Zombie-Lending in the United States
Prevalence *versus* Relevance

Maximilian Göbel *
ISEG - Universidade de Lisboa

Nuno Tavares †
ISEG - Universidade de Lisboa

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Abstract

Extraordinary fiscal and monetary interventions in response to the COVID-19 pandemic have revived concerns about zombie prevalence in advanced economies. The literature has already linked this phenomenon – observed over the course of the last two decades – to impeding the performance of healthy firms in Japan and Europe. To make the case for the United States, we analyze banks' and capital markets' zombie-lending practices on the basis of a sample of publicly listed U.S. companies. Our results suggest that zombie prevalence and zombie-lending *per se* are not a defining characteristic of the U.S. economy. Nevertheless, we find evidence for negative spillovers of zombie-lending on productivity, capital-growth, and employment-growth of non-zombies as well as on overall business dynamism. It is predominantly the class of healthy small- and medium-sized companies that is sensitive to zombie-lending activities, with financial constraints further amplifying these effects.

Keywords: zombie lending; business dynamism; bank credit; non-viable firms; productivity

JEL Codes: D24, E24, G21, L25, O40.

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*Corresponding author. E-mail: maximilian.goebel@phd.iseg.ulisboa.pt

†E-mail: nuno.tavares@phd.iseg.ulisboa.pt

1 Introduction

The COVID-19 pandemic outbreak constitutes the single most disruptive event that the world economy has experienced since the second world war. The tremendous health and safety challenges posed by the pandemic forced governments to undertake unprecedented action to contain the spread of the disease. Many countries adopted strict lockdown policies that constrained firms in nonessential sectors to shut down completely. Policy responses designed to keep businesses afloat included public support on firms' liquidity, such as wage bills and tax relief schemes, moratoriums on credit installment payments, and credit guarantees. Although there is a large consensus about the need for measures that help to flatten the curve of corporate insolvency of otherwise viable firms, there is increasing concern that urgency measures combined with ill-designed screening schemes might have allowed resources to flow into non-viable firms commonly known as zombies Boddin et al. (2020).

The term "zombie" was first introduced by Caballero et al. (2008) in their analysis of Japan's *"lost decade"* of the 1990s and is often used to describe firms that are consistently unable to generate enough profits to meet their debt-servicing expenses. The literature on the topic has been consistent in identifying zombies and zombie-lending as drivers of productivity slowdown, either by stifling overall productivity growth or by intensifying misallocation of resources in the economy (Caballero et al., 2008; McGowan et al., 2018). The literature also points to the fact that zombie-enduced congestion contributes to declining profits of healthy firms, discouraging investment and entry of new firms (see for instance Hallak et al. (2018) for the European case). The rise of zombies is often associated with weaknesses stemming from the financial sector (Andrews and Petroulakis, 2019). Weaker banks, overflowed with doubtful assets sunken into zombies, may have strong incentives to engage in debt evergreening practices, allowing them to roll over loans instead of writing them off, thus exacerbating resource misallocation (Peek and Rosengren, 2005; Storz et al., 2017).

Extraordinary monetary stimulus and lingering crisis-driven support for small- and medium-sized enterprises (SME) was the European response to the Global Financial Crisis (GFC). Combined with institutional factors, such as poor insolvency regimes, these policies have raised concerns that non-viable firms are kept alive artificially (McGowan and Andrews, 2018). Recent events, prompted by the pandemic, have further stimulated the debate about whether these actions, although justifiable, may fuel the zombie phenomenon, as the need to act fast and decisively reduces incentives and increases the difficulty to accurately screen the creditworthiness of borrowers (Laeven et al., 2020). The U.S. economy is no exemption. The unprecedented fiscal and monetary policy support in the wake of the COVID-19 pandemic has triggered similar fears of firm zombification[1]. Favara et al. (2021) find that zombie prevalence is not widespread among private and publicly listed firms in the U.S. However, they also note that it is too early to dismiss concerns that the current economic conditions may be breeding ground for new zombie firms.

[1]See for instance: *"Here's one more economic problem the government's response to the virus has unleashed: Zombie firms"* (Washington Post, June 23, 2020); *"Pandemic debt binge creates new generation of 'zombie' companies"* (Financial Times, September 13, 2020)

The evidence from other parts of the world is rather unambiguous. Several studies on Japanese and European firms have found zombification to constrain the flourishing of non-zombies, leading to diminished growth in productivity, investment, and employment (Caballero et al., 2008; McGowan et al., 2018; Andrews and Petroulakis, 2019; Acharya et al., 2019). Others go even further by noting that zombie prevalence interferes with an efficient transmission of monetary policy (Acharya et al., 2020). Despite these findings, little evidence has been brought to bear about the influence of zombies and, in particular zombie-lending, on economic outcomes in the U.S.[2] In this paper, we intend to address this gap by analysing potential spillovers of zombification – and zombie-lending – on productivity, investment, employment-growth, and business entry dynamics. We merge firm-level data of publicly listed firms, sourced from Compustat and Capital IQ for the 2002-2019 period, to identify non-viable firms and their debt structure. This data set allows us to not only distinguish between debt, intermediated by banks, and credit, taken up via capital markets, but to also discriminate between short- and long-term funding.

Our contribution to the literature on zombification is threefold: First, we provide an overview of the degree of zombie prevalence in the U.S. economy. We identify zombie firms using common definitions proposed in the related literature. Specifically, we construct two alternative measures of zombie identification, a broader version that operationalizes the concept based on McGowan et al. (2018), and a narrower version that includes expectations about future profitability (Banerjee and Hofmann, 2018). Both definitions reveal a steady increase in the share of zombie firms in the U.S. dating back to the mid-'90s. After peaking during the GFC, the share of zombies started to dwindle from 2010 onwards, although still far from pre-crisis levels. Yet, zombie prevalence does not seem to be a defining feature in the U.S., particularly if we use more stringent and demanding criteria to access the zombie status of firms. Our second contribution answers the question whether the lack of prevalence translates into the irrelevance of zombies when it comes to economic outcomes? Our results suggest it does not. We find negative spillover effects of zombie-lending on the performance of healthy companies, emerging both from public debt markets as well as from capital intermediated via the traditional bank-lending channel. The impact is most pronounced for small- and medium-sized firms, corroborating the findings in Banerjee and Hofmann (2020). Bank-dependency and not having access to capital markets further amplify the negative effects, suggesting financial constraints to be a catalyst of zombie-lending. Lastly, our findings add to the literature on business dynamism. The results suggest that inflows of zombie-credit from the banking sector interfere with entry and exit dynamics at the two-digit NAICS industry level.

The remainder of this paper is organized as follows. Section 2 discusses relevant literature on the topic. In Section 3 we describe our datasets and report firm-level financial fundamentals. In section 4 we present and discuss both measures used to identify zombies. Section 5 outlines our empirical approach and our chieftain results. Section 6 concludes.

[2] Banerjee and Hofmann (2020) include the United States in their analysis of zombification in 14 advanced economies, but focus more on the life cycle of zombies across several countries than on the micro- and macroeconomic consequences of zombification – and in particular lending to zombies.

2 Literature Review

The debate about zombie firms can be traced back to Caballero et al. (2008) who first introduced the concept in their study on Japan's *"lost decade"*. They argue that the prevalence of this type of firm depressed market prices and increased wages relative to productivity, preventing healthy firms from flourishing by stifling the creative destruction process. Building upon this work, a recent series of papers have tracked the zombie phenomenon among OECD countries. For instance, Banerjee and Hofmann (2020) describe the life cycle of zombies across 14 advanced economies – which also comprises the United States. In their sample of listed companies, zombies make up about 6%-7% of total assets, capital and debt and is found to be a particularly widespread phenomenon among SMEs. Although a large proportion of zombies can eventually recover, they remain weaker and more fragile than their peers, which have never been classified as non-viable. Despite the aggregate numbers appearing to be minor, the authors warn against the perception that zombie prevalence won't have a saying in the future trajectory of the economy. McGowan et al. (2018) show that the prevalence of resources sunk in zombie firms have risen since the mid-2000s and that the increasing survival of these low productivity firms at the margins of exit congests markets and constrains the growth of more productive firms. Furthermore, they show that a higher share of industry capital sunk in zombie firms lowers investment and employment growth of the typical non-zombie firm. Similarly, Acharya et al. (2020) conclude that zombie-lending results in a misallocation of capital that culminates in lower product prices, productivity, investment, and value added. We add to this literature by, firstly, providing a general description of zombie prevalence in the United States under various classification schemes, and secondly, by discussing the implications of zombie-lending – both from the banking sector and via capital markets – for the performance of non-zombies.

A defining feature of the literature on zombies relates to the problem of identification using firm-level data. Whereas, in economic terms, zombies can be defined as non-viable firms that would exit the market in the absence of frictions, the operationalization of the concept is not straightforward. For instance, Caballero et al. (2008) consider a firm to be a zombie if it has continued access to financial support from their creditors, despite their poor performance in terms of profitability. To make this definition operational, the authors compare the interest rate paid by the firm with a benchmark rate applied to high-quality borrowers. Those firms that present a negative interest gap receive subsidized credit and are thus classified as zombies. This method, although feasible, is very demanding in terms of data that is rarely available. A similar approach to zombie-firm classification can be found in Acharya et al. (2019, 2020). Alternatively, a definition that is often used as a benchmark definition (McGowan et al., 2018; Banerjee and Hofmann, 2018; Andrews and Petroulakis, 2019), only requires knowledge of a firm's age and its interest coverage ratio (ICR). This zombie metric is less demanding in terms of data availability, though Andrews and Petroulakis (2019) still remark poor coverage of a firm's interest expenses in certain data sets. To get around a potentially sparsely populated ICR, the literature also classifies a firm as being a zombie, if – over three consecutive years – the firm reports a low debt-service capacity, and either negative return on assets (ROA) or negative capital-growth (Storz et al., 2017; Andrews and Petroulakis, 2019). In Section 4, we discuss the implication of using a firm's age and its ICR as the defining features in the U.S. case and argue in favor of a slight modification.

Another strand of the literature, which our underlying data does not allow us to follow up on, addresses the motivation to engage in zombie-lending from a lender's perspective. On the one hand, institutional bottlenecks such as poor insolvency regimes are found to be important enablers of zombification (McGowan et al., 2017), constituting a mix which aggravates the macroeconomic effects of corporate credit booms going bust (Jordà et al., 2020). On the other hand, an increasing body of literature links the frailties of the financial sector to the rise of zombies. Early work by Peek and Rosengren (2005) already found that weaker firms were more likely to receive additional credit, because troubled Japanese banks were incentivized to allocate funds to severely impaired borrowers in order to avoid the realization of losses on their own balance sheets. Observing lender-borrower relationships in Italy, Schivardi et al. (2021) find that undercapitalized banks were less likely to cut credit to zombie firms, whereas for the broader European case, Andrews and Petroulakis (2019) show that non-viable firms are more likely to be connected to weak banks, suggesting that zombie prevalence in Europe may at least partly stem from bank forbearance. In spite of growing regulatory pressure, there is evidence that zombie-lending remains widespread, even in developed countries (Bonfim et al., 2020).

Lastly, we add to the literature on business dynamism by examining the link between zombie-lending and the rate of entrance at the industry-level. Studying zombie firms and specifically *"zombie-credit"* in Europe, Acharya et al. (2020) find that increased lending to zombies hampers the cleansing effect in the economy, i.e. the replacement of non-viable firms by new entrants. We find similar effects for the U.S., with the main spillovers emerging from bank-related zombie-lending. We also find support for a working hypothesis – also outlined in Acharya et al. (2020) – explaining one channel through which zombie-lending compromises market entry.

Before turning to the empirical analysis, the next two sections provide further details on the characteristics of the data we use.

3 Data

Our empirical analysis is based on annual firm-level observations of publicly traded U.S. companies. For information on companies' balance sheets we resort to Compustat's annual files and while Standard & Poor's Capital-IQ (CapIQ) database is our source for companies' debt instruments. The benefit of these two databases is the one-to-one mapping between the debt instruments listed in CapIQ and the company's fundamentals in Compustat's annual files. The drawback of CapIQ is its poor coverage prior to 2002, which shrinks our effective sample size to 18 years between 2002-2019.[3]

[3] Another source of information about a company's lending-relationships is *DealScan*, which reports syndicated loan arrangements, and allows to identify both borrower and lender. However, a direct mapping between DealScan and Compustat is not given without a little detour. Further, syndicated loan agreements usually come with large face-values. As further analyses will show, zombie-firms are rather small compared to their peers in the Compustat sample. Thus, the analysis of data from DealScan has shown that zombies (even when following along our most generous zombie-definition) are only sparsely represented.

We consider all firms in the Compustat database with an identifier $fic = USA$. Furthermore, we exclude sectors with NAICS codes 11, 22, 52, 55, 81, and 92. We deflate financial variables by the industry-specific producer price index derived from $KLEMS$[4] with base year 2002.[5]

3.1 Company Financials

Our goal is to evaluate the spillovers of zombie-lending on non-zombies. To measure the relative performance of non-zombies, we focus in particular on productivity, capital- and employment-growth. Appendix A.2 describes the computation of Total Factor Productivity (TFP) and Appendix A.2 contains a description of the variables used in the empirical part of the paper.

3.2 Debt Contracts

The use of Standard and Poor's Capital-IQ (CapIQ) database allows us to observe both the extent of bank-related credit intermediation in the form of Bank-/Term-Loans (BL) and Revolving Credit Facilities (RC), and information on firms' financing operations via capital markets in the form of Bonds and Notes (BN). Table 3 shows the total number of debt contracts differentiated by the type of debt and maturity at the date of origination. Overall, BN account for more than 60% of all observed debt contracts, making it a vital component when trying to paint a comprehensive picture of firm-level debt financing. In contrast to other studies on zombie-lending in Europe (McGowan et al., 2018; Andrews and Petroulakis, 2019; Schivardi et al., 2021), our data set allows us to not only differentiate between bank-intermediated debt and other debt securities, but also to distinguish between short- and long-term funding.

Before proceeding to the empirical analysis, some further pre-processing steps are necessary. First, we compute $BC_{i,t}$ as the amount of bank-credit being granted to firm i in year t as the sum of Bank-/Term Loans $BL_{i,t}$ and Revolving Credit $RC_{i,t}$. From now on, we will thus only distinguish between bank-credit, $BC_{i,t}$, and credit taken on via public debt markets in the form of bonds and notes $BN_{i,t}$. Throughout the empirical analysis of Section 5, the main (explanatory) variable of interest is the industry-share of new debt being granted to zombies in year t.[6] Therefore, we define $BC_{s,t}$ and $BN_{s,t}$ as the *share* of newly granted credit to industry s in year t sitting with zombies, as follows:

$$L_{s,t} = \frac{\sum_{i \in S} L^{Z}_{i,t}}{\sum_{i \in S} L^{Z}_{i,t} + L^{NZ}_{i,t}}, \qquad \text{for } L = BC, BN \quad ,$$

where S spans the set of two-digit NAICS industries, Z is the zombie indicator and NZ the

[4]Source: bea.gov

[5]We do not winsorize the data or omit any percentiles in our empirical analysis.

[6]In CapIQ, debt obligations are identified via their *componentid*. Existing debt obligations only get assigned a new *componentid* if their contract details have changed. However, the same *componentid* may occur multiple times in a company's financial statements if, for example, a downpayment has been made. Henceforth, we only count the reporting of $BL_{i,t}$, $RC_{i,t}$, or $BN_{i,t}$ in year t, if its *componentid* has not appeared in any year before t in firm i's filings.

non-zombie indicator respectively. To reduce the number of reporting errors in the data, we only include an observation, if its face value does not exceed the borrower's total debt, as reported in the Compustat filings.[7]

Lastly, Table 3 shows that the majority of new debt obligations features a maturity of less than 10 years. We therefore differentiate between short-term credit as debt obligations with a maturity of less than one year and long-term credit as those with a maturity of more than one but less than 10 years at the date of origination.

4 "Zombies" – Non-Viable Firms

Though the issue of zombie prevalence has been discussed in previous studies already, the literature does not provide a uniform definition of a "zombie-firm", but deploys various classification schemes – also depending on data availability.[8] In this section, we will discuss two prominent definitions, which require a small number of financial variables and are compatible with our data set.

4.1 The Broader Definition

Our first approach to separate non-viable firms ($Z_{i,t}$) from their healthy peers ($NZ_{i,t}$), follows McGowan et al. (2018); Banerjee and Hofmann (2018); Andrews and Petroulakis (2019) and defines a zombie as a firm that (I) has reported an Interest Coverage Ratio ($ICR_{i,t} = XINT_{i,t}/EBITDA_{i,t}$)[9] bigger than one for three consecutive years, and (II) is at least 10 years of age. We refer to firms, identified as zombies according to this definition, as Z^{BROAD}. Banerjee and Hofmann (2018) raise the concern that this definition is not stringent enough to single out those companies, which experience temporary difficulties, but which are generally perceived to have encouraging growth prospects. In their sample, the median Tobin's Q – a proxy for expected future profitability as perceived by stock market participants – of zombies is higher than the non-zombie counterpart.

4.2 A Narrower Definition

Banerjee and Hofmann (2018) extend the previous (broader) zombie-definition (Z_t^{BROAD}) by accounting for a firm's growth potential. Recall that our prevailing definition of firm i being a zombie is based on two requirements: (I) a firm's ICR over the past three years has not fallen below 1 and (II) the firm is at least 10 years of age. Banerjee and Hofmann (2018) augment this definition by requiring that (III) a firm's *Tobin's Q* in a given year t ranges below the industry-median.[10] Let us define the set of companies, meeting all three requirements in a given year t, as $Z^{NAR.X}$.

[7] Table 10 in Appendix A.3 documents the corresponding acceptance rates.

[8] For definitions different from the ones used in this paper, see for example Caballero et al. (2008), Acharya et al. (2019), Andrews and Petroulakis (2019).

[9] $XINT$ = Interest and Related Expense Total and $EBITDA$ = Earnings Before Interest, Taxes, Depreciation, and Amortization

[10] We define an industry via two-digit NAICS codes.

Nonetheless, this more conservative definition does not come without costs, and if adopted without further considerations, introduces non-negligible distortions. The first issue arising from $Z^{NAR.X}$ is a potential decline in the total number of companies. This stems from the sparsity of *Tobin's Q*, which shrinks the set of companies being eligible for classification. This reduced set of observations also alters the characteristics of zombies and non-zombies. Table 1 compares company fundamentals for the two zombie-definitions Z^{BROAD} and $Z^{NAR.X}$. Under the narrow definition, zombies are on average more productive, larger, less indebted, and more profitable than zombies under the broader measure.

An explanation for this puzzle can be found in Bargagli Stoffi et al. (2020), who detect a positive correlation between a firm's failure and it holding back financial information. Similar to Bargagli Stoffi et al. (2020), we compute a binary variable for a firm's exit ($E_{i,t}$), which equals 1 in the year prior to its liquidation, and zero otherwise. Another binary variable ($V^B_{i,t}$), is set to 1 in year t if $E_{i,t} = 1$ and if a certain financial variable of interest (V) – e.g. *Tobin's Q* or *Interest Expenses* – was missing at least once in the current or preceding two years. Using $V = \{\text{Tobin's Q}, \text{ Interest Expenses}\}$ we get a correlation of $Cor\left(E, V^B\right) = 0.55$ in the case of *Tobin's Q* and $Cor\left(E, V^B\right) = 0.49$ in the case of *Interest Expenses*. These numbers suggest that firms are either more reluctant or less capable of reporting information necessary to calculate their *Tobin's Q* than reporting *Interest Expenses* in the three years prior to their passing. Thus, conditioning our definition of zombies on the more restrictive definition, which includes *Tobin's Q*, mechanically excludes not only potential zombies but literally *non-viable* firms from the sample.

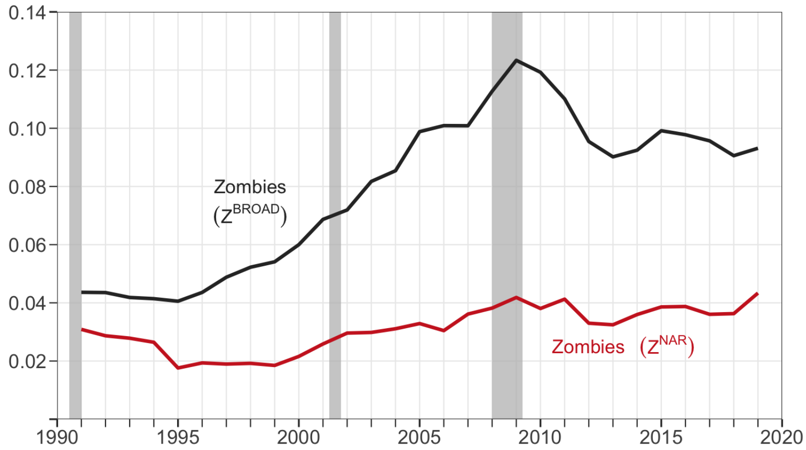
Despite its reasonable theoretical underpinnings, the inclusion of *Tobin's Q* as an additional criterion for classifying zombies, ultimately falls short of capturing the most distressed firms. We therefore modify $Z^{NAR.X}$ as follows: we classify a firm as a zombie in year t, if it either complies with all three requirements of the narrow definition or if it fails to report *Tobin's Q* in year t. We call the set of firms complying with this extended narrower definition Z^{NAR}. Table 2 shows summary statistics for Z^{NAR} for several company fundamentals over the period 2002 and 2019. Zombies are on average less productive than their viable counterparts, smaller – both in terms of assets and employees – and operate with less leverage. Figure 1 provides an overview of zombie-prevalence since the early 1990s under the two zombie definitions Z^{BROAD} and Z^{NAR}. The differences are remarkable, peaking at about eight percentage points at the end of the Great Recession. Though, both definitions share a steady upward trend starting in the mid 1990s and ending during the financial crisis of 2007 through 2009, and a decline thereafter.

Table 1: Summary Statistics – Full Sample: 2002-2019

	Mean				Median				Units
	$\text{All}^{\text{BROAD}}$	$\text{All}^{\text{NAR.X}}$	Z^{BROAD}	$Z^{NAR.X}$	$\text{All}^{\text{BROAD}}$	$\text{All}^{\text{NAR.X}}$	Z^{BROAD}	Z^{NAR}	
TFP	0.03	0.04	-0.30	-0.20	0.10	0.10	0.08	0.10	
Assets	2.52	2.58	0.21	0.29	0.19	0.19	0.01	0.03	Bill. USD
Sales	2.08	2.14	0.19	0.16	0.15	0.15	0.00	0.01	Bill. USD
(Book) Leverage	2.45	2.61	13.18	0.23	0.22	0.21	0.22	0.13	
Asset Tangibility	0.24	0.24	0.17	0.19	0.14	0.14	0.07	0.08	
CapX / Assets	0.06	0.06	0.05	0.02	0.03	0.03	0.01	0.01	
ROA	-6.44	-6.99	-22.73	-0.30	0.00	0.01	-0.40	-0.18	
Value Added	656.38	645.52	94.15	28.81	43.85	41.63	-1.44	-0.49	Mill. USD
Age	17.14	18.40	19.48	20.90	12.61	14.11	17.33	17.81	Years
Employees ($\times 10^3$)	9.12	9.02	1.62	0.93	0.72	0.69	0.05	0.09	
	IQR				SD				Units
	$\text{All}^{\text{BROAD}}$	$\text{All}^{\text{NAR.X}}$	Z^{BROAD}	$Z^{NAR.X}$	$\text{All}^{\text{BROAD}}$	$\text{All}^{\text{NAR.X}}$	Z^{BROAD}	Z^{NAR}	
TFP	0.51	0.51	0.96	0.67	0.92	0.92	1.49	1.23	
Assets	1.07	1.09	0.05	0.10	12.22	12.65	1.28	1.17	Bill. USD
Sales	0.90	0.91	0.03	0.06	10.36	10.77	2.21	0.70	Bill. USD
(Book) Leverage	0.42	0.39	0.72	0.36	61.25	64.02	147.80	0.27	
Asset Tangibility	0.31	0.31	0.20	0.22	0.25	0.25	0.24	0.24	
CapX / Assets	0.05	0.05	0.03	0.02	0.30	0.31	0.33	0.06	
ROA	0.30	0.29	0.96	0.32	255.61	267.23	413.47	0.54	
Value Added	308.25	300.16	7.37	9.65	042.25	2982.30	1669.80	233.88	Mill. USD
Age	17.94	18.12	10.39	11.75	15.33	15.30	8.78	10.38	Years
Employees ($\times 10^3$)	4.52	4.41	0.16	0.28	46.55	46.17	22.20	5.02	

Notes: For each year in the sample, we first compute the cross-sectional mean, median, IQR, and SD, and then compute the each time-series' average for each metric. See the Appendix for the computation of each variable.

Figure 1: Zombie Prevalence under Different Zombie-Definitions



Notes: Shaded areas mark NBER recessions.

Table 2: Summary Statistics – Full Sample: 2002-2019

	Mean			Median			Units
	All	Z^{NAR}	Non-Zombies	All	Z^{NAR}	Non-Zombies	
TFP	0.04	-0.20	0.04	0.10	0.10	0.10	
Assets	2.52	0.40	2.60	0.19	0.03	0.20	Bill. USD
Sales	2.08	0.43	2.14	0.15	0.01	0.17	Bill. USD
(Book) Leverage	2.45	0.69	2.52	0.22	0.13	0.22	
Asset Tangibility	0.24	0.19	0.24	0.14	0.08	0.15	
CapX / Assets	0.06	0.02	0.06	0.02	0.01	0.03	
ROA	-6.44	-0.01	-6.68	0.00	-0.18	0.01	
Value Added	656.38	250.95	672.16	43.85	-0.46	51.34	Mill. USD
Age	17.14	20.94	17.00	12.61	18.06	12.17	Years
Employees ($\times 10^3$)	9.12	3.86	9.32	0.72	0.10	0.82	
	IQR			**SD**			**Units**
	All	Z^{NAR}	Non-Zombies	All	Z^{NAR}	Non-Zombies	
TFP	0.52	0.66	0.51	0.92	1.22	0.91	
Assets	1.07	0.11	1.14	12.22	1.88	12.44	Bill. USD
Sales	0.90	0.06	0.95	10.36	3.47	10.52	Bill. USD
(Book) Leverage	0.42	0.38	0.42	61.25	4.48	62.27	
Asset Tangibility	0.31	0.24	0.31	0.25	0.25	0.25	
CapX / Assets	0.05	0.02	0.05	0.30	0.06	0.31	
ROA	0.30	0.32	0.29	255.62	5.43	260.25	
Value Added	308.25	9.88	329.17	3042.25	2659.61	3035.65	Mill. USD
Age	17.94	11.78	18.22	15.33	10.34	15.46	Years
Employees ($\times 10^3$)	4.52	0.30	4.82	46.55	35.48	46.68	

Notes: For each year in the sample, we first compute the cross-sectional mean, median, IQR, and SD, and then compute the each time-series' average for each metric. See the Appendix for the computation of each variable.

4.3 "Zombie"-Lending

So far, many empirical studies (Schivardi et al., 2021; McGowan et al., 2018; Andrews and Petroulakis, 2019; Schivardi et al., 2020) have evaluated the effect of zombie-prevalence and/or zombie-lending in the Euro Area. This study shifts the focus onto the United States.

Our empirical analysis focuses mainly on the implications of zombie-lending for the performance of non-zombies. Zombie-lending can occur in the form of increased credit supply and/or reduced costs of funding (Acharya et al., 2021). While the latter has attracted heightened attention in the literature[11], our analysis targets the former, i.e. supply of credit to non-viable firms.

As outlined in Section 3.2, CapIQ allows us to differentiate among different types of debt and different maturities. Sticking with our two zombie-definitions, Table 3 provides an overview of the overall number of new BL, RC, and BN filings, split into several maturity bins. It is immediately apparent that the number of observations associated with zombie-lending decreases significantly when shifting from the broader zombie-definition Z^{BROAD} in the lower panel to Z^{NAR}, shown in the upper panel. Overall, BN also make the bulk of zombie-lending with about 54% under Z^{NAR} and 64% under Z^{BROAD} of total observations reported by zombies. In terms of bank-credit, zombies – other than their non-zombie counterparts – rely more heavily on BL than on RC. Zombies seem to prefer debt with a maturity of two to five years, followed by short-term contracts of up to one year, which is most often associated with the intention to cover working capital needs (Amberg and Jacobson, 2021). This stands in contrast to non-zombies, for which debt with maturities of 2 to 5 years and 5 to 10 years seem to be the favored contracts.

Before turning to the empirical analysis, it is worth having a look at the share of total lending being granted to zombie firms. The upper panel in Figure 2 shows this fraction for the three types of debt across different maturity buckets when applying the Z^{NAR}-definition. The graphs leave little ground for arguing that overall zombie-lending consumes a major part of the overall lending-pie, which is in line with the observations in Favara et al. (2021).

Though, previous summary statistics have shown that zombies are rather small in size compared to the other companies in the Compustat sample. When it comes to lending, zombies may thus not necessarily compete with large but rather small- and medium sized companies. For this reason, the lower panel in Figure 2 shows the amount of zombie-credit relative to the total amount of debt granted to firms with less than 1,000 employees (SMEs). Within this size-category, zombie-lending is much more prevalent with shares rising to levels of up to 40% of newly granted credit.

These simple descriptive results already provide valuable insights for the upcoming empirical analysis: looking at the entire sample of Compustat firms may indeed reveal zombie-lending to not have any significant economic impact. For the class of small- and medium-sized companies, however, this perception may change. In the following section, we will evaluate these observations more formally.

[11] See Acharya et al. (2021) for a more comprehensive overview of related studies.

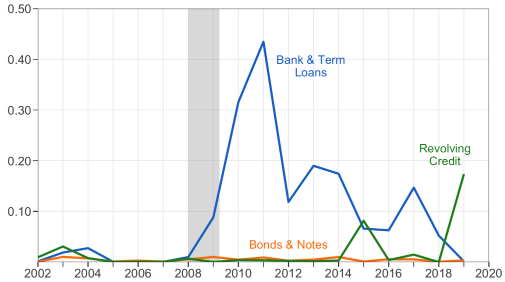
Table 3: Total Number of Debt Obligations and their Maturities – Full Sample: 2002-2019

	Zombie-Definition: Z^{NAR}											
	Bank/Term Loans			Revolving Credit Facility			Bonds and Notes			Total		
	All	Zombies	Non-Zombies	All	Zombies	Non-Zombies	All	Zombies	Non-Zombies	All	Zombies	Non-Zombies
1Q $\leq m \leq$ 4Q	13,687	505	13,182	16,665	601	16,064	31,751	976	30,775	63,015	2082	60,933
5Q $\leq m \leq$ 8Q	9,569	402	9,167	12,221	463	11,758	26,277	754	25,523	48,445	1,619	46,826
9Q $\leq m \leq$ 20Q	28,035	916	27,119	32,255	540	31,715	68,250	1,667	66,583	129,266	3,123	126,143
21Q $\leq m \leq$ 40Q	16,645	391	16,254	15,858	174	15,684	68,491	927	67,564	101,284	1,492	99,792
41Q $\leq m \leq$ 100Q	3,881	142	3,739	2,212	43	2,169	31,603	414	31,189	37,716	599	37,117
101Q $\leq m \leq$ 120Q	304	21	283	72	0	72	11,837	47	11,790	12,213	68	12,145
121Q $\leq m \leq$ 200Q	179	44	135	13	0	13	2,464	182	2,282	2,656	226	2,430
Total	72,300	2,421	69,879	79,296	1,821	77,475	240,673	4,967	235,706	394,595	9,209	385,386

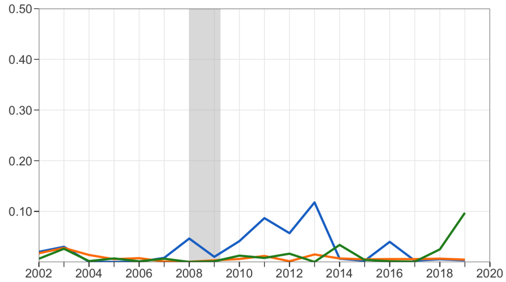
	Zombie-Definition: Z^{BROAD}											
	Bank/Term Loans			Revolving Credit Facility			Bonds and Notes			Total		
	All	Zombies	Non-Zombies	All	Zombies	Non-Zombies	All	Zombies	Non-Zombies	All	Zombies	Non-Zombies
1Q $\leq m \leq$ 4Q	13,687	1,538	12,149	16,665	1,312	15,353	31,751	6,003	25,748	63,015	8,853	54,162
5Q $\leq m \leq$ 8Q	9,569	1,111	8,458	12,221	964	11,257	26,277	3,644	22,633	48,445	5,719	42,726
9Q $\leq m \leq$ 20Q	28,035	2,211	25,824	32,255	1,311	30,944	68,250	5,400	62,850	129,266	8,922	120,344
21Q $\leq m \leq$ 40Q	16,645	922	15,723	15,858	450	15,408	684,91	1,990	66,501	101,284	3,362	97,922
41Q $\leq m \leq$ 100Q	3,881	213	3,668	2,212	66	2,146	31,603	689	30,914	37,716	968	36,748
101Q $\leq m \leq$ 120Q	304	22	282	72	0	72	11,837	73	11,764	12,213	95	12,118
121Q $\leq m \leq$ 200Q	179	47	132	13	0	13	2,464	187	2,277	2,656	234	2,422
Total	72,300	6,064	66,236	79,296	4,103	75,193	240,673	17,986	222,687	394,595	28,153	366,442

Notes: We show the total number of newly reported debt obligations in company filings in Compustat's Capital-IQ database in the years 2002-2019. The left-most columns shows the different maturity bins.

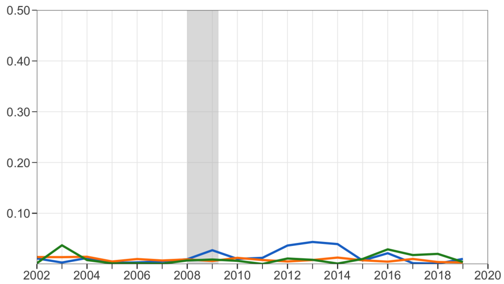
Figure 2: Share of Newly Granted Credit Sunk with Zombies – Zombie-Definition Z^{NAR}



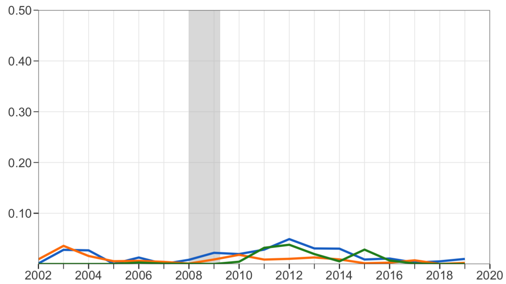
(I) $1\text{Q} \leq m \leq 4\text{Q}$



(II) $5\text{Q} \leq m \leq 8\text{Q}$

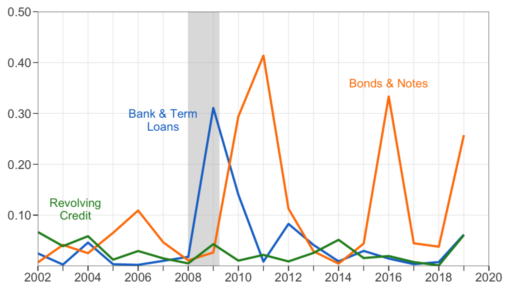


(III) $9\text{Q} \leq m \leq 20\text{Q}$

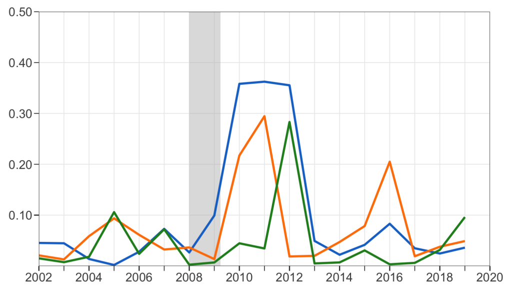


(IV) $21\text{Q} \leq m \leq 40\text{Q}$

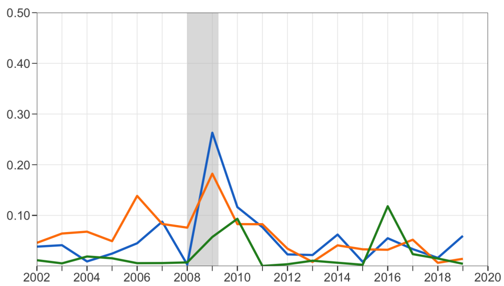
(a) Full Sample



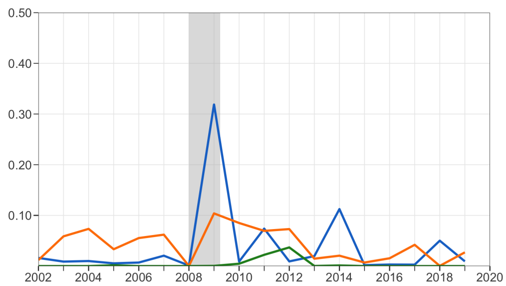
(I) $1\text{Q} \leq m \leq 4\text{Q}$



(II) $5\text{Q} \leq m \leq 8\text{Q}$



(III) $9\text{Q} \leq m \leq 20\text{Q}$



(IV) $21\text{Q} \leq m \leq 40\text{Q}$

(b) Small- & Medium-Sized Companies

Source: Compustat and author's calculations. The shaded areas mark NBER recessions. We show the fraction of zombie-lending, i.e. the share of total first-time reported debt-obligations in year t, which were granted to zombie-firms. We show BL in *blue*, RC in *green*, and BN in *red*.

5 Empirical Evidence on Zombie-Lending in the U.S.

Over the past decade, advanced economies have experienced a period of low productivity growth. Recent research has linked this phenomenon to factors such as widening productivity dispersion across firms (Andrews et al., 2016), rising capital misallocation (Gopinath et al., 2017), subdued growth of non-zombies relative to zombies (Schivardi et al., 2021) and declining business dynamism (Decker et al., 2017).

Previous sections may have conveyed the impression that zombie prevalence might not be a defining feature within our set of publicly listed U.S. companies. This does however not rule out the potential for zombification and zombie-lending to affect – adversely or not – the performance of their non-zombie peers. In what follows, we test this hypothesis by targeting explicitly the root of zombie prevalence, namely the funding of non-viable firms. In particular, we assess the extent to which the share of fresh credit, granted to zombie-firms of a given industry s, affects productivity, capital-growth, and employment of their non-zombie peers. As described in Section 3, we allow for two types of credit: the first subsumes the sum of bank- and term-loans (BL) and revolving credit facilities (RC) under the notion of bank credit (BC); the second type captures credit taken up via capital markets in the form of bonds and notes (BN). We further differentiate between short-term contracts with a maturity of up to four quarters, and long-term debt, i.e. contracts with a maturity of more than one, but not exceeding ten years upon origination. As the upcoming sections will show, this differentiation uncovers the heterogeneity in the sensitivity of non-zombies' performance to the maturity structure of zombie-credit.

The remainder of this section is structured as follows: in Section 5.1 we assess the relationship between zombie-lending and its implications for productivity, and capital- and employment-growth of non-zombies. In Sections 5.1.1, 5.1.2, and 5.1.3, we assess each performance measure more in-depth by splicing the group of non-zombies into more granular subgroups. Section 5.2 concludes our empirical analysis by inspecting the consequences of zombie-lending for business dynamism.

5.1 Zombie-Lending and Non-Zombie Performance

We begin our empirical analysis by evaluating the spillovers of zombie-lending on the performance of non-zombies. As mentioned previously, we proxy "performance" by productivity, i.e. Total Factor Productivity (TFP), capital-growth, and employment-growth. We deploy the following models to describe these relationships for both short-term and longer-term zombie-credit:

$$TFP_{i,t} = \mathbb{X} + \beta_{BC}\ NZ_{i,t-1} \times BC^{Z}_{s,t-1} + \beta_{BN}\ NZ_{i,t-1} \times BN^{Z}_{s,t-1} + \varepsilon_{i,t} \tag{1}$$

$$\Delta log\left(K_{i,t}\right) = \mathbb{X} + \beta_{BC}\ NZ_{i,t-1} \times BC^{Z}_{s,t-1} + \beta_{BN}\ NZ_{i,t-1} \times BN^{Z}_{s,t-1} + \varepsilon_{i,t} \tag{2}$$

$$\Delta EMP_{i,t} = \mathbb{X} + \beta_{BC}\ NZ_{i,t-1} \times \Delta log\left(BC^Z_{s,t}\right) + \beta_{BN}\ NZ_{i,t-1} \times \Delta log\left(BN^Z_{s,t}\right) + \varepsilon_{i,t} \quad (3)$$

As stated above, we use a firm's Total Factor Productivity ($TFP_{i,t}$) to analyze the relationship between zombie-lending and non-zmobies' productivity. In Equation (2) we measure the dependent variable ($\Delta log\left(K_{i,t}\right)$) as the first-difference of a firm's logged stock of (net) property, plant and equipment ($\Delta log\left(PPENT_{i,t}\right)$). Lastly, we follow Chodorow-Reich (2013) and measure employment-growth ($\Delta EMP_{i,t}$) by the symmetric growth formula (see Equation (7) for further details).

All models contain a full set of controls ($\mathbb{X}$), which comprise firm-, sector-, year- and sector-year-fixed effects (α_i and δ_t), a non-zombie indicator, $NZ_{i,t-1} \in \{0; 1\}$, and a model-specific set of firm characteristics, which we describe in more detail in each of the corresponding subsections below.

Our main variable of interest is zombie-credit in the form of (i) $BC^Z_{s,t-1}$, which is the share of new bank-intermediated credit to industry s that has been granted to non-viable firms in year t, and (ii) $BN^Z_{s,t-1}$, which is the share of new bonds and notes issued by zombie firms in industry s in year t. Aggregating these lending variables to industry-shares is motivated by specifications found in the literature, which look at spill-overs from zombification at the industry-level to the performance of healthy companies (Caballero et al., 2008; McGowan et al., 2018; Schivardi et al., 2020). Furthermore, recent evidence suggests the rise of specialized lenders, granting credit to only a selected set of industries (Di and Pattison, 2021). Though this phenomenon is observed among small businesses, it aligns well with the specifications in upcoming sections.

The industry-shares of zombie-credit are interacted with an indicator for non-zombies ($NZ_{i,t-1}$) to directly assess the differential effect of zombie-lending on non-zombies' performance. In Equations (1) and (2), these zombie-credit variables enter with a one period lag, whereas (3) incorporates the lagged growth-rate of $BC^Z_{s,t-1}$ and $BN^Z_{s,t-1}$ respectively.

The results in Table 4 can be summarized fairly quickly: none of the models could establish a statistically significant relationship between zombie-lending and the performance of non-zombies – neither for contracts with a maturity of up to four quarters upon origination nor for longer-term debt. Overall, the results are grist to the mill of those questioning whether the observed adverse effects of zombification in Europe (Andrews et al., 2016; McGowan and Andrews, 2018; Schivardi et al., 2021; Acharya et al., 2019) also hold in the case of the United States. Nevertheless, it might be premature to take the short-cut and writing up the conclusion about spillover effects of zombie-lending on non-zombies' performance. As documented in Table 2, there are stark differences in firm characteristics between zombies and viable companies in our sample. One of those is firm size – whether measured in terms of total assets or employees. As already asserted in Section 4.3, the class of viable firms may comprise companies, which do not directly compete with zombies in the search for appropriate funding. Lumping all non-zombies together, may therefore suffer from insufficient granularity and obscure the effects of zombie-lending for a certain type of non-zombies. This is why in the remainder of this section, we will continue our analysis by further discriminating the group of non-zombies according to several firm characteristics, such as firm size, bank-dependency and access to capital markets. Unlike in this subsection, we proceed by dedicating a single subsection to each of our three performance measures.

Table 4: Regressions Results: Zombie-Lending & Non-Zombie Performance
Zombie-Definition Z^{NAR}

Maturity (m)	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$
	(1)	(2)	(3)
Variables	$TFP_{i,t}$	$\Delta log\left(K_{i,t}\right)$	$\Delta EMP_{i,t}$
$NZ_{i,t-1}$	-0.003	0.194***	7.768***
$NZ_{i,t-1} \times BC^{Z}_{s,t-1}$	-0.085	-0.251	
$NZ_{i,t-1} \times BN^{Z}_{s,t-1}$	0.177	0.107	
$NZ_{i,t-1} \times \Delta log\left(BC^{Z}_{s,t}\right)$			-0.293
$NZ_{i,t-1} \times \Delta log\left(BN^{Z}_{s,t}\right)$			-0.241
Years		2002 - 2019	
Observations	39,287	69,229	41,897
Firms	5,643	9,422	7,313
Fixed Effects	X	X	X
Controls	X	X	X
Within-R^2	0.03	0.12	0.06
Maturity (m)	$5Q \leq m \leq 40Q$	$5Q \leq m \leq 40Q$	$5Q \leq m \leq 40Q$
	(4)	(5)	(6)
Variables	$TFP_{i,t}$	$\Delta log\left(K_{i,t}\right)$	$\Delta EMP_{i,t}$
$NZ_{i,t-1}$	0.002	0.190***	7.196***
$NZ_{i,t-1} \times BC^{Z}_{s,t-1}$	-0.464	-0.339	
$NZ_{i,t-1} \times BN^{Z}_{s,t-1}$	-0.130	0.405	
$NZ_{i,t-1} \times \Delta log\left(BC^{Z}_{s,t}\right)$			-0.585
$NZ_{i,t-1} \times \Delta log\left(BN^{Z}_{s,t}\right)$			-0.607
Years		2002 - 2019	
Observations	39,289	69,314	52,087
Firms	5,644	9,426	8,237
Fixed Effects	X	X	X
Controls	X	X	X
Within-R^2	0.03	0.12	0.06

Notes: Each estimation includes firm-, industry-, year- and -industry-year-fixed effects. Standard errors are clustered at the firm-level. Controls are composed as follows: Models (1) and (4) include a lagged measure of size ($log\left(AT_{i,t-1}\right)$) and a firm's lagged R&D intensity ($XRD_{i,t-1}/AT_{i,t-1}$). Models (2) and (5) include a lagged measure of size ($log\left(AT_{i,t-1}\right)$) and a firm's lagged asset tangibility ($PPENT_{i,t-1}/AT_{i,t-1}$) Models (3) and (6) include a lagged measure of size ($log\left(AT_{i,t-1}\right)$), a firm's lagged cash ratio ($CHE_{i,t-1}/LT_{i,t-1}$), it's profitability ($ROA_{i,t-1} = IB_{i,t-1}/AT_{i,t-1}$),and the lagged proxy for a firm's asset tangibility ($PPENT_{i,t-1}/AT_{i,t-1}$). For better visualization, coefficients for Models (3) and (6) are multiplied by a factor of 10^2. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

5.1.1 Productivity

Our first in-depth analysis concerns the effects of zombie-lending on a firm's Total Factor Productivity ($TFP_{i,t}$). In order to divide the entire set of non-zombies into subgroups, we deploy the following model:

$$
\begin{aligned}
TFP_{i,t} = \quad & \beta_{BC}\ NZ_{i,t-1} \times D^{\mathrm{t}}_{i,t-1} \times D^{\mathrm{i}}_{i} \times BC^{Z}_{s,t-1} && + \beta_X\ X_{i,t-1} \\
& + \beta_{BN}\ NZ_{i,t-1} \times D^{\mathrm{t}}_{i,t-1} \times D^{\mathrm{i}}_{i} \times BN^{Z}_{s,t-1} && + \alpha_i\ +\ \delta_t\ +\ \varepsilon_{i,t}
\end{aligned} \tag{4}
$$

where α_i and δ_t comprise a full set of firm-, sector-, year- and sector-year-fixed effects. $NZ_{i,t-1} \in \{0; 1\}$ is an indicator for firm i being a viable firm, i.e. *not* being classified as a zombie, in year t. The vector of firm-level covariates, $X_{i,t-1}$, comprises a measure of lagged company size ($log\,(AT_{i,t-1})$) and a firm's lagged R&D intensity ($XRD_{i,t-1}/AT_{i,t-1}$).

To recap, our main variables of interest are (i) the share of new BC to industry s, which was granted to non-viable firms in year t, $BC^{Z}_{s,t-1}$, and (ii) the share of new bonds and notes, measured in U.S. dollars, that was issued by zombie firms in industry s in year t ($BN^{Z}_{s,t-1}$). These variables are interacted with several dummy variables. In addition to the indicator for non-zombies ($NZ_{i,t}$), we distinguish between two further sets of dummies: (i) the set of time-varying dummies, $D^{\mathrm{t}}_{i,t-1} = \{\mathbb{1}, SM_{i,t-1}\}$, where $SM_{i,t}$ symbolizes *small- & medium-sized* firms (SME) following the definition in Chodorow-Reich (2013). Therein, "small" firms are defined as $EMP_{i,t} < 250$, and medium-sized firms as $250 \leq EMP_{i,t} < 1000$.; (ii) the set of firm-specific and time-invariant dummies ($D^{\mathrm{i}}_{i} = \{\mathbb{1}, bank.dep_i, bond_i, no.bond_i\}$, where $bank.dep_i$) indicates whether firm i is bank-dependent or not. Similarly, $bond_i$, $no.bond_i$ respectively, are indicators used to determine whether firm i has access to capital markets. A firm is classified as bank-dependent, i.e. $bank.dep_i = 1$, if it relied more extensively on bank credit than on bonds and notes over the sample period, i.e.

$$
\text{if} \quad \sum_{t=2002}^{2019} BC_{i,t} > \sum_{t=2002}^{2019} BN_{i,t} \ \Rightarrow\ bank.dep_i = 1\ .
$$

For $bond_i = 1$, firm i is required to have reported the issuance of bonds – conditional on the maturity bucket – at least once throughout the sample period. Equation (4) collapses to Equation (4) in case of both dummies just being an identity-vector, i.e. each element i being set to 1, such that $D^{\mathrm{t}}_{i,t-1} = D^{\mathrm{i}}_{i} = \mathbb{1}$ the first and third terms in Equation 4 collapse to $NZ_{i,t-1} \times BC^{Z}_{s,t-1}$ and $NZ_{i,t-1} \times BN^{Z}_{s,t-1}$ respectively. Figure 4 in Appendix A.4 plots the share of SMEs and respective subgroups over the sample period 2002-2019.

The results are summarized in Table 5. Models (1)-(3) capture fresh inflows of short-term credit to non-viable firms and Models (4)-(6)) document the effects of longer-term funding. The first row in Table 5 shows that, in general, viable firms are not more productive than their non-viable counterparts. Nevertheless, the negative spillovers from zombie-lending on TFP of non-zombies can hardly be overlooked and occur in each of the six specifications.

In Model (1) we ask whether zombie-lending compromises productivity of non-zombie SMEs. The statistically significant relationship between $BN^{Z}_{s,t-1}$, interacted with the non-zombie and SME indicators, points to this specific subgroup seeing their productivity to drop by about -0.539 for every percentage point of an industry's previous period's new inflows of short-term BN, that was allocated to zombie firms. To get a sense of the economic impact implied by these results, consider

$BN^Z_{i,t-1}$ to increase by one standard deviation (SD = 0.059). This would cause TFP of non-zombie SMEs to decrease by $SD \times \beta_{BN} \equiv 0.059 \times (-0.539) = -0.032$. With the median TFP of non-zombie SMEs being 0.094, this translates into a drop of -34%. In Model (2) we further zoom in on bank-dependent and capital-market dependent non-zombie SMEs. Here, the negative spillovers from public debt markets' short-term zombie-lending activities increase by over 60% to -0.887. On the banking side, the addition of the bank-dependency indicator, helps uncover non-zombie SME's sensitivity to banks' engagement with zombie-firms. In Model (3) we restrict the set of bank-dependent non-zombie SMEs even further by zooming in on the subgroup that has no access to capital markets. Compared to the set of companies in Model (2), this subgroup of highly bank-dependent, viable firms sees its productivity subsequently decrease by an additional -15.7% to -1.026 for every percentage point of an industry's amount of new credit inflows, that is intermediated by banks and channeled to zombie firms. A one standard deviation expansion in $BC^Z_{i,t-1}$ would therefore decrease the TFP of this subgroup by $SD \times \beta_{BC} \equiv 0.058 \times (-1.026) = -0.060$, which equates to a drop in that group's median TFP (0.071) of 84.5%. The increasing magnitude and statistical significance of the β_{BN} coefficient from Model (1) to Model (3) points to financial constraints amplifying the effect of banks' engagement in zombie-lending activities. Models (4)-(6) copy the specifications of Models (1)-(3), but look at the longer-term contracts of zombie-lending activities. The spillover arising from issuance of bonds and notes are qualitatively similar to those observed in Models (1)-(3). The fact that the statistical significant relationship between banks' zombie-lending activities, observed in Model (4), does not emerge in Models (5) and Model (6) suggests that the amplification mechanism via financial frictions, does not exist for zombie-debt with longer-term maturities.

In a nutshell, Tables 4 and 5 establish the following results: first, there exist statistically significant negative spillovers of zombie-lending on TFP, which however predominantly affect small- and medium-sized companies. Second, financial constraints amplify the economic impact of increased zombie-lending in the market of short-term bank-funding. Lastly, the negative spillovers emerge primarily from capital markets, but do also arise via the banking-channel. The effects can both be found in short-term and longer-term debt contracts.

Table 5: Regressions Results: Total Factor Productivity & Zombie-Lending – Zombie-Definition Z^{NAR}

Maturity (m)	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$	$5Q \leq m \leq 40Q$	$5Q \leq m \leq 40Q$	$5Q \leq m \leq 40Q$
Variables	(1) $TFP_{i,t}$	(2) $TFP_{i,t}$	(3) $TFP_{i,t}$	(4) $TFP_{i,t}$	(5) $TFP_{i,t}$	(6) $TFP_{i,t}$
$NZ_{i,t-1}$	0.013	0.053	0.050	0.016	0.039	0.054
$NZ_{i,t-1} \times SM_{i,t-1}$	-0.14			0.008		
$NZ_{i,t-1} \times SM_{i,t-1} \times BC^Z_{s,t-1}$	0.075			-0.880**		
$NZ_{i,t-1} \times SM_{i,t-1} \times BN^Z_{s,t-1}$	-0.539***			-2.814***		
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i$		-0.023			0.020	
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i$		-0.019			-0.021	
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times BC^Z_{s,t-1}$		-0.510*			-0.133	
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i \times BN^Z_{s,t-1}$		-0.887*			-5.096***	
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times no.bond_i$			-0.028			-0.024
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i$			-0.017			-0.029
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times no.bond_i \times BC^Z_{s,t-1}$			-1.026**			0.699
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i \times BN^Z_{s,t-1}$			-0.926*			-5.072***
Years	2002 - 2019					
Observations	36,899	22,286	22,286	36,901	30,470	30,470
Firms	5,308	2,616	2,616	5,309	3,897	3,897
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Within-R^2	0.03	0.04	0.04	0.03	0.03	0.03

Notes: Each estimation includes firm-, industry-, year- and -industry-year-fixed effects. Standard errors are clustered at the firm-level. Controls include a measure of lagged size ($log\left(AT_{i,t-1}\right)$) and a firm's lagged R&D intensity ($XRD_{i,t-1}/AT_{i,t-1}$). Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

5.1.2 Capital Growth

We now turn to the interaction between capital-growth and zombie-lending. Our model is designed along the lines of McGowan et al. (2018), and collapses to Equation (2) when setting each element i in $D^{\mathrm{t}}_{i,t-1}$ and D^{i}_{i} equal to one:

$$\begin{aligned}\Delta log\,(K_{i,t}) = \quad & \beta_{BC}\ NZ_{i,t-1} \times D^{\mathrm{t}}_{i,t-1} \times D^{\mathrm{i}}_{i} \times BC^{Z}_{s,t-1} \quad + \beta_{X}\ X_{i,t-1} \\ & + \beta_{BN}\ NZ_{i,t-1} \times D^{\mathrm{t}}_{i,t-1} \times D^{\mathrm{i}}_{i} \times BN^{Z}_{s,t-1} \quad + \alpha_i\ +\ \delta_t\ +\ \varepsilon_{i,t}\end{aligned} \tag{5}$$

where α_i and δ_t again comprise a full set of firm-, sector-, year- and sector-year-fixed effects. The dependent variable is capital-growth, measured as the first-difference of a firm's logged stock of (net) property, plant and equipment ($\Delta log\,(PPENT_{i,t})$). The set of covariates accounts for lagged firm size and lagged asset tangibility. The time-varying ($D^{\mathrm{t}}_{i,t-1}$) and time-invariant (D^{i}_{i}) dummies follow the description of Equation (4). As in the previous exercise on productivity, our main coefficients of interest are β_{BC} and β_{BN}. We again lag the share of zombie-lending in industry s by one period, in order to disentangle the strain of causality between reduced investment opportunities for non-zombies and an increase in the share of zombie-lending.

The negative effects in Table 6 are not as dominant as those documented in Table 5. Though non-zombies invest more than non-viable firms, there is no statistical evidence for short-term zombie-lending impairing capital-growth of non-zombies. One explanation for this absence is the fact that short-term debt is generally perceived to cover working-capital needs, whereas expenses for investment purposes are associated with longer-term maturities (Amberg and Jacobson, 2021). However, Models (4)-(6) are again only scarcely covered with statistically significant relationships. Unlike for TFP, the negative spillovers build up exclusively in public debt markets and only affect non-zombie SMEs, which are capital market dependent. β_{BN} in Models (5) and (6) quantifies investment of this specific subgroup of viable firms to decrease by more than -3.25%, for a one standard deviation increase in an industry's share of newly issued longer-term bonds and notes being held by zombies.[12]

Though the negative consequences of zombie-lending are less pronounced when measuring non-zombies' performance in terms of capital-growth, a common denominator seems to build up: viable SMEs, which are reliant on funding from capital markets are sensitive to public debt markets' lending to zombie firms.

[12] For Model (5): $SD \times \beta_{BN} \equiv 0.040 \times (-0.815) \times 100 = -3.26\%$ and for Model (6) respectively: $SD \times \beta_{BN} \equiv 0.040 \times (-0.817) \times 100 = -3.27\%$.

Table 6: Regressions Results: Capital Growth & Zombie-Lending – Zombie-Definition Z^{NAR}

Maturity (m)	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$	$5Q \leq m \leq 40Q$	$5Q \leq m \leq 40Q$	$5Q \leq m \leq 40Q$
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	$\Delta log\,(K_{i,t})$	$\Delta log\,(K_{i,t})$	$\Delta log\,(K_{i,t})$	$\Delta log\,(K_{i,t})$	$\Delta log\,(K_{i,t})$	$\Delta log\,(K_{i,t})$
$NZ_{i,t-1}$	0.202***	0.187***	0.172***	0.203***	0.180***	0.173***
$NZ_{i,t-1} \times SM_{i,t-1}$	-0.011			-0.013		
$NZ_{i,t-1} \times SM_{i,t-1} \times BC^{Z}_{s,t-1}$	-0.070			-0.178		
$NZ_{i,t-1} \times SM_{i,t-1} \times BN^{Z}_{s,t-1}$	-0.180			0.153		
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i$		-0.039			-0.028	
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i$		-0.021			-0.000	
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times BC^{Z}_{s,t-1}$		0.221			-0.213	
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i \times BN^{Z}_{s,t-1}$		-0.265			-0.815***	
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times no.bond_i$			-0.020			-0.047
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i$			-0.013			0.567*
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times no.bond_i \times BC^{Z}_{s,t-1}$			0.196			0.003
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i \times BN^{Z}_{s,t-1}$			0.274			-0.817**
Years	2002 - 2019					
Observations	63,415	39,136	39,136	63,498	53,092	53,092
Firms	8,638	4,296	4,296	8,642	6,360	6,360
Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Within-R^2	0.12	0.12	0.12	0.12	0.12	0.12

Notes: Each estimation includes firm-, industry-, year- and -industry-year-fixed effects. Standard errors are clustered at the firm-level. Controls include a lagged measure of size ($log\left(AT_{i,t-1}\right)$) and a firm's lagged asset tangibility ($PPENT_{i,t-1}/AT_{i,t-1}$). Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

5.1.3 Employment

Lastly, we evaluate the effects of zombie-lending on non-zombies' employment-growth. Chodorow-Reich (2013) finds that changes in credit supply during the Great Recession materialized in diminished employment-growth, with SMEs being most affected. Moreover, having no access to capital markets aggravated the role of banks' credit supply in firms' employment-growth. The findings in Sections 5.1.1 and 5.1.2 suggested that zombie-lending impairs the performance of non-zombies via similar transmission channels. To test whether this observation also holds in terms of non-zombies' employment-growth, we deploy the following model[13]:

$$\begin{aligned}\Delta EMP_{i,t} = \quad & \beta_{BC}\ NZ_{i,t-1} \times D^{\mathrm{t}}_{i,t-1} \times D^{\mathrm{i}}_{i} \times \Delta log\left(BC^{Z}_{s,t}\right) \quad + \beta_X\ X_{i,t-1} \\ & + \beta_{BN}\ NZ_{i,t-1} \times D^{\mathrm{t}}_{i,t-1} \times D^{\mathrm{i}}_{i} \times \Delta log\left(BN^{Z}_{s,t}\right) \quad + \alpha_i \ + \ \delta_t \ + \ \varepsilon_{i,t}\end{aligned} \tag{6}$$

where α_i and δ_t again comprise a full set of firm-, sector-, year- and sector-year-fixed effects. The set of controls, $X_{i,t-1}$, includes a lagged indicator for non-zombies, $NZ_{i,t-1}$, and several firm characteristics such as a lagged measure of size ($log\left(AT_{i,t-1}\right)$), a firm's lagged cash ratio ($CHE_{i,t-1}/LT_{i,t-1}$), a firm's ROA as a proxy for profitability ($IB_{i,t-1}/AT_{i,t-1}$), and the lagged measure for a firm's asset tangibility ($PPENT_{i,t-1}/AT_{i,t-1}$). The dependent variable $\Delta EMP_{i,t}$ is our measure of employment growth, measured by the symmetric growth formula as in Chodorow-Reich (2013):

$$\Delta EMP_{i,t} = \frac{EMP_{i,t} - EMP_{i,t-1}}{0.5 \times (EMP_{i,t} + EMP_{i,t-1})} \tag{7}$$

The results in Table 7 are in line with previous findings, though they exhibit a mix of Table 5 and 6. Unlike capital-growth, employment-growth of small- and medium-sized non-zombies is compromised as new bank-credit is granted to non-viable firms. Spillovers from capital-markets do not play a statistically significant role for viable SMEs and their subgroups considered here. Comparing Models (2) and (3), we can again observe the amplification mechanism, caused by financial frictions, at play: the subgroup of bank-dependent non-zombie SMEs, which does not enjoy access to public debt markets, is most severely impacted by zombie-lending activities of the banking sector.

Quantifying the impact of zombie-lending on employment-growth in economic terms, the β_{BC} estimates in Models (1) through (3) suggest employment growth to decrease by about -0.6% to -1.3% for a one standard deviation increase in $\Delta log\left(BC^{Z}_{s,t}\right)$.[14] To spare the reader another lengthy table, we can confirm no statistically significant effects of longer-term debt contracts on employment.

[13] As in the previous sections, this equation collapses to Equation (3) when setting each element i in $D^{\mathrm{t}}_{i,t-1}$ and D^{i}_{i} equal to one.

[14] Note that coefficients in Table 7 are multiplied by a factor of 10^2 for visualization purposes. Therefore, an increase in $\Delta log\left(BC^{Z}_{s,t}\right)$ by one standard deviation ($SD = 3.147$) leads to a decline in employment-growth of $3.147 \times (-0.186) \times 0.01 = -0.06\%$ (Model (1)), $3.147 \times (-0.329) \times 0.01 = -1.04\%$ (Model (2)), and $3.147 \times (-0.415) \times 0.01 = -1.31\%$ (Model (3)) in the respective subgroup non-zombies considered in each specification.

Table 7: Regressions Results: Employment Growth & Zombie-Lending
Zombie-Definition Z^{NAR}

Maturity (m)	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$	$1Q \leq m \leq 4Q$
	(1)	(2)	(3)
Variables	$\Delta EMP_{i,t}$	$\Delta EMP_{i,t}$	$\Delta EMP_{i,t}$
$NZ_{i,t-1}$	1.356	2.845	4.966***
$NZ_{i,t-1} \times SM_{i,t-1}$	7.418***		
$NZ_{i,t-1} \times SM_{i,t-1} \times \Delta log\left(BC^{Z}_{s,t}\right)$	-0.186*		
$NZ_{i,t-1} \times SM_{i,t-1} \times \Delta log\left(BN^{Z}_{s,t}\right)$	-0.033		
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i$		7.395***	
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i$		6.000***	
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times \Delta log\left(BC^{Z}_{s,t}\right)$		-0.329*	
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i \times \Delta log\left(BN^{Z}_{s,t}\right)$		-0.078	
$NZ_{i,t-1} \times SM_{i,t-1} \times bank.dep_i \times no.bond_i$			7.945***
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i$			4.714**
$NZ_{i,t} \times SM_{i,t-1} \times bank.dep_i \times no.bond_i \times \Delta log\left(BC^{Z}_{s,t}\right)$			-0.415*
$NZ_{i,t-1} \times SM_{i,t-1} \times CapM.dep_i \times \Delta log\left(BN^{Z}_{s,t}\right)$			-0.078
Years	2002-2019	2002-2019	2002-2019
Observations	41,897	25,357	25,357
Firms	7,313	3,725	3,725
Fixed Effects	X	X	X
Controls	X	X	X
Within-R^2	0.06	0.07	0.07

Notes: For better visualization, coefficients are multiplied by a factor of 10^2. Each estimation includes firm-, industry-, year- and -industry-year-fixed effects. Standard errors are clustered at the firm-level. Controls include a lagged measure of size ($log\left(AT_{i,t-1}\right)$), a firm's lagged cash ratio ($CHE_{i,t-1}/LT_{i,t-1}$), it's profitability ($ROA_{i,t-1} = IB_{i,t-1}/AT_{i,t-1}$),and the lagged proxy for a firm's asset tangibility ($PPENT_{i,t-1}/AT_{i,t-1}$). Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Before moving on to the last part of our empirical analysis, we briefly summarize the findings so far. The applications of this section have provided evidence – both in statistical and in economic terms – that zombification, and in particular zombie-lending, is a phenomenon that is not to be dismissed as non-existent in the U.S. economy. It is primarily small- and medium-sized healthy companies that are exposed to the negative spillovers of granting credit to non-viable firms. Furthermore, different metrics of performance respond to different forms of zombie-lending: TFP is susceptible to zombie-lending activities by both banks and capital markets in the form of both short- and longer-term debt. In contrast, capital-growth is only sensitive to zombie-lending in the form of longer-term financing in the form of bonds and notes. Short-term financing and banks' engagement in zombie-lending does not seem to matter from a statistical point of view. Again, employment-growth shows the opposite characteristics, with the negative spillover emerging exclusively via the bank-lending channel in the form of short-term debt contracts. Lastly, the results also revealed the existence of financial frictions amplifying the negative effects of short-term zombie-lending, with the subgroups of bank-dependent SMEs, and especially those with no access to public debt markets, being most severely affected. Even though Figures 2 and 1 may have conveyed the impression of zombie prevalence not being a defining characteristic of the U.S. economy, the results of this subsection suggest that the performance of certain subgroups of corporations does indeed suffer from the negative spillovers of zombie-lending activities.

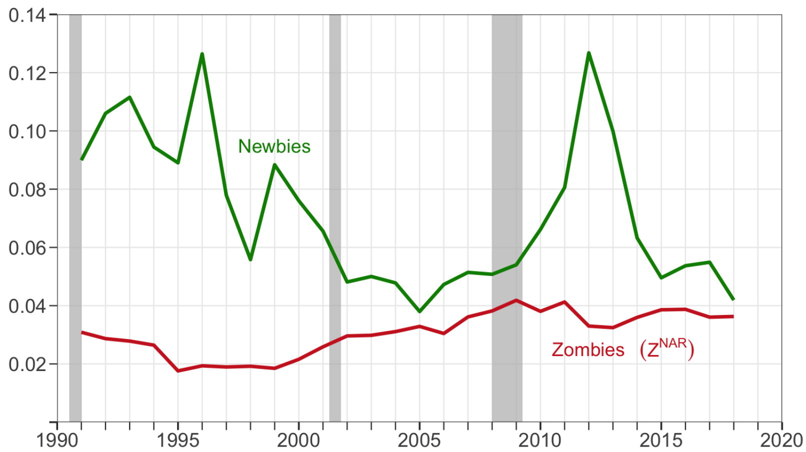
In the next section, we examine whether zombie-lending also has its saying in the evolution of another mechanism, whose demise is said to have contributed to the sluggish productivity-growth over the past decade: business dynamism.

5.2 Zombie-Lending and Business Dynamism

Business dynamism describes the replacement of non-viable firms by new and striving entrants. It slowing down is regarded as one reason for weak productivity-growth in recent decades. One explanation for this downward trend is the inefficient allocation of available resources (Decker et al., 2017). This cleansing effect is supposed to serve as a catalyst of economic growth, but keeping certain firms artificially alive, by granting them new funding, congests this growth engine: the prevalence of zombies diminishes the availability of capital and labor in the economy, thereby putting downward pressure on firms' profits and increasing the threshold for new firms to enter the market (Caballero et al., 2008).

Figure 3 shows the share of zombies and new entrants (*newbies*, NB_t) in each year between 1991 and 2018. While the share of zombies increased steadily over the course of the mid 1990s until the aftermath of the Great Recession, the share of newbies per year fell sharply starting at the end of the 1990s, recovered in the years after the financial crisis, before retreating again. The movements of the newbies- and zombie-share in the first half of that period corroborates the slowing down of business dynamism with both shares gradually converging. Even though the fraction of zombies – under our definition of Z^{NAR} – never surpasses the share of newbies, the difference between the two has started to narrow down again from 2015 onward.

Figure 3: Zombies vs. Newbies – Zombie-Definition Z^{NAR}



Notes: Shaded areas mark NBER recessions. The denominator for both series includes all firms in a given year, whose data reporting allows for an assessment of their zombie-status. That is, the total number of individual firms in a given year may be larger than the set of firms, for which a statement about their zombie-status is possible, due to missing data.

We therefore continue our empirical analysis to see how zombie-lending affects entry decisions of new firms. To do so, we aggregate the firm-level observations to two-digits NAICS industry-level data and set up the following model:

$$
\begin{aligned}
\frac{NB_{s,t}}{N_{s,t}} = \quad & \beta_{BC}\ BC^{Z}_{s,t-1} && + \beta_{BN}\ BN^{Z}_{s,t-1} \\
& + \beta_{BC^{B}}\ bank.dep_{s,t-1} \times BC^{Z}_{s,t-1} && + \beta_{BN^{CM}}\ CapM.dep_{s,t-1} \times BN^{Z}_{s,t-1} \\
& + \beta_{NB} \times \frac{NB_{s,t-1}}{N_{s,t-1}} && + \alpha_s \ + \ \delta_t \ + \ \varepsilon_{s,t}\ ,
\end{aligned} \tag{8}
$$

where α_s andδ_t are industry- and year-fixed effects, respectively. The dependent variable, $\frac{NB_{s,t}}{N_{s,t}}$, is the share of newbies in industry s in year t, where $NB_{s,t}$ is the number of newbies and $N_{s,t}$ the total number of firms in industry s in year t. As in the previous sections, $BC^{Z}_{s,t-1}$, and $BN^{Z}_{s,t-1}$ respectively, is the share of newly granted credit from banks, and public debt markets respectively, to industry s in year t. The terms in the second row of Equation (8) each contain two further indicator variables, $bank.dep_{s,t-1}$ and $CapM.dep_{s,t-1}$. In the firm-level regressions of previous sections these indicators were time-invariant. Here, we allow them to vary over time. That is, industry s is classified as being *bank-dependent* in year t if that year's industry inflows of fresh bank-credit exceeded the amount of debt taken up via capital markets in the form of bonds and notes. Equivalently, an industry is classified as being *capital market dependent* if the reverse is true. Since we again discriminate between short- and long-term debt, these indicators are conditional on the respective maturity bucket. Therefore, industry s could be classified as being bank-dependent for short-term maturities, while resorting predominantly to public debt markets for longer-term funding. Lastly, since allowing for persistence in the share of newbies does not come at the cost of losing a significant number of observations[15], we deploy the Arellano and Bond (1991) estimator to account for potential correlation between the lagged dependent variable ($\frac{NB_{s,t-1}}{N_{s,t-1}}$) and the unobserved industry-fixed effects α_s.

Table 8 documents the relation between zombie-lending and entry dynamics on the industry-level. Even though the prefixes of β^{CM}_{BN} are counter to what theory would have predicted, the coefficients on the variables describing banks' behavior are consistent with the prevailing narrative. The negative coefficients on $BC^{Z}_{s,t-1}$ and $bank.dep_{s,t-1} \times BC^{Z}_{s,t-1}$ provide statistically robust evidence for industries, which have a larger share of total credit being granted to non-viable firms, experiencing less newbies entering the market subsequently. The period mismatch of one year between dependent and independent variables, establishes a chain of causality by asserting that banks' participation in zombie-lending drags on a industry's entrance dynamics. In the case of short-term debt, the effect amounts to a -2.3 percentage point lower share of newbies in bank-dependent industries for every percentage point in the share of new zombie-to-total industry-credit that has

[15] This is not the case for the firm-level regressions, which is why we abstain from applying a similar methodology in Sections 5.1.1, 5.1.2, and 5.1.3

been intermediated by banks. Moving over to longer maturities, we see a similar story. However, with the coefficient on $BC^Z_{s,t}$ turning statistically significant, the negative spillovers do not only affect the subgroup of bank-dependent industries anymore. The results hint at a general tendency across all industries to see less firms entering their markets with a rise in banks' previous period's engagement in zombie-lending relative to their total lending activities.

Table 8: Regressions Results: Zombie-Lending & Business Dynamism
Zombie-Definition Z^{NAR}

Maturity (m)	$1Q \leq m \leq 4Q$	$5Q \leq m \leq 40Q$
	(1)	(2)
Variables	$\frac{NB_{s,t}}{N_{s,t}}$	$\frac{NB_{s,t}}{N_{s,t}}$
$BC^Z_{s,t-1}$	0.005	-0.031**
$BN^Z_{s,t-1}$	-0.005	-0.021
$bank.dep_{s,t-1} \times BC^Z_{s,t-1}$	-0.023**	-0.013
$CapM.dep_{s,t-1} \times BN^Z_{s,t-1}$	0.022	0.030
Years	2002-2019	2002-2019
Observations	309	320
Industries	18	18
Fixed Effects	X	X
Controls	X	X

Notes: Each estimation includes industry- and year-fixed effects. Standard errors are clustered at the industry-level. We restrict the sample to only those companies that reported either one of the bank-credit instruments, BL or RC, or an issuance of *bonds & notes* (BN) at least once over the period 2002 - 2019. $BC^Z_{s,t}$ and $BN^Z_{s,t}$ represent the amount of bank-credit, and bonds and notes respectively, of industry s sitting with zombies in year t. $B_{s,t}$ and $CM_{s,t}$ are indicators with a value of one, if industry s is classified as bank-dependent, and capital-market dependent respectively, in year t. These classifications may differ for different maturity buckets. Controls include a lag of the dependent variable $\frac{NB_{s,t-1}}{N_{s,t-1}}$. We use the Arellano and Bond (1991) estimator to account for correlation between the lagged dependent variable and unobserved industry-fixed effects. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Given the observed negative spillovers of zombie-lending and entry dynamics at the industry-level, the question arises about how these effects materialize on the firm-level. One hypothesis describes the ambivalent nature of providing non-viable firms with vital liquidity (Acharya et al., 2019) and the trade-off between short-run damage-control but long-term efficiency losses (Acharya et al., 2021). With non-viable firms remaining afloat, fewer workers are laid of compared to the case of liquidation. On the one hand, this implies higher aggregate employment relative to the liquidation scenario, on the other hand labor supply is scarce, and wages abstain from dropping. The implications are twofold: the shortage of labor and artificially elevated industry-wages deter newbies from entering, leaving productive labor force locked up at non-viable incumbents. This hoarding of labor capacity does ultimately not only result in a within-industry misallocation of labor, but also impedes business dynamism.

The following regression shall shed some light on the assertions made above, by looking deeper into the relationship between zombie-lending and employment-growth of newbies:

$$\Delta EMP_{i,t} = \beta_{BC}\ NB_{i,t-1} \times \Delta log\left(BC^Z_{s,t}\right) + \beta_X\ X_{i,t-1} + \beta_{BN}\ NB_{i,t-1} \times \Delta log\left(BN^Z_{s,t}\right) + \alpha_i + \delta_t + \varepsilon_{i,t} \tag{9}$$

where $\Delta EMP_{i,t}$ is the symmetric growth-rate of employment as outlined in Section 5.1.3. The set of controls, $X_{i,t-1}$, includes a lagged indicator for firm i being a newbie ($NB_{i,t-1}$), as well as a firm's lagged firm size ($log\,(AT_{i,t-1})$), its lagged asset tangibility ($PPENT_{i,t-1}/AT_{i,t-1}$), and sales growth. The zombie-lending variables $BC^Z_{s,t}$ and $BN^Z_{s,t}$ are defined as above.

Table 9 shows results for short- and long-term lending, and for two different – though related – measures of employment growth: Models (1) and (2) are based on the symmetric growth rate and the latter two models deploy the first-difference of the log-level of employment. All models suggest newbies to see their labor force grow in the first year after entry. Although not showing any statistical significance, β_{BC} and β_{BN} are both negative in all but one specification. The only statistically significant effect emerges from Model (3), which finds newbies' employment-growth to decline by -1.3% for every 100 basis point increase – or by about -4.1% for every increase of one standard deviation – in the share of fresh zombie-credit intermediated via the banking channel. Even though the coefficients mostly fail to reveal a statistically significant relationship, their prefixes point into a common direction. Without making a strong claim about statistical significance, the results lend suggestive support to the hypothesis – as also outlined in Acharya et al. (2019) – that zombie-prevalence deters potential candidates from entering by congesting the job market.

Table 9: Regressions Results: Newbies, Employment Growth & Zombie-Lending – Zombie-Definition Z^{NAR}

Maturity (m)	$1Q \leq m \leq 4Q$	$5Q \leq m \leq 40Q$	$1Q \leq m \leq 4Q$	$5Q \leq m \leq 40Q$
	(1)	(2)	(3)	(4)
Variables	$\Delta EMP_{i,t}$	$\Delta EMP_{i,t}$	$\Delta log\,(EMP_{i,t})$	$\Delta log\,(EMP_{i,t})$
$NB_{i,t-1}$	0.067***	0.041***	0.081***	0.044**
$NB_{i,t-1} \times \Delta log\left(BC^Z_{s,t}\right)$	-0.010	-0.001	-0.013*	0.005
$NB_{i,t-1} \times \Delta log\left(BN^Z_{s,t}\right)$	-0.003	-0.011	-0.002	-0.012
Years	2002-2019	2002-2019	2002-2019	2002-2019
Observations	42,197	53,267	42,197	53,267
Firms	7,079	8,027	7,079	8,027
Fixed Effects	X	X	X	X
Controls	X	X	X	X
Within-R^2	0.09	0.10	0.09	0.10

Notes: Each estimation includes firm-, sector-, year- and sector-year-fixed effects. Standard errors are clustered at the firm-level. Control variables are lagged and include a proxy for firm size ($log\,(AT_{i,t-1})$), a firm's asset tangibility, i.e. the capital-to-asset ratio ($PPENT_{i,t-1}/AT_{i,t-1}$), and the first-difference of $log\,(SALE_{i,t})$. Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

Fueled by loose monetary policy and easy credit, the phenomenon of zombification in advanced economies has been discussed in several studies over the course of the last decade. The case of the United States, however, remains largely untouched. In this study we try to fill that gap by examining the macroeconomic consequences of lending to non-viable firms.

Our empirical analysis of publicly listed U.S. companies and their debt structure sees zombie prevalence not as a widespread phenomenon. Based on our working definition the share zombies barely exceeds 4% between the early 1990s and 2019. Nonetheless, we find zombie-lending to be of relevance in explaining the performance of non-zombies in terms of productivity, capital-, and employment growth. Negative spillovers not only emerge from lending activities of banks, but also from capital markets, as investors buy up debt securities from non-viable firms. Yet, the effects are most pronounced for small- and medium-sized companies. Funding characteristics, such as being bank-dependent or not having access to public debt markets, amplify the negative spillovers of zombie-lending. Our analysis further shows that a differentiation among contracts with different maturities is worthwhile. While both short- and long-term lending to zombies impedes productivity of non-zombies, capital-growth of non-zombies is more sensitive to changes in long-term credit, and employment-growth is exclusively responsive to fresh inflows of short-term zombie-credit. Lastly, our results suggest that banks' zombie-lending activities congest entry- and exit-dynamics and thereby hamper the cleansing effect in the U.S. economy. This observation materializes in the observation that a higher share of new credit being granted to zombie firms in the year a firm enters the market, results in lower employment-growth within the group of newbies in the year thereafter.

In a nutshell: even though the prevalence of zombification and zombie-lending may not be a prominent issue among major publicly listed U.S. companies, it would be frivolous to dismiss its relevance for the broader U.S. economy. We find spillovers from zombie-lending to materialize predominantly among small- and medium-sized companies. Going forward, a more comprehensive assessment of the implications of zombification and zombie-lending, may primarily focus on the class of private and public SMEs.

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A Appendix

A.1 Computation of Total Factor Productivity

For computing $TFP_{i,t}$, we adopt the approach in Baqaee and Farhi (2019) and use the method developed in Olley and Pakes (1996) to estimate firm i's production function.[16] In particular, we use $log\,(SALE_{i,t})$ as our outcome variable, the variable inputs $log\,(COGS_{i,t})$ as the "free" variable, the capital stock ($log\,(PPENT_{i,t})$) as the "state" variable. $log\,(CAPX_{i,t})$ serves as the instrument for productivity.

A.2 Other Company Financials

This section documents the calculation of company-level variables and ratios used in the main text of the paper. Compustat identifiers are in brackets.

- **Assets**: *Total Assets* (AT).
- **Sales**: *Net Sales* ($SALE$).
- **(Book) Leverage**: Sum of *Long-Term Debt* ($DLTT$) and *Debt in Current Liabilities* (DLC) divided by *Total Assets* (AT).
- **Asset Tangibility**: *Net Property, Plant and Equipment* ($PPENT$) divided by *Total Assets* (AT).
- **CapX / Assets**: *Capital Expenditures* ($CAPX$) divided by *Total Assets* (AT).
- **ROA**: *Net Income* (IB) divided by *Total Assets* (AT).
- **Age**: Difference between the year under observation and the year when the company was first listed on Compustat.
- **Employees**: *Number of Employees* ($EMP \times 10^3$).
- **Capital**: *Net Property, Plant and Equipment* ($PPENT$).
- **R&D Intensity**: Expenses for Research and Development (XRD) divided by *Total Assets* (AT).
- **Cash Ratio** Cash and Short-Term Investments (CHE) divided by *Total Liabilities*: (LT).

Not directly used in any of the estimations, but part of Tables 1 and 2, we compute **Value Added** as the difference between *Net Sales* ($SALE$) and *Materials*, where *Materials* is the difference

[16] For the computational implementation see Rovigatti (2017).

between *Total Expenses* and *Labor Costs*. *Total Expenses* are computed as *Net Sales* ($SALE$) - *Operating Income Before Depreciation* ($OIBDP$). *Labor Costs* are *Staff Expense* (XLR). In case, XLR is not reported, we proxy *Labor Costs*, LC^P, by the product of *Number of Employees* ($EMP \times 10^3$) and *annual labor costs per capita in the U.S. manufacturing sector*, which itself is derived from *Average Hourly Earnings of Production and Nonsupervisory Employees, Manufacturing* (FRED: $CES3000000008$) and *Average Weekly Hours of Production and Nonsupervisory Employees, Manufacturing* (FRED: $AWHMAN$).

A.3 Additional CapIQ Statistics

Table 10 shows the share of of first-time granted debt contracts, whose face value did not exceed the firm's reported total debt in the corresponding annual files in Compustat. A reporting was only considered eligible for the empirical analysis if its reported face value did not exceed the borrower's reported total debt.

Table 10: Acceptance Rates of Debt Obligations by Maturities – Full Sample: 2002-2019

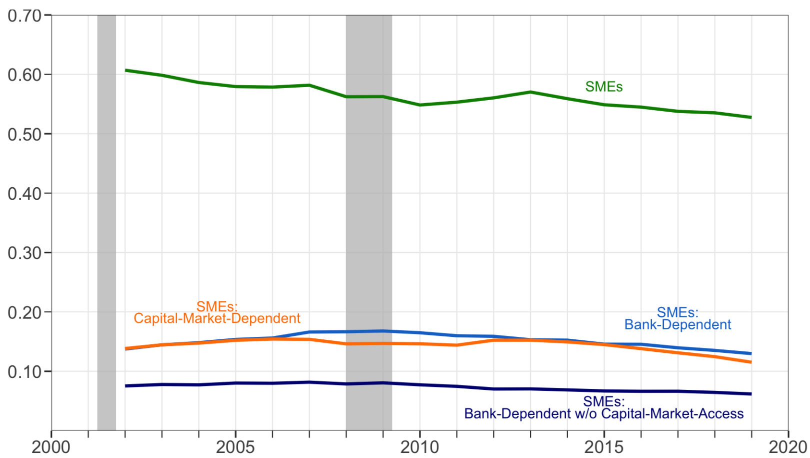
	Bank/Term Loans		Revolving Credit Facility		Bonds and Notes	
	Total Obs.	Accepted	Total Obs.	Accepted	Total Obs.	Accepted
$1Q \leq m \leq 4Q$	13,687	76.15%	16,665	69.45%	31,751	79.39%
$5Q \leq m \leq 8Q$	9,569	83.94%	12,221	70.52%	26,277	86.36%
$9Q \leq m \leq 20Q$	28,035	85.13%	32,255	69.06%	68,250	88.91%
$21Q \leq m \leq 40Q$	16,645	87.64%	15,858	64.50%	68,491	93.04%

Notes: We show the fraction of newly reported debt obligations in company filings in Compustat's Capital-IQ database in the years 2002-2019, which passed the following data-cleaning procedure: an reporting of a newly reported debt obligation is only accepted to be considered in the empirical analysis if its face value does not surpass the company's total debt reported in the annual company filings.

A.4 Small- & Medium-Sized Enterprises and Subgroups

See Section 5.1.1 for details on the definition of SMEs and the corresponding subgroups.

Figure 4: Share of SMEs and Corresponding Subgroups



Notes: Shaded areas mark NBER recessions.