# Could Extended Periods of Ultra Easy Monetary Policy Cause Unintended Adverse Consequences[1]

ABSTRACT: Ultra-easy monetary policies in advanced economies have been key in preventing financial crises and spurring recovery during recent large shocks. Yet, they also kindled discussions around their unintended effect: the "zombification" of weak companies. Our study, using firm-specific and macroeconomic data, reveals that recessions greatly contribute to the surge in zombie firms. While an expansionary policy can help curb this rise at the zero lower bound (ZBL), prolonged ultra-easy policy heightens the zombification risk. These findings underscore the delicate balance policymakers must strike between countercyclical measures, helpful in downturns, and long-term expansionary policies, which can lead to low interest rates, stagnated growth, and increased financial instability. Such a tradeoff is not a concern currently when most countries have tightened their monetary policy stance, but policymakers should be mindful of it during future recessions.

# Introduction

During the Global Financial Crisis in 2008 and the COVID-19 pandemic in early 2020, the central banks of advanced economies lowered policy rates effectively to the zero lower bound (ZLB) and conducted ultra-easy monetary policy for extended periods, including the so-called unconventional monetary policy (UMP) operations. The view that such policies helped to avoid a financial meltdown and close output and inflation gaps has broad support, but there have also been concerns in some quarters that ultra-easy monetary policy is not a “free lunch.” In particular, there have been suggestions that ultra-easy monetary policy for long periods could lead to unsustainable capital flows and booms in housing and financial asset prices, thus raising the odds of a future financial crisis (IMF, IEO, 2019) and supporting weak companies at the cost of healthy ones, leading to their zombification.

Justification for the ultra-easy monetary policy has evolved over time. Initially, these exceptional measures introduced by the central banks of major economies were aimed at restoring financial stability since there were serious concerns about the possibility of a financial meltdown with implications for the real economy. There is a broad consensus that these policies successfully prevented a financial meltdown. However, as the financial system stabilized, the justification for ultra-easy monetary policy was changed to link it to the need to restore aggregate demand after the sharp economic downturns in the absence of inflationary pressures.

On theoretical and practical considerations, ultra-easy monetary policy could easily be defended. After the recession of 2008 and during 2020 and early 2021, many economies were operating well below potential, and inflationary pressures remained subdued. Indeed, various authors used versions of the Taylor rule to assert that the real policy rate required to reestablish a full employment equilibrium (and prevent deflation) was significantly negative (White, 2012). In this context, “shadow interest rates” can be a useful tool to assess the actual monetary policy stance since they can reach negative values, including through the implementation of UMP such as quantitative easing.[2]

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[1] By Etibar Jafarov (IMF) and Enrico Minnella (when he was at the IMF)

[2] The shadow rate, first suggested in Black’s (1995) seminal work, corresponds to the shortest maturity interest rate that the yield curve would have generated had the ZLB not been binding. The literature offers many alternatives to estimating

However, there is also an alternative perspective that focuses on how extended periods of ultra-loose monetary policy can lead to unintended consequences in the medium-to-long term. In fact, this strand of thought is not new. In particular, the Austrian business cycle theory, spearheaded by von Mises and Hayek, suggests that credit-driven expansions would eventually lead to a costly misallocation of real resources ("malinvestments") that would end in a crisis. Similarly, under Minsky's financial-instability hypothesis (Minsky (1977)), easy monetary policy could aggravate financial fragility.

There is also a branch of literature considering extended periods of ultra-loose monetary policy as financial repression. For example, Reinhart and Rogoff (2013) and Reinhart and Sbrancia (2015) document how financial repression in the form of low real interest rates, which is essentially a tax on bondholders and savers, contributed significantly to reducing public debt in the period after the Second World War, when capital controls and regulatory restrictions forced "captive" investors to finance government debt at low cost. Related to this, analyzing the experience of 90 countries over 45 years, Jafarov, Maino, and Pani (2019) estimate that financial repression in the form of interest rate ceilings poses a significant drag on growth.

In this context, Japan's experience following its asset price bubble collapse in 1991 offers an informative case study. The Japanese authorities attempted to stimulate the economy through large fiscal deficits and ultra-loose monetary policy. Moreover, Japanese banks often engaged in "sham loan restructurings that kept credit flowing to otherwise insolvent borrowers," which Caballero and others (2008) called zombies. They estimated that around 30 percent of Japanese firms were recipients of the so-called zombie lending in the late 1990s. Some analysts argue that zombie lending was not only a by-product of economic conditions but also contributed to Japan's low output growth during its "lost decade" (Peek and Rosengren, 2005).

Similarly, Acharya and others (2019) suggest that the OMT (Outright Monetary Transactions) programs in the eurozone during the Sovereign Debt Crisis have contributed to the zombification of weak firms. They document that while the program improved the health of banks in the periphery of the eurozone and thus supported their lending, most of this lending benefited low-quality borrowers. This outcome, in turn, caused negative spillovers to the more productive firms within sectors with higher shares of zombie firms. Indirectly, these findings imply that expansionary policies may hinder the process of "creative destruction," where new and stronger firms replace old and less productive firms.[3]

In this paper, we analyze if extended periods of ultra-loose monetary policy in advanced economies contributed to the zombification of weak firms and to low growth in those economies. Using both firm-level and macroeconomic data, we find that recessions are a critical factor in the increase in the number of zombie firms and that a too-accommodative monetary policy for extended periods is associated with a higher probability of

this measure. For example, Krippner (2013), Wu & Xia (2016), and Lemke & Vladu (2017) employ term-structure models, while Lombardi & Zhu (2018) use factor analysis, and Mavroeidis (2021) and Ikeda and others (2020) develop a new vector autoregression estimation technique which nests the estimation of a shadow rate. Many theoretical and empirical papers have employed such instruments in the recent past. Among others, Mouabbi & Sahuc (2019) and Hohberger and others (2019) estimate DSGE models, with the first using a shadow EONIA rate and the second with an occasionally binding constraint on the ZLB by employing a shadow interest rate. They both build macroeconomic scenarios with low nominal interest rates and assess the effect of UMPs.

[3] Ates and Saffie (2021) find that in Chile the number of firms created during crises is fewer, but these firms tend to be more productive than incumbent firms.

zombification. We also find that, in such environments, small and medium enterprises are more likely to become zombie firms since they are less dynamic than other firms and usually are in the sectors least exposed to foreign competition. Moreover, we find that Japan experienced a larger economic slowdown than other countries (during our sample period of 1996-2021) due to the increases in the number of zombie firms. This raises concerns about the sustainability of too-easy monetary policy implementation, especially in countries with a low growth rate.

This paper makes a couple of contributions to the literature. First, it uses both macroeconomic and large microdata from the Orbis data set to study zombification trends and the latter's impact on resource allocation and growth. Second, it analyzes the impact of the "too low for too long" policies on zombification.

The paper is organized as follows: Section 2 describes the data and methods used and presents the results of various empirical analyses of factors of zombification, including extended periods of ultra-loose monetary policy. Section 3 discusses the impact of zombification on economic growth. Section 4 discusses the impact of zombification on financial stability. Section 5 concludes.

# Empirical Analysis of Zombification

Answering questions related to zombie firms has an initial challenge related to defining such firms. Although zombies can certainly be considered unprofitable corporates, Caballero and others (2008) depart from this assumption and classify firms as zombies based on whether they have received subsidized credit. They do so by calculating a hypothetical lower bound on interest payments they expect from high-quality borrowers and comparing it with the actual interest payment. Giannetti and others (2013) and Acharya and others (2019) use a similar definition. On the other hand, Banerjee and Hoffman (2018) focus on the profitability of firms by considering two different definitions. A broader measure, following McGowan and others (2017), considers firms as zombies if their interest coverage ratio (ICR)--defined as the ratio between earnings before interest and taxes and interest payments--is less than unity for at least three consecutive years and if they are at least ten years old, and a narrower measure if the firm's Tobin's q is lower than its sector median. While the former focuses on the firm's current profitability (more precisely, on the firm's ability to pay its interest expenses), the latter focuses on future profitability.

For our analysis, we follow the second literature strand and inspect firms' profitability. We use firm-level annual data for publicly traded companies and small firms from the Orbis database, provided by Bureau Van Dijk, with around half a million firm-year observations.[4] The dataset spans 1996 to 2021 and contains balance sheet data and ratios for around 60,000 companies from 21 countries, including the United States, Japan, and all 19 Eurozone countries.[5] According to our definition, a firm is classified as a zombie if it is at least ten years old and its ICR is lower than one for at least two consecutive periods. The first requirement allows not to include as zombies some relatively young, healthy corporates which might suffer initial losses due to their high investments - some of which through high loan volumes - in their first years of activity. In addition, we allow firms to fluctuate between the zombie and non-zombie states whenever the conditions above are not met. By doing so, we can detect the year-specific characteristics of a firm and link them to the current monetary policy

[4] We merge firm-level data and information coming from different Orbis sub-databases and clean the dataset following the steps outlined in Diez and others (2019).

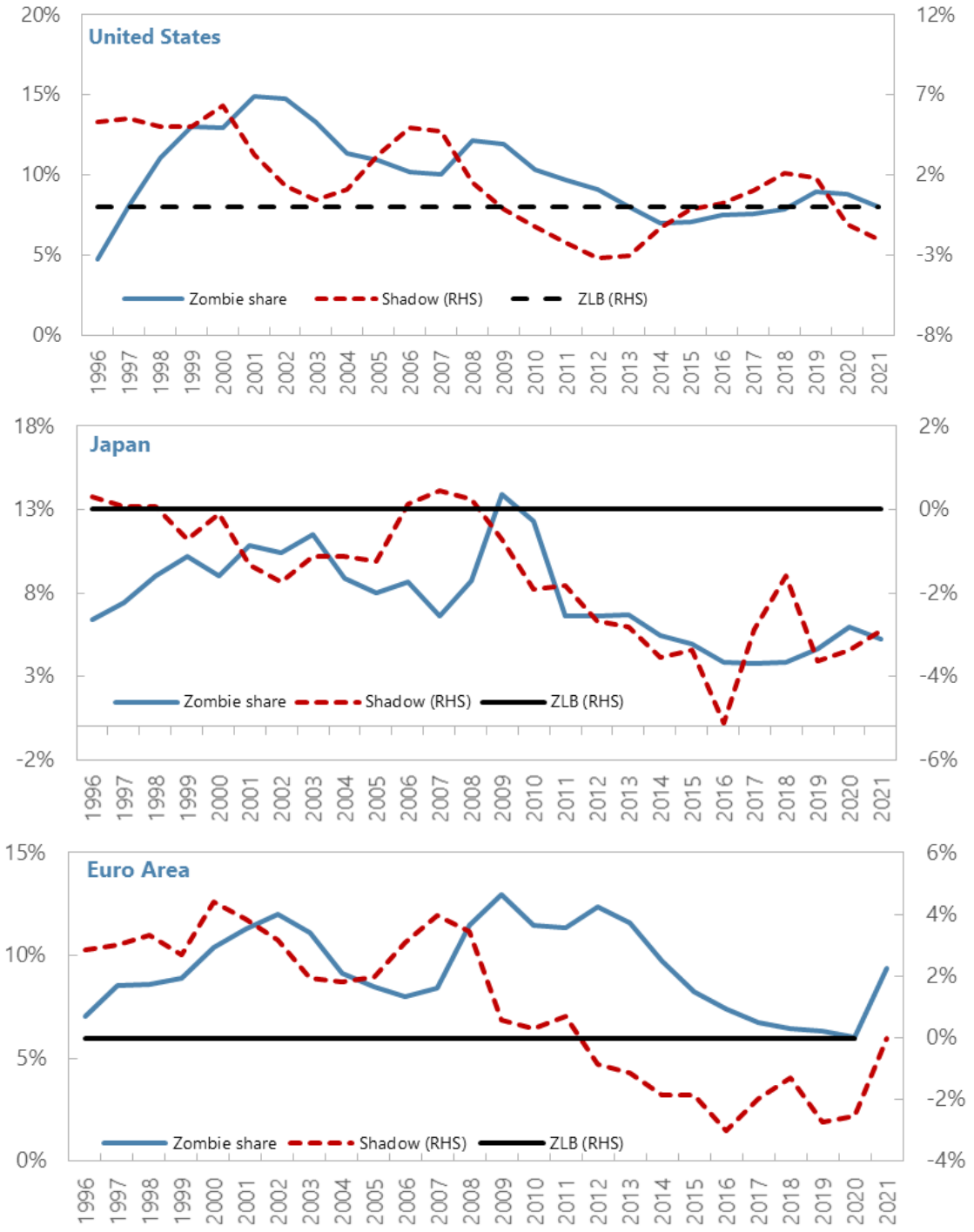
[5] Data availability is very limited for Slovakian firms compared to the rest of the sample.

implementations to inspect their correlation in the recession and ZLB periods. To check the robustness of our results, we also repeat the analyses using an alternative definition of zombie firms, under which a company's ICR is below one in three successive years, which produces similar results.

## STYLIZED FACTS

As can be seen from Figure 1, the number of zombie firms and their share in the total number of firms increased after recessions and broadly declined at other times. In the US, the share of zombie firms increased during the recessions in the early-2000s (after the collapse of the speculative dot-com bubble and the September 11th terrorist attacks), during the global financial crisis, and during the COVID-19 pandemic, when the output gap turned negative. The share gradually declined in most other periods. In Japan, the share of zombie firms had a similar pattern, but Japan had high levels of zombie share also before our sample period, as documented by Caballero and others (2008). In Europe, the zombie share increased to the highest level during the global financial crisis and increased the most (among the three regions) during the pandemic. On the other hand, the shadow rates were reduced following the recessions and were tightened when the economies recovered. These episodes imply negative correlations between the shadow rate and zombie share, but there were also periods, such as 2011-13 in the US, 2011-15 in Japan, and 2012-15 in the EA, when both variables moved in the same direction. Note that in Japan, the shadow rate has been in the negative area since the early 2000s, except for a brief period in 2007-2008. In the Eurozone, the shadow rate turned negative during the global financial crisis and stayed at negative levels for most years after that, when the share of zombie firms also declined. These point to the importance of controlling for the business cycle, which we do by including the recession variable, GDP growth rate, and output gap in various specifications.

**Figure 1: Share of Zombies and the Shadow Rate**



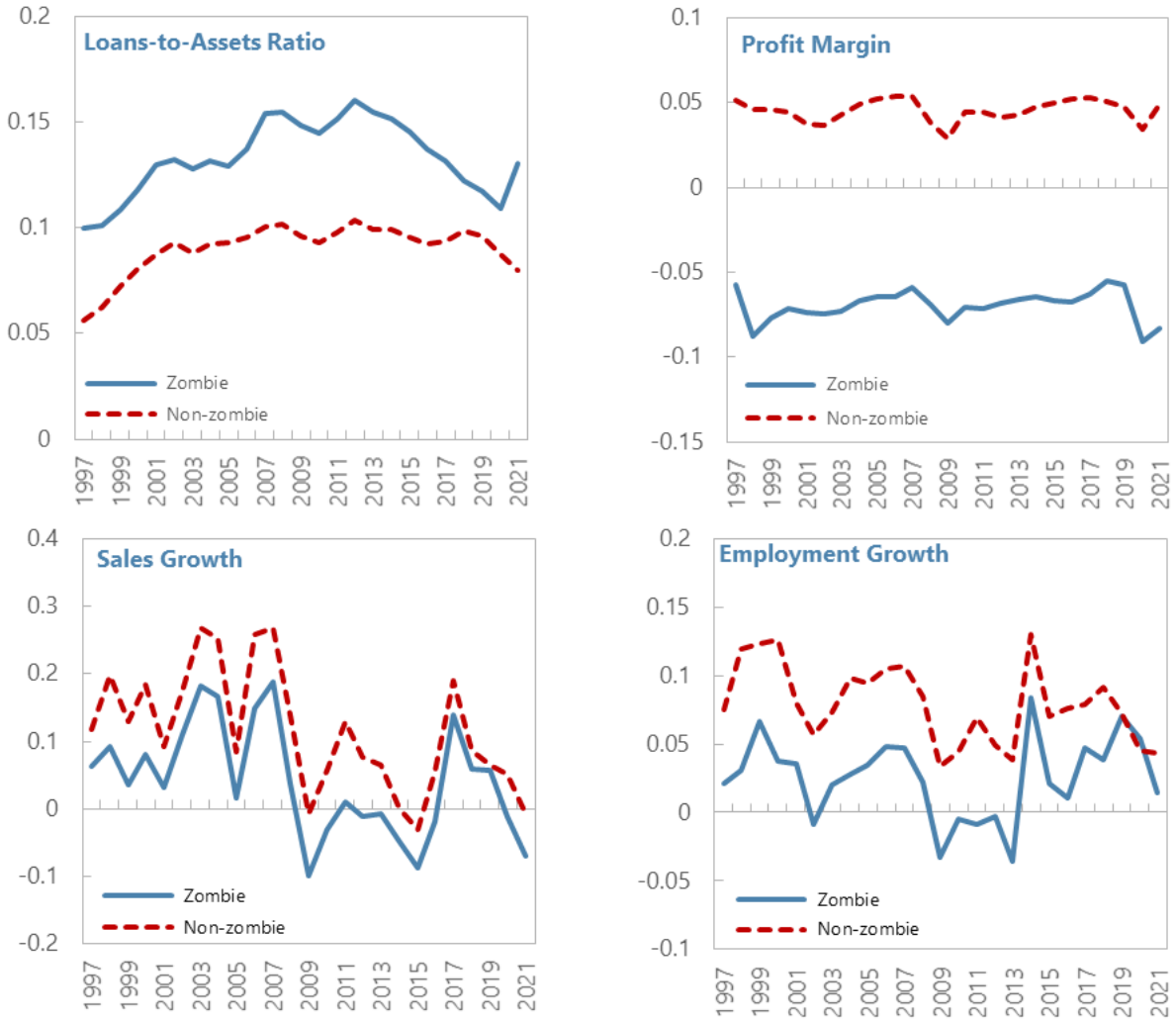

Notes: The zombie shares are computed as the fraction of zombie firms over the total number of firms at time t. The shadow rates are taken from Krippner (2013).

Sources: Orbis database, and the authors' calculations.

As expected, the data set reveals that zombie firms' financial performance is worse than those of non-zombie firms. Almost by definition, zombie firms are more indebted, and most make losses. They also recorded lower

sales and employment growth (Figure 2). But it is worth noting that most of them were still increasing their sales, employment, and borrowing except for the aftermath of the global financial crisis, suggesting that they might have taken market shares from their healthier competitors.

**Figure 2: Zombie vs Non-zombie Performance**



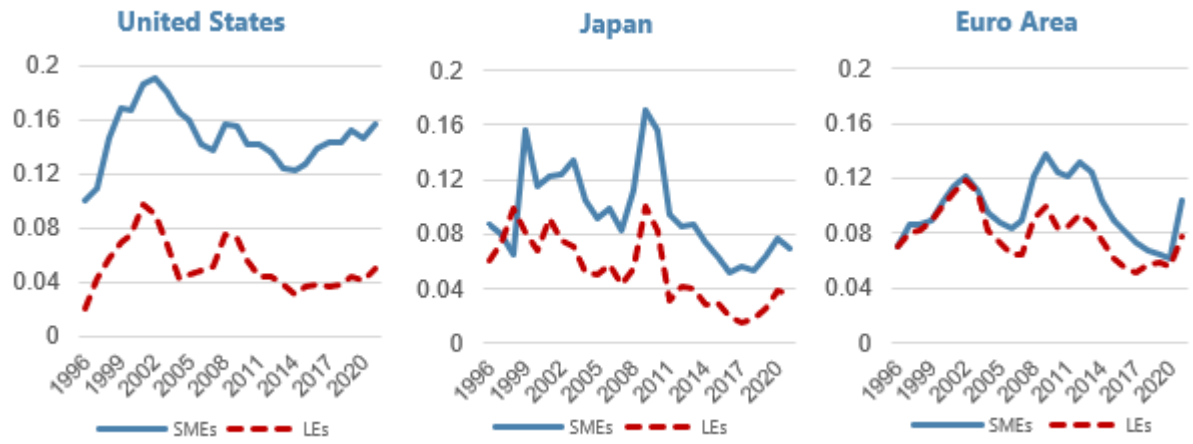

Notes: The solid blue line denotes the mean value of the corresponding performance indicator for the firms classified as zombies, whereas the dashed red line denotes the mean value of the firms not classified as zombies in our dataset.

Sources: Orbis database, and the authors' calculations.

Descriptive statistics from our dataset also reveal an interesting pattern for smaller companies compared to larger enterprises. We identify the former as firms with 1,000 or fewer employees. Figure 3 shows the ratios of identified zombie firms over the total number of firms for both small and medium enterprises (SMEs) and large enterprises (LEs). In all regions, both series closely follow the path of the economic cycle, increasing during recessions and decreasing during expansions, and depict a clear outperformance of the LEs, having lower zombie shares throughout the sample period.

However, there are some notable differences across regions. First, the US experiences a larger gap between SMEs and LEs, with the latter being on average 10 percent less than the former. Second, the gap spikes in Japan around 2000, coinciding with the beginning of the Zero-Interest Rate Policy (ZIRP) implemented by the Bank of Japan and persists until the end of the sample period, although somewhat narrowing. Third, a similar gap emerges in the Euro Area in the early 2000s, increasing even further during the GFC. The gap narrows around 2020 but then increases again during the COVID-19 pandemic. On average, SMEs have a higher share of zombie firms.

**Figure 3: Zombie share in SMEs vs. Large Enterprises**




Notes: The solid blue line and the dashed-red line correspond to the zombie shares of SMEs and LEs.
Sources: Orbis database, and the authors' calculations.

## MONETARY POLICY AND ZOMBIFICATION

### MICRO DATA

In our first regression analysis, we investigate the effect of monetary policy implementation on the probability of a firm becoming a zombie. Our baseline specification for firm *i* in country *j* at time *t* reads as:

$$Zombie_{i,j,t} = \beta 1 \cdot Shadow_{j,t} + \beta 2 \cdot Rec_{j,t} + \beta 3 \cdot ZLB_{j,t} + \beta 4 \cdot Shadow_{j,t} \cdot Rec_{j,t} + \beta 5 \cdot Shadow_{j,t} \cdot ZLB_{j,t} + \beta 6 \cdot SME_{i,j,t} + \gamma \cdot X_{i,j,t} + u_{i,j,t}, \quad (1)$$

where $Zombie_{i,j,t}$ is a dummy variable equal to one if a firm is classified as zombie according to our definition, $Shadow_{j,t}$ is the shadow interest rate estimated using term-structure models as by Krippner (2013),[6] $Rec_{j,t}$ and $ZLB_{j,t}$ are dummy variables that are equal to one in recession periods and when the interest rate is lower than 25 bps, respectively. We also include their respective interaction terms with the shadow rate. We include an $SME_{i,j,t}$ dummy variable for small and medium enterprises, identified as corporates with fewer than 1,000 employees, and a set of country-level and firm-level control variables $X_{i,j,t}$, including real GDP growth, the one-year lag of the shadow rate variable, return on firms' assets, and their profit margin (for each firm).

Table 1 shows the results of our first estimation exercise. The first four columns illustrate panel fixed-effect estimates according to four different specifications. The first regression includes the recession and its interaction term with the shadow rate, while the second regression includes the ZLB dummy variable and its interaction term with the shadow rate. The third column includes both dummies and their interaction terms, and the fourth column augments this last specification with a lag of the shadow rate. In all settings, we control for firm size, profitability, balance sheet characteristics, and economic growth measured by GDP.

The estimation highlights a positive relationship between our dependent variable and the recession variable and a negative relationship with the shadow rate when the policy rate is above the ZLB. This means being in a recession increases the probability of a firm being a zombie firm. Being a small or medium enterprise also increases this probability.[7] On the contrary, increases in aggregate output as well as the ROA (return on asset) and the profit margin of a firm, which control for firm-level health, reduce the probability of being a zombie firm.

The impact of monetary policy decisions, represented by the shadow rate, on zombification depends on the economic cycle when these decisions are made. In particular, while the shadow rate is negatively correlated with the probability of a firm being a zombie under the first specification, this correlation turns positive when we control for ZBL environments under the second specification. Specifically, the interaction of the shadow rate with the ZLB variable (in the second specification) has a positive coefficient, which exceeds the negative coefficient for the shadow rate. Hence the relationship between the shadow rate and the dependent variable is positive. In other words, an expansionary monetary policy implementation at the ZLB reduces the probability of a firm being a zombie but such a policy would lead to more zombification in the other (non-ZBL) periods.[8] The third and fourth specifications, which include all the variables and the lag of the shadow rate variable, yield similar results. Columns five and six show the results with the same set of variables using a panel probit model. These results are consistent with the LPM estimates (in the previous columns) both in terms of the sign and magnitude.

[6] We use the shadow rates as estimated by Krippner (2013) since they are the most comprehensive coverage of the countries/regions studied here.

[7] This outcome might be because smaller firms often belong to the sectors least exposed to foreign competition and thus may be less productive and more exposed to domestic economic cycles. The reasons for this finding are not pursued further here.

[8] The estimated coefficients for the shadow rate and its interaction terms are the correlations between a one percent variation in the shadow rate and the probability of a firm becoming a zombie. Note that this one percent change in the shadow rate does not translate into a variation of 100 bps in the headline monetary policy rate.

**Table 1: Probability of Being a Zombie Firm during Recessions and at the ZLB**

| | *Linear probability model* | | | | *Probit model (mfx)* | |
|---|---|---|---|---|---|---|
| Dependent variable: *Zombie* | (1) | (2) | (3) | (4) | (5) | (6) |
| *Shadow rate* | −0.0025*** (0.0003) | −0.0047*** (0.0005) | −0.0052*** (0.0004) | −0.0051*** (0.0005) | −0.0025*** (0.0002) | −0.0025*** (0.0003) |
| *Recession* | 0.012*** (0.001) | | 0.008*** (0.001) | 0.005*** (0.0012) | 0.004*** (0.0006) | 0.0008 (0.0007) |
| *Shadow rate × Recession* | 0.0024*** (0.0004) | | 0.0030*** (0.0004) | 0.0023*** (0.0004) | 0.0013*** (0.0002) | −0.0007*** (0.0003) |
| *ZLB* | | 0.01*** (0.002) | 0.0095*** (0.002) | 0.011*** (0.002) | 0.0045*** (0.001) | 0.0074*** (0.001) |
| *Shadow rate × ZLB* | | 0.011*** (0.008) | 0.010*** (0.0008) | 0.011*** (0.0008) | 0.0069*** (0.0004) | 0.0075** (0.0005) |
| *SME* | 0.0059** (0.0028) | 0.0053* (0.0028) | 0.0055* (0.0028) | 0.0051 (0.003) | 0.0031*** (0.001) | 0.0065*** (0.001) |
| *GDP growth* | −0.024** (0.012) | −0.059*** (0.010) | −0.035*** (0.011) | −0.029** (0.012) | −0.014** (0.006) | −0.018*** (0.007) |
| *ROA* | −0.0047*** (0.0004) | −0.0047*** (0.0001) | −0.0047*** (0.0001) | −0.0052*** (0.0001) | −0.0043*** (0.0001) | 0.005*** (0.0001) |
| *Profit margin* | −0.0022*** (0.0001) | −0.0022*** (0.0001) | −0.0021*** (0.0001) | −0.021*** (0.0001) | −0.0006*** (0.0001) | −0.0005*** (0.0001) |
| *Shadow rate* (−1) | | | | 0.0010*** (0.0004) | | 0.0014*** (0.0003) |
| *constant* | 0.10*** (0.002) | −0.011*** (0.002) | 0.11*** (0.002) | 0.12*** (0.002) | | |
| Firm FE | Yes | Yes | Yes | Yes | No | No |
| Observations | 433,151 | 433,151 | 433,151 | 371,626 | 433,151 | 371,626 |
| Individual firms | 63,488 | 63,488 | 63,488 | 54,813 | 63,488 | 54,813 |
| $R^2$ | 0.09 | 0.09 | 0.09 | 0.10 | | |

Sources: Orbis database, IMF WEO database, and the authors' estimates.

## MACRO DATA

To check the robustness of our results, we also analyze the relationship between monetary policy implementation and the rise of zombie firms in a macroeconomic setting. First, we build the zombie share variable, a country-level measure of the number of zombies in country j at time t over the total number of firms. Then, we regress it against a set of relevant macroeconomic variables while allowing for country-specific fixed effects. Table 2 shows that, on average, being in a recession or at the ZLB increases the zombie share. However, when expansionary measures are implemented when the economy reaches the ZLB, the effects are beneficial to those firms, confirming the results of our previous estimation exercise.

**Table 2. Effect of Macroeconomic Variables on the Country-specific Zombie Shares**

| Dependent variable: *Zombie share* | (1) | (2) | (3) |
|---|---|---|---|
| *Shadow rate* | 0.0025*** | −0.0033*** | −0.0036*** |
| | (0.0004) | (0.0008) | (0.0007) |
| *Rec* | 0.020*** | | 0.016*** |
| | (0.002) | | (0.002) |
| *Shadow rate × Rec* | 0.0034*** | | 0.0034*** |
| | (0.001) | | (0.001) |
| *ZLB* | | 0.010*** | 0.004 |
| | | (0.004) | (0.003) |
| *Shadow rate × ZLB* | | 0.020*** | 0.017*** |
| | | (0.002) | (0.002) |
| *GDP growth* | −0.039** | −0.068*** | −0.012 |
| | (0.017) | (0.015) | (0.016) |
| *Inflation* | 0.0024** | 0.0033*** | 0.0017* |
| | (0.001) | (0.003) | (0.001) |
| *constant* | 0.085*** | 0.10*** | 0.10*** |
| | (0.002) | (0.003) | (0.002) |
| Country FE | Yes | Yes | Yes |
| Observations | 546 | 546 | 546 |
| Countries | 21 | 21 | 21 |
| $R^2$ | 0.32 | 0.37 | 0.46 |

Sources: Orbis database, IMF WEO database, and the authors' estimates.

## MONETARY POLICY: TOO LOW FOR TOO LONG

While the previous subchapter found that expansionary policy is generally associated with higher zombification but can help reduce zombification at the ZLB, this chapter aims to assess the impact of prolonged periods of low interest rates. We do so by introducing a variable named Long (*j*,*t*), a dummy variable for country *j* at time *t*, capturing periods when the short-term policy rate was kept low for an extended period. We set it equal to one if two conditions apply. Firstly, if the policy rate was lower than 25 bps for at least two consecutive years. Secondly, since unconventional monetary policies can on their own exert some effect on the probability of a firm becoming a zombie, we decide to set the dummy equal to one at time *t* if also QE was not implemented. This second requirement ensures that we can capture the implementation of persistently low-interest rate

policies without mistakenly including the effects of QE on firms' borrowing costs and other financial indicators.[9] [10] For this analysis, we estimate the following regression:

$$Zombie_{i,j,t} = \beta 1 \cdot Shadow_{j,t} + \beta 2 \cdot Long_{j,t} + \beta 3 \cdot Shadow_{j,t} \cdot Long_{j,t} + \beta 4 \cdot Rec_{j,t} + \beta 5 \cdot SME_{i,j,t} + \gamma \cdot X_{i,j,t} + u_{i,j,t}, \quad (2)$$

where $X_{i,j,t}$ includes the same set of control variables as in equation 1.

Table 3 reports the results of panel OLS and probit model estimations. Both estimations confirm the negative relationship between the shadow rate and the probability of being a zombie firm. Long periods of low interest rates seem to be correlated with higher probabilities of having zombie firms, given the interaction term of the monetary policy rate during prolonged periods of low interest rates is highly negative and significant. These results highlight the negative impact that a too-accommodative monetary policy can have on the rise of zombie firms. As discussed by Caballero and others (2008), when interest rates are very low and banks are subject to strict capital requirements, their willingness to keep lending to unprofitable firms can generally increase as they may hope for government support to the borrowers. Furthermore, expectations play an important role. The longer interest rates are kept low, the more likely the agents will believe that the central bank will stick to a low-interest rate policy, even exacerbating this mechanism. This is mainly captured by the Japanese experience, which was the first country to adopt the ultra-easy monetary policy with the implementation of the ZIRP before extensively using QE for the first time in an advanced economy.

[9] In addition, asset purchases of central banks normally focus on buying financial instruments of healthier large firms experiencing some liquidity issues. Accordingly, QE might not be detrimental to productivity, while lower interest rates for extended periods would facilitate the survival of zombie firms, increasing the probability of a weak firm becoming a zombie. There are also alternative views. For example, Krishnamurthy & Vissing-Jorgensen (2011) highlight that the default-risk channel of QE could benefit riskier firms more than healthier firms, increasing the probability of their survival and thus the probability of becoming zombie firms.

[10] Note that the purpose here is not to identify monetary policy shocks. Instead, we focus on the correlation between extended periods of low interest rates and zombification.

**Table 3. Probability of Being a Zombie Firm During Long Periods of Low Interest Rate**

| | *Linear probability model* | | *Probit model (mfx)* | |
|---|---|---|---|---|
| Dependent variable: *Zombie* | (1) | (2) | (3) | (4) |
| *Shadow rate* | −0.0021*** | −0.0022*** | −0.0003*** | −0.0004*** |
| | (0.0003) | (0.0003) | (0.0001) | (0.0001) |
| *Long* | 0.025*** | 0.020*** | 0.012*** | 0.009*** |
| | (0.003) | (0.003) | (0.001) | (0.001) |
| *Shadow rate × Long* | −0.035*** | −0.030*** | −0.017*** | −0.014*** |
| | (0.004) | (0.004) | (0.002) | (0.002) |
| *Recession* | | 0.010*** | | 0.005*** |
| | | (0.001) | | (0.001) |
| *SME* | 0.005** | 0.006** | 0.003*** | 0.003*** |
| | (0.003) | (0.003) | (0.001) | (0.001) |
| *GDP growth* | −0.087** | −0.037** | −0.045*** | −0.017*** |
| | (0.01) | (0.01) | (0.005) | (0.006) |
| *ROA* | −0.0047*** | −0.0047*** | −0.0043*** | −0.0043*** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| *Profit margin* | −0.002*** | −0.002*** | −0.001*** | −0.001*** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| *constant* | 0.11*** | 0.11*** | | |
| | (0.002) | (0.002) | | |
| Firm FE | Yes | Yes | No | No |
| Observations | 433,151 | 433,151 | 433,151 | 433,151 |
| Individual firms | 63,488 | 63,488 | 63,488 | 63,488 |
| $R^2$ | 0.09 | 0.09 | | |

Sources: Orbis database, IMF WEO database, and authors' estimates

To show the robustness of our results, we augment our previous specification by controlling for all cross-sectional and time variations within firm, sector, and country. Table 4 shows that the coefficient for the interaction term between the monetary policy instrument and our "long" measure is negative and significant in all settings. This supports the claim that keeping interest rates too low for an extended period increases the probability of a firm turning into a zombie firm.

**Table 4. Too Low for Too Long - Saturated Specification**

| Dependent variable: *Zombie* | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Shadow rate × Long* | −0.037*** | −0.058*** | −0.031*** | −0.035*** | −0.016*** | −0.016*** |
| | (0.005) | (0.006) | (0.004) | (0.004) | (0.006) | (0.006) |
| *Controls* | Yes | Yes | Yes | Yes | Yes | Yes |
| *Time* | No | Yes | Yes | No | Yes | No |
| *Firm* | No | No | Yes | Yes | No | No |
| *Firm × Time* | No | No | No | No | Yes | No |
| *Sector* | No | No | No | Yes | Yes | No |
| *Sector × Time* | No | No | No | No | No | Yes |
| *Country* | No | No | No | Yes | No | No |
| Observations | 433,151 | 433,151 | 433,151 | 423,851 | 433,151 | 433,151 |
| $R^2$ | 0.095 | 0.097 | 0.56 | 0.56 | 0.10 | 0.10 |
| $R^2_{adj}$ | 0.095 | 0.097 | 0.49 | 0.49 | 0.10 | 0.10 |

Sources: Orbis database, IMF WEO database, and the authors' estimates.

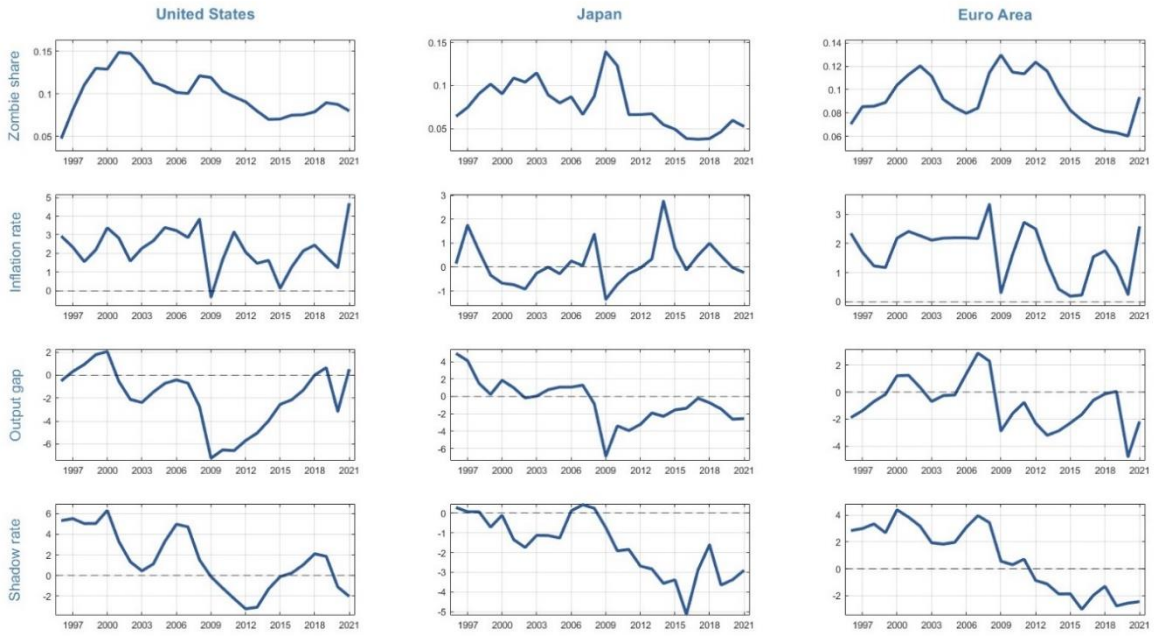
# Zombification and Economic Growth

## IMPACT ON GROWTH

The previous micro and macro analyses suggest that a too-accommodative monetary policy in extended periods can indeed facilitate zombification, but it needs to be clarified if and how the rise of zombie firms would reduce economic growth. On the one hand, at the firm level, there is a negative correlation between GDP growth and the probability of being a zombie firm. On the other hand, this relationship is not always significant on the macroeconomic side, as seen in Table 2. To shed light on this matter, we estimate a Bayesian panel VAR on the three units of our sample corresponding to monetary unions, namely the United States, Japan, and the Eurozone. We identify the structural shocks using a Cholesky ordering. The variables of the system are the region-specific zombie share, the CPI inflation rate, the output gap, and the shadow rate in that order, based on the idea that monetary policy shocks do not have contemporaneous effects on the other variables of the system, which is consistent with the existing literature on SVAR models, including Bernanke & Mihov (1998), Christiano and others (1999) and Primiceri (2005). It is worth noting that the results are robust to different Cholesky ordering.

Figure 4 shows the endogenous variables of the panel VAR system for each country of our sample. Given the time coverage of the firm-level dataset, we estimate the model for the period 1996 - 2021. As outlined by Canova and Ciccarelli (2013), there exist many alternatives to the estimation of panel VAR models in a Bayesian setting with different degrees of complexity. As we are interested in capturing the cross-sectional differences in the impact of the increase in the share of zombies on economic activity, we use the algorithm of Jarocinski (2010). Their Gibbs sampler employs hierarchical priors and treats the common mean and covariances of the VAR coefficients as random parameters. We estimate 50,000 MCMC simulations and discard the first 20,000 as burn-in.

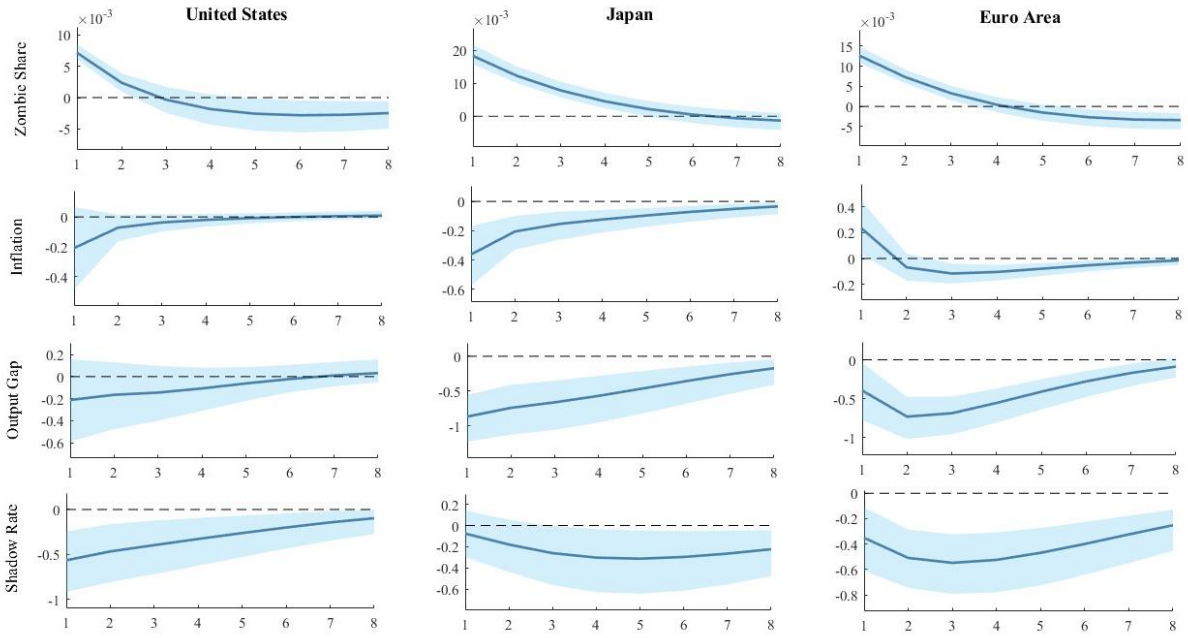
## Figure 4. Variables of the Panel VAR




Notes: Each column of the figure corresponds to a cross-sectional regional unit of the panel-VAR, while each row shows the variables of the system. The zombie share is the fraction of zombie firms over the total number of firms for each regional unit; the inflation rate comes from the Fred database of the FED of St. Louis for the US, from the Bank of Japan's website for Japan, and from Eurostat for the EA; the output gap is obtained from the IMF database; and the monetary policy rates are the shadow rates as estimated by Krippner (2013).
Sources: Orbis database, IMF WEO database, and the authors' calculations.

Figure 5 shows the impulse response functions following a one-standard-deviation shock increase in the region-specific zombie share on itself, CPI inflation rate, output gap, and the shadow rate. We can gauge different responses among the panel units. In particular, the effect of the increased zombification on the output gap is negative in all the regions, peaking at negative 0.9 percent in Japan, followed by 0.75 percent in the EA, although it is statistically insignificant in the case of the US. This might be evidence that the Japanese and European experiences in keeping interest rates very low for an extended period resulted in the zombification of their weak firms, which was more detrimental to growth than in the US. Note that the shadow rates significantly decrease in response to the shock, which implies the monetary policy authorities responded to the increase in the share of zombie firms with expansionary policies. It is also worth noting that the lower shadow rates in response to the shock are more persistent in Japan while they recover to the pre-shock level relatively quickly in the US, potentially explaining the differences in the adverse effects of zombification in the three regions.

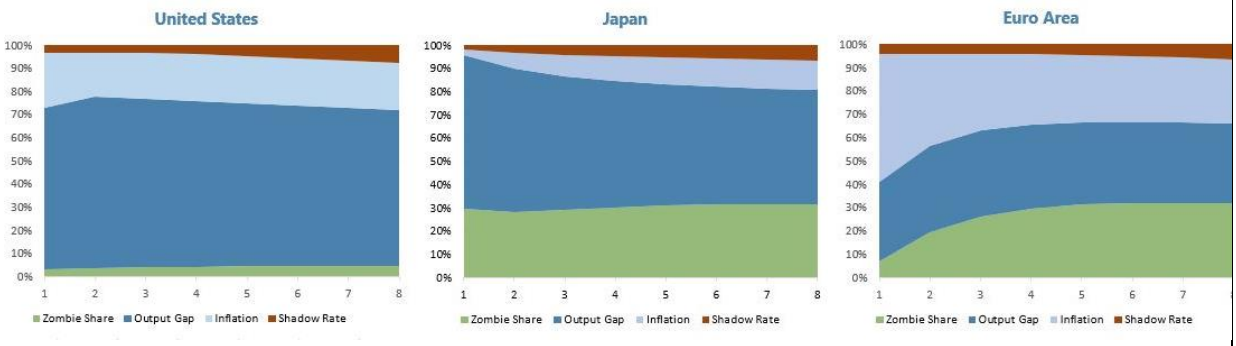
## Figure 5. Impulse Response Functions - Zombie Share Shock




Notes: Each column of the figure corresponds to a cross-sectional regional unit of the panel-VAR, while each row shows the variables of the system. The solid blue line denotes the posterior median response, while the shaded blue bands correspond to the 68% posterior percentiles.
Sources: Orbis database, IMF WEO database, and the authors' estimates.

Figure 6 further supports the evidence that Japan and the Eurozone suffered the most from the rise of zombie firms. Each chart corresponds to the region-specific forecast error variance decomposition of the output gap resulting from the panel VAR estimation. The output gap explains most of its variance throughout the response horizon period in all three regions. However, while the zombie share explains respectively around 6 percent of the variability of the output gap in the US, this contribution accounts for up to 30 percent in Japan and the Eurozone. As noted earlier on the higher persistency of the IRFs, the contribution of the zombie share is, on average, higher for the Japanese economy in the selected horizon, followed by the Eurozone. This finding suggests that Japan, followed by the Eurozone, experiences the sharpest economic slowdown explained by the zombification of its corporate sector.

**Figure 6. Forecast Error Variance Decomposition of the Output Gap**



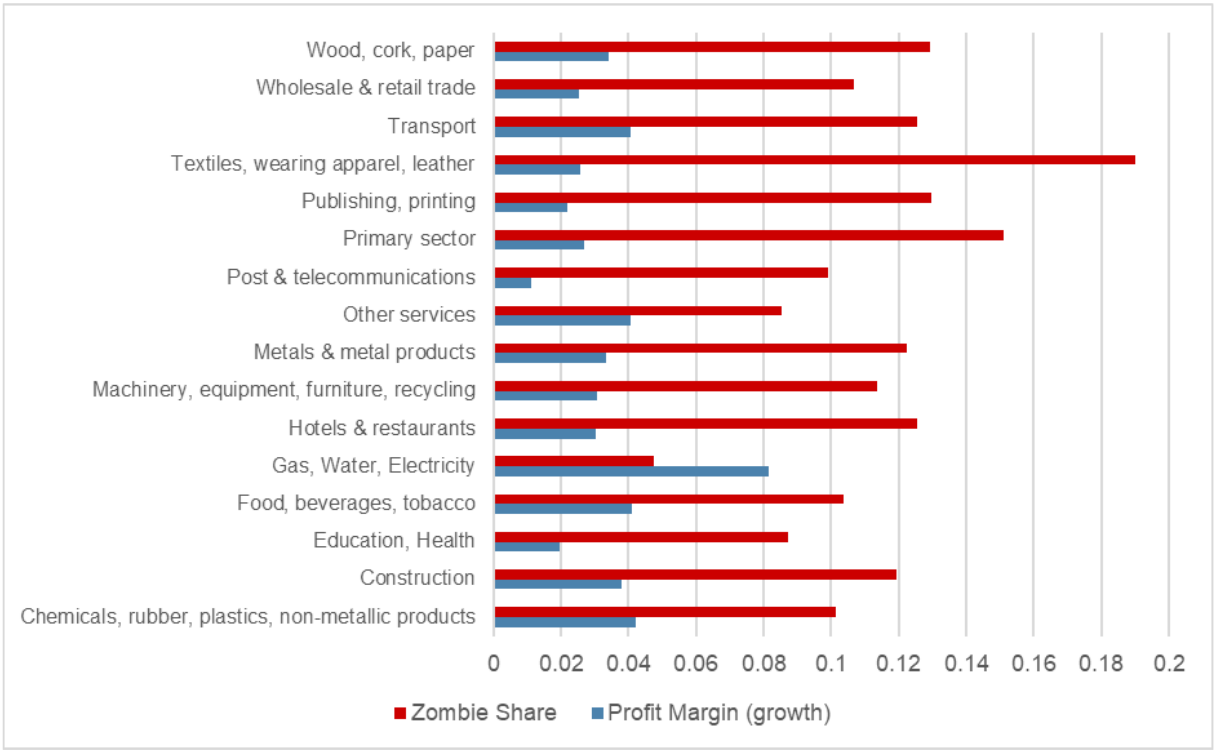

Notes: Each chart shows the region-specific percentage of the variance of the output gap, respectively explained by shocks in the zombie share in green color, the output gap itself in blue, and the shadow rate in red.

Sources: Orbis database, IMF WEO database, and the authors' estimates.

## SPILLOVER EFFECTS

The above adverse effects of zombification on economic growth might come from both direct effects of the presence of zombie firms with worse performance and indirect effects through impact on the more profitable and healthy firms. To analyze the latter effect, we first employ descriptive statistics computed from our firm-level dataset and compute zombie shares and profit margin growth for each sector. Figure 7 compares the full sample averages of the two variables, from which we can notice some degree of negative correlation between sector performance and the zombie share. The sectors with lower profit margin growth, such as textiles, apparel, leather, and the primary sector, have a relatively higher number of zombies. At the same time, gas, water, and electricity, experiencing the lowest sectoral zombie share, has the highest average profit margin growth. These imply that adverse shocks affect both zombie and non-zombie firms.

**Figure 7. Sectoral zombie shares and economic performance**




Notes: for each sector the blue and the red lines correspond to the average zombie share and the average profit margin growth, respectively.

In order to analyze indirect adverse effects of zombification on growth (through adverse effects on healthier firms), we test whether high shares of zombie firms had a negative impact on the healthier firms of the same sector. We consider a similar specification as in Acharya and others (2019) and estimate the following panel fixed-effects regression:

$$y_{i,j,t} = \beta 1 \cdot Nonzombie_{i,j,h,t} + \beta 2 \cdot Nonzombie_{i,j,h,t} \cdot Sector\ Frac\ Zombie_{j,h,t} + \gamma \cdot X_{i,j,h,t} + u_{i,j,t}, \quad (3)$$

where dependent variables are the employment growth and the profit margin of firms, $Nonzombie_{i,j,h,t}$ is a dummy variable equal to one if a firm *i*, in country *j*, sector *h* and at time *t* is not a zombie according to our specification, $Sector\ Frac\ Zombie_{j,h,t}$ measures the sector-specific zombie share, and $X_{i,j,t}$ is a set of firm-level control variables including the ICR, loan growth and and the ratio between the earnings before interest and taxes (EBIT) and toal assets. In this specification, the coefficient $\beta 2$ estimates the impact of an increase in the sector-specific zombie share on the respective dependent variable of non-zombie firms belonging to the same sector, hence, if zombie firms produce negative spillovers to healthy firms.

Table 5 shows that an increase in the sector-specific zombie share exerts a sizable reduction on both the employment growth and the profit margin of non-zombie firms operating in the same sector. By augmenting our fixed-effects specification, we obtain an average 12% decrease on the employment growth and a 12.2% decrease on the profit margin of healthy firms. Our results are consistent with Banerjee and Hoffman (2018), who employ a similar measure of zombie firm.

What might be in place is a potential transmission channel that leads to a more general resource misallocation problem. If prolonged periods of an ultra-easy monetary policy increase the probability that unprofitable firms keep on "floating," the market will indirectly deprive the healthier firms of investment possibilities, in turn leading to lower employment and profits. In this sense, monetary policy at very low level of interest rates could be considered a form of financial repression.

**Table 5. Spillovers to Non-zombie Firms.**

| Dependent variable: | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| ***Employment growth*** | | | | | |
| *Sector frac zombie × Nonzombie* | −0.18*** | −0.15*** | −0.11** | −0.06* | −0.10* |
| | (0.03) | (0.03) | (0.004) | (0.03) | (0.05) |
| Observations | 312,045 | 312,045 | 303,447 | 303,447 | 303,447 |
| $R^2$ | 0.03 | 0.06 | 0.16 | 0.16 | 0.17 |
| $R^2_{adj}$ | 0.03 | 0.06 | 0.03 | 0.03 | 0.04 |
| ***Profit margin*** | | | | | |
| *Sector frac zombie × Nonzombie* | −0.12*** | −0.15*** | −0.11*** | −0.12*** | −0.11*** |
| | (0.004) | (0.006) | (0.007) | (0.005) | (0.007) |
| Observations | 300,812 | 300,812 | 292,659 | 292,659 | 292,618 |
| $R^2$ | 0.29 | 0.30 | 0.64 | 0.64 | 0.65 |
| $R^2_{adj}$ | 0.29 | 0.30 | 0.59 | 0.59 | 0.60 |
| *Controls* | Yes | Yes | Yes | Yes | Yes |
| *Time* | No | Yes | Yes | No | No |
| *Firm* | No | No | Yes | Yes | Yes |
| *Time × Country* | No | No | No | No | Yes |
| *Sector* | No | No | No | Yes | Yes |
| *Country* | No | No | No | Yes | No |

Sources: Orbis database, IMF WEO database, and the authors' estimates

# Financial Stability Aspects

As discussed above, some existing literature points to a weak banking sector as a key factor facilitating zombie firms' emergence and survival. Specifically, undercapitalized banks tend to "evergreen" their loans to loss-making companies because properly classifying these loans would require additional provisioning, thus reducing these banks' capital adequacy ratios. Using specific loan information, Caballero and others (2008)

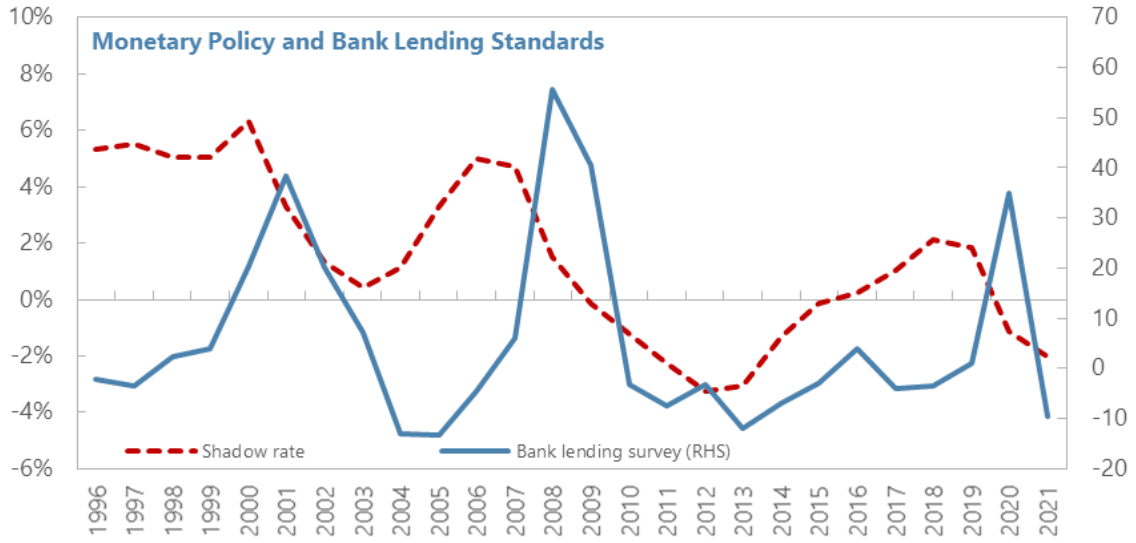
document such zombie lending in Japan in the 1990s, and Blattner and others (2019) show that weak European banks directed cheap credit to nonviable firms in the aftermath of the Global Financial Crisis.

In the absence of specific loan information, we try to gauge if banks had leniency toward weak companies by assessing trends in the Senior Loan Officer Surveys on Bank Lending Practices (SLOSOBL) in the U.S. Specifically, we analyze trends in net changes in the standards and terms on bank loans to small and medium businesses in the U.S. As can be seen from Figure 8, there is a strong correlation between the shadow rate (with a two-year delay) and the loan standards in the US in the periods when the shadow rate was reduced to low levels. While it is normal to expect loan demand and supply to increase when interest rates are low [and the government introduces various incentives for bank lending], the fact that banks continued easing loan standards for long periods in 2004-06, when financial imbalances were building before the global financial crisis, and in 2010-2018, when the economy was normalizing after the global financial crisis, can arguably be interpreted as leniency toward weaker companies.

However, Favara and others (2021) find that U.S. banks do not seem to offer credit at favorable terms to zombie firms. They, on average, charge zombie firms higher loan spreads, require more collateral, and offer shorter-maturity loans than non-zombie firms. Moreover, banks appear to assess zombie firms as having a higher probability of default and systematically rate their credit ratings lower than the other firms.

All in all, related financial sector risks in the 21 countries studied appear manageable in the short-to-medium term. Banks have significantly improved their lending and loan classification practices, capital and liquidity adequacy ratios, and stress testing capacity in the aftermath of the global financial crisis, especially in the context of Basel III reforms. Recent stress tests by banks, respective authorities, and the IMF (in the context of the respective Financial Sector Assessment Programs, FSAP) suggest that the financial systems in these countries can weather large but plausible shocks. Moreover, the countries have significantly improved their financial sector supervision and crisis management and resolution frameworks, notably with respect to early warning systems and pre-insolvency frameworks, which means that they can identify adverse trends and manage crises if they occur. Indeed, the financial systems performed well during the COVID-19 pandemic, a once-in-a-century shock.

**Figure 8. Monetary Policy and Bank Lending Standards in the U.S**




Sources: The Federal Reserve Bank of the U.S., and the authors' estimates

However, the long period of low interest rates poses challenges for financial markets in the medium-to-long term, especially in Japan. As noted in the 2017 FSAP for Japan, if interest rates remained at low levels, net interest margins would continue to evaporate over the next 5-10 years as older higher-yielding loans and bonds are replaced at lower interest rates. Profitability pressures are even more intense for smaller institutions outside of urban regions (in Japan) due to declining populations in these areas. Furthermore, the prolonged low domestic interest rate environment is pushing life insurers to turn to foreign investments to provide the yield needed to meet interest guarantees on old policies. These imply risks that need to continue to be monitored.

# Conclusion

While expansionary policies can stimulate economic activity and bolster financial health for both weak and healthy firms, the prolonged implementation of ultra-easy monetary policy may induce undesirable side effects. Our empirical research affirms that economic recessions and sluggish growth significantly contribute to an upswing in the number of zombie firms. In these scenarios, expansionary policies may be useful, provided that central banks maintain credibility and inflationary pressures are absent. However, our findings also indicate that the extended use of ultra-easy monetary policy facilitates the survival of zombie firms, ultimately leading to resource misallocation and reduced market share for healthier businesses, thus dampening economic growth. These insights suggest a delicate balance between employing countercyclical monetary policy and utilizing expansionary monetary policy over extended periods, which could cultivate an environment of low interest rates, low growth, and heightened financial vulnerability. This tradeoff does not currently pose an issue, as most countries have tightened their monetary policy stances. Nevertheless, policymakers should remain aware of this tradeoff during future economic downturns.

The potentially detrimental effects of ultra-easy monetary policy are especially pronounced in regions like Japan and the Eurozone, where the negative impact of increased zombification on the output gap is the highest. These observations evoke concerns regarding the sustainability of ultra-easy monetary policy, particularly in regions with sluggish growth.

The adverse effects of ultra-easy monetary policies can be substantially mitigated if the banking system is robust, properly supervised, and successfully distinguishes between strong and weak firms, thereby promoting healthy competition. Since the global financial crisis, considerable reforms have fortified financial systems, rendering them more resilient to shocks and significantly decreasing the risks of "evergreening" non-performing loans. Nevertheless, long-term ultra-easy monetary policy can still pose financial stability risks, especially if followed by policy tightening in later periods. Thus, these risks should be closely monitored.

# Appendix

This appendix includes a set of robustness exercises to strengthen the paper's main results.

First, we check the robustness of our main findings by departing from our preferred identification scheme of a zombie firm in our dataset. Table A.1 shows the results of different specifications of Equation 1, where a firm is classified as a zombie if it is at least ten years old and its ICR is lower than one for at least three consecutive periods, compared with the two periods in our baseline approach. The results are similar both from a qualitative and quantitative perspective, and the economic intuitions drawn in section 2.1 remain valid. The correlation between the shadow rate and the probability of becoming a zombie firm depends on the economic environment, with expansionary policies being associated with lower probabilities of a firm being a zombie under the ZBL and being associated with a higher probability of being a zombie in the other periods. A difference is that the coefficient for the lagged shadow rate in column (4) here is very low and statistically insignificant.

**Table A1. Probability of Being a Zombie Firm during Recessions and at the ZLB**

| | *Linear probability model* | | | | *Probit model (mfx)* | |
|---|---|---|---|---|---|---|
| Dependent variable: *Zombie* | (1) | (2) | (3) | (4) | (5) | (6) |
| *Shadow rate* | −0.0025*** | −0.0048*** | −0.0052*** | −0.0045*** | −0.0024*** | −0.0025*** |
| | (0.0003) | (0.0004) | (0.0004) | (0.0004) | (0.0002) | (0.0003) |
| *Recession* | 0.006*** | | 0.003*** | 0.003*** | 0.0007 | 0.0008 |
| | (0.0008) | | (0.0003) | (0.0010) | (0.0005) | (0.0007) |
| *Shadow rate × Recession* | 0.0026*** | | 0.0030*** | 0.0027*** | 0.0015*** | −0.0007*** |
| | (0.0003) | | (0.0003) | (0.0003) | (0.0002) | (0.0003) |
| *ZLB* | | 0.0062*** | 0.0069*** | 0.0065*** | 0.0037*** | 0.0074*** |
| | | (0.001) | (0.001) | (0.002) | (0.0008) | (0.001) |
| *Shadow rate × ZLB* | | 0.010*** | 0.010*** | 0.010*** | 0.0064*** | 0.0075** |
| | | (0.0007) | (0.0007) | (0.0007) | (0.0004) | (0.0005) |
| *SME* | 0.0063** | 0.0057** | 0.0059** | 0.0061** | 0.0019*** | 0.0065*** |
| | (0.0026) | (0.0026) | (0.0026) | (0.003) | (0.0007) | (0.001) |
| *GDP growth* | −0.028** | −0.037*** | −0.037*** | −0.030** | −0.018*** | −0.018*** |
| | (0.011) | (0.008) | (0.010) | (0.011) | (0.005) | (0.007) |
| *ROA* | −0.0029*** | −0.0029*** | −0.0029*** | −0.0033*** | −0.0022*** | 0.005*** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| *Profit margin* | −0.0018*** | −0.0018*** | −0.0018*** | −0.018*** | −0.0004*** | −0.0005*** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| *Shadow rate (−1)* | | | | 0.0004 | | 0.0014*** |
| | | | | (0.0003) | | (0.0003) |
| *constant* | 0.08*** | −0.09*** | 0.09*** | 0.12*** | | |
| | (0.002) | (0.002) | (0.002) | (0.002) | | |
| Firm FE | Yes | Yes | Yes | Yes | No | No |
| Observations | 433,151 | 433,151 | 433,151 | 371,626 | 433,151 | 371,626 |
| Individual firms | 63,488 | 63,488 | 63,488 | 54,813 | 63,488 | 54,813 |
| $R^2$ | 0.07 | 0.07 | 0.07 | 0.08 | | |

Sources: Orbis database, IMF WEO database, and the authors' estimates.

Second, in table A.2, we replicate the estimation of equation 2 with the zombie firm identification used in Table A.1. As in the previous exercise, we can draw conclusions similar to our baseline estimation. Keeping the

interest rates low for an extended period, as during long periods of too accommodative monetary policy, is correlated with a higher probability of a firm being a zombie.

**Table A2. Effect of Macroeconomic Variables on the Country-specific Zombie Shares**

| | *Linear probability model* | | *Probit model (mfx)* | |
|---|---|---|---|---|
| Dependent variable: *Zombie* | (1) | (2) | (3) | (4) |
| *Shadow rate* | −0.0022*** | −0.0022*** | −0.0004*** | −0.0004*** |
| | (0.0003) | (0.0003) | (0.0001) | (0.0001) |
| *Long* | 0.017*** | 0.014*** | 0.008*** | 0.007*** |
| | (0.003) | (0.003) | (0.001) | (0.001) |
| *Shadow rate × Long* | −0.0055* | −0.0028 | −0.004** | −0.0029* |
| | (0.003) | (0.003) | (0.002) | (0.002) |
| *Recession* | | 0.005*** | | 0.002*** |
| | | (0.0008) | | (0.001) |
| *SME* | 0.006** | 0.006*** | 0.002*** | 0.003*** |
| | (0.003) | (0.0003) | (0.0007) | (0.001) |
| *GDP growth* | −0.057** | −0.029** | −0.027*** | −0.014*** |
| | (0.008) | (0.009) | (0.005) | (0.005) |
| *ROA* | −0.0029*** | −0.0029*** | −0.0021*** | −0.0021*** |
| | (0.0001) | (0.009) | (0.0001) | (0.0001) |
| *Profit margin* | −0.002*** | −0.002*** | −0.0004*** | −0.004*** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| *constant* | 0.08*** | 0.08*** | | |
| | (0.002) | (0.002) | | |
| Firm FE | Yes | Yes | No | No |
| Observations | 433,151 | 433,151 | 433,151 | 433,151 |
| Individual firms | 63,488 | 63,488 | 63,488 | 63,488 |
| $R^2$ | 0.07 | 0.07 | | |

Sources: Orbis database, IMF WEO database, and the authors' estimates

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