



Zombie Prevalence and Survival

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Abstract

We document the rise in the share of zombie firms starting from the late 1990s in the US economy across various sectors. We compare multiple definitions used in literature to identify zombies and discuss how they continue to survive. We find zombies issue more debt compared to non-zombies. A subset of zombies defined as growing zombies are able to raise equity too.

JEL Classification: G33, G34

Keywords: Zombie Lending, Subsidized Lending, Profitability

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1 Introduction

The rise of zombie firms is discussed as one of the possible reasons for the weak recovery and productivity slowdown in major OECD economies after the global financial crisis.¹ In a well-functioning market economy, the process of creative destruction requires poorly performing firms either to become more efficient or exit the market. However, the proliferation of unprofitable firms that would otherwise exit the market but continue to operate as zombies has resulted in increased interest in exploring their dynamics.

The rise of zombies is attributed to various reasons ranging from complex bank-firm relationship² (Peek and Rosengreen 2005, Jaskowski 2015), government forbearance to evergreening of loans (Peek and Rosengreen 2005, Caballero et al., 2008, Giannetti and Simonov, 2013). Bank capitalization (Schivardi et al., 2016) and monetary policy³ (Acharya et al., 2019, Banerjee and Hoffman, 2018) are other possible reasons that have been put forward in the existing literature for the proliferation of zombie firms.

Zombies have spillover effects on their industries and on the economy. The existence of zombie firms can dampen investment and the growth prospects of healthy firms by crowding them out (Ferrando et al., 2015, Schivardi et al., 2017, McGowan et al., 2017, Storz et al., 2017, Banerjee and Hoffman, 2018, Acharya et al., 2019). Throttling the growth prospects of healthy firms is attributed to misallocation of credit to zombie firms (Acharya et al., 2019.) Healthy firms may not receive as much credit as they would have in the absence of zombies. The presence of zombie firms has also been associated with depressed prices, increased labour costs and increased cost of capital (Banerjee and Hoffman, 2018).

¹ See McGowan et al., (2017), Haldane (2017), Banerjee and Hoffman, (2018), Acharya et al., (2019)

² The close and complex Keiretsu structure of Japan has been attributed to have caused Japanese banks to start the policy of forbearance with financially weak borrowers in order to avoid reporting loans as non-performing. This technique of evergreening loans created zombie forms that continued to function. Unimpeded due to government policy of forbearance, primarily to avoid a possible credit crunch and economic downturn associated with bank failure.

³ The major argument is that post-crisis, an era of exceptionally low interest rates has reduced the pressure on creditors to clean up their balance sheets and encourage them to evergreen loans to zombies. Lower rates also incentivize the risk-taking behavior of firms thereby aggravating the problem.

Following the unprecedented surge in the US corporate debt and the pandemic induced recession, there is a growing need for a detailed study that explores the prevalence and functioning of zombies in the US economy. Against this backdrop, this paper contributes to the literature by identifying the prevalence of zombies in the US. The most common method for identifying zombies is via the detection of subsidized lending (Caballero et al, 2008). More recently, McGowan et al., (2017) and Banerjee and Hoffman (2018) have identified zombies in OECD economies based on profitability. Nurmi et al., (2020) categorize zombies based on employment growth in Finland. In this paper, we combine these methods and study zombie prevalence in the US economy.

We also contribute to existing literature by exploring the various survival and exit strategies employed by zombies. This helps us better understand their channels of operation. Finally, we discuss the sectoral distribution of zombies in the US context.

The rest of the paper is organized as follows. Section 2 provides a brief description of the methods to identify zombies used in this paper, describes the empirical specification and discusses zombie prevalence in the US economy and across sectors. In Section 3 and 4, we discuss survival and exit strategies used by zombies respectively. Section 5 concludes the paper.

2 Identification

The most widely used method for identifying zombie firms is based on the seminal work of Caballero et al., (2008). To determine whether a firm receives subsidized loans, the actual interest paid by the firm is compared to the expected interest expense of the highest-quality borrowers with the same amount of debt. A firm is considered a zombie if this difference is negative and the firm is rated below investment grade. They first calculate a hypothetical lower bound for interest payments (r^*) that the highest quality borrowers are expected to pay. This is compared to the interest payment of the firms. The difference between the actual interest rate (r) and the notional lower bound (r^*) is used to identify whether subsidized

lending is present. The interest rate gap is defined as

$$x_{i,t} = \frac{R_{i,t} - R_{i,t}^*}{B_{i,t-1}} = r_{i,t} - r_{i,t}^*$$

If this interest rate gap is negative, the authors identify the firm to be a zombie for that year. Following Caballero et al., (2008), substantial literature has emerged that identify zombies based on subsidized credit for Japan (Giannetti and Simonov, 2013), and Europe after the sovereign debt crisis (Schivardi et al., 2017, Acharya et al., 2019).

The biggest drawback of this method of identification is the underestimation of the true extent of zombies in an economy. The interest rate gap variable does not account for a firm taking new loans to repay past loans. Further, during crises, banks might resort to evergreening their nonperforming assets rather than recognizing losses and reporting the actual extent of non-performing assets. This has been observed in Nordic economies (Drees and Pazarbasioglu, 1995), the US during the Saving and Loan Crisis (Akerkof and Romer, 1993), and in developing nations like India (Banerjee et al., 2009) and Chile (Velasco, 1991) etc⁴.

Other methods of identifying zombie firms seek to fill these gaps. One such method uses interest payment capacity as a metric (Mcgowan et al., 2017, Banerjee and Hoffman, 2018), categorizing firms as zombies if they have an interest coverage ratio (ICR) of less than one for three consecutive years. ICR identifies a wider set of firms that are unable to cover their interest payments with their profits. This method in isolation can include many firms that are investing heavily and are initially unprofitable. Adding the age threshold allows distinction between actual zombie firms from young start-ups. Banerjee and Hoffman, (2018) also discuss a narrower measure of identifying zombies based on expected future growth potential. Firms are identified as zombies if Tobin's Q (ratio of their asset's market value to replacement cost) is below the median for the sector for a given year.

It is also possible to classify firms into growing or declining zombies based on whether they expect future growth in employment. Nurmi et al., (2020) categorize firms as declining

⁴ See Giannetti and Simonov (2013) for a detailed account.

zombies if the annual growth rate of employed workers is negative for at least two years within the zombie period (ICR being less than one for three consecutive years). If this growth rate is positive, then the firms are classified as growing zombies. In this paper, we use these three identification methods to compare and study zombie prevalence in the US economy.

2.1 Data and Empirical Specification

We use accounting data for listed US firms from Standard & Poor’s COMPUSTAT database. We then exclude firms operating in financial services (NAICS = 52) following standard practice. We restrict our sample period from 1991 to 2018 and to firms that have data for at least three years in this period. This leaves us with 20,643 firms and 210,608 firm-year observations. The summary statistics are shown in Table 1.

To identify subsidized zombies, we start with Caballero et al., 2008 and Acharya et al., 2019. Their classification of a firm as a zombie hinges on the firm receiving subsidized credit from banks. A firm receives subsidized credit if its interest rate on borrowing is lower than the rate paid by the most creditworthy firms in the economy. We calculate the interest rate paid by the most creditworthy firms in two ways. First, we calculate the median of the average interest rate (*total interest expense/total debt*) paid by firms with an AAA rating in any given year. Second, we calculate the median of the average interest rate paid by the top decile of firms by interest coverage ratio (ICR). The interest coverage ratio is a good proxy for the S&P rating of a firm and thus of the highest rated firms.

To be conservative, we take the lower of the two interest rates as the rate paid by the most creditworthy firms in the economy. Given this interest rate benchmark (r^{top}) and the total debt of a firm (D_{it}), we calculate the minimum required interest payment of a firm (R^{min}),

$$R_{it}^{min} = r_t^{top} * D_{it}$$

Next, we calculate the excess interest paid by the firm. Excess interest is the difference between the actual interest expense of a firm (R_{it}) and the minimum required interest pay-

ment.

$$x_{it} = R_{it} - R_{it}^{min}$$

Given x_{it} , a firm is classified as a zombie if it meets the following criteria: (i) x_{it} is negative *i.e.* the excess interest paid by the firm is negative which implies that its interest cost is less than that of the most creditworthy firms (ii) it is in the bottom tercile of firms when classified by the 3-year average interest coverage ratio. For small firms (<\$5bn in market cap), $ICR = 3$ corresponds to a rating of BB while for larger firms, $ICR = 2$ is equivalent to a BB rating (Damodaran). When using the bottom tercile of ICR as a proxy for S&P's rating, only one datapoint has an ICR above 3 and 1.2% of the data points have an ICR greater than 2. Hence, selecting the bottom tercile is a good proxy for a firm's credit rating. We call these firms subsidized zombies.

We next identify firms as ICR zombies if they have an interest coverage ratio of less than one for three consecutive years and are older than ten years. We divide this sample of zombies into growing and declining zombies. Firms are put in the growing bucket if they have positive employment growth for two of the past three years, otherwise they are classified as declining zombies.

Additionally, for all three zombie classifications, a firm continues to remain in the zombie state until it has an interest coverage ratio of greater than one for two out of the past 3 years.

Dependent Variables We aim to explain the survival of zombie firms, so our main variables of interest are *debt issuance*, *equity issuance*, *change in assets*, and an indicator for *firm exit*. All variables are normalized by lagged *PPE*.

Controls For our analysis, we need to control for factors that affect a firm's borrowing decision. We use *Tobin's Q* to proxy for investment opportunities and the *Kaplan-Zingales Index* (KZ) and firm *age* to proxy for financing constraints. *Tobin's Q* (market-to-book

ratio) is calculated as the ratio of a firm’s market value to its book value. The *KZ-Index* is calculated as

$$KZ-Index = -1.002 * (ib - dp)/at_{t-1} - 39.368 * (dvc - dvp)/at_{t-1} - 1.315 * che/at_{t-1} + 3.139 * (dltt + dlc)/(dltt + dlc + seq) + 0.283 * q$$

where *ib* is the income before extraordinary items, *dp* is depreciation and amortization, *at* is the book value of a firms assets, *dvc* and *dvp* are the common and preferred dividends, *che* is the cash and short-term investment, *dltt* and *dlc* are the long-term and short-term debt, and *seq* is the shareholders’ equity.

To ensure that our results are robust, we winsorize all ratio variables at the 1% and 99% levels.

Results In Figure 1, we document zombie prevalence in the US economy. We can see that the subsidized borrowing methodology identifies fewer zombies than the other methods. ICR zombie prevalence increased rapidly starting from the late 1990s, declined substantially during the 2008 global financial crisis and shows an increasing trend in recent years. The share of total firms classified as ICR zombies has hovered around 15% in the sample. Declining zombies closely mimic the trends in ICR zombies, while we note a relatively stable proportion of growing zombies, which accounts for roughly 5% of all firms. We also note that though declining zombies as a share of ICR zombies have decreased in the current decade, it still continues to remain high constituting around 65% of ICR zombies.

Figure 2 shows the zombie prevalence in the US economy when we add the age and Tobins’ Q conditions. These criteria reflect the expectation of future profitability as seen by the market. Adding these narrows the scope of identifying firms as zombies, resulting in a decline in their share. As can be seen, the trends mimic the trend for ICR zombies.

Next, we look at zombies within a sector to understand their prevalence in various sectors of the US economy. Figure 3 depicts the proportion of zombie firms for different sectors using various definitions discussed previously. Almost all sectors show an increasing zombie

prevalence. Sectors such as manufacturing, health and services contribute the most towards the rapid rise of zombies. On an average, the proportion of zombies (based on ICR) is close to 25% in these sectors in recent years. In telecommunications, we note a decline in zombies.

Segregating the ICR zombies based on employment retention (growing versus declining zombies) also provides some crucial insights. The share of declining zombies is quite high in the manufacturing, wholesale, and services sectors, accounting for almost 15% of all firms. However, for the latter two categories, their share is increasing rapidly, particularly after the global financial crisis indicating a concentration of distressed firms in these sectors. On the other hand, for health and non-durable manufacturing, growing zombies tend to show a rising trend in recent years.

3 Survival Strategies

All firms need to generate cash to survive. Since zombies generate insufficient profits to pay their interest expense (ICR zombies specifically) they would need to generate cash from non-operating activities. In this section, we discuss the possible survival strategies adopted by zombie firms to survive. On the asset side, some of the common responses to distress are asset sale, capital expenditure reduction, and layoffs. On the liability side, restructuring of debt and raising equity or debt financing are possible.

Figure 4 shows debt issuance as a share of the total long-term assets for both non-zombies and zombies using different classifications of zombie firms. Zombie firms raise more debt as a percentage of their assets as compared to non-zombie firms. Thus, over time, zombie firms become more levered. Although declining and growing zombies follow similar trends, declining zombies have higher debt issuance as compared to growing zombies after the 2007-09 crisis. Table 2 confirms the observation from the graph and shows that zombies issue more debt compared to non-zombies. Subsidized zombies are the zombies that are able to raise debt from banks at a lower than market rate and we see that they are also able to raise more debt compared to other zombie types.

We find that zombie firms are more levered compared to non-zombie firms (Figure 5, Table 1). After the 2007-09 crisis, as deleveraging has slowed, zombie firms have locked in more resources, thereby hindering efficient allocation of resources. Even within these, declining zombies are getting more levered compared to growing zombies indicating that they are more distressed.

Figure 6 shows that equity raised as a share of assets has increased after the 2007-09 financial crisis for both zombies and non-zombies, although the ratio is higher for the former group. One interesting observation is that growing zombies seem to be able to raise equity in the markets while declining zombies cannot (Table 3). This may be because a firm which is increasing employment has profitable investment opportunities, which allows them to raise equity and increase employment.

Distressed firms may sell their assets to survive and zombies are no exception. Existing literature confirms that asset sales are a common feature of firms in distress. For instance, Asquith et al., (1994) discuss financially distressed firms that issued junk bonds engaging in asset sales. Similar results are found in Maksimovic and Phillips (1998) who also argue that industry conditions are one of the key factors for asset redeployment. Thus, we expect zombie firms to sell more assets compared to non-zombies. Table 4 confirms this pattern. We find that zombies reduce their assets when compared to non-zombies. However, this is significant only for growing zombies.

4 Exit Strategies

In a competitive market, creative destruction results in quick exit of unproductive firms and allows resources to be channeled to healthy firms. In this section we study the exit rates of all firms and compare them to the exit rate of zombies (Figure 7). We show that the exit rate of zombies is higher than the exit rates of all firms. Overall, exit rates have been declining after the 2007-09 crisis, which is one of the reasons for the increasing proportion of zombies. While the exit rates of both growing and declining zombies increased between

2007 and 2010, they have declined in recent years. Table 5 shows zombie exit probabilities for various categories. We find that for all categories other than growing zombies, the exit probability is statistically significantly higher than the exit probability of the average firm.

We also document the composition of exiting firms. Figure 8 shows the percentage of different types of zombie firms which exit the market. Declining zombies constitute almost three-fourths of all the exiting ICR zombies. Even though declining zombies constitute a higher proportion of ICR zombies, they exit more than proportionately compared to growing zombies which is indicative of the truly distressed nature of these firms.

Most firms exit the market via acquisitions, bankruptcy, or liquidation. The most common reason for exit is an acquisition or a merger, which account for 50% of all the exits. This is followed by bankruptcy (Chapter 11) and liquidation (Chapter 7) which account for 7% and 3% of all exits respectively. Liquidation is likely to fetch a low price in the market compared to takeovers. Thus, when firms start realizing their distress (asset sales), exit via takeovers might help to alleviate indirect bankruptcy costs (Eckbo, 2008). Figure 9 documents the reasons for exit for all firms and finds mergers and acquisitions to be the most prevalent reason for a firm exiting the market. A similar pattern is seen for zombies across all definitions.

Since mergers and acquisitions are the most important exit strategy, we explore the composition of firms getting merged or acquired. Figure 10 shows the percentage share of various zombie types using merger and acquisition as an exit strategy among total exiting firms. Out of all firms that are either merged or acquired around 15% belong to ICR zombies, while 10% are declining zombies. M&A of zombies seems to follow a cyclical pattern.

5 Conclusion

This paper documents the prevalence of zombie firms in the US economy and explores how they continue to survive. Zombie prevalence has increased rapidly since the late 1990s, declining during the global financial crisis and increasing again in recent years. Declining

zombies account for a large share of these zombies.

We find that zombies issue more debt compared to non-zombies. Growing zombies are also able to raise equity from the market while declining zombies fail to do so. In the absence of sources of external funds, zombies would need to exit the market. We find that the exit probability is significantly higher for all except growing zombie firms. Declining zombies have higher exit rates indicating their truly distressed nature. Out of all the reasons for exit, merger and acquisition seems to be the most common reason for exit.

Following the massive surge in debt levels and the pandemic-induced recession, recent policy proposals have been directed around state intervention by setting up bad banks to remove toxic debts from a lender's balance sheet, injecting equity directly to the business in return for restrictions on dividend payments,⁵ etc. as well as mass debt forgiveness.⁶ However, since increasing zombie concentration is driven by declining zombies in specific sectors (manufacturing, wholesale, and services), debt forgiveness for these sectors may allow declining zombies to thrive in an environment with lesser competition, adversely affecting both efficiency and employment growth. On the other hand, policies like debt restructuring or state support might help unprofitable firms in the healthcare and non-durable manufacturing sectors which have a higher proportion of growing zombies. Our study shows the importance of sector-specific targeted policies as opposed to mass debt-forgiveness policies.

⁵ See for instance: ECB pushes for Eurozone bad bank to clean up soured loans, Financial Times, April 2020: <https://www.ft.com/content/15d17d1d-8e1b-4f84-97b4-b62e6ae8f962>

⁶ See for instance: We'll need mass debt forgiveness to recover from the coronavirus, New York Magazine, <https://nymag.com/intelligencer/2020/05/coronavirus-debt-forgiveness-rent-mortgage-recession.html>

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Table 1: Summary Statistics

	Subsidized Zombies	ICR Zombies	Declining Zombies	Growing Zombies	Non-Zombies
Assets	414.59	322.53	328.77	309.38	2144.06
Market Cap	387.04	300.81	219.64	464.66	1777.59
Total Debt	9.86	10.20	11.27	8.18	3.52
Debt Issue	0.26	0.26	0.28	0.23	0.16
Equity Issue	2.47	2.49	2.14	3.20	2.26
ICR	-52.97	-57.50	-50.03	-72.88	12.95
Leverage	0.57	0.63	0.72	0.43	0.30
KZ Index	1.90	2.03	2.28	1.53	0.57
Tobin's Q	6.00	7.39	8.48	5.16	3.36

Table 2: Debt Issue by Zombies

	(1)	(2)	(3)	(4)
	Debt Issue			
Subsidized Zombie	0.060*** (0.007)			
ICR Zombie		0.021*** (0.006)		
Growing Zombie			0.014* (0.007)	
Declining Zombie				0.012* (0.006)
Tobin's Q	0.015*** (0.001)	0.015*** (0.001)	0.015*** (0.001)	0.015*** (0.001)
KZ Index	-0.001 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)
Observations	119147	119147	119147	119147
R ²	0.43	0.43	0.43	0.43
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Equity Issue by Zombies

	(1)	(2)	(3)	(4)
	Equity Issue			
Subsidized Zombie	-0.339*** (0.102)			
ICR Zombie		-0.045 (0.086)		
Growing Zombie			0.752*** (0.135)	
Declining Zombie				-0.518*** (0.077)
Tobin's Q	0.142*** (0.008)	0.142*** (0.008)	0.143*** (0.008)	0.143*** (0.008)
KZ Index	-0.003 (0.008)	-0.003 (0.008)	-0.004 (0.008)	-0.003 (0.008)
Observations	115509	115509	115509	115509
R ²	0.26	0.26	0.26	0.26
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Asset Sale by Zombies

	(1)	(2)	(3)	(4)
	Δ Asset			
Subsidized Zombie	0.101 (1.147)			
ICR Zombie		-1.452 (1.092)		
Growing Zombie			-2.186** (1.068)	
Declining Zombie				-0.085 (0.711)
Tobin's Q	1.219*** (0.271)	1.219*** (0.271)	1.218*** (0.271)	1.219*** (0.271)
KZ Index	0.104 (0.218)	0.108 (0.219)	0.107 (0.218)	0.105 (0.218)
Observations	114615	114615	114615	114615
R ²	0.12	0.12	0.12	0.12
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Zombie Exit Probability

	(1)	(2)	(3)	(4)
	Firm Exit			
Subsidized Zombie	0.022*** (0.003)			
ICR Zombie		0.031*** (0.003)		
Growing Zombie			0.002 (0.004)	
Declining Zombie				0.030*** (0.003)
Tobin's Q	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
KZ Index	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Observations	121510	121510	121510	121510
R ²	0.19	0.19	0.19	0.19
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Proportion of zombie firms using various definitions

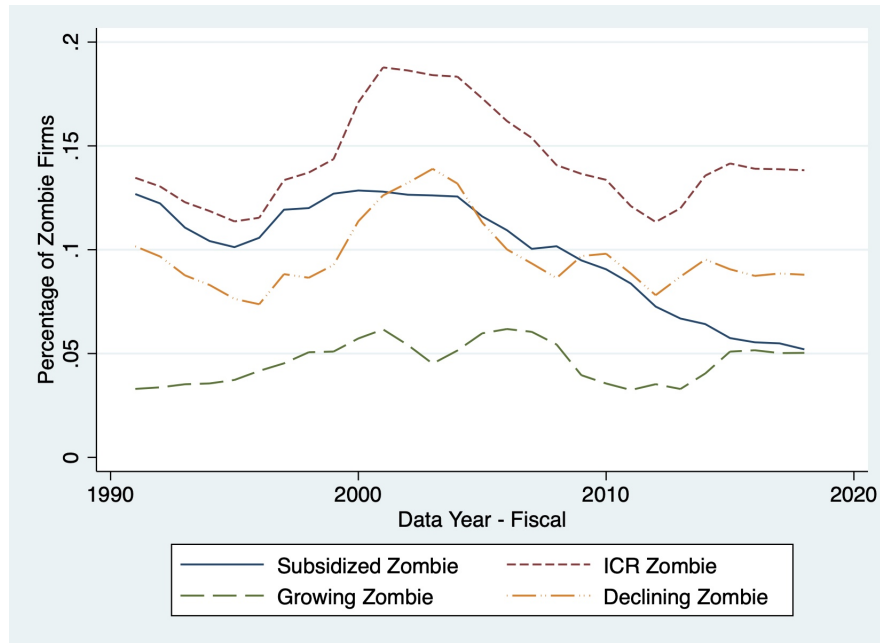


Figure 2: Proportion of zombie firms with added criteria

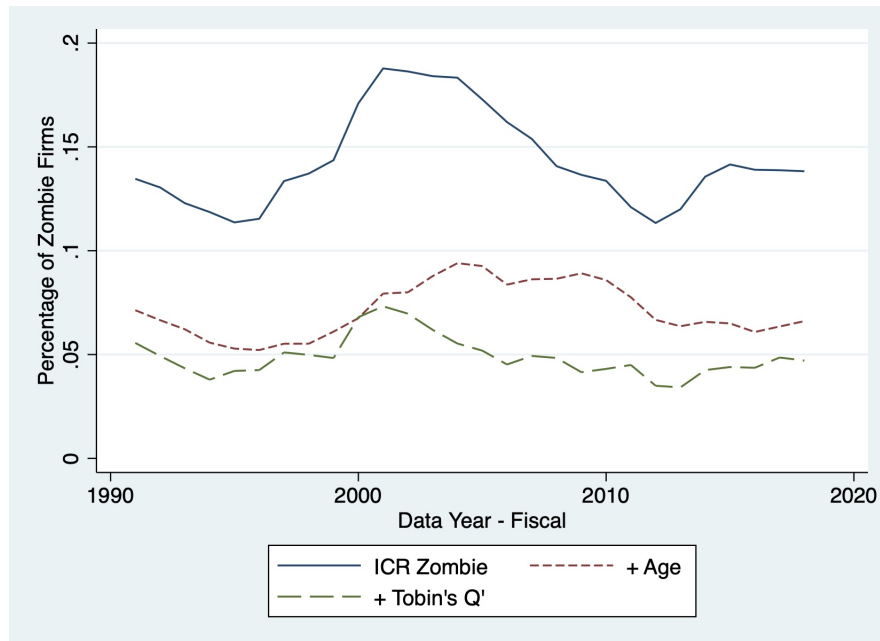


Figure 3: Sectoral analysis of zombie concentration

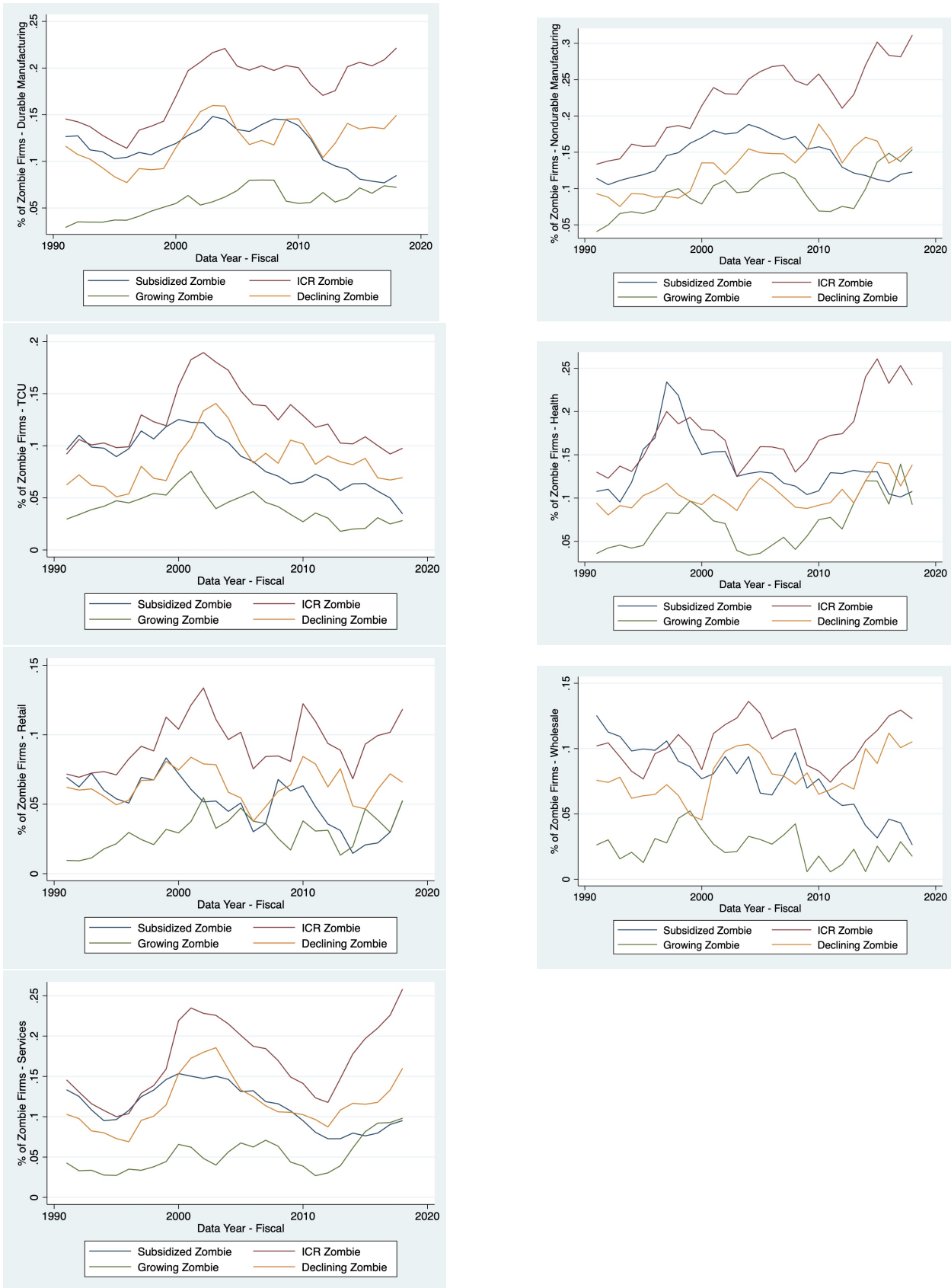


Figure 4: Debt issuance by zombies as compared to non-zombies following alternative definitions

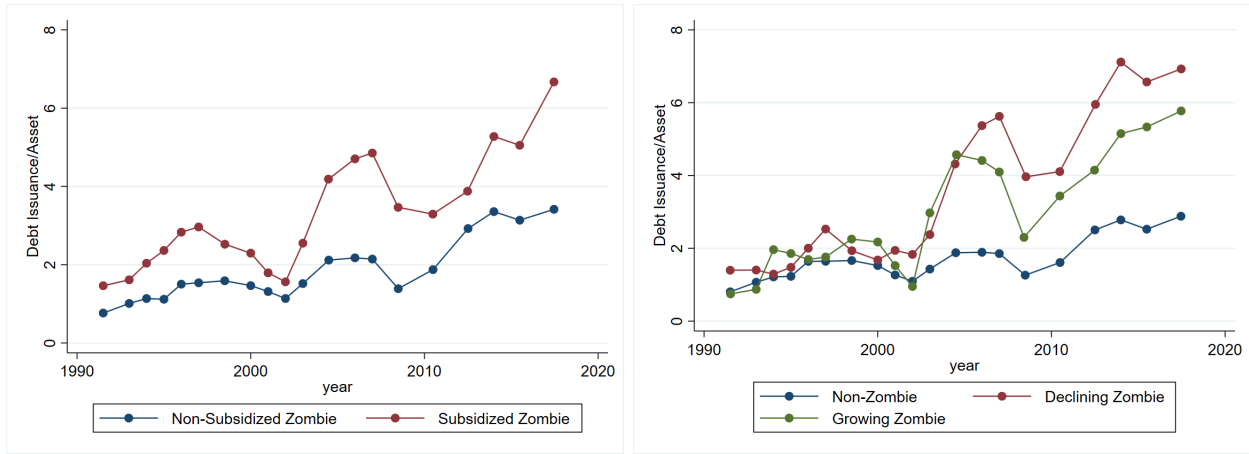


Figure 5: Leverage of zombies as compared to non-zombies following alternative definitions

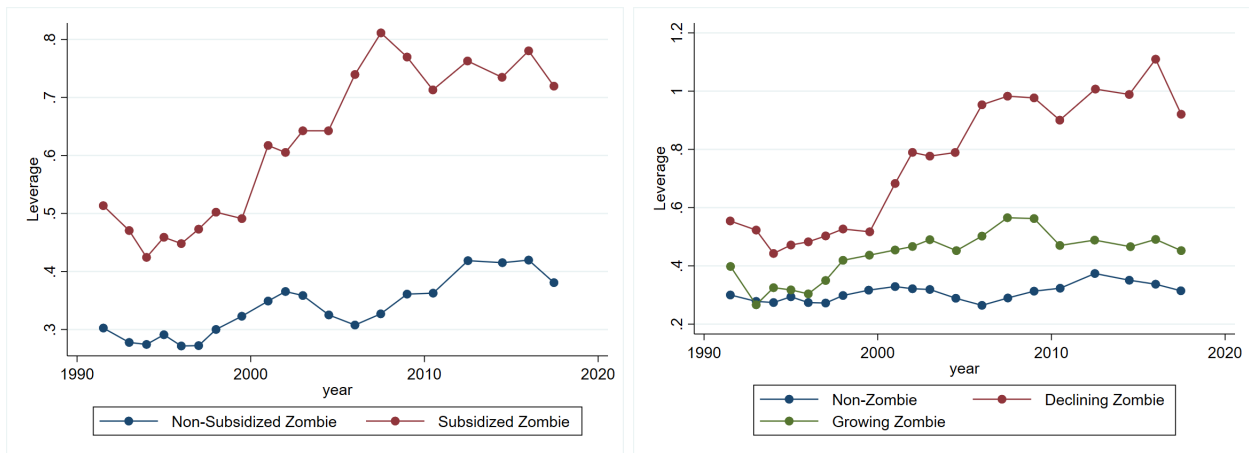


Figure 6: Equity raised by zombies as compared to non-zombies following alternative definitions

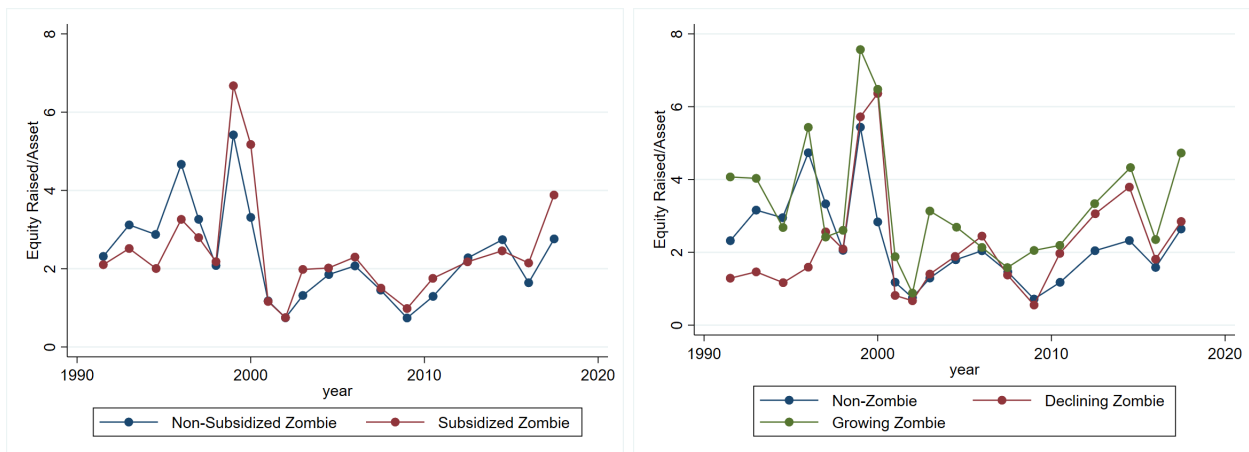


Figure 7: Exit rates of all firms and zombies

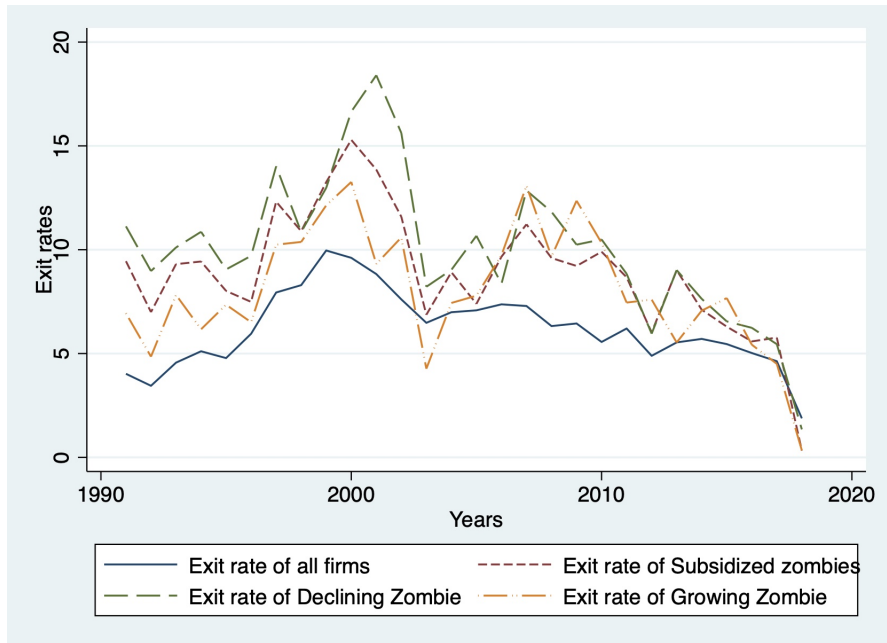


Figure 8: Composition of exiting firms

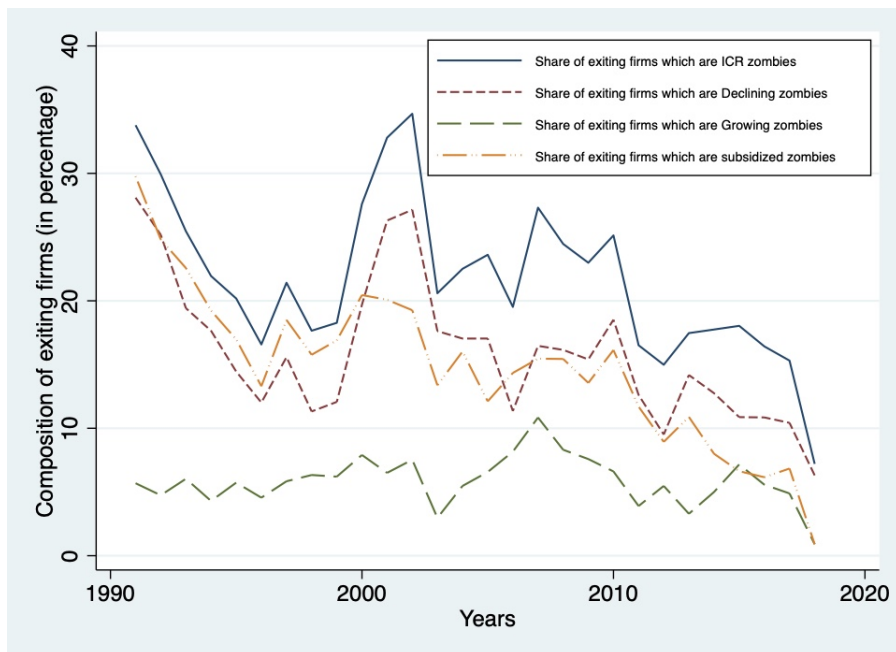


Figure 9: Reasons for exit

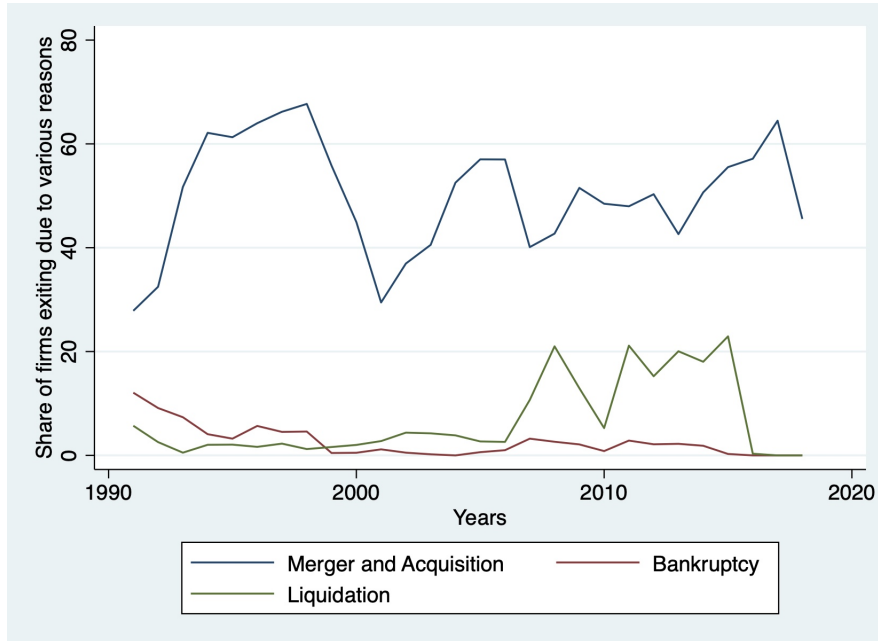


Figure 10: Percentage of exiting zombies out of all exiting firms which are either merged or acquired

