + IndustryFE + LawOriginFE + \varepsilon_{i,k,c,t}, \tag{1}$$

where *i* indexes firms, *k* indexes industries, *c* indexes countries, and *t* indexes years. The dependent variable is *zombie*, a dummy that equals 1 if the firm is classified as a zombie firm. We include fixed effects by year to control for secular trends. We lag the other controls by one year to mitigate potential endogeneity problems. To control for disparities in the litigation environments between nations and differences in legal origin affecting access to credit, we employ fixed effects by law origin. The coefficient  $\alpha_2$  captures how cross-country differences in institutional and cultural environments are associated with zombie problems.

Table 4 reports the results. Columns (1)–(4) of Table 4 display the results of our analysis on the impact of corporate insolvency rules’ efficiency on the prevalence of zombie firms<sup>6</sup>. According to our hypothesis, we expect a negative relationship between higher insolvency scores and the likelihood of firms being classified as zombie firms, while the resolution time is expected to have the opposite effect. Upon examining Columns (1)–(4), we find that our observations align with these expectations. The coefficient on resolution time exhibits the predicted sign but is not statistically significant.

In Columns (5)–(8), we present the results regarding the influence of culture on the prevalence of zombie firms. Our analysis aligns with our initial hypothesis, as the results demonstrate a significant relationship between the cultural environment and the prevalence of zombie firms. Specifically, we find that cultures characterized by higher levels of individualism, power distance, and masculinity exhibit a negative association with the occurrence of zombie firms. In contrast, cultures characterized by higher levels of uncertainty avoidance are positively related to the creation and growth of zombie firms.

**Table 4.** The effects of regulatory and culture environments.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	Zombie	Zombie	Zombie	Zombie	Zombie	Zombie	Zombie	Zombie
l1lnasset	−0.416 *** (−33.88)	−0.413 *** (−34.27)	−0.419 *** (−33.57)	−0.406 *** (−31.08)	−0.447 *** (−40.98)	−0.441 *** (−39.79)	−0.449 *** (−37.38)	−0.443 *** (−40.00)
l1LGDP	0.386 *** (9.18)	0.364 *** (7.64)	0.333 *** (10.87)	0.340 *** (8.70)	0.340 *** (7.66)	0.225 *** (8.97)	0.179 *** (5.04)	0.260 *** (12.26)
l1bankzscore	0.008 ** (2.31)	0.008 ** (2.39)	0.008 ** (2.29)	0.008 ** (2.38)	0.012 *** (2.80)	0.018 *** (3.48)	0.014 *** (3.71)	0.017 *** (4.21)
l1realgdpgrowth	−0.005 (−1.08)	−0.005 (−1.24)	−0.006 (−1.47)	−0.007 * (−1.68)	−0.002 (−0.44)	−0.000 (−0.10)	0.002 (0.37)	−0.003 (−0.67)
l1salegrowth	0.041 (0.70)	0.042 (0.72)	0.037 (0.64)	0.047 (0.82)	0.062 (0.95)	0.063 (0.97)	0.057 (0.89)	0.057 (0.89)
creditor right	−0.181 *** (−5.69)	−0.176 *** (−5.52)	−0.187 *** (−5.80)	−0.162 *** (−5.00)	−0.081 *** (−2.59)	−0.039 (−1.20)	−0.097 *** (−3.12)	−0.112 *** (−4.04)
l1resolving insolvency score	−0.006 *** (−3.10)							
l1recover rate score		−0.003 * (−1.72)						
l1frame work score			−0.006 *** (−3.46)					
l1resolution time				0.050 (1.37)				
individualism					−0.006 * (−1.91)			
uncertainty avoidance						0.006 *** (2.95)		
power distance							−0.006 ** (−2.15)	
masculinity								−0.006 *** (−2.86)
Constant	−0.856 *** (−2.72)	−0.898 ** (−2.33)	−0.231 (−0.83)	−1.057 ** (−2.01)	−0.158 (−0.46)	−0.108 (−0.41)	1.677 *** (2.60)	0.568 ** (2.44)
Observations	136,034	136,034	136,034	135,565	160,039	160,039	160,039	160,039
legal origins FE	NO	NO	NO	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Pseudo R2	0.128	0.127	0.128	0.125	0.143	0.143	0.143	0.144

Robust z-statistics in parentheses: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , and \*  $p < 0.1$ .



### 5. Robustness Tests

In this section, we aim to assess the robustness of our previous results by employing alternative proxies for zombie firms and main independent variables.

#### 5.1. Alternative Measure of Zombie Firms

To enhance the robustness of our measurement, we employ an alternative definition of zombie firms. This alternative definition is based on a two-stage filtering process proposed by Altman et al. (2024), which uses a default prediction model. Specifically, firms are considered zombie firms if their three-year moving average interest coverage ratio is less than 1 and their three-year moving average Z-score<sup>7</sup> or Z''-score<sup>8</sup> is less than zero. From Table 5, we find that the main findings regarding the effects of corporate insolvency efficiency on the incidence of zombie firms remain consistent. Through Columns (5)–(8), we observe that the effects of individualism and uncertainty avoidance on the incidence of zombie firms remain unchanged. However, the influence of the other two cultural dimensions, power distance and masculinity, on the prevalence of zombie firms becomes insignificant.

Table 5. Alternative measure of zombie firms.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	altman_zb	altman_zb	altman_zb	altman_zb	altman_zb	altman_zb	altman_zb	altman_zb
l1nasset	−0.323 *** (−17.32)	−0.314 *** (−17.13)	−0.329 *** (−17.48)	−0.314 *** (−15.23)	−0.357 *** (−20.02)	−0.345 *** (−18.56)	−0.343 *** (−16.65)	−0.349 *** (−19.05)
l1LGDP	0.213 *** (3.82)	0.237 *** (3.66)	0.103 ** (2.47)	0.156 *** (2.90)	0.179 *** (2.69)	−0.014 (−0.36)	0.095 (1.63)	0.050 (1.58)
l1bankzscore	0.003 (0.46)	0.004 (0.74)	0.002 (0.40)	−0.004 (−0.65)	−0.003 (−0.46)	0.008 (0.92)	−0.006 (−0.89)	−0.000 (−0.05)
l1realgdpgrowth	0.013 * (1.86)	0.015 * (1.93)	0.010 (1.36)	0.014 (1.58)	0.013 (1.55)	0.015 * (1.65)	0.012 (1.40)	0.013 (1.49)
l1salegrowth	−0.491 ** (−1.98)	−0.488 * (−1.96)	−0.497 ** (−2.01)	−0.428 * (−1.81)	−0.441 * (−1.85)	−0.427 * (−1.81)	−0.436 * (−1.85)	−0.435 * (−1.85)
creditorright	−0.036 (−0.72)	−0.019 (−0.37)	−0.041 (−0.82)	−0.041 (−0.77)	−0.029 (−0.53)	0.060 (1.05)	−0.011 (−0.20)	−0.036 (−0.76)
l1resolving insolvency score	−0.012 *** (−4.43)							
l1recover rate score		−0.009 *** (−3.88)						
l1frame work score			−0.010 *** (−3.52)					
l1resolution time				0.130 ** (2.42)				
individualism					−0.009 ** (−1.98)			
uncertainty avoidance						0.010 *** (3.15)		
power distance							0.004 (0.82)	
masculinity								−0.003 (−0.97)
Constant	−0.498 (−1.24)	−1.147 ** (−2.20)	0.556 (1.64)	−1.039 (−1.45)	−0.823 (−1.59)	−0.762 * (−1.76)	−0.936 (−0.87)	0.027 (0.07)
Observations	127,861	127,861	127,861	127,401	130,142	130,142	130,142	130,142
legal origins FE	NO	NO	NO	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Pseudo R2	0.0828	0.0821	0.0817	0.0857	0.0926	0.0929	0.0912	0.0914

Robust z-statistics in parentheses: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , and \*  $p < 0.1$ .

#### 5.2. Alternative Measure of Culture

We use alternative measures of individualism. As suggested by Beugelsdijk et al. (2017), we do this by interacting the individualism score with the Gelfand et al. (2011) national culture tightness score (TGHT), rescaled to the 0–1 range. This approach enables us to calculate adjusted cultural variables that consider the variations in culture tightness across different countries.

We employ alternative measurements of individualism, including institutional collectivism and in-group collectivism from the GLOBE study (House et al. 2004), which provide more recent data compared to Hofstede’s culture dimensions. These measurements capture the

equal distribution of resources within a society and individuals’ expressions of pride, loyalty, and cohesiveness in organizations or families. The definitions of these three measurements are close to those of Hofstede’s (1983) individualism/collectivism. They are also negatively correlated with the individualism score. Thus, we should expect negative coefficients.

In Table 6, our initial hypothesis is supported by the results, as they reveal a negative relationship between cultural environments characterized by higher levels of individualism and the incidence of zombie firms. Conversely, higher levels of collectivism are positively related to the incidence of zombie firms.

**Table 6.** Alternative measures of individualism.

	(1)	(2)	(3)
Variables	Zombie	Zombie	Zombie
l1nasset	−0.470 *** (−34.52)	−0.480 *** (−37.66)	−0.478 *** (−36.29)
l1salegrowth	−0.030 (−0.46)	−0.012 (−0.21)	−0.011 (−0.19)
l1LGDP	0.297 *** (14.60)	0.264 *** (11.48)	0.332 *** (6.86)
l1realgdpgrowth_	−0.023 *** (−3.05)	0.004 (0.93)	0.006 (1.29)
Creditor right	−0.004 (−0.11)	−0.071 * (−1.77)	−0.029 (−0.72)
l1bankzscore	0.014 ** (2.46)	0.017 *** (3.46)	0.021 *** (4.53)
Adjusted individualism	−0.023 *** (−10.34)		
Collectivism (institution)		0.236 ** (2.18)	
Collectivism (in-group)			0.179 ** (2.11)
Constant	0.249 (1.03)	−0.161 (−0.25)	−0.862 (−0.95)
Observations	144,309	146,474	146,474
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Legalorigin FE	YES	YES	YES
Pseudo R-squared	0.161	0.163	0.163

Robust z-statistics in parentheses: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , and \*  $p < 0.1$ .

## 6. Conclusions

In this study, utilizing data from forty-three countries spanning the years 2015 to 2021, we provided a comprehensive analysis of zombie firms across a diverse set of countries, offering insights into their global prevalence and determinants. We found large variations in the frequency of zombie firms across countries. By examining the impact of the inefficiency of bankruptcy law and cultural factors on shaping lenders’ incentives to liquidate/reorganize zombie firms, we extended the recent study of research on causes of zombie firms mainly centered around weak bank incentives (Begenau et al. 2023; Acharya et al. 2022).

Our findings have direct policy implications for how countries should address their zombie problems. While the traditional perspective on zombie firms highlights the importance of addressing banks’ incentives, the effectiveness of using bad banks to meaningfully attenuate zombie lending remains unclear (Acharya et al. 2022; Jaskawski 2015). Our research shows that simply realigning banks’ incentives is unlikely to single-handedly solve the issue. We suggest that tackling the inefficiencies of bankruptcy law may be a meaningful way to reduce the prevalence of zombie firms. Moreover, policymakers need to be cognizant of cultural nuances and consider them when designing strategies and interventions to address the problem.

This study has several limitations. Firstly, it lacks a detailed mechanism analysis to fully understand the underlying processes influencing the relationship between national culture and the inefficiency of bankruptcy laws on the prevalence of zombie firms. Secondly, while we examined the influence of national culture, there may be other cultural dimensions and factors not explored in this study that could further impact the prevalence of zombie firms. Additionally, following previous research (Becker and Ivashina 2023), we measured the inefficiency of bankruptcy law by the resolving insolvency score, which allows for the heterogeneity comparison of cross-country differences. Future research can focus on law reform and a more detailed examination of bankruptcy laws to better understand their impact on the prevalence of zombie firms. Future research can focus on law reform and a more detailed examination of bankruptcy laws to better understand their impact on the prevalence of zombie firms.

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## Notes

- <sup>1</sup> Their research focuses primarily on one dimension of debt enforcement, which is the number of days it takes for a creditor to enforce a simple debt contract.
- <sup>2</sup> Following to Mingarelli et al. (2022), we perform several steps to clean and prepare the data for analysis. First, we exclude firms based on their NACE Rev. 2 industry classification from the financial and insurance activities (NACE divisions 64, 65, and 66), the public sector (NACE division 84), activities of households (NACE divisions 97 and 98) and extraterritorial organizations (NACE division 99). Given the structural differences to other firms, we additionally exclude firms from the primary sector (NACE divisions starting with 0). Second, we look at the highest level of consolidation available. Accordingly, we limit our analysis to reports with Orbis consolidation codes C1 (consolidated statement of a mother company where no unconsolidated companion is reported in Orbis), C2 (consolidated statement of a mother company where an unconsolidated companion is reported in Orbis) and U1 (unconsolidated statement of a company with no consolidated companion in Orbis). Third, we only consider firms for which the reported balance sheets are consistent. We require firms to report positive total assets and non-negative debt.
- <sup>3</sup> The availability of these measures only until 2020 limits our analysis of corporate insolvency regimes to the sample period from 2015 to 2020.
- <sup>4</sup> Individualism is referred to as the only cultural value that empirically affects economic development (Gorodnichenko and Roland 2011).
- <sup>5</sup> For a detailed description of Hofstede’s cultural dimensions, see <https://geerthofstede.com/research-and-vsm/dimension-data-matrix/> (accessed on 13 June 2024).
- <sup>6</sup> These measures of the efficiency of bankruptcy law are strongly correlated with legal origin (Djankov et al. 2008). Thus, we opted to exclude the fixed effects associated with legal origin in our analysis on the influence of resolving insolvency regimes on the prevalence of zombie firms.
- <sup>7</sup>  $Z \text{ Score} = 1.2 \times \frac{\text{Current assets}}{\text{Current Liabilities}} + 1.4 \times \frac{\text{Retained Earnings}}{\text{Total Assets}} + 3.3 \times \frac{\text{EBIT}}{\text{Total Assets}} + 0.6 \times \frac{\text{Market value of Equity}}{\text{Total Liabilities}} + 1.0 \times \frac{\text{Sales}}{\text{Total Assets}}$ .
- <sup>8</sup>  $Z'' \text{ Score} = 3.25 + 6.56 \times \frac{\text{Current assets}}{\text{Current Liabilities}} + 3.26 \times \frac{\text{Retained Earnings}}{\text{Total Assets}} + 6.72 \times \frac{\text{EBIT}}{\text{Total Assets}} + 1.05 \times \frac{\text{Book Value of Equity}}{\text{Total Liabilities}}$ .

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