

Not All Weak Firms Are Alike: How Financial Viability Shapes Monetary Policy Transmission

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Abstract. How monetary policy transmits to firms that differ in their financial viability remains an open question. Standard proxies for financial constraints treat financially weak firms as a single group, implying that monetary transmission to investment is monotonic in financial weakness. Using balance-sheet data on 5 million Euro Area firms over 2005–2022, I separate financially weak firms into zombies, whose businesses are shrinking, and distressed firms, whose businesses are stable or expanding, and compare them to healthy firms. I find that the *nature* of financial weakness matters for monetary transmission: three groups of firms imply three strengths of responsiveness. Following a contractionary monetary policy shock, all firms reduce investment. Compared to healthy firms, however, distressed firms respond more strongly in reducing their investment, while zombie firms respond less strongly. Responsiveness is therefore non-monotonic in financial weakness, and pooling the two groups of distressed and zombie firms masks offsetting investment responses. These offsetting responses are driven by loan evergreening shielding zombie firms’ credit conditions, widening the zombie-distressed gap where banks are poorly capitalised or burdened by non-performing loans. In aggregate, I show that zombie firms dampen monetary policy transmission. Thus, this paper shows that firm composition shapes monetary policy transmission, and highlights a link between prudential and monetary policy through banks’ lending behaviour.

Keywords: *monetary policy, firm heterogeneity, investment, zombie firms, banking*

JEL: E22, E44, E52, E58, G21, G33

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1 Introduction

The Euro Area’s fastest tightening cycle in its history has shifted the question from whether monetary policy can still stimulate the economy to how strongly rate increases transmit to output and inflation. Firm investment is one major channel of monetary policy transmission, and the strength of transmission can differ substantially across firms. How it varies with firms’ financial viability remains an open question. This matters beyond the individual firm. The same change of the policy rate affects the economy differently depending on whether its capital sits with firms that respond strongly to financing conditions or with firms that barely do. A central bank setting a single policy rate therefore needs to know not just that transmission is heterogeneous, but which firms respond in which direction.

The financial accelerator mechanism provides a central explanation for such heterogeneity, proposing that financially weaker firms respond more to monetary tightening (Bernanke and Gertler, 1995). Higher rates erode their net worth and raise the premium they pay for external finance, amplifying the fall in investment more than for healthy firms. Ottonello and Winberry (2020) argue the opposite. Firms close to default already pay rates rising more steeply for each additional unit of credit, so a given change in policy rates moves their investment less. Both theoretical mechanisms are plausible but usually presented as mutually exclusive, since it is implicit that one channel dominates the other. This implicit assumption suggests a monotonic relationship between financial weakness and investment responsiveness, and it is either increasing (financial accelerator) or decreasing (default risk) in financial weakness. The empirical literature has provided results in support of both mechanisms, usually relying on a single characteristic such as age, size, or leverage to proxy financial constraints.

This paper proposes a way to reconcile this apparent puzzle: two firms can appear similarly weak on one balance sheet dimension such as leverage, but may differ in the broader nature of their financial viability. Financial viability here refers to whether a firm can meet its debt obligations out of its own operations on a persistent basis, and whether the business generating those operations is growing or shrinking. I show that both accounts, the financial accelerator and the default risk channel, can co-exist in the same sample of firms by realising that the relationship between financial viability and investment responsiveness is non-monotonic. This is because financial viability captures the trajectory weak firms are on, rather than their static financial position, and combines several dimensions of firm heterogeneity, rather than relying on a single dimension like leverage. To see this, consider two firms with the same high leverage, both unable to cover their interest payments out of current earnings. The first runs a business that is still growing, while the business of the second is

shrinking. A monetary tightening raises the cost of debt servicing and refinancing for both firms. For the first firm, which I call *distressed*, the question is how much investment remains worth financing at the higher cost, entailing a reduction in investment. For the second firm, which I call a *zombie*, the tightening pushes a shrinking business closer to default, and its investment response depends on how that is resolved: through an even sharper reduction in investment, exit, or continued access to finance to keep investing.¹ Hence, two firms ranked identically by standard proxies may respond differently to the same monetary policy shock.

To investigate how the nature of financial viability affects the transmission of monetary policy, I use granular balance-sheet data from Orbis Historical for approximately 5 million firms across 20 Euro Area countries from 2005 to 2022. A central strength of this dataset is the inclusion of unlisted small and medium-sized firms, which constitute around 80% of the Euro Area economy. Excluding them risks systematically understating the severity of the zombie phenomenon as these firms are typically more bank-dependent. I classify firms into three groups: healthy, distressed, and zombie firms. Healthy firms are not financially weak. Both distressed and zombie firms are financially weak firms, meaning they are highly leveraged and cannot service their debt out of current earnings.² In the sample, financially weak firms account for a non-negligible share of economic activity, by holding up 15% to of total Euro Area assets in recessions, and 11.5% on average over the sample period. Of that, zombie firms hold, 4.0%, and distressed firms an additional 7.5%. The prevalence of zombies increases in recessions and is highest in cyclical sectors and in countries more exposed to the Global Financial Crisis (GFC) and the European sovereign debt crisis. Within financially weak firms, zombies continue to operate although their sales are shrinking.³ Their position at the weakest end of the financial viability distribution makes them a particularly revealing case: if financial weakness amplifies monetary policy transmission via the financial accelerator, zombies should be expected to respond most strongly to a monetary tightening.

I estimate the responses of the three groups of firms to high-frequency monetary policy surprises using panel local projections. Three key findings show that the nature of financial viability matters for monetary policy transmission. First, investment contracts for all three types of firms following a monetary policy surprise, but at three different strengths. For healthy firms, the reduction in investment reaches its peak impact of 3.2 percentage points after two years. Distressed firms' investment contracts by around 20% *more* than for healthy

¹Zombie firms are a concept coined by Caballero et al. (2008).

²Note that I use the term *financial weakness* rather than *financial constraints* because it is broader. Financially weak firms are not necessarily financially constrained, as this paper shows in Section 4.4.

³The exact definitions are described in Section 2.2. Note that the baseline definition is agnostic about the survival mechanism for zombie firms; it does not condition on favourable lending conditions. Baseline results are robust to various definitions, including using subsidised credit.

firms. In isolation, this result is in line with the financial accelerator. However, the investment of zombie firms contracts by 34% *less* than healthy firms, making the weakest firms are the least responsive. Distressed and zombie firms respond in opposite directions relative to healthy firms, so that the responsiveness of firm investment to monetary policy does not increase monotonically with financial weakness. These differential group responses cannot be explained by traditional proxies of financial constraints like age, size, leverage, cash flow, or sales growth.

The response a single financially weak group pooling zombie and distressed firms is statistically indistinguishable from healthy firms' response. By comparing healthy and all financially weak firms, one may thus conclude that financial weakness does not shape transmission at all. However, the pooled response reflects the sample composition, not the absence of heterogeneity. In this sample, the responses offset almost exactly, but shares of zombie and distressed firms vary over countries and time. This finding reconciles the conflicting evidence in the literature: a single-proxy estimate recovers a composition-weighted average of two differentials of opposite sign. Thus, a sample whose financially weak firms are mostly distressed will appear to confirm the financial accelerator of Bernanke and Gertler (1995), and one with a larger zombie share will appear to confirm Ottonello and Winberry (2020).

Second, because both firm types are financially weak, the zombie-distressed contrast offers a sharper test of the mechanisms behind heterogeneous transmission than the healthy-weak contrast. The evidence points to lenders. The dampened zombie response is asymmetric, arising from interest rate hikes rather than cuts. I also show that zombie firms' credit growth contracts by less than that of healthy and distressed firms following a tightening. Furthermore, the zombie-distressed gap in responsiveness is more pronounced in countries with weak banking sectors as captured by triple interactions with thin capital buffers and high banking stress, indicated by higher non-performing loan and low coverage ratios. Passing tighter financial conditions on to zombie firms could trigger their default and force weak banks to recognise losses. The combined evidence is thus consistent with loan evergreening, although the zombie definition used does not presuppose subsidised credit.⁴ Related work by Havemeister and Horn (2023) shows that Euro Area zombie firms indeed obtain more favourable credit terms than non-zombie firms with the same credit rating using loan-level data. For zombie firms, loan evergreening thus dominates the financial accelerator logic and accounts for the heterogeneity within the set of financially weak firms. I show that two alternative mechanisms cannot explain the zombie-distressed gap. One is that zombie firms lack profitable investment opportunities, so that their investment would not respond to any policy rate changes. However, I find that zombies increase their investment following

⁴Peek and Rosengren (2005) coin the term loan evergreening in the context of Japan in the 1990s.

expansionary monetary shocks. Another possibility is that different borrower characteristics, such as collateral, could warrant different credit conditions for the two firm types. I find that collateral differences do not account for the gap in investment responses.

Third, a back-of-the-envelope exercise quantifies what these three different strengths of investment responsiveness imply for aggregate transmission. If zombie firms responded like distressed firms to a tightening, the reduction in aggregate investment would be 2.4% larger in absolute value. What determines this dampening effect is composition, and composition varies both over time and across countries. Average zombie capital shares range from 2.3% in Germany to 8.3% in Greece, yielding an implied dampening effect that is three times larger in Greece (4.5%) than Germany (1.3%). At peak recession times, these shares diverge even more, with zombie firms holding 1.4% of capital in Germany in 2011 compared to 14.6% in Greece in 2011, roughly a factor of ten.

For monetary policy-makers, these findings imply that changes in transmission may not only reflect changes in monetary stance, but also in the composition of firm viability. Given the varying shares of zombie and distressed firms, zombie prevalence is one channel through which a common monetary policy shock transmits unevenly across the Euro Area and over time. Zombie prevalence rises in downturns and the dampening operates during policy rate tightenings. Therefore, the drag on transmission is largest when monetary policy tightens against an already elevated stock of zombie firms. This was for example the case with the 2011 rate increases during the sovereign debt crisis. The empirical findings in this paper are consistent with weakly capitalised banks shielding zombie borrowers to avoid recognising losses. This suggests that prudential policy and monetary transmission are more closely linked than is usually assumed. Weak banks then affect not only credit allocation and financial stability but also the effectiveness of monetary policy, strengthening the case for resilient bank balance sheets.

This paper speaks to two strands of the literature. The first is the empirical literature on heterogeneous firms and monetary policy, to which I contribute the insight that heterogeneity *within* the set of financially weak firms matters as much as the distinction between financially weak and healthy firms. According to the financial accelerator, information asymmetries generate an external finance premium relative to internal financing sources (Bernanke and Gertler, 1989; Bernanke et al., 1999). This premium rises with interest rates, amplifying the impact on constrained borrowers through both the balance sheet and bank lending channels. Ottonello and Winberry (2020) find that another channel dominates this financial accelerator: financially weaker firms have a lower investment response because of default risk pricing. Following a monetary easing, expanding investment requires borrowing at interest spreads that rise more rapidly the closer firms are to default. Empirically, the literature

proxies financial constraints with a single characteristic, such as age (Cloyne et al., 2023; Krusell et al., 2023; Durante et al., 2022), size (Crouzet and Mehrotra, 2020; Gertler and Gilchrist, 1994), leverage (Grob and Züllig, 2024; Ottonello and Winberry, 2020), collateral (Caglio et al., 2026), liquidity (Jeenas, 2023), debt maturity (Jungherr et al., 2026), and bank dependence (Crouzet, 2021). Across proxies and samples, evidence on whether the most financially vulnerable firms respond the most remains mixed. Without fixing a characteristic ex ante, recent work by Drechsel et al. (2026) finds that observable firm characteristics explain little of the investment response to monetary policy, while combinations of two observables of size and age are more informative. I argue that financially weak firms are not one group but several. A single characteristic is insufficient to capture the heterogeneities in transmission, which is why I assess financial viability directly. In line with Drechsel et al. (2026), traditional proxies of financial constraints cannot explain the investment response patterns I find.

The second is the zombie firm literature, which has documented three adverse macroeconomic consequences of zombie existence: crowding out resources from healthier firms (Acharya et al., 2022; Acharya et al., 2019; Banerjee and Hofmann, 2022; Banerjee and Hofmann, 2018; Schivardi et al., 2022), impeding creative destruction and productivity growth (Adalet McGowan et al., 2018; Andrews et al., 2016; Caballero et al., 2008), and posing risks to financial stability. I add a novel fourth macroeconomic consequence: zombie firms dampen the transmission of monetary policy to the real economy. This channel has received little attention despite its direct relevance to central banks.

The mechanism analysis for the zombie-distressed gap points to zombie firms' credit conditions being shielded from tightening. This mirrors the mechanisms through which, according to the literature, zombie firms survive in the first place. Caballero et al. (2008), who coined the term "zombie firms" for unproductive firms in Japan's lost decade, attribute their survival to loan evergreening, that is, banks extending cheap credit relative to underlying risk of the loan (Peek and Rosengren, 2005). Various theoretical mechanisms explaining loan evergreening have been suggested, including weak banks avoiding loss realisation under minimum capital requirements or high liquidation costs (Blattner et al., 2023; Jordà et al., 2022; Becker and Ivashina, 2022), expansionary monetary and fiscal policies encouraging risk-shifting, especially during crises (Acharya et al., 2021), and information asymmetries or relationship lending (Tracey, 2025; Faria-e-Castro et al., 2024; Hu and Varas, 2021). Importantly, a recent literature shows that zombie firms are systematically mislabelled as distressed firms despite exhibiting markedly different behaviour, most notably, a much lower propensity to exit (Álvarez et al., 2023; Mingarelli et al., 2022; De Martiis et al., 2021).

This paper is closest to Albuquerque and Mao (2025), who find that zombies' investment and employment growth respond less than non-zombies' to contractionary US monetary

shocks in 47 advanced and emerging economies over 2000–2019. My paper differs in three key respects. First, I split the non-zombie comparison group into healthy and distressed firms. If zombies and distressed firms respond in different directions, pooling them biases estimates of how financially weak firms respond to monetary policy.⁵ Second, I use a representative sample including non-listed firms whose limited access to market-based finance makes them more likely to be credit-constrained. Third, I focus on the Euro Area, where bank-based funding makes zombie firms more prevalent (IMF, 2023) and a single monetary policy meets 20 heterogeneous financial systems, government support schemes, and crisis exposures.⁶

The remainder of this paper is structured as follows. Section 2 discusses the data and firm viability definitions, while Section 3 presents empirical facts around zombies and distressed firms in the Euro Area. Section 4 first introduces the empirical strategy. It then investigates the differential impact of monetary shocks on healthy, distressed and zombie firms, before examining empirical mechanisms which can account for the gap between zombie and distressed firm responses. Section 5 calculates the back-of-the-envelope forgone investment due to zombie firms, and translates the results into policy implications for monetary and prudential policy-makers. Section 6 concludes.

2 Data and Definitions

2.1 Data

To investigate whether distressed and zombie firms react differently to monetary shocks, I use data on firms’ balance sheets and on monetary shocks.

Granular firm-level balance sheet data is sourced from the Bureau van Dijk Orbis Historical Database. A key advantage of this database is that it includes non-listed firms of all sizes. Considering that the vast majority of Euro Area (EA) firms are small and medium-sized enterprises (SMEs) with high bank dependence, it is crucial and a key contribution of this paper to include non-listed firms in this analysis on firm viability and monetary policy transmission. Furthermore, Orbis is representative and consistent in providing harmonised, detailed balance sheet data across the Euro Area countries (Kalemli-Özcan et al., 2024). Despite its annual frequency and a reporting lag of 1-2 years, Orbis constitutes the best available data source to study a large set of firms, including non-listed ones, across the 20 Euro Area countries.

⁵Albuquerque and Mao (2025) briefly note that distressed firms are more responsive to monetary shocks than zombies, but do not pursue this contrast systematically.

⁶Note that as of 01.01.2026, there are 21 Euro Area countries. Given the sample period until 2022, I am not including Bulgaria in this analysis.

Following standard data cleaning practices for Orbis outlined in Appendix A, the resulting sample includes 4.9 million unique non-financial corporations, corresponding to roughly 32 million unique firm-year observations from 2005 to 2022 across the 20 Euro Area countries.⁷ The sample period is chosen due to data availability and results are robust to using the full sample from 1999-2022 (see Appendix C). Nominal variables are deflated using country-sector-specific producer and consumer price indices as deflators.⁸ Table 1 reports descriptive statistics for various balance sheet variables for the full sample after cleaning.

The baseline monetary policy shock series is taken from the Euro Area Monetary Policy Event-Study Database (EA-MPD) by Altavilla et al. (2019). The identifying assumption is that the change in interest rates from before the ECB press release at 2.15pm to after the press conference at 3.45pm is solely attributable to the central bank’s decisions. Following Krusell et al. (2023) and Durante et al. (2022), I use the change in the 3-month overnight index swap rate and compute the 12-month moving sum of monetary policy surprises to match the annual balance sheet data. The rationale is that firms’ investment decisions are more likely to be affected by the cumulative change in monetary policy over the past year than by one single monetary event. Given different reporting months in Orbis, there is variation in the monetary shocks affecting individual firms.

Surprises in the EA-MPD series can be decomposed into a genuine monetary policy surprise and an information effect. In the latter case, a rate hike could be interpreted as a signal of superior central bank information that the economy is performing better than markets expected, prompting stock prices to increase. Thus, the EA-MPD shock series is classified into 185 monetary policy surprises when stock prices and interest rates move into opposite directions, and 114 information shocks between 1999 and 2023 (see Figure B.1 for the distribution). The following analysis excludes the identified information shocks.

2.2 Firm Viability Definitions

To classify firms into healthy, distressed and zombie firms, I first differentiate healthy firms from financially weak firms based on a combination of balance sheet characteristics. These firms are deliberately labelled financially weak instead of financially constrained, as firms can have weak balance sheets, but are not necessarily financially constrained. Therefore, financially weak firms are those that carry a high debt burden relative to their peers, and that cannot persistently service debt out of current earnings. The set of financially weak

⁷Several countries joined the Euro only during the sample period. Given the Eurozone’s accession criteria, those countries’ monetary policy should have followed ECB monetary policy closely in the years preceding their accession.

⁸All results are robust to using sovereign deflators for each country (details see Appendix A).

Table 1. Summary Statistics for the Full Sample

All firms	Mean	Median	SD	10%	90%	Obs
Zombie Firms	0.04	0.00	0.19	0.00	0.00	0.90
Distressed Firms	0.05	0.00	0.23	0.00	0.00	1.29
Healthy Firms	0.91	1.00	0.29	1.00	1.00	21.36
Firm Age	16.25	13.00	12.61	5.00	31.00	32.89
Employees	17.63	5.00	224.79	1.00	34.00	20.96
Total Assets (EUR thous.)	2344.08	514.58	10141.70	75.06	4931.29	32.92
Fixed Assets (EUR thous.)	985.57	125.58	6448.24	5.16	1777.48	32.92
Fixed Assets / TA (%)	37.20	29.51	30.79	2.27	86.65	32.92
Tang. Fixed Assets (EUR thous.)	680.66	64.42	4499.23	1.46	1187.61	32.69
Tang. Fixed Assets / TA (%)	26.82	15.55	28.56	0.52	75.10	32.69
EBITDA (EUR thous.)	189.62	35.40	9936.77	-14.02	375.62	32.07
EBITDA / TA (%)	5.81	7.65	4944.84	-4.93	26.21	32.06
Sales (EUR thous.)	2645.68	469.41	16149.58	45.63	4955.78	29.14
Sales / TA (%)	160.13	117.61	6693.46	11.30	297.55	29.14
Cash Flow (EUR thous.)	153.01	26.67	55464.75	-15.98	294.05	31.20
Equity / TA (%)	3.84	26.87	7966.53	-4.29	71.13	32.92
Leverage (%)	29.05	14.69	370.19	0.00	60.80	32.70

Notes: This table shows the summary statistics for the dummy variables indicating the three firm groups, some key firm characteristics (age, number of employees), and balance sheet variables. The average zombie share is 3.8%, and the average distressed firm share is 5.5% (pure count, unweighted). Number of observations are in million. For the three firm groups, the number of observations counts the observations classified as each group in the full sample. All values in 2015 EUR.

firms is then further separated into zombie firms and distressed firms. Zombie firms are financially weak firms whose business is shrinking, suggesting that their continuation value is low. Of the three firm groups, zombies have the weakest balance sheets, as shown in Section 3.1. Distressed firms are financially weak firms that are not zombies. Their business continues to operate, suggesting a higher continuation value.

More formally, the definitions are as follows.

Definition 1 (Financially weak firms). *A firm is financially weak if, for two consecutive years,*

- (i) *its interest coverage ratio is below one ($ICR < 1$) and*
- (ii) *its leverage ratio exceeds the median of its peers in the same sector and year.*

The ICR is measured as a company's earnings before interest and taxes (EBIT) divided by interest paid. It indicates how easily a firm can pay the interest on its debt out of current earnings. A ratio below 1, also known as cash-flow insolvency, indicates that current earnings are not sufficient to meet current interest obligations, which is a standard indicator of financial distress in the literature.⁹ A higher-than-median leverage ratio in the same

⁹Identifying the best *predictors* of firms' financial distress and bankruptcy is one subject of the corporate finance literature pioneered by Altman (1968) with the Altman z-score, combining a *range* of liquidity, profitability and solvency ratios. In contrast, the aforementioned literature on firm heterogeneity and monetary policy aims to identify the best *proxy* of financial constraints, often using a *single indicator* like age or size. In between these two extremes, there are many ways of classifying a firm as financially distressed.

sector and year indicates that the firm is likely facing difficulties in obtaining additional debt. The requirement that these two criteria hold for at least two consecutive years avoids misclassifying temporary cyclical weakness as severe financial distress.

Definition 2 (Zombie firms). *A firm is a zombie firm if, for two consecutive years,*
(i) its interest coverage ratio is below one ($ICR < 1$),
(ii) its leverage ratio exceeds the median of its peers in the same sector and year and
(iii) its real sales growth is negative.

Zombie firms are identified via an additional criterion. This baseline definition requires zombie firms to be shrinking, measured by negative real sales growth. This “shrinking condition” aims to identify firms with poor performance prospects, as sales growth is a strong predictor of future growth and productivity (Albuquerque and Iyer, 2024; Álvarez et al., 2023). Note that the definition employed here does not explicitly condition on the zombie firm receiving evergreened loans, often measured through subsidised credit rates. It is therefore agnostic about the mechanism through which zombie firms are held alive. This has the advantage of investigating the mechanisms differentiating zombie and distressed firms explicitly (see Section 4.4), rather than assuming them.

Definition 3 (Distressed firms). *The set of financially weak firms minus zombie firms is the set of distressed firms.*

Distressed firms are financially weak firms that do not satisfy the zombie classification. They correspond more closely to what the literature typically has in mind when referring to financially constrained firms. While both groups are subsets of financially weak firms, this paper treats them as conceptually distinct. This distinction is corroborated empirically in Section 3. The central argument is that the existing literature has implicitly conflated financially weak firms with financially constrained firms.

I broadly follow Albuquerque and Mao (2025) for the baseline definitions for two main reasons. First, their definition is quite strict, therefore, the estimates presented can be read as a conservative lower bound. Second, this zombie definition uses a measure of performance and profitability as the additional criterion for identifying zombie firms. It thereby follows an approach widely employed in the zombie literature, see, for instance, Altman et al. (2024), Banerjee and Hofmann (2022), Adalet McGowan et al. (2018), Favara et al. (2024), Schivardi

et al. (2022), Storz et al. (2017).¹⁰ Using a zombie definition that is agnostic about the reason for zombie existence, and contrasting zombies with similarly weak firms, provides a novel set-up to empirically test for the mechanisms helping zombie firms survive. This constitutes a contribution of this paper to the zombie literature.

To ensure the findings are not driven by the specific choice of balance sheet characteristics in the definition, I conduct an extensive robustness analysis using alternative definitions. Appendix C implements the main analysis under two such alternatives: Storz et al. (2017), who employ alternative balance sheet measures of performance and productivity that rely neither on leverage nor on real sales growth, and Acharya et al. (2024), who apply a subsidised credit criterion (see Table C.1). To define distressed firms under these to zombie definitions, I rely on the approach proposed by Mingarelli et al. (2022). All main results are robust to these alternative definitions. Having established the taxonomy, the following section presents key characteristics of healthy, distressed, and zombie firms and documents their prevalence across the Euro Area.

3 Stylized Facts

This section presents stylized facts about zombie firms and distressed firms over time, across countries, and across sectors, highlighting that financially weak firms constitute a non-negligible share of firms in the Euro Area economy. It then summarises key balance sheet characteristics to show that zombie firms are significantly weaker than distressed firms.

3.1 Prevalence of Zombie and Distressed Firms in the Euro Area

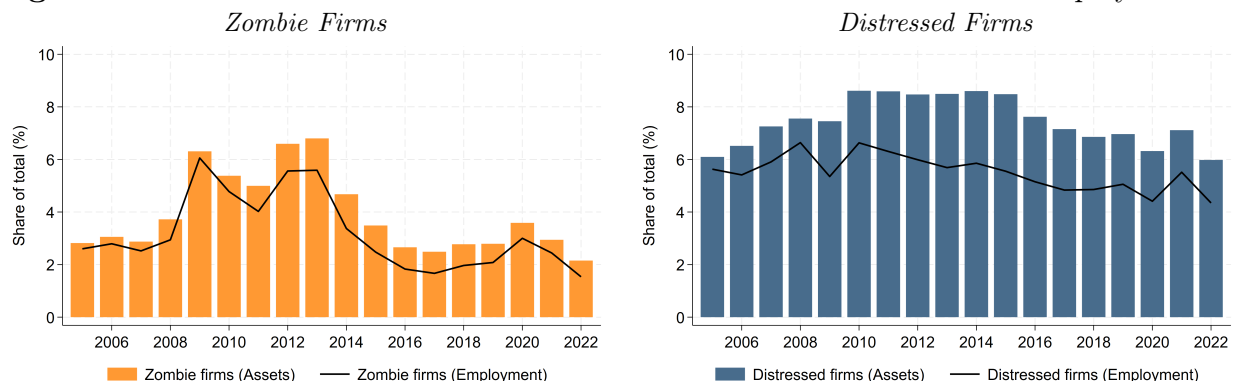
Every firm in the sample is either classified as healthy, distressed, or zombie in any given year. The viability status of firms can change over time. Applying the baseline definitions, 3.8% of observations (548,700 unique firms) for which viability is defined are classified as zombies at least once during their existence in the sample. 5.5% of observations (686,400 unique firms) are classified as distressed (see Table 1).

¹⁰Another strand of definitions identifies zombies through measures of subsidized credit, arguing that the existence of zombie firms hinges on cheap bank loans (Álvarez et al., 2023; Acharya et al., 2022; Caballero et al., 2008). Havemeister and Horn (2023) provide a more detailed discussion. Several drawbacks render this approach less suitable for this paper. First, data availability only allows for an approximate, backward-looking measure of subsidized credit, prone to measurement error. This measure may not capture zombie firms that pay higher rates than those of the top-rated firms they are compared to, but still lower than what credit models would imply based on their riskiness. Second, a low interest rate could indicate high-quality collateral (Banerjee and Hofmann, 2022) or long-standing bank relationships. Furthermore, viable firms might pay lower-than-average interest rates due to crisis-related state support measures (Schivardi et al., 2020).

Figure 1 shows the share of total assets and employees in the economy held by zombie firms (orange, left panel) and distressed firms (blue, right panel) over time. Together, these financially weak firms hold between 8.9% (2005) and 15.3% (2013) of total assets. Similarly, between 6.5% (2017) and 11.5% (2012) of all Euro Area employees in this sample are employed in financially weak firms (black lines in Figure 1). This clearly illustrates the crowding-out of resources by financially weak firms from more productive firms. The risks to unemployment and financial stability stemming from distressed and zombie firms render their existence an issue of macroeconomic relevance. Comparing the two groups over time, zombie firm prevalence is more counter-cyclical than that of distressed firms.

Relatedly, Figure 2 shows the share of total assets held by zombie firms (orange bars, sorted from highest to lowest) and distressed firms (blue bars) by Nace2 sector. Financially weak firms are most concentrated in cyclical sectors like arts and entertainment, accommodation and food, and professional services. This interaction with the macroeconomic cycle becomes even clearer when investigating the prevalence of zombie and distressed firms across countries.

Figure 1. Prevalence of Zombie and Distressed Firms in Total Assets and Employment

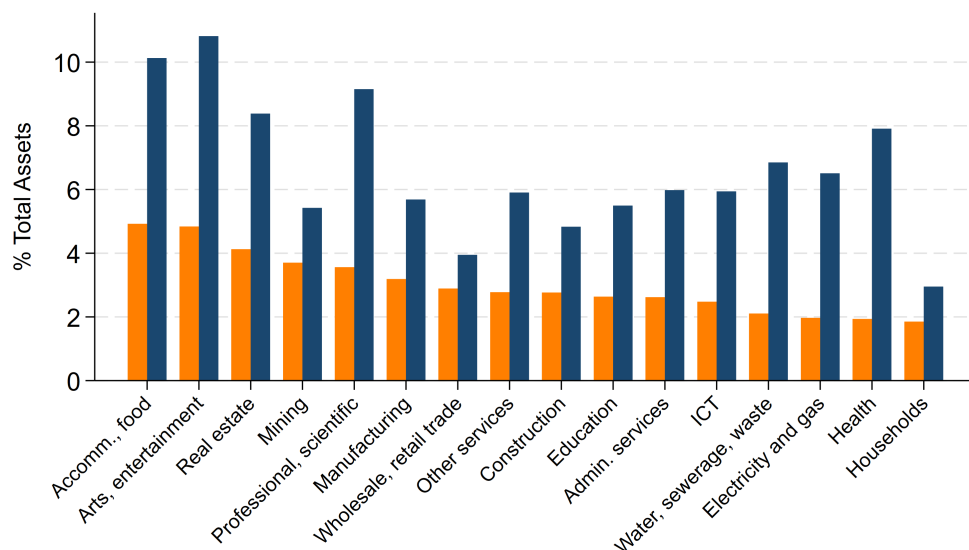


Notes: These graphs show the percentage share of total assets held by zombie firms (orange, left) and distressed firms (blue, right) as defined above. The lines show the corresponding shares in terms of number of employees.

Figure 3 plots the shares of total assets held by zombie firms (left panel) and distressed firms (right panel) by country and over time. The countries shown are the four largest EA economies (dashed lines), as well as the three countries with the largest average zombie or distressed firm shares over the sample period. Although zombie shares vary widely across countries, the average share of total assets held by EA zombie firms over the sample period is 4.0% (Figure 3, left).¹¹ Figure 3 further elicits that zombie creation appears to be counter-

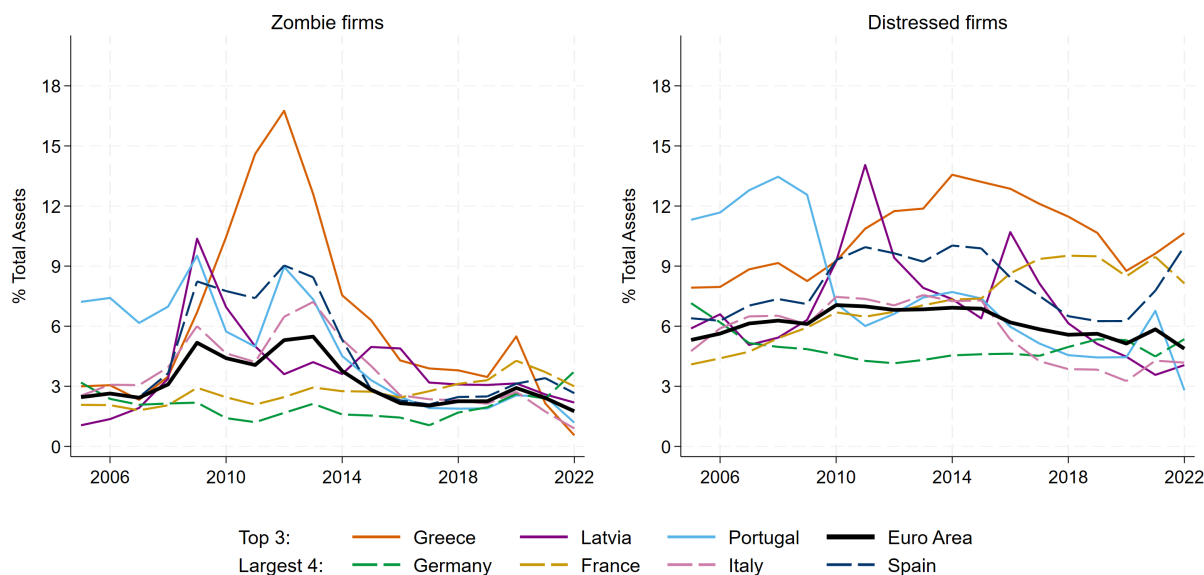
¹¹This is in line with zombie shares identified by Helmersson et al. (2021), Adalet McGowan et al. (2018) and Storz et al. (2017), but below the very high numbers of 10-20% reported by Banerjee and Hofmann (2022), Acharya et al. (2019) or Schivardi et al. (2020) given the relatively strict definition.

Figure 2. Prevalence of Zombie and Distressed Firms Across Sectors



Notes: This graph shows the percentage share of total assets held by distressed firms (blue) and zombie firms (orange) by sector, computed as the average share over the whole sample period.

Figure 3. Zombie and Distressed Firm Shares for Selected Euro Area countries



Notes: This graph shows the percentage share of assets held by zombie firms (left) and distressed firms (right) in a given country and year from 2005 to 2022. It shows the top three exposed countries (solid lines), the Euro Area average (black line), and four largest EA economies (dashed lines).

cyclical, with the EA average rising to 6.8% in 2013 during the European Sovereign Debt Crisis. This phenomenon is well-known in the literature as recessions favour zombie creation in at least three ways (Acharya et al., 2024; Acharya et al., 2022; Banerjee and Hofmann, 2022). First, recessions deteriorate credit quality, leading to more non-performing loans and defaults. To avoid undershooting their capital buffer requirements, banks increase loan evergreening, helping zombie firms stay alive. Second, expansionary monetary policy in response to financial crises lowers the return on assets, incentivising riskier lending. Finally, crisis responses like fiscal stimuli and government loan guarantees also favour risk shifting and evergreening. The country composition of zombie shares underlines this counter-cyclical: countries like Greece, Spain or Portugal, that were particularly affected by the GFC and the sovereign debt crisis, exhibit the highest zombie shares, in recessions and on average.

A share of 7.5% of EA firms are distressed over the sample period (Figure 3, right).¹² Three notable differences between the cross-country patterns for zombie and distressed firms stand out. First, there is a higher average prevalence of distressed firms than zombie firms. Second, while zombie firms are more concentrated in more crisis-affected countries, distressed firms are not. Compared to zombie firms, there is more heterogeneity in the prevalence of distressed firms across countries. For instance, France exhibits a high share of distressed firms, whilst not appearing in the countries most exposed to zombie firms. Third, zombie shares converge between countries during the low-interest environment from 2014, while distressed firm shares do not. The prevalence of distressed firms seems almost acyclical compared to that of zombie firms in most countries. This observation is consistent with different structural factors underpinning the existence of either firm type: While it might be recession exposure, weaker banks, and interest rates for zombies, that does not seem to hold for distressed firms. This further motivates this paper’s analysis of monetary policy sensitivity, separating zombies from distressed firms. Although both are financially weak, their responsiveness to monetary policy shocks may differ.

3.2 Zombie and Distressed Firm Characteristics

Zombie and distressed firms differ significantly in their characteristics and transition probabilities between viability states. Table 2 compares mean and median characteristics of firms by group, while tables B.1-B.3 show detailed summary statistics for each group separately.

The median zombie is 15 years old, alleviating the concern of misclassifying young growing firms like start-ups as zombie firms.¹³ The median distressed and healthy firms are 13 years

¹²Recall that the sample of distressed firms *excludes* zombie firms.

¹³Age is constructed as the year of observation minus the year of incorporation plus one, such that a firm has a minimum age of one year.

Table 2. Summary Statistics by Firm Type

	Healthy		Distressed		Zombie	
	Mean	Median	Mean	Median	Mean	Median
Firm Age	16.74	13.00	16.30	13.00	18.23	15.00
Employees	19.62	6.00	19.56	5.00	15.48	5.00
Total Assets (EUR thous.)	2659.37	636.23	3688.54	692.51	2713.59	547.39
Tang. Fixed Assets (EUR thous.)	713.63	68.84	1272.99	122.03	907.09	89.92
Tang. Fixed Assets / TA (%)	23.34	12.78	34.79	26.51	31.89	22.58
EBITDA (EUR thous.)	246.48	48.04	-2.15	0.40	-66.68	-7.97
EBITDA / TA (%)	7.00	8.10	-7.84	0.08	-13.22	-2.01
Sales (EUR thous.)	3137.74	633.08	2500.55	357.49	1703.01	252.02
Sales / TA (%)	159.99	121.36	122.71	75.18	104.19	62.71
Cash Flow (EUR thous.)	199.52	34.15	-9.74	-1.65	-74.81	-10.39
Equity / TA (%)	17.08	27.82	-12.84	8.06	-20.12	7.86
Leverage (%)	17.62	8.45	50.43	37.38	50.53	37.74
Interest Paid (EUR thous.)	32.19	4.33	78.41	10.72	60.02	8.95
Debt Servicing Cap.	184.21	0.45	-4.62	0.00	-7.43	-0.05

Notes: This table shows the mean and median values for key characteristics (age, number of employees) and balance sheet variables for each firm viability group as defined in section 2.2. The average zombie share is 3.8%, and the average distressed firm share is 5.5% (pure count, unweighted). All values in 2015 EUR. Further summary statistics for each group are presented in Tables B.1 to B.3.

old. Zombie firms are older, but have a lower median debt servicing capacity than distressed firms. This finding sheds doubt on age as a good proxy for financial constraints, used for example by Cloyne et al. (2023) and Krusell et al. (2023), and motivates the distinction between distressed and zombie firms in this paper.¹⁴ All firm types are similar in size, with a median of five employees for zombie and distressed firms and six employees in the median healthy firm. In average terms, zombie firms are smaller than distressed and healthy firms. Zombies and distressed firms are more capital-intensive than healthy firms. Their median tangibility ratios, defined as tangible fixed assets over total assets, are 26.5% for distressed and 22.6% for zombie firms, compared to 12.8% for healthy firms. In addition, median levels of tangible fixed assets are positive and higher distressed and zombie firms than for healthy firms. Across the whole sample, zombie firms hold 4.5% and distressed firms 9.0% of the economy’s capital stock.

Average real sales levels are highest for healthy firms, followed by distressed and zombie firms. Similarly, median earnings as measured by EBITDA is negative for both distressed and zombie firms, confirming that the baseline definition does capture weak firms. Earnings are positive for the average distressed firms, but remain negative for the average zombie firm. This is important in light of the finding by Drechsel (2023) that firms’ earnings, not just their collateral, can directly determine firms’ access to loans. By definition, both distressed and zombie firms exhibit high median leverage ratios around 40%, indicating that potential

¹⁴In a similar vein, Gnewuch and Zhang (2025) argue that age or size are insufficient to capture the financial accelerator channel. This is because they find that younger (smaller) firms are more sensitive to monetary policy also *in the absence of* financial constraints.

loan defaults of these firms might raise substantial financial stability concerns. Interestingly, zombies pay less interest than distressed firms in the mean and median.

The finding that zombie firms are smaller, older, and have lower earnings is in line with the literature, which also finds that zombies grow less and exhibit much weaker credit quality than healthy firms (Havemeister and Horn, 2023; Banerjee and Hofmann, 2022). Therefore, firm viability does not seem to be linearly correlated with common proxies of financial constraints like age or size. Instead, the zombie and distressed definitions identify firms that differ along multiple dimensions although the classification does not condition on these observables.

Table 3 shows the probabilities that a firm with viability status in time t has a certain viability status in time $t+1$. The table supports the case for separating zombie and distressed firms as the probability for a distressed firm to become a zombie and vice versa are low.¹⁵ Taken together with the firm characteristics in Table 2, this suggests that the groups are distinct. If zombie firms were just “older distressed firms” (life-cycle argument), the transition rate from distressed to zombie status would have to be much higher.¹⁶ Table 3 elicits two more interesting findings. First, the definitions allow for recovery from distressed or zombie status. This addresses Nurmi et al. (2022)’s concern of overestimating how many firms remain zombies once classified as such. On average, the probability of remaining a zombie is 41%. This magnitude is close to that under alternative zombie definitions by Storz et al. (2017) and Nurmi et al. (2022), see also Havemeister and Horn (2023). The average probability of remaining distressed is 47.5%, slightly higher than for zombies. The probability of staying healthy plausibly exhibits the highest persistence with 95.7%. Second, zombie firms are more likely to recover entirely and become healthy (37.7%) than to become distressed (21.3%). The fact that zombie firms can recover appears plausible considering that banks would be more likely to sustain firms that have some chance of rehabilitation.

In summary, the existence of financially weak firms matters: distressed and zombie firms account for up to 15.3% of total assets and 11.5% of employees in this sample of 4.9 million unique firms. The prevalence especially of zombie firms is counter-cyclical. The firm viability

¹⁵Following Banerjee and Hofmann (2022), the probability of remaining a zombie is the ratio of current zombies in t which will remain zombies in the subsequent period $t+1$ to the total number of zombie firms in t . I apply this method to all transitions between the three viability states, conditioning on the firm surviving in the current and the subsequent period.

¹⁶Note that Orbis does not provide a clean measure of firm exit. I approximate exit using the status and status date variables. More specifically, a firm exits the sample when its status is dissolved, in liquidation, bankruptcy, or administratively suspended. A firm is also classified as exiting when the status is inactive or active (default of payment/ insolvency proceedings) *and* it is the last time the firm is observed in the sample. This leads to exit rates between 10-15% in a given year, which appears reasonable given exit rates found in the literature (Bornstein and Castillo-Martinez, 2026; Cefis et al., 2022). The patterns described for transitions between states hold when including firm exit.

Table 3. Transition Matrix

	Healthy (at t+1)	Distressed (at t+1)	Zombie (at t+1)
Healthy (at t)	95.7	2.2	2.2
Distressed (at t)	38.6	47.5	13.9
Zombie (at t)	37.7	21.3	41.0

Notes: This table shows the transition probabilities across viability states, conditional on the firm surviving in t and $t+1$. The rows describe firm status in time t , the columns describe firm status in $t+1$. Values in percent. The probabilities are robust to conditioning on the firm surviving during the full sample period.

classification identifies groups of firms that are financially weak, but distinct, as shown by key firm characteristics and low transition probabilities between distressed and zombie states.

4 Empirical Results

4.1 Empirical Strategy

To estimate the dynamic effect of monetary policy shocks on firm investment, I employ panel data local projections following Jordà (2005). This is the standard approach in the literature on firm heterogeneity and monetary policy and allows estimating impulse response functions over a horizon of h years, where $h = (0, 1, 2, 3, 4)$.

The dependent variable $\Delta_h Y_{i,t+h}$ is investment, defined as the cumulative log difference in real tangible fixed assets times 100.¹⁷ This type of investment includes physical capital like plants, machinery or property. It is difficult to reverse and long-term in nature, thereby capturing how firms react to macroeconomic changes (Bomprezzi et al., 2025). The findings are robust to considering fixed assets, which additionally include intangible assets. The main independent variable is the monetary policy shock, ϵ_t^{MP} , which is the 12-month moving sum of monetary surprises. Note that a contractionary shock corresponds to a positive monetary surprise.

Following Jordà (2005), controls are lagged by one period. This assumes that the macroeconomic controls X_{t-1} , which include GDP, inflation and unemployment, do not affect investment contemporaneously. This appears plausible given the predetermined and lumpy nature of investment. Equivalently, the firm controls $Z_{i,t-1}$ are assumed not to determine investment in the same period but with a lag. These firm controls include log age and two lags of total assets, cash flow, leverage, and real sales growth. The regressions are run on the sample for which the firm viability variable is defined. Firm fixed-effects, $\alpha_{i,h}$, eliminate unobservable time-invariant between-firm differences in investment behaviour (Krusell et al.,

¹⁷This definition of investment follows, for instance, Ottonello and Winberry (2020), Krusell et al. (2023).

2023; Durante et al., 2022; Jungherr et al., 2026; Ottonello and Winberry, 2020). Standard errors are two-way clustered at the firm and time levels in specification (1). Given the large N and comparatively small T, two-way clustered standard errors are more appropriate than Diskroll-Kraay standard errors (Inoue et al., 2026).

Specification (1) estimates the response of the average firm i in sector s , country c and horizon h in the sample to a monetary shock ϵ_t^{MP} :

$$\Delta_h Y_{i,t+h} = \delta_h * \epsilon_t^{MP} + \zeta_h Z_{i,t-1} + \Gamma_h X_{c,t-1} + \alpha_{i,h} + u_{i,t+h} \quad (1)$$

The same specification is used to estimate the response of the average healthy firm, restricting the sample to only healthy firm-years, which account for 90.7% of all observations.

Specification (2) estimates the differential group responses of distressed and zombie firms relative to healthy firms.¹⁸ In specification (2), the monetary policy shock is interacted with dummy indicators for the groups of financially weak firms; $Distressed_{i,t-1}$ for distressed firms, and $Zombie_{i,t-1}$ for zombie firms. The group indicators are lagged by one year to avoid simultaneity with the monetary shock and are thus defined over $t-1$ and $t-2$. The three groups of firms are mutually exclusive and exhaustive for the sample of interest, such that each observation is either healthy, distressed, or zombie. Specification (2) includes sector-country-year fixed effects, $\theta_{tsc,h}$, to eliminate any aggregate sector-level shocks in a specific country and year affecting investment choices (Jungherr et al., 2026; Ottonello and Winberry, 2020). This absorbs aggregate controls and the monetary policy shock. Standard errors are clustered at the firm level.

$$\begin{aligned} \Delta_h Y_{i,t+h} = & \beta_h^0 + \beta_h^d * Distressed_{i,t-1} * \epsilon_t^{MP} + \beta_h^z * Zombie_{i,t-1} * \epsilon_t^{MP} + \\ & \gamma_h^d * Distressed_{i,t-1} + \gamma_h^z * Zombie_{i,t-1} + \zeta_h Z_{i,t-1} + \alpha_{i,h} + \theta_{tsc,h} + u_{i,t+h} \end{aligned} \quad (2)$$

The main two coefficients of interest β_h^g for $g = d, z$ capture the response of distressed or zombie firms to a monetary policy shock relative to the omitted base category of healthy firms. Taking the financial accelerator mechanism as a prior would predict that distressed firms are more responsive (i.e., invest less) to a monetary shock than healthy firms. This would imply that, following a contractionary shock, the coefficient on the interaction between the distressed-group dummy and the monetary policy shock is significantly negative $\beta_h^d < 0$. Evidence from Section 3 suggests that zombie firms have weaker balance sheets than distressed firms, such that the financial accelerator would imply $\beta_h^z < \beta_h^d$, i.e. zombie firms show the most negative investment response to a monetary policy shock. In contrast, the

¹⁸Table D.1 lists all variables and coefficients from the regression in table format.

logic proposed by Ottonello and Winberry (2020) would imply that zombie firms respond the least, given that they are the closest to default, based on the definition used here (recall that the baseline definition does not impose subsidised credit). Zombie firms would thus be the least responsive, followed by distressed firms, which would be less responsive than healthy firms, $\beta_h^z > \beta_h^d$. Given that the responses are measured relative to healthy firms, note that a positive coefficient implies lower responsiveness, assuming a negative healthy response to a contractionary monetary policy shock ($\delta_h < 0$).

The interaction term gives rise to a marginal effect with respect to firm type: $\gamma_h^g + \beta_h^g * \epsilon_t^{MP}$ captures how differently the investment of a distressed or zombie firm behaves in general relative to healthy firms. For both groups, I expect γ_h^g to be negative and significant. This would indicate that distressed and zombie firms invest less than healthy firms, on average and in absence of a monetary shock. In addition, based on the descriptive statistics in Section 3, I expect $\gamma_h^z < \gamma_h^d$, so that zombie firms invest less than distressed firms.

The following empirical results are presented in three steps. First, I investigate how investment of the average firm in the full sample and in the sub-sample of healthy firms responds to a monetary policy shock. Second, I examine the differential investment responses of distressed and zombie firms *relative to* healthy firms. Third, I test mechanisms that may account for the different strengths of investment responses between distressed and zombie firms.

4.2 Average Investment Response Across All Firms

As a first exercise, I estimate the average impact of a monetary policy shock across the whole sample and for the sub-sample of healthy firms using Equation (1). Figure 4 (top panel) shows the corresponding cumulative impulse response function for the average healthy firm, which indicates the percentage point deviation of investment growth from its counterfactual path following a monetary policy shock. All responses are shown for a one standard deviation monetary policy shock, which corresponds to 8.64 basis points (with a mean of 1.2 basis points).

As expected, the average effect of a contractionary monetary surprise on investment is negative. On impact, the coefficient not significant. This is likely an artefact of timing, as this is the investment response in the same year as the 12-month monetary shock. After one year, the negative effect on investment for healthy firms is significant and persistent for all subsequent horizons. A one standard deviation in the monetary policy shock reduces investment by 3.2 percentage points (pp) cumulatively after two years. The full results for the average firm in the full sample as well as for the average healthy firm are reported in

Table E.

The size and shape of the response are in line with Durante et al. (2022), if not slightly more significant. Durante et al. (2022) also use Orbis data on tangible fixed assets to calculate investment for the four largest EA economies and the shock series by Jarociński and Karadi (2020) to measure monetary policy. Note that the impulse response function for the sample of all firms is almost identical, as shown in Table E and Figure E.1 (left). This is due to the fact that the vast majority of firms classify themselves as healthy.

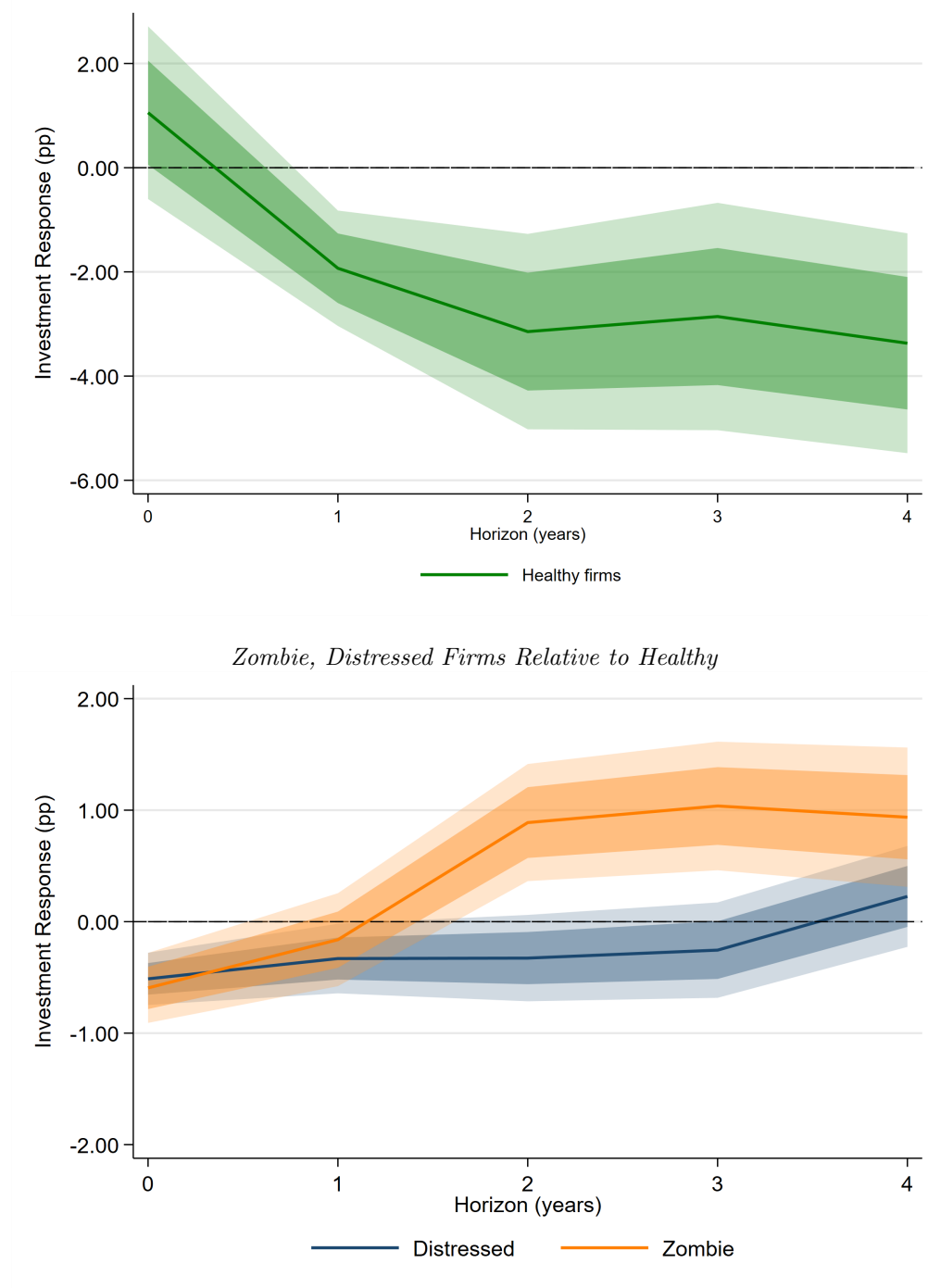
4.3 Differential Group Responses to Monetary Policy Shocks

To investigate how a monetary policy shock affects the groups of firms differently conditional on their financial viability, I estimate Equation (2) in four variations. Table 4 reports the results. While all specifications include firm fixed-effects and country-sector-year fixed-effects, column (1) estimates Equation (2) without any firm-level controls. Column (2) adds two lags of total assets, leverage, cash flow, real sales growth, and log age, respectively, and constitutes the baseline specification. Column (3) additionally includes interactions of the first lags of these firm controls with the monetary policy shock. Column (4) repeats the exercise using dummy indicators commonly used as proxies for financial constraints (e.g., young, small) instead of the continuous firm controls, interacted with the shock. Three patterns hold across all columns; Figure 4 (bottom panel) illustrates the distressed and zombie responses compared to healthy firms corresponding to the baseline specification in column (2).

First, the main coefficient of interest for distressed firms, β_h^d , is significant and negative on impact at $h = 0$. It remains negative between one and three years after the shock. The cumulative response after four years is not significant. Against the negative investment response of healthy firms, the negative response of distressed firms *relative to* healthy firms implies that distressed firms are *more* responsive to a monetary policy shock. Their investment contracts by 0.26pp more than for healthy firms at the peak response three years after the shock. This higher sensitivity of distressed firms' investment to monetary shocks is in line with financial accelerator, suggesting that distressed firms are more financially constrained than healthy firms.

Second, the interaction coefficient for zombies, β_h^z , is negative on impact. From two years post-shock onward, the differential response of zombie firms to a monetary policy shock is significantly positive. Combined with the negative response of healthy firms, this indicates that zombie firms are significantly *less* responsive to monetary policy shocks than healthy firms. While their investment contracts, the peak cumulative zombie response is only two

Figure 4. Baseline Investment Responses to a Monetary Policy Shock by Group
Healthy Firms



Notes: *Top:* Average response for the healthy sample to a one standard deviation monetary policy shock, with 90% and 68% confidence intervals. Equation (1) estimated using firm fixed effects, aggregate controls (lagged GDP growth, lagged inflation and lagged unemployment rate) and firm-level controls (lagged real sales growth and number of employees). The shaded areas are the 90% and 68% confidence intervals. Standard errors are clustered on the firm-time-level. For regression table see Table E. *Bottom:* The orange (blue) line plots the differential response of zombie (distressed) firms relative to healthy firms. Equation (2) includes firm fixed effects, sector-country-time fixed effects and firm-level controls (total assets, lagged real sales growth, leverage, log age). Errors are clustered by firm and time.

Table 4. Local Projection Results: Distressed and Zombie Firms

Investment Rate	(1) No Controls	(2) Baseline	(3) Financial constraints proxies Continuous	(4) Financial constraints proxies Dummies
Zombie_{t-1} × Shock				
$h = 0$	-0.36** (0.16)	-0.59*** (0.19)	-0.63*** (0.19)	-0.44** (0.20)
$h = 1$	0.34 (0.22)	-0.16 (0.25)	0.01 (0.26)	-0.26 (0.26)
$h = 2$	1.20*** (0.27)	0.89*** (0.32)	1.27*** (0.32)	0.64* (0.33)
$h = 3$	1.46*** (0.30)	1.04*** (0.35)	1.39*** (0.36)	0.92** (0.36)
$h = 4$	1.57*** (0.33)	0.94** (0.38)	1.21*** (0.38)	0.88** (0.39)
Distressed_{t-1} × Shock				
$h = 0$	-0.40*** (0.11)	-0.51*** (0.14)	-0.52*** (0.15)	-0.49*** (0.15)
$h = 1$	-0.10 (0.15)	-0.33* (0.19)	-0.17 (0.19)	-0.46** (0.20)
$h = 2$	0.12 (0.19)	-0.33 (0.24)	0.02 (0.24)	-0.38 (0.24)
$h = 3$	0.11 (0.21)	-0.26 (0.26)	0.08 (0.27)	-0.18 (0.27)
$h = 4$	0.53** (0.23)	0.23 (0.27)	0.47* (0.28)	0.37 (0.29)
$N (h = 0)$	16,129,253	11,117,700	11,117,700	11,117,700
$R^2 (h = 0)$	0.189	0.192	0.192	0.192
Macro controls	✓	✓	✓	✓
Firm controls		✓	✓	✓
Fin. constr. proxies (cont.) × Shock			✓	
Fin. constr. proxies (dummies) × Shock				✓

Notes: Columns: (1) no firm controls; (2) baseline with firm controls; (3) baseline + controls × shock interactions. Dependent variable: Investment rate. All specifications include firm fixed effects and Country×Sector×Year fixed effects. Standard errors are clustered on the firm level. * p<0.10, ** p<0.05, *** p<0.01.

thirds of that of healthy firms. Crucially, the total marginal effect, $\gamma_h^g + \beta_h^g * \epsilon_t^{MP}$, remains negative and significant across all groups: while the zombie investment response is muted, it is not eliminated.¹⁹ These results are robust to the alternative specifications reported in Appendix C. Consistent with Figure B.3, investment levels absent a monetary policy shock are lower for zombies than for distressed firms, $\gamma_h^z < \gamma_h^d$.

Third, as clearly shown in Figure 4 (right) and confirmed by Wald tests, the response of zombie firms is statistically different from that of distressed firms from one year after the shock. The zombie interaction coefficient is significantly larger than for distressed firms, $\beta_h^z > \beta_h^d$. This underlines the importance of distinguishing between groups of financially weak firms, which constitutes the key argument of this paper.

The muted response of zombie firms is a surprising result in light of the financial accelerator. This channel predicts that zombie firms, which have the weakest balance sheets, would be most responsive to monetary policy. Following the logic by Ottonello and Winberry (2020), zombie firms face the steepest marginal cost curve of capital, leading to the smallest response to a monetary shock. However, in this context, the finding that distressed firms are more responsive than healthy firms is unexpected. Therefore, the prevailing explanations for firm heterogeneity in monetary policy transmission cannot reconcile the findings presented in Figure 4. The remainder of this paper is concerned with investigating and explaining this significant gap in investment responsiveness *within* the set of financially weak firms.

To test whether my classification of firm viability is distinct from the proxies used to capture financial constraints in the existing literature, column (3) in Table 4 includes interactions of firm controls with the monetary policy shock. This includes lagged total assets (proxying size), age, leverage, cash flow, and real sales growth. In addition, column (4) constructs dummy variables for financial constraints instead of employing the firm-level controls as continuous variables. Specifically, dummy variables for a firm being young (lowest quartile of log age), small (lowest quartile of log total assets), highly leveraged (highest quartile), with low cash flow (lowest quartile) or low sales growth (lowest quartile), are interacted with the monetary policy shock. If my findings can be replicated using these traditional proxies of financial constraints, the zombie and distressed coefficients should become smaller and insignificant. Instead, columns (3) and (4) show that the sign, size and significance of the coefficients of interest, β_h^z, β_h^d , are virtually unchanged. This suggests that the classification into zombie and distressed firms captures information about the investment response to monetary policy shocks *beyond* what traditional indicators like age or size can explain. Zombieness is a distinct feature of the firm and not simply a different way of thinking about

¹⁹The smaller investment response is calculated by dividing the zombie coefficient by the healthy firm coefficient at the peak impact of $h = 3$.

distressed firms, underlining the key argument of this paper.

The muted response of zombie firms and its significantly different reaction to distressed firms is robust to: (i) alternative fixed-effects structures and sample restrictions, (ii) alternative investment measures, (iii) variations of the baseline financial viability classification, (iv) alternative zombie definitions (profitability-based and subsidised-credit-based), and (v) alternative monetary shock series. Across all specifications, zombie firms' investment is significantly less sensitive to contractionary monetary policy shocks than both healthy and distressed firms. A more detailed description of robustness checks is in Appendix C.

In a nutshell, zombies respond significantly less to a shock than healthy firms, while distressed firms respond more. Zombie and distressed firms differ significantly in their overall investment behaviour following a monetary policy shock. Classifying firm types according to financial viability offers novel insights into investment responses to monetary policy shocks beyond what traditional proxies of financial constraints can capture.

4.4 Mechanisms

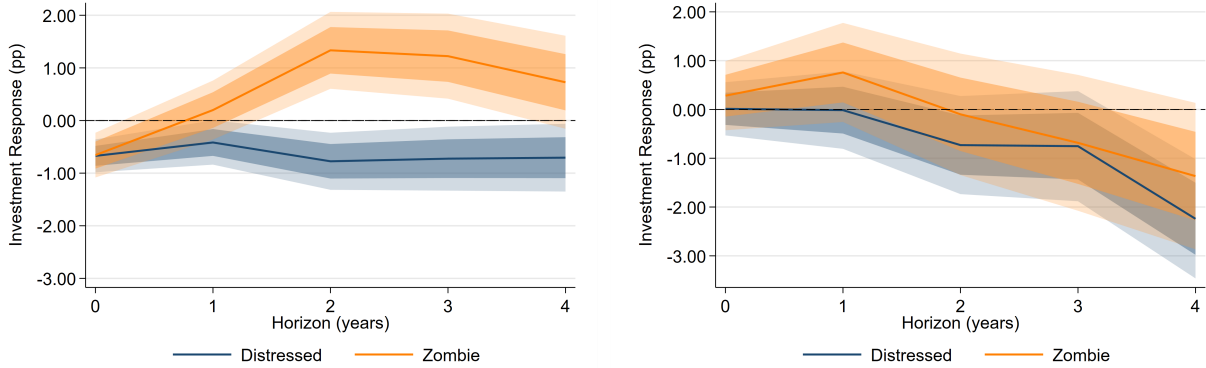
The findings so far underline the necessity of distinguishing zombie firms from distressed firms. This raises the question of the mechanism that leads to the opposite investment responsiveness to monetary policy shocks of zombie and distressed firms *within* the set of financially weak firms. This subsection empirically tests three different mechanisms: a lack of investment opportunities for zombie firms, different borrowing conditions for distressed and zombie firms, and lenders treating the two groups of firms differently.

4.4.1 Lack of Investment Opportunities. One possible explanation for the muted response of zombie firms to a monetary policy shock could be that they do not invest at all. Against the backdrop of their financial weakness, it would appear possible that zombie firms do not have any projects with positive net present value to invest in, while distressed firms still face worthwhile investment opportunities. In this case, neither a policy rate hike nor a cut would affect the investment response of zombie firms.

To put this mechanism to the test, I investigate potential asymmetries between interest hikes and cuts by splitting the series of monetary shocks into positive and negative surprises.

The average investment response for healthy firms following Equation (1) is estimated separately for hikes and cuts. To ensure sufficient variation of hikes and cuts over time, country-sector fixed-effects are used instead of firm fixed-effects. The cumulative investment response to a positive monetary surprise (corresponding to a hike) is negative, see Figure E.1 (right panel). This reaction is in line with the standard view that higher interest rates tighten financial conditions, which lowers firm investment and dampens output. Following

Figure 5. Asymmetries: Differential Investment Responses to Positive and Negative Shocks



Notes: The graph shows the differential responses of zombie firms (orange) and distressed firms (blue) relative to healthy firms following a positive monetary shock (left panel) and a negative monetary shock (right panel). Positive surprises are constructed by setting all negative surprises to zero and vice versa. Estimates are shown in percentage points, the horizontal axis shows the horizon h after the shock in time t (Equation (2)).

a negative surprise (corresponding to a cut), the cumulative average investment response is positive, in line with the standard prediction that as interest rates fall, financing conditions loosen and demand and output are stimulated, increasing firm investment. Similarly to the average response, investment reacts with a lag, which could be due to the fact that it is often predetermined for at least one year for most firms (Bomprezzi et al., 2025). This is also consistent with long lags of monetary policy (Aruoba and Drechsel, 2024). The same pattern holds for the full sample of firms.

Figure 5 plots the differential investment responses of distressed and zombie firms to a hike (left panel) and a cut (right panel) in policy rates. The differential responses of the respective firm groups following a contractionary surprise (hike) mirror and amplify those of the linear baseline specification. The investment response of distressed firms to a contractionary shock is significantly negative across all horizons. Thus, distressed firms reduce their investment significantly more than healthy firms when policy rates increase. The investment of zombie firms responds significantly less than that of healthy firms starting a year after the contractionary shock. This means that zombie investment still contracts, but by much less than for healthy firms. As in the baseline, the zombie response to a hike differs significantly from that of distressed firms.

For an expansionary monetary policy shock, neither response is significantly different from that of healthy firms, and the responses of distressed and zombie firms do not differ significantly from each other. Considering that healthy firms increase their investment following lower interest rates, this finding implies that zombie and distressed firms do the same.

Two insights follow from investigating asymmetric responses. First, the baseline results

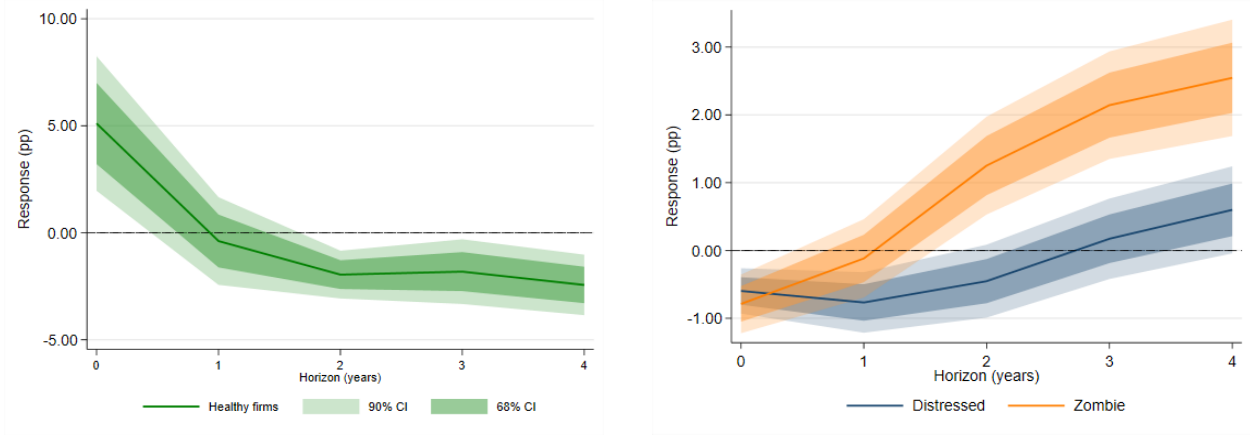
seem to be driven by contractionary interest rate surprises. Second, the insignificant differential investment responses of zombies and distressed firms suggest that all firms increase their investment following expansionary policy rate surprises. This rejects the hypothesis that zombie firms do not invest at all. As such, these asymmetric responses to contractionary and expansionary surprises provide evidence that the lack of investment opportunities for zombie firms cannot drive the zombie-distressed gap. As a consequence, this paper turns to credit-related mechanisms to investigate the different investment responses of zombie and distressed firms.

4.4.2 Credit channels. Firm heterogeneity in monetary policy transmission between healthy and financially weak firms is often traced back to credit-related channels. Within the set of financially weak firms, there are two candidate mechanisms that may explain the heterogeneities between zombie and distressed firms. On the one hand, they may differ in certain fundamental characteristics that would warrant different borrowing conditions, leading to differing investment responses. On the other hand, even if fundamentals between the two groups do not differ, certain credit supply factors may induce lenders to treat the two groups differently. Both of these mechanisms would require a differing responsiveness of zombie and distressed firms in credit-related variables such as debt growth.

I therefore employ the machinery described in subsection 4.1 to the dependent variables of debt growth, constructed as the log difference in total debt multiplied by 100, and split into short-term debt and long-term debt.²⁰ Figure 6 shows the results for long-term debt growth. In response to a monetary policy shock, long-term debt growth increases for healthy firms on impact. At the same time, the response of zombie and distressed firms is negative, indicating that their debt grows less than that of healthy firms on impact. This relation reverses one year after the shock and becomes clear after two years: long-term debt growth for healthy firms turns negative, as is the expected response when policy rates rise. Distressed firms show a negative reaction, making them more responsive than healthy firms at peak impact. They also reduce their long-term debt growth by more than healthy firms, in line with the financial accelerator. In contrast, zombie firms show a positive coefficient. This suggests that their reduction in long-term debt growth is significantly less than that of healthy and distressed firms. Hence, after a monetary shock, zombie firms seem to retain and lengthen credit. As for investment, the relationship between the long-term debt growth response and financial

²⁰I also investigate interest rates, constructed as interest paid over total debt, as is the standard proxy in the literature. However, even after cleaning the variable, results are counter-intuitive: average interest rates for healthy firms decrease following a policy shock. Taking this result at face value, there is no significant difference between the responses of zombie and distressed firms, suggesting that the price of debt does not seem to be the operating channel distinguishing the zombie from the distressed response. The section therefore only relies on debt growth, interest rate results are available upon request.

Figure 6. Long-term Debt Growth: Investment Responses to a MP Shock by Group
Healthy Firms *Zombie, Distressed Firms Relative to Healthy*



Notes: Left: Average response of long-term debt growth (log difference in long-term debt scaled by 100) for the healthy sample to a one standard deviation monetary policy shock, with 90% and 68% confidence intervals. Equation (1) estimated using firm fixed effects, aggregate controls (lagged GDP growth, lagged inflation and lagged unemployment rate) and firm-level controls (lagged real sales growth and number of employees). Standard errors are clustered on the firm-time-level. Right: The orange (blue) line plots the differential response of the long-term debt growth of zombie (distressed) firms relative to healthy firms. The shaded areas are the 90% and 68% confidence intervals. Equation (2) includes firm fixed effects, sector-country-time fixed effects and firm-level controls (total assets, lagged real sales growth, leverage, log age). Errors are clustered by firm and time.

weakness is not monotonic. Results for short-term debt do not show a differential response between zombie and distressed firms, implying that the mechanism operates through the quantity and maturity of debt.

The zombie-distressed gap is thus likely driven by credit-related channels, which can operate either through the borrower side or the lender side.

4.4.3 Credit channels: Borrowing conditions. Turning to borrower characteristics first, a key variable affecting credit conditions is collateral. Collateral can affect the zombie-distressed gap in two ways with opposite signs. First, the collateral channel of monetary policy transmission predicts that collateral values fall when policy rates increase (Kiyotaki and Moore, 1997; Bernanke and Gertler, 1995). Firms holding more pledgeable assets face a larger contraction in borrowing capacity when borrowing constraints bind. Distressed firms hold more collateral than zombie firms: median tangible fixed assets relative to total assets are 26.5% for distressed and 22.6% for zombie firms (see Table 2), while median leverage is nearly identical across the two groups (37.7% vs. 37.4%). If the collateral channel applies, a contractionary policy shock tightens distressed firms' borrowing conditions by more than for zombie firms, making them more responsive to monetary policy. This could explain the zombie-distressed differential. Second, a larger collateral stock provides slack against a binding borrowing constraint. This could lead to more favourable borrowing conditions and dampen the response. Since distressed firms hold more collateral, this mechanism works

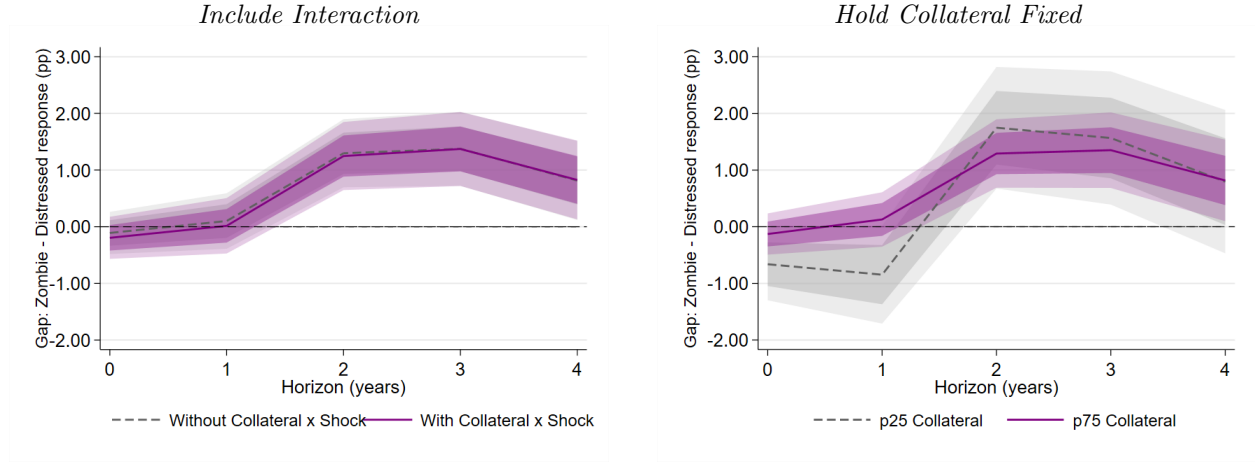
against the observed differential. Which effect dominates, and whether it is large enough to matter, is an empirical question.

Figure 7 shows the results of two tests for these collateral channels. The left panel adds the interaction of pre-shock tangibility in $t - 1$ with the monetary shock to my baseline specification (2) and plots the distressed-zombie gap in the specification with the interaction (solid purple line) and without (dashed gray line). I find that the zombie–distressed gap is unchanged for all horizons. The difference in tangibility between the two groups accounts for at most 2% of the gap from $h = 2$ onwards (Figure 7, left). The right panel in Figure 7 plots the gaps in investment responses between zombies and distressed firms conditional on being in the 25th percentile of collateral (dashed gray line) or the 75th percentile of collateral in $t - 1$ (solid purple line). If collateral differences between zombies and distressed firms explain the gap, it should disappear when comparing firms with equal collateral. The gap differs significantly between high- and low-collateral firms from $h = 2$ onward. At short horizons ($h = 0-1$), the gap is lower among low-tangibility firms, but this difference disappears thereafter (Figure 7, right). This finding is robust to splitting firms at the top quartile of tangibility measured in $t - 1$ or measured as the average over the firm’s first three years in the sample, which is predetermined with respect to the outcome window. Under all measures, the zombie-distressed gap is positive and of similar magnitude as in the baseline (Figure 7). Differences in collateral therefore cannot account for the zombie-distressed differential in investment responses following a monetary shock.

The collateral channel is nonetheless present in the data. The interaction term of tangibility and the monetary shock itself is negative at $h = 0 - 2$: firms with more collateral respond more strongly to a tightening. Because financially weak firms hold twice as much collateral as healthy firms, this accounts for most of their short-run responsiveness relative to healthy firms. It does not affect the zombie–distressed comparison as zombies and distressed firms hold similar amounts of collateral. The slack mechanism finds no support: firms with more debt per unit of collateral, and hence less slack, respond slightly less to a tightening rather than more.

Having ruled out collateral as the source of the differential, I turn to the lending side of credit markets.

Figure 7. Borrower Characteristics Mechanism: Collateral



Notes: The figure plots the gaps in investment responses of zombies and distressed firms for different levels of collateral. *Left:* The left panel shows the gap when including (solid line) or not including (dashed line) the interaction between collateral and the monetary shock. *Right:* The right panel shows the gap for zombies and distressed firms at the 25th (dashed line) and 75th percentiles (solid line) of tangibility. Shaded areas show 68% and 90% confidence intervals; standard errors are clustered at the firm level.

4.4.4 Credit channels: Credit supply. The set-up here provides a useful laboratory to empirically test the prevailing explanation of zombie lending, namely loan evergreening.²¹ Loan evergreening as coined by Peek and Rosengren (2005) is defined as banks extending new loans to impaired borrowers, enabling those weak firms to pay interest on already existing loans. This practice happens when banks have an incentive not to realise losses on their own balance sheets, and is therefore more common among banks with capital ratios near the required minimum (Peek and Rosengren, 2005). Recall that the definition used in this paper does not condition on zombie firms receiving subsidised credit, allowing to test loan evergreening as an outcome, rather than assuming it. Instead of comparing zombie firms to healthy firms as is common in the literature, I investigate the distinction between zombie firms and distressed firms. This creates a cleaner group for comparison with zombie firms, indirectly controlling for financial weakness.

To investigate the specific mechanisms leading to bank forbearance, the European Central

²¹The zombie literature puts forward several evergreening incentives: Minimum capital requirements or high liquidation costs enticing (weak) banks to keep non-performing loans on their balance sheets (Fariae-Castro et al., 2024; Blattner et al., 2023; Jordà et al., 2022; Becker and Ivashina, 2022), information asymmetries and relationship lending (Hu and Varas, 2021; Tracey, 2025), or political economy considerations around “too big to fail” firms or expansionary monetary and fiscal policies encouraging risk-shifting, especially during crises (Acharya et al., 2021). Relationship lending means that a bank extends cheap credit to unprofitable firms due to long-standing relationships. Running the triple interaction set-up with age (old age indicating relationship lending) or a country-level measure of government-owned bank assets from the World Bank *GFDD* Database show both channels are not significantly explaining the zombie-distressed gap. However, this may also be due to insufficient variation of relationship lending or state ownership within the Euro Area. Results are available upon request.

Bank's *CBD2* database provides detailed banking sector data across Euro Area countries.²² These include information on the average tier 1 capital ratio, coverage ratio, non-performing loan (NPL) ratio, and bank profitability, measured as the return on equity (ROE) of a banking sector in a given country and year. Table F.1 shows the summary statistics for these variables. I construct two main dummy variables to indicate weak banking sectors, corresponding to a below-median tier 1 capital ratio and banking stress, which is the joint set of high NPL and low coverage ratios. See Table F.2 for an overview of the country-year distribution for these two indicators.²³

To test whether weakness in the banking sector can explain the zombie–distressed gap, I interact these country-level indicator of banking-sector weakness, $\text{WeakBank}_{c,t-1}$, with the firm group indicators and the monetary policy shock, where c denotes the country of firm i .

$$\begin{aligned}\Delta_h Y_{i,t+h} = & \beta_h^0 + \beta_h^{d,W} \cdot \text{WeakBank}_{c,t-1} \cdot \text{Distressed}_{i,t-1} \cdot \varepsilon_t^{MP} + \beta_h^{z,W} \cdot \text{WeakBank}_{c,t-1} \cdot \text{Zombie}_{i,t-1} \cdot \varepsilon_t^{MP} \\ & + \gamma_h^{d,W} \cdot \text{WeakBank}_{c,t-1} \cdot \text{Distressed}_{i,t-1} + \gamma_h^{z,W} \cdot \text{WeakBank}_{c,t-1} \cdot \text{Zombie}_{i,t-1} \\ & + \beta_h^d \cdot \text{Distressed}_{i,t-1} \cdot \varepsilon_t^{MP} + \beta_h^z \cdot \text{Zombie}_{i,t-1} \cdot \varepsilon_t^{MP} \\ & + \gamma_h^d \cdot \text{Distressed}_{i,t-1} + \gamma_h^z \cdot \text{Zombie}_{i,t-1} \\ & + \zeta_h X_{i,t-1} + \alpha_{i,h} + \theta_{cst,h} + u_{i,t+h}\end{aligned}\tag{3}$$

Because $\text{WeakBank}_{c,t-1}$ varies only at the country-year level, its level and its interaction with ε_t^{MP} are absorbed by $\theta_{cst,h}$ and do not appear in the specification. The zombie–distressed gap in the shock response, in banking sectors with $\text{WeakBank}_{c,t-1} = w$, is

$$\text{Gap}_h(w) = \left(\beta_h^z + w \beta_h^{z,W} \right) - \left(\beta_h^d + w \beta_h^{d,W} \right), \quad w \in \{0, 1\},$$

and the triple difference compares this gap across weak and sound banking sectors:

$$\Delta \beta_h^W \equiv \text{Gap}_h(1) - \text{Gap}_h(0) = \left[(\beta_h^z + \beta_h^{z,W}) - (\beta_h^d + \beta_h^{d,W}) \right] - \left[\beta_h^z - \beta_h^d \right] = \beta_h^{z,W} - \beta_h^{d,W}.$$

The triple difference $\Delta \beta_h^W$ measures how the gap changes with the channel: a positive value indicates that the channel widens the zombie–distressed gap, a negative value that it narrows it.

Figure 8 compares the zombie–distressed gaps in country-years with low versus high tier

²²Data available at [ECB Consolidated Banking data - CBD2](#).

²³The results shown are robust to using a below-median coverage ratio, a below-median ROE, an above-median NPL ratio to indicate weak banking sectors.

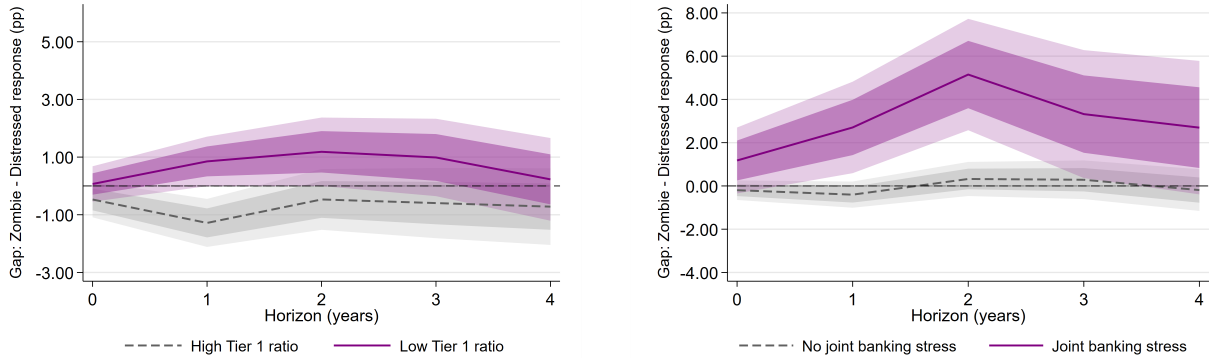
1 capital ratios (left panel) and highly stressed versus less stressed banking sectors (right panel). The triple differences between the two scenarios are significant for each panel, see Figure F.1. The comparison based on tier 1 capital ratios shows an interesting result: the gap between zombies and distressed firms reverses for country-years with well-capitalised banking sectors. In those cases, zombie firms cut their investment by more than distressed firms. Banks with higher tier 1 capital ratios have less of an incentive to keep their weaker borrowers alive to avoid undercutting the minimum capital requirements. This suggests that well-capitalised banking sectors do not engage in loan evergreening to an extent that outweighs the financial accelerator effect. In less well capitalised banking sectors, the positive zombie-distressed gap remains.

The comparison between banking sectors with above-median and below-median stress paints an even clearer picture. The zombie–distressed gap is concentrated in country-years with more stressed banking sectors. Where banking sectors exhibit high NPL ratios and low provisioning coverage ratios, zombies cut investment by substantially less than distressed firms after a contractionary shock. Outside such episodes, the gap is indistinguishable from zero. Decomposing the triple interaction shows that zombies in countries and years with more stressed banks are even less sensitive than zombies in countries with a healthier banking sector, while there is no change for distressed firms. Similar patterns hold for banking sectors with low return on equity, and with high NPL ratios or low coverage ratios individually.

Taken together, these findings seem to suggest that the gap in investment responsiveness to a monetary policy shock between zombie firms and distressed firms is driven by weak banking sectors. What matters is not only low bank capital, but even more so a large stock of unprovisioned low-quality loans. These keep being rolled over to zombie firms, because recognising them as high-risk, close-to-default firms would reveal losses that are not yet reflected on banks’ balance sheets. Bank capital still matters in the incentives to shield zombie firms, but through the hit the loss recognition would cause banks, not simply through the distance to minimum capital requirements. These minimum capital requirements have been raised through Basel III after the Global Financial Crisis. Because the zombie-distressed gap depends on the state of lenders’ balance sheets rather than on borrower characteristics, the evidence is consistent with weak banking sectors shielding zombie borrowers to defer loss recognition. This is difficult to reconcile with a pure credit-demand explanation, suggesting credit supply as the mechanism that separates distressed and zombie firms.

In a nutshell, the dampened response of zombie firms is more pronounced in environments characterised by weaker bank profitability and higher banking-sector stress, consistent with regulatory capital pressure and loss-concealment incentives. Taken together, the findings support an interpretation in which bank forbearance and loan evergreening shield zombie

Figure 8. Credit-supply Mechanisms: Low Capital Ratios and High Banking Sector Stress
Tier 1 Capital Ratios *Banking Sector Stress*



Notes: *Left:* This figure estimates the zombie-distressed gap separately for country-sectors with below-median tier 1 capital ratios of the banking sectors and those with above-median tier 1 capital ratios. A positive value indicates that the channel variable widens the zombie-distressed investment gap, while a negative value indicates narrowing. Shaded areas show 68% and 90% confidence intervals; standard errors are clustered at the firm level. Results are robust to two-way clustering on the firm and country-sector levels. *Right:* The right panel repeats this exercise, but comparing gaps with above-median banking stress as indicated by high NPL ratios and low coverage ratios with below-median banking stress.

borrowers from higher rates and tighter financing conditions. Loan evergreening thus emerges as a conclusion of the analysis rather than featuring as an assumption built into the firm classification.

5 Macroeconomic and Policy Implications

So far, this paper has shown that grouping all financially weak firms together obscures an important heterogeneity *within* the set of financially weak firms: zombies and distressed firms respond in opposite directions relative to healthy firms to the same monetary tightening. The relationship between financial weakness and investment responsiveness is therefore non-monotonic. The mechanism accounting for these opposite reactions of financially weak firms is consistent with loan evergreening. In the context of this paper, loan evergreening seems to take the form of shielding zombie firms' credit conditions by sustaining their credit growth, especially in countries with weaker banking sectors. What do these results imply for the aggregate transmission of monetary policy in the Euro Area, and hence for policy-making? The following section proposes a back-of-the-envelope calculation to translate the firm-level estimates into consequences for aggregate transmission, which is the relevant margin for policy. The section then discusses some policy implications for monetary policy, prudential policy, and beyond.

5.1 Aggregate Investment Effects

As a first step in the aggregation exercise, I assign each firm-year observation the estimated cumulative peak response to a contractionary shock (as shown in Figure 5, left) of the viability group the firm belonged to in the preceding year. I then weigh this response by the firm's lagged tangible fixed assets. Subsequently, all firm-year observations in the estimation sample are summed up. Because status and capital are matched at the firm-year level, a firm that moves between groups contributes its capital to the group it occupies in each year, so the weights reflect the transitions documented in Table 3. The exercise holds group status fixed at its pre-shock value: it does not capture transitions induced by the shock itself, and it abstracts from general-equilibrium spillovers of zombie firms onto other firms.

Table 5 provides an overview of the aggregate investment responses following a one standard deviation monetary policy tightening (+8.64bp shock). Weighing all firm-year observations in the sample by their tangible fixed assets, healthy firms hold 86% of capital, distressed firms hold 9%, and zombie firms hold 5%. These shares are slightly higher than those for total assets or employment presented in Section 3 because financially weak firms hold more capital relative to their total assets. Following a contractionary monetary policy shock, healthy firms reduce their investment by 3.5 pp cumulatively after three years, as shown in Figure E.1. Combining the healthy firm coefficients with the differential group coefficients of Figure 5 shows that distressed firms reduce their investment by 4.2pp after a contractionary shock, which is a 20% stronger response compared to healthy firms. In contrast, zombie firms reduce their investment only by 2.3pp, which is a 34% weaker response than for healthy firms. Taken together, a contractionary monetary shock reduces aggregate investment by 3.55pp for the whole economy captured by my sample.

Forgone investment is calculated by comparing this baseline economy to several counterfactual scenarios. In scenario I, zombie firms behave like distressed firms. In scenario II, zombie firms behave like healthy firms, whereas distressed firms turn healthy in scenario III. Finally, scenario IV contrasts only one group of financially weak firms with healthy firms.

Scenario I assigns the peak cumulative investment response of distressed firms to zombie firms, keeping the coefficients constant as the ones estimated in Section 4. This nearly doubles the total reduction in investment of zombie firms from a 2.3pp reduction in investment to 4.2pp, translating into an aggregate reduction of 3.64 pp. Compared to the baseline level, this implies that the economy's investment response could have been 2.4% larger if zombie firms were as responsive as distressed firms. Zombie firms hold 4.5% of the tangible capital stock and 4% in total assets. Hence, the 2.4% attenuation implies that each additional percentage point of capital held by zombie firms dampens the aggregate investment response

Table 5. Overview of Aggregate Investment Effects in Baseline and Counterfactual Scenarios

	Healthy	Distressed	Zombie	Aggregate	vs. actual
Share of capital (TFA)	86%	9%	5%	100%	
Response to a tightening	-3.5	-4.2	-2.3	-3.55	
		20% stronger	34% weaker		
<i>Counterfactuals</i>					
I) Zombies respond like distressed	-3.5	-4.2	-4.2	-3.64	+2.4%
II) Zombies respond like healthy	-3.5	-4.2	-3.5	-3.61	+1.6%
III) Distressed respond like healthy	-3.5	-3.5	-2.3	-3.49	-1.8%
<i>Two groups: Healthy vs. financially weak</i>					
IV) Financially weak	-3.5	-3.6	-3.6	-3.54	-0.2%

Notes: This table provides estimates for the reduction in investment for each firm group (first three columns) and on aggregate (fourth column). The fifth column calculates the difference in investment response compared to the baseline.

to a tightening by roughly half a percentage point of that response: A zombie capital share of 5.5% would raise the dampening effect to 3.0%.²⁴ Due to the higher responsiveness of distressed firms, this muting effect is slightly smaller when turning zombie firms into healthy firms instead of distressed: Aggregate investment contracts by 3.61 pp, implying a 1.5% larger investment response compared to the baseline. Scenario III illustrates this higher sensitivity of distressed firms: Turning all distressed firms into healthy lowers the aggregate investment response to 3.49pp, around 1.8% smaller.

So, what is the advantage of considering three groups of firms instead of two? To highlight the role of the additional heterogeneity within the set of financially weak firms, consider scenario IV in which there are only two groups: healthy firms and financially weak firms, which includes both zombies and distressed firms. Scenario IV is not a reassignment of coefficients but a re-estimation: I estimate the impulse response function of financially weak firms compared to healthy firms using Equation (2). The results are shown in Figure E.2. I find that the investment response of the combined set of financially weak firms does not differ significantly from that of healthy firms. The aggregate investment response is almost identical to the baseline at 3.54pp, implying no observed change in aggregate investment compared to the baseline. Similarly, scenarios II and III offset almost exactly: an economy in which no firm was financially weak would have contracted investment by 3.54pp, against 3.55pp in the baseline. Therefore, pooling zombie and distressed firms into one set of financially weak firms masks their opposite responses to a monetary policy shock.

By just comparing healthy and financially weak firms, one may conclude that there are

²⁴Note that this exercise is partial-equilibrium as it uses the coefficients estimated in the observed economy, where some credit is locked in by zombie firms through bank forbearance. In a zombie-free world, this credit would be reallocated to healthy (or distressed) firms, amplifying their investment response beyond what the estimated healthy-firm coefficient implies. Therefore, the estimated muting of monetary policy transmission to investment through zombie firms is a conservative estimate.

no heterogeneities in monetary transmission at all. This paper has shown that this is not the case: distressed and zombie firms respond in opposite directions to the same monetary shock, relative to healthy firms. Therefore, the composition of financial weakness matters for monetary policy transmission.

This offers a potential reconciliation of the conflicting evidence in the literature: a single-proxy estimate in fact recovers a composition-weighted average of two differentials of opposite sign. A sample whose financially weak firms are mostly distressed will tend to recover the amplification predicted by the financial accelerator. Instead, one with a larger zombie share will appear to confirm Ottonello and Winberry (2020), albeit through a different mechanism (zombie muting instead of default risk). This paper highlights heterogeneities *within* the set of financially weak firms and challenges the view that monetary policy responsiveness can be summarised by a function that is monotonically increasing or decreasing in financial weakness. Instead, it suggests a non-monotonic relationship between financial weakness and monetary policy responsiveness.

5.2 Policy implications

The estimates for aggregate investment presented in the previous subsection point to a roughly two-to-one relationship between zombie prevalence and monetary policy dampening: increasing the share of zombie firms by one percentage point raises the muting effect by approximately half a percentage point. From a policy perspective, these results offer four key insights.

First, the results show that monetary policy transmission depends not only on the amount of financially weak firms in the economy, but also on the composition. Pooling all financially weak firms together masks important heterogeneities in monetary policy transmission: Distressed firms are more responsive, whilst zombie firms dampen transmission. A central bank monitoring “financially vulnerable firms” as a single category would conclude that financial weakness does not matter for transmission, which is a conclusion not supported by this paper. How monetary policy transmits to the economy is therefore not only a function of changes in monetary stance, but also of changes in the firm viability composition. A higher zombie prevalence may reduce the responsiveness of aggregate investment to policy tightening, warranting a larger policy adjustment, whereas a higher share of distressed firms would amplify transmission. Thus, it is important for policy-makers to understand the *nature* of financial weakness in the economy to calibrate changes in monetary stance accordingly.

Second, firm viability and banking-sector health may be a channel through which common monetary policy is transmitted heterogeneously across member states. This paper has shown

that the composition of financially weak firms varies substantially not only over time but also across countries, with average asset-weighted zombie shares ranging between 2.4% in Germany and 8.3% in Greece. This corresponds to a muting effect that varies from 1.3% of the baseline response to a magnitude almost three times as large at 4.5%, compared to the Euro Area average of 2.4%. Hence, firm composition and zombie dampening are one avenue through which the same monetary shock can affect the members of a currency union like the Euro Area at different strengths. As a single monetary policy cannot respond to such differences, they matter primarily for national supervisory and structural policies, and for the central bank’s assessment of transmission across member states.

Third, zombie prevalence also varies over time and is counter-cyclical, with higher shares in recessions. The zombie share is therefore a candidate state variable for state-dependent monetary transmission (Tenreyro and Thwaites, 2016). At the same time, the shielding of zombie firms and the subsequent muting operate on contractionary monetary policy. Combining these two facts, the drag on transmission is largest when monetary policy tightens against a still-elevated stock of zombie firms. Central banks rarely tighten in downturns. Instead, this combination arises mainly when supply-driven inflation forces the central bank to tighten despite weak activity, as in the 2011 rate increases during the sovereign debt crisis or, beyond my sample, the 2022–23 tightening cycle. These are precisely the episodes in which the central bank already faces a trade-off between output and inflation stabilisation, making the effectiveness of monetary policy transmission a primary concern.

Finally, the results suggest that monetary transmission is closely linked to prudential policy via bank balance sheets. Especially weak banking systems extend credit to the least viable borrowers, namely zombie firms. The muting effect of zombie firms on monetary policy is thus facilitated by unintended consequences of prudential policy. The results associating low Tier 1 ratios with zombie lending are consistent with Blattner et al. (2023), who find that minimum capital requirements lead to credit misallocation. Therefore, loan evergreening is a channel linking banking supervision and prudential policy to the effectiveness of monetary policy. If lender incentives matter for transmission in the way the results imply, then banking supervision has macroeconomic consequences beyond financial stability and for monetary policy. This highlights the interactions between price stability, which is often the central bank’s primary mandate, and financial stability, which is usually handled separately.

Relatedly, a driver of distorted bank incentives in addition to capital requirements could be insolvency regimes. Becker and Ivashina (2022) show that weak insolvency regimes can incentivise zombie lending. Strengthening insolvency procedures and harmonising them across all Euro Area countries, as adopted in March 2026 under the Directive 2026/799 by the European Parliament and Council (2026) is therefore also important from the standpoint of

monetary transmission.

6 Conclusion

This paper studies how firms’ financial viability shapes the transmission of monetary policy in the Euro Area. Using granular data on 5 million distinct firms across 20 Euro Area economies from 2005 to 2022, I partition firms into three groups of financial viability: healthy, distressed, and zombie firms. I then estimate dynamic investment responses of these groups to high-frequency monetary policy shocks using panel local projections. The investment response of zombie firms to a monetary policy shock differs significantly from that of distressed firms, although both firm types are financially weaker than healthy firms. Specifically, zombie firms’ investment contracts by one third less than that of healthy firms, while distressed firms respond around 20% more than healthy firms to a monetary shock. This zombie-distressed differential cannot be accounted for by proxies commonly used in the literature. Pooling all financially weak firms together obscures this effect.

These results offer a potential reconciliation of the mixed evidence on monetary transmission and financial weakness in the literature: Existing one-dimensional proxies of financial constraints like age, size, or leverage conflate zombies and distressed firms into one group. In addition, they impose a monotonic relationship whereby the responsiveness of firm investment monotonically increases (financial accelerator) or decreases (default risk logic following Ottonello and Winberry (2020)) with financial weakness. Instead, this paper finds that the relationship is non-monotonic. Different sample compositions and overly broad financial constraint proxies can thus lead to conflicting results.

This paper investigates three mechanisms that could explain the difference in responsiveness of zombies and distressed firms to monetary policy shocks. The evidence points toward regulatory capital pressure and bank loss concealment: in countries where banks are closer to undercutting their minimum capital requirements, face acute NPL burdens and hold insufficient provisions, the incentive to evergreen zombie loans and avoid recognition of impaired assets is strongest. The dampened investment response of zombie firms to a monetary policy shock therefore seems to reflect loan evergreening via credit growth, especially in long-term debt, due to bank balance sheet incentives. Although specific to the monetary policy context, these findings speak to the broader zombie firm literature: the evidence confirms, rather than assumes, the view that weak banks and regulatory incentives to conceal losses are a primary driver of zombie firm survival, lending more support to this channel than to alternatives put forward in the theoretical zombie literature.

The broader implication is that the composition of firm viability matters for aggregate

monetary transmission. A back-of-the-envelope aggregation suggests that the investment response could be up to 2.4% higher if zombie firms behaved like distressed firms, following a one-standard-deviation monetary policy shock. Increasing the share of zombie firms in the economy by one percentage point increases the dampening of the aggregate investment response to a monetary policy shock by around half a percentage point. This dampening effect of zombie firms provides an explanation for heterogeneities in monetary transmission across countries and over time. It identifies a channel through which banking-sector frictions dampen transmission in a bank-based economy, with implications that extend beyond monetary transmission to financial stability and the design of prudential regulation.

A natural next step is to employ matched loan-level data such as AnaCredit to investigate matched bank-firm relationships directly, and analyse additional measures of credit conditions, including interest rates. Future research could investigate whether non-bank financial intermediaries, which face no comparable minimum capital constraints, treat distressed and zombie firms differently, and sustain zombie firms or discipline them.

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Appendix

A Sample Restrictions for the Datasets Used

I utilize firm-level data from Bureau van Dijk’s Orbis Historical, merging data on firmographics (including firm characteristics like name, age and sector) with balance sheet financials. The following sets out the precise cleaning procedure, which broadly follows Kalemli-Özcan et al., [2024](#).

A.1 Orbis Firmographics Dataset

I take the following steps to eliminate duplicates, with the goal of obtaining one observation per firm (as identified by its unique BvD ID number). I first drop duplicates in terms of **all variables** in the sample. Second, I aim to eliminate **duplicates in terms of National ID, National VAT, EU VAT and ISIN number**, to then break this down further with every step. As such, of the duplicate rows, I keep the ones with non-missing National VAT numbers. For these rows where National ID, National VAT, EU VAT and ISIN number are identical, I drop the ones with missing address types. If rows are still duplicate in all four identifiers but exhibit two different address types, I keep the one equal to “Registered address” as it is the most common address type in our sample. This eliminates all duplicates in terms of the four identifiers above. Third, I eliminate duplicates in terms of **National ID, National VAT, EU VAT** by dropping the rows with a missing ISIN number. Next, I forward and backward fill the European VAT number where missing. I aim to preserve as much variation in national identifiers as possible, such that I drop rows where some non-missing identifiers are identical:

- Drop if duplicate in BvD ID and National VAT and National VAT equals National ID
- Drop if duplicate in BvD ID and National VAT and EU VAT equals National ID
- Drop if duplicate in BvD ID and National VAT and EU VAT is missing
- Drop if duplicate in BvD ID and EU VAT and National VAT is missing
- Drop if duplicate in BvD ID and EU VAT and EU VAT equals National VAT

Finally, for the remaining duplicates in terms of **BvD ID number**, I drop rows where both National and EU VAT numbers are missing. As a last step, I drop duplicate BvD ID observations which have a missing EU VAT number. Our resulting sample has unique observations by firm (BvD ID number) with maximum variation in identifiers.

A.2 Orbis Financials Dataset

For the balance sheet variables, I aim for unique firm-financial year observations. Therefore, I first establish unique observations in terms of **BvD ID, financial year, consolidation code and filing type** by keeping the latest observation, i.e. a reporting month closer to December, and a reporting day closer to 31. Second, to get unique observations in terms of **BvD ID, year, and consolidation code**, I drop duplicate rows of these three variables where the filing type is local registry filings in favor of annual reports. This is because local registry filings are more often coded as limited financials. Third, to get unique **BvD ID and year** observations, I deal with consolidation codes. Following Kalemli-Özcan et al., 2024, I keep unconsolidated over consolidated accounts to avoid double counting. Within consolidated accounts, I keep those where the company headquarter does not present an unconsolidated account. Within unconsolidated accounts, I keep those where the company headquarter does not present a consolidated account. Next, I treat same-year reporting by keeping the observation with the reporting month closer to December. Similar, for same-month reporting, I keep the reporting day closer to the end of the month. Finally, for BvD ID-year observations which differ only in terms of original reporting units, I keep the observations in “units” as this is the most frequent reporting unit.

Having eliminated duplicates, I address likely reporting errors, employing basic data cleaning following Kalemli-Özcan et al., 2024. As such, I drop firms with negative total assets, sales, fixed assets, or tangible fixed assets. Furthermore, I drop observations with negative employees or more than 2 million employees. I also drop observations where total assets *and* operating revenue *and* sales *and* employment are jointly missing. Observations with a negative leverage ratio, computed as $(\text{long-term debt} + \text{loans}) / \text{total assets}$, are dropped. Finally, I construct an indicator for inconsistent balance sheets by comparing total assets to the sum of shareholder funds, current and non-current liabilities. This ratio should equal 1 for consistency, and I drop observations with a ratio below the 1st or above the 99th percentiles.

A.3 Orbis Merged Firmographics - Financials Dataset

I am using an inner join between the two above datasets, keeping only firms that have both Firmographics and Financials data. Further cleaning steps on the merged data include dropping few observations with missing NACE2 main sector classifications, and observations which belong to sectors K (Financial and insurance activities), O (Public administration and defense), U (Extraterritorial organizations) and T (Activities of households as employers). In addition, I drop firms where the reporting year predates year of incorporation (negative

age). I also drop observations with missing or zero values of total assets, and with negative long-term debt, loans, or R&D expenses while keeping observations with missing values. I exclude firms which change original reporting units over time when the transformation between units is implausible.

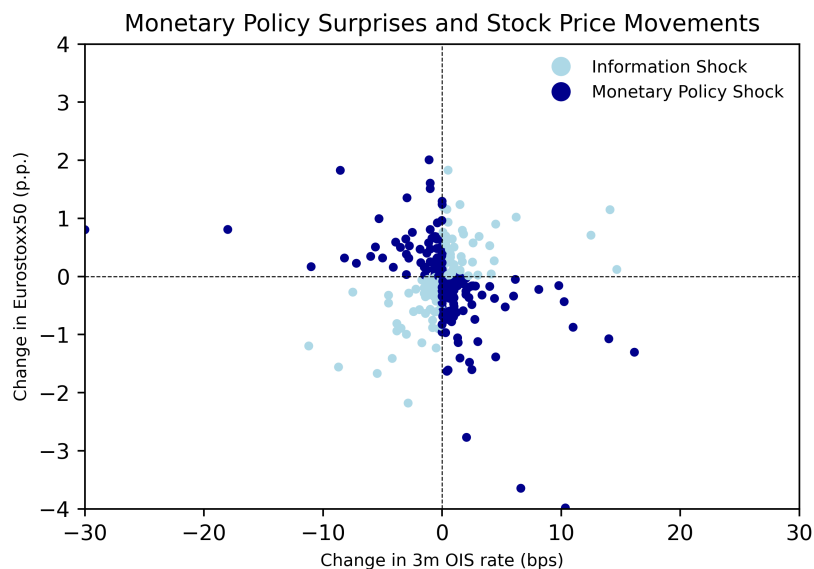
In addition, I trim the dataset to eliminate extreme outliers. First, I drop all observations where total assets are below the 1st or above the 99th percentiles. Second, I drop all observations where the leverage ratio is below the 1st or above the 99th percentiles.

All financial variables are deflated using the original currency deflator on industry-level and thus in real values.

Finally, note that I exclude 42,022 observations (0.2% of the regression sample) which are Italian firms that show a jump in the growth rate of tangible fixed assets that exceeds 20 percentage points and is matched by a similarly large jump in equity in 2008 or 2009. This is in order to exclude the effects of the law *DL 185/2008 (art. 15, commi 16–23)*, which let Italian firms write up the book value of their real estate in their 2008 accounts. The scheme was designed to strengthen equity ratios and preserve access to bank credit against the backdrop of the Global Financial Crisis. The revaluation of firms' real estate increased the value of their book equity through a higher value of tangible fixed assets on the balance sheet, while real investment was unaffected. I identify these cases by checking whether a jump of over 20 percentage points in tangible fixed assets growth is matched by a similar jump in equity in 2008 and 2009, and exclude the matched observations. As this law directly affects my outcome variable of investment but is unrelated to the monetary shock, including these observations slightly biases my results. Specifically, the response of distressed firms compared to healthy firms becomes insignificant, likely because they were the firms that made use of law *DL 185/2008 (art. 15, commi 16–23)*. The gap between the investment responses between zombies and distressed firms is robust to including these observations, results are available upon request. Robustness checks which exclude observations in all countries with such large jumps in tangible fixed assets growth and equity do not change the results, suggesting that the Italian law is an isolated case. Although countries like Spain and Portugal introduced similar revaluation laws, they restricted access to firms with lower leverage, therefore not interfering with the set-up in this paper.

B Further Summary Statistics

Figure B.1. Monetary Policy Shocks



Notes: This graph plots the distribution of monetary policy shocks using the 3m OIS rate against changes in the EuroStoxx50 during the event window. There are 185 “true” monetary surprises from 1999-2023, where stock markets move in the opposite direction to interest rates (dark blue), and 114 information shocks, where stock markets move in the same direction as interest rates (light blue).

Table B.1. Summary Statistics: Zombie Firms

Zombie firms	10%	Mean	Median	SD	90%	Obs
Firm Age	6.00	18.23	15.00	13.13	34.00	897,416
Employees	1.00	15.48	5.00	60.47	31.00	626,597
Total Assets (EUR thous.)	72.47	2713.59	547.39	10169.63	6343.07	898,160
EBITDA	-183.86	-66.68	-7.97	7378.78	76.47	859,194
Sales (EUR thous.)	15.98	1703.01	252.02	8875.27	3126.24	898,160
Tang. Fixed Assets (EUR thous.)	1.44	907.09	89.92	5239.32	1859.01	891,035
Leverage	0.12	0.51	0.38	3.05	0.85	898,160
Equity (EUR thous.)	-187.80	552.67	31.54	4431.99	1394.69	898,159
Cash Flow (EUR thous.)	-208.38	-74.81	-10.39	1061.55	71.12	841,558
Interest Paid (EUR thous.)	0.66	60.02	8.95	845.35	118.65	898,160
Debt Servicing Cap.	-0.99	-7.43	-0.05	3298.69	0.18	859,194

Notes: This table shows the summary statistics for key characteristics (age, number of employees) and balance sheet variables for zombie firms. All values in 2015 EUR.

Table B.2. Summary Statistics: Distressed Firms

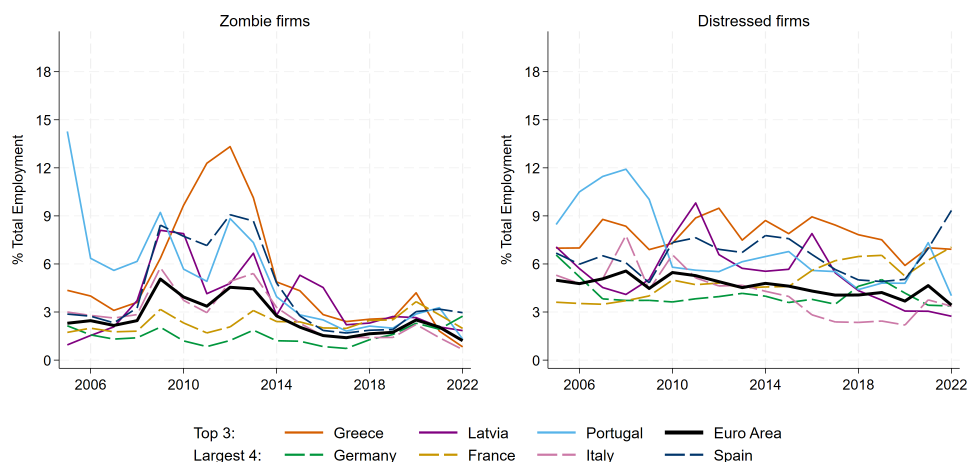
Distressed firms	10%	Mean	Median	SD	90%	Obs
Firm Age	4.00	16.30	13.00	13.23	32.00	1291470
Employees	1.00	19.56	5.00	168.98	39.00	884,970
Total Assets (EUR thous.)	78.40	3688.54	692.51	13171.81	9040.42	1,292,658
EBITDA	-136.31	-2.15	0.40	964.61	166.21	1,255,896
Sales (EUR thous.)	35.23	2500.55	357.49	11700.33	4704.76	1,292,658
Tang. Fixed Assets (EUR thous.)	2.34	1272.99	122.03	6486.03	2686.12	1,284,060
Leverage	0.12	0.50	0.37	2.98	0.87	1,292,658
Equity (EUR thous.)	-164.92	851.62	40.47	5638.17	2086.78	1,292,657
Cash Flow (EUR thous.)	-154.81	-9.74	-1.65	1364.72	167.04	1,226,708
Interest Paid (EUR thous.)	0.73	78.41	10.72	437.62	158.41	1,292,658
Debt Servicing Cap.	-0.70	-4.62	0.00	1352.75	0.26	1,255,896

Notes: This table shows the summary statistics for key characteristics (age, number of employees) and balance sheet variables for distressed firms. All values in 2015 EUR.

Table B.3. Summary Statistics: Healthy Firms

Healthy firms	10%	Mean	Median	SD	90%	Obs
Firm Age	5.00	16.74	13.00	12.85	33.00	21,341,612
Employees	1.00	19.62	6.00	135.10	38.00	14,555,541
Total Assets (EUR thous.)	95.52	2659.37	636.23	10628.17	5638.18	21,353,876
EBITDA	-6.35	246.48	48.04	3543.52	487.04	20,580,034
Sales (EUR thous.)	66.09	3137.74	633.08	18157.61	6017.95	21,356,836
Tang. Fixed Assets (EUR thous.)	1.84	713.63	68.84	4545.74	1273.68	21,252,252
Leverage	0.00	0.18	0.08	0.72	0.49	21,134,212
Equity (EUR thous.)	5.06	958.28	142.13	5091.44	1898.25	21,354,842
Cash Flow (EUR thous.)	-7.80	199.52	34.15	68747.91	369.27	20,301,832
Interest Paid (EUR thous.)	0.19	32.19	4.33	418.82	59.81	21,356,836
Debt Servicing Cap.	-0.01	184.21	0.45	42405.03	6.93	15,158,631

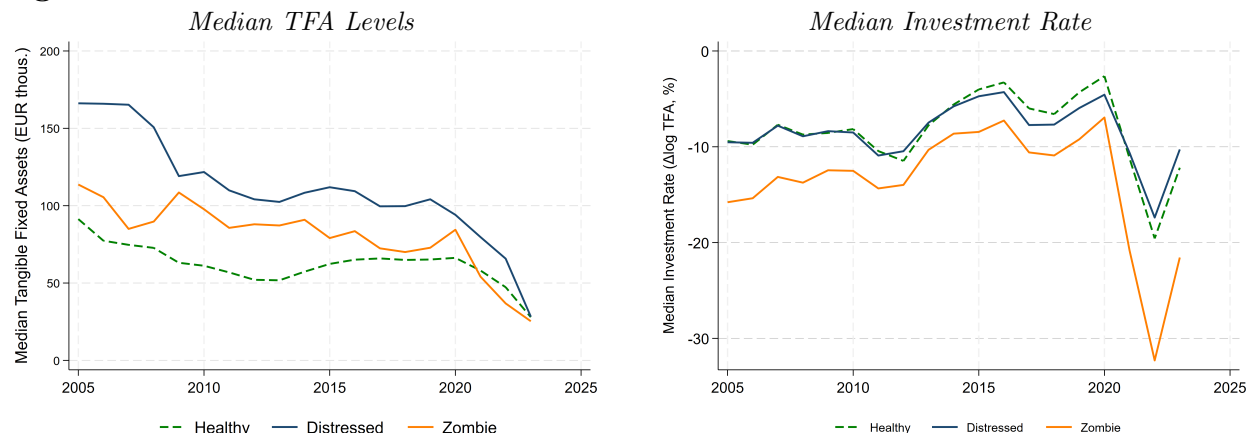
Notes: This table shows the summary statistics for key characteristics (age, number of employees) and balance sheet variables for healthy firms. All values in 2015 EUR.

Figure B.2. Zombie and Distressed Firm Shares for Selected EA countries: Employment

Notes: This graph shows the percentage share of employment held by zombie firms (left) and distressed firms (right) as defined in Section 2.2 in a given country and year from 2005 to 2022. It shows the top three exposed countries (solid lines), the Euro Area average (black line), and the four largest EA economies (dashed lines).

B.1 Investment Behaviour of Healthy, Distressed and Zombie Firms

Figure B.3. Investment Behaviour of Zombie and Distressed Firms



Notes: *Left:* This chart plots the median level of tangible fixed assets (TFA) by firm viability group, from 2005-2022. The green line corresponds to healthy firms, the blue line to distressed firms, and the orange line to zombie firms. *Right:* This chart plots the median investment rate, measured as the log difference in TFA and hence reported in percent, by firm viability group.

The key question this paper investigates is how the investment response to a monetary policy shocks differs between healthy, distressed and zombie firms. This warrants a closer investigation of investment by viability group.

Relative to their total assets, Table 2 shows that distressed and zombie firms hold more tangible fixed assets (TFA) than healthy firms. Plotting median levels of TFA by group over time confirms that zombies and distressed firms hold more tangible capital than the median healthy firm (Figure B.3, left).

Investment is measured as the percentage growth rate of firms' tangible capital, i.e., the log difference of real TFA multiplied by 100. Healthy firms' mean investment rate hovers closer to zero and is occasionally positive, in contrast to negative average investment rates for distressed and zombie firms (Figure B.3, right). This is consistent with the downward trend in TFA levels shown in the left panel. Therefore, financially weak firms maintain substantial capital stocks while investing less than healthy firms.

C Robustness Checks

I employ a series of robustness checks along the following dimensions: (i) alternative fixed-effects structures and sample restrictions, (ii) alternative investment measures, (iii) variations of my baseline financial viability classification, (iv) alternative zombie definitions (profitability-based and subsidised-credit-based), and (v) alternative monetary shock series. The two key results of zombie muting of monetary policy transmission and the significant difference between zombies and distressed firms in their investment response to monetary policy shocks hold across all robustness checks employed (Figure C.1).

C.1 Alternative Specifications

The baseline results remain unchanged for different fixed effect structures. For specification (1), I employ sector-country, sector, or country fixed effects in addition to the firm fixed effects. For the differential responses in specification (2), key results are robust to country-time, sector-time or time fixed effects instead of country-sector-time fixed effects (Figure C.1, panels (I) and (II)). I choose sector-country-time fixed effects for my baseline, however, to ensure the strictest fixed effects structure possible and to control for shocks in a sector in a specific country over time. Importantly, this includes fiscal and corporate tax differences between EA countries.

Standard error clustering affects the significance of the coefficients. My results are robust to clustering at the sector-country, or the sector level instead of at the firm level.

The period of analysis from 2005 is chosen because of the lower number of observations from 1999 to 2005. In addition, those observations that are available in that time frame are often sparsely populated for many variables. The average and differential investment responses to a monetary shock are broadly robust in estimating the local projections for the period 1999-2022 since the introduction of the Euro (Figure C.1, panel (III)).

C.2 Measure of Investment

The baseline measure of investment is the log difference of tangible fixed assets, that is, investment in physical capital. For robustness, I run the baseline local projections using the log difference in total fixed assets instead, which also includes intangible assets like patents or trademarks. The baseline results are confirmed; the difference between the differential responses of distressed and zombie firms is even more pronounced (Figure C.1, panel (IV)).

C.3 Persistence and Status Switching

Following Albuquerque and Iyer (2024), a degree of persistence is added to the definitions. Thus, a firm only exits distressed status if its ICR exceeds 1 for two consecutive years or if its leverage ratio is below the peer median for two consecutive years. For zombie firms, persistence requires that either of the three conditions must not hold for two consecutive years for the firm to exit zombie status. The results are broadly robust to persistent zombie definitions: Zombie firms are less sensitive to monetary shocks than healthy and distressed firms (Figure C.1, panel (V)). However, distressed firms exhibit a slightly positive interaction coefficient - although still significantly different from zombie firms, they become slightly less sensitive than healthy firms from previously showing no difference in investment response.

A related concern could be that firms that switch more frequently between viability groups behave systematically differently in response to monetary policy shocks than firms that do not. As a robustness check, I restrict the sample to firms that held the same viability status in the two years preceding the shock. Since the zombie and distressed firm definitions require two years of data, this effectively conditions for four years of stable status. The key results hold (Figure C.1, panel (VI)).

C.4 Definitions of Firm Viability

The literature on zombie firms proposes a myriad of ways to define zombie firms. In addition to my baseline definition that I use for the reasons described in Section 2.2, I employ two further zombie definitions for robustness. They rely on a very different approach of classifying firms, namely the definition by Storz et al. (2017), also used by Mingarelli et al. (2022), Helmersson et al. (2021) and Andrews and Petroulakis (2019), and a definition by Acharya et al. (2024) using a subsidised interest criterion. Table C.1 summarises the definitions used.

First, according to the approach by Storz et al. (2017), a zombie firm has, for two consecutive years,

- i. negative returns to assets (net income divided by total assets)
- ii. negative net investments (net total change in fixed assets year-on-year)
- iii. a debt servicing capacity below 5% (EBITDA over total financial debt, which is long-term debt plus loans).

Criterion (i) stipulates that the firm is unprofitable. This is an alternative measure of profitability to the negative real sales growth criterion employed in my baseline. To avoid misclassifying young, growing firms like start-ups, criterion (ii) requires that the firm

Table C.1. Overview of Zombie and Distressed Firm Definitions

BASELINE Zombie Definition: Mao and Albuquerque (2025)	Distressed Firms Mao and Albuquerque (2025)
1. ICR <1 (<i>EBIT divided by interest paid</i>)	ICR <1
2. Leverage ratio >median of its peers in the sector	Leverage ratio >sector median
3. Real sales growth <0	
ALTERNATIVE Zombie Definition 1: Storz et al. (2017)	Distressed Firms Broadly following Mingarelli et al. (2022)
1. Returns to assets <0 (<i>net income divided by total assets</i>)	Returns to assets <country-sector-year median
2. Net investments <0 (<i>net total change in fixed assets year-on-year</i>)	
3. Debt servicing capacity <5% (<i>EBITDA / total financial debt</i>)	Debt servicing cap. <country-sector-year median
ALTERNATIVE Zombie Definition 2: Acharya et al. (2024)	Distressed Firms Mingarelli et al. (2022)
1. ICR <country-sector-year median	ICR <country-sector-year median of the sub-sample firms above the median
2. Leverage ratio >country-sector-year median	Leverage ratio >country-sector-year median of the sub-sample firms below the median
3. Interest rate gap <0 (<i>interest paid / total debt vs. top-rated firms</i>)	Interest rate gap <country-sector-year median whose gap is below the median

Notes: All criteria need to hold at the same time for two consecutive years in each respective definition except for the last one, which only applies in the current period.

disinvests. Criterion (iii) is similar to the ICR, where a value below 5% indicates that a firm might be unable to service its debt. Using debt servicing capacity instead of the ICR aims to remedy the “ICR critique”, arguing that if zombie firms did indeed receive subsidised credit, this would lower their interest payments and artificially increase the ICR. Therefore, it is important to check robustness of my results with regards to this definition, though the ICR remains the most widely used criterion employed in the literature to identify zombies.

To classify distressed firms, I remove the shrinking condition for real sales. Furthermore, following Mingarelli et al. (2022), I use looser cut-off points for distressed firms for the remaining two criteria. This approximates a continuous financial viability indicator along the three dimensions of profitability, investment and leverage. A firm is classified as distressed when each characteristic is below the median value in a given country, sector and year. Formally, a distressed firm has, for two consecutive years,

- i. a return on assets below the median return on assets of firms in the same country, sector and year as the firm under investigation
- ii. a debt servicing capacity below the median of the corresponding country-sector-year triplet.

Then, the share of observations in my local projections sample that are classified as zombies is 3.25%, and 15.4% for distressed firms, compared to 3.8% and 5.5% under the baseline. As this definition by Storz et al. (2017) is viewed as stricter than most zombie definitions in the literature, the baseline definition seems to be even similarly restrictive on zombies and slightly looser for distressed firms. The local projections using this definition are broadly consistent with the baseline results. Distressed and zombie firms invest significantly less than healthy firms. Moreover, a contractionary monetary surprise mutes the response of zombie firms’ investments relative to healthy firms, as the coefficient is positive and significant across all horizons. In contrast to my baseline results, the interaction coefficients for distressed firms is positive and statistically significant as well, though significantly lower in magnitude than for zombie firms and flat over time. Accordingly, zombies do respond differently to monetary shocks than healthy or distressed firms, such that the main result is robust to employing the definitions based on Storz et al. (2017) (Figure C.1, panel (VII)).

Second, I employ the zombie definition proposed by Acharya et al. (2024) which directly requires zombies to receive subsidised credit. Specifically, a firm is classified as a zombie if its

- i. interest coverage ratio is below that of its peers in the same sector, country and year
- ii. leverage ratio exceeds that of its peers in the same sector, country and year

- iii. interest rate gap is negative. This implies that the interest rate paid by zombie firms (approximated as interest paid over total debt) is lower than that paid by top-rated firms (identified by having an ICR higher than the 95th percentile).

I follow the approach by Mingarelli et al. (2022) to define a firm as distressed when its

- i. ICR is below the country-sector-year median in the sub-sample of firms for which the ICR is above the median
- ii. leverage ratio exceeds the median leverage ratio of the peers in the same sector, country and year whose leverage is below the median
- iii. interest rate gap is below the median interest rate gap of the peers in the same sector, country and year whose interest rate gap is below the median.

With this different approach of defining firm viability, 1.05% of observations in my local projections sample are zombies, 8.49% are distressed firms. The results presented in Section 4 are broadly robust to this definition. Specifically, zombie firms exhibit positive coefficients against a negative average response, though their differential investment response is only significant different from distressed firms from two years after the shock (Figure C.1, panel (VIII)). Distressed firms, however, show a negative significant response, meaning that they are more sensitive to monetary shocks than healthy firms and zombie firms. However, note that the interest rate proxy is poorly populated in Orbis data, such that measurement issues may occur with this approach, as argued in Section 2.2.

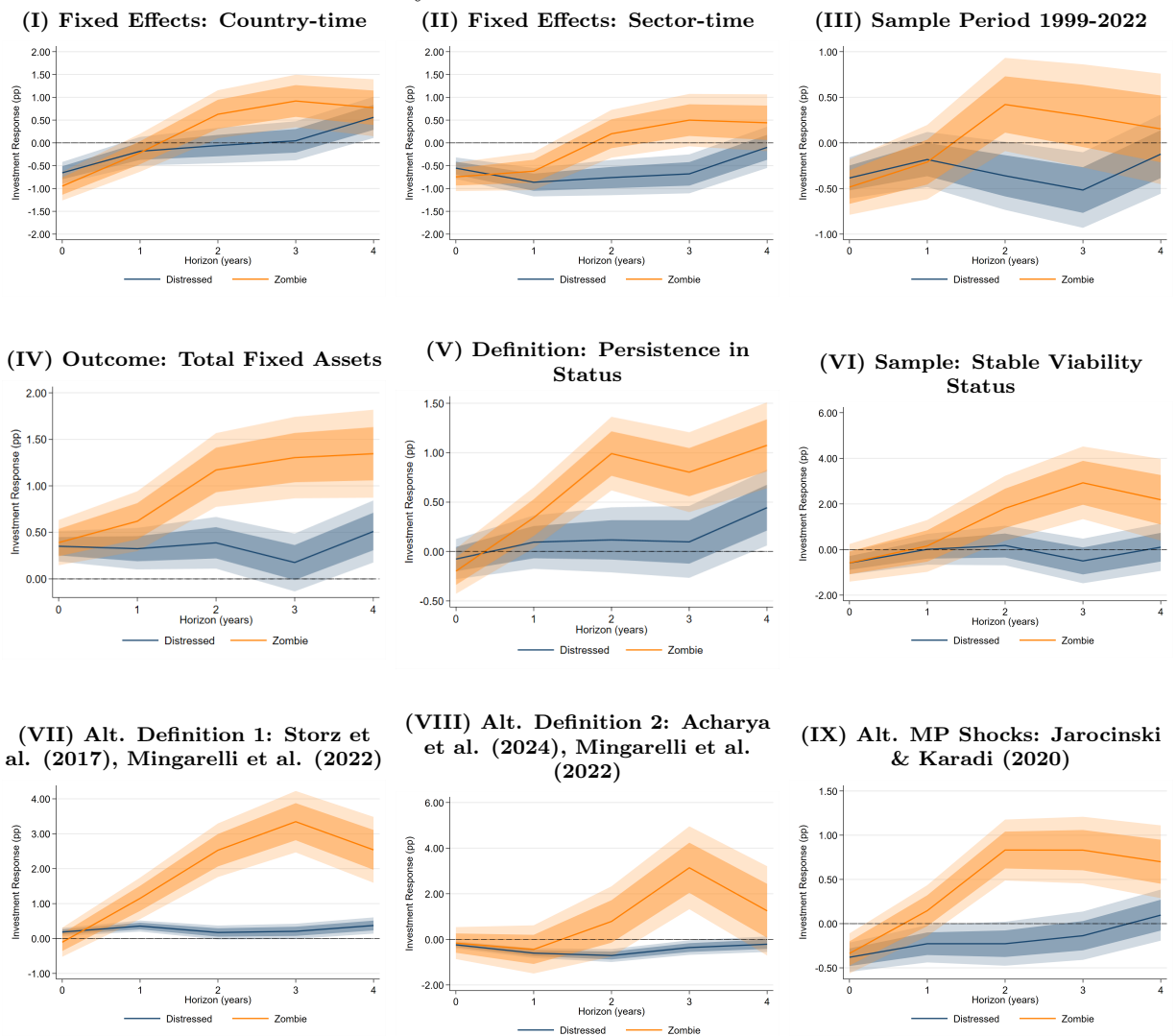
Therefore, the muted response of zombie firms and the differing reactions of zombie and distressed firms' investments to a monetary shock hold across various firm group definitions.

C.5 Monetary Shocks

I am using the monetary shocks series on interest rate surprises constructed by Altavilla et al. (2019). However, comparing several US monetary shock series, Brennan et al. (2025) find that results can differ markedly in sign and magnitude depending on the monetary shock series employed. Therefore, I also run the local projections analysis using the monetary shock series by Jarociński and Karadi (2020). I use the monetary surprises (discarding the information shocks) constructed from the first principal component of changes in the overnight index swaps rates (OIS) with maturities 1-, 3-, 6-months and 1-year during the monetary event window. The shocks thus provide a broader measure compared to my baseline shocks, where I use the 3-month OIS changes from Altavilla et al. (2019). Like for the baseline shocks, I aggregate the surprises to annual frequency by constructing the 12-month moving sum of

the monthly shocks. All results are robust to using this alternative shock series (Figure C.1, panel (IX)). Compared to the results described in Section 4, the responses of zombies and distressed firms seem even more distinct, strengthening again the idea of differentiating the two groups of financially weak firms.

Figure C.1. Robustness Checks: Investment Response to MP Shock of Zombies and Distressed Firms Relative to Healthy Firms



Notes: Differential investment responses of zombie (orange) and distressed firms (blue) for different robustness checks. Key results of zombie muting of monetary policy transmission and significant difference between zombies and distressed firms hold.

D Variable Definitions

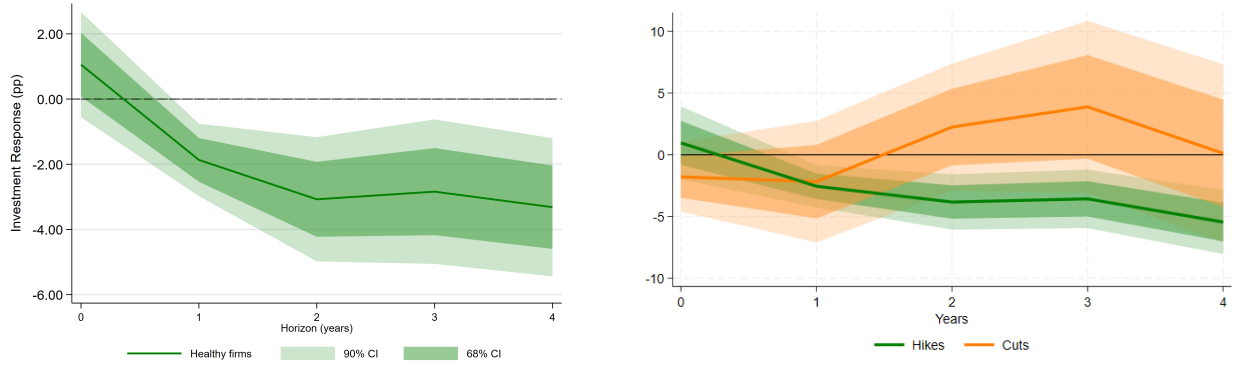
Table D.1. Variable and Coefficient Definitions

Symbol	Definition
<i>Panel A: Outcome, shock, and group indicators</i>	
$\Delta_h Y_{i,t+h}$	Cumulative change in firm i 's investment from $t - 1$ to $t + h$.
ε_t^{MP}	Monetary policy shock: 12-month moving sum of monetary policy surprises. A positive value denotes a contractionary shock.
$Distressed_{i,t-1}$	Indicator equal to one if firm i is classified as distressed in $t - 1$.
$Zombie_{i,t-1}$	Indicator equal to one if firm i is classified as a zombie in $t - 1$.
<i>Panel B: Coefficients</i>	
$\beta_h^g, g \in \{d, z\}$	Coefficients of interest: differential response of group g 's investment to a monetary policy shock, relative to healthy firms.
$\gamma_h^g, g \in \{d, z\}$	Investment of group g relative to healthy firms in the absence of a monetary policy shock.
δ_h	Response of the average firm's investment to a monetary policy shock (specification (1) only).
β_h^0	Intercept.
<i>Panel C: Controls and fixed effects</i>	
X_{t-1}	Aggregate controls (specification (1) only): lags of GDP growth, inflation, and the unemployment rate.
$Z_{i,t-1}$	Firm controls: two lags each of total assets, cash flow, leverage ratio, sales growth, and log age.
$\alpha_{i,h}$	Firm fixed effect.
$\theta_{cst,h}$	Country $\times$ sector $\times$ year fixed effect.

E Further Local Projection Results

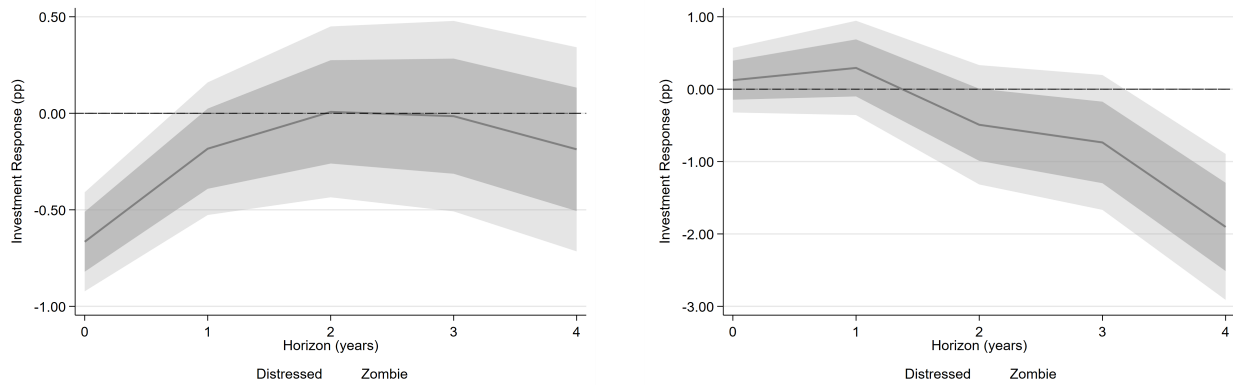
The results in this section supplement the baseline results presented in Section 4. Figure E.1 shows the investment response of the full sample to a one standard deviation shock (left panel), and the response of healthy firms split into contractionary and expansionary shocks (right panel). Table E documents the coefficients for the corresponding regression for the full sample, and for healthy firms only.

Figure E.1. Average and Differential Investment Responses to a Monetary Policy Shock
All Firms, Average Response *Healthy Firms, Asymmetry*



Notes: *Left:* Average response in the whole sample of firms to a one standard deviation monetary policy shock, with 90% and 68% confidence intervals. Equation (1) is estimated using firm fixed effects, aggregate controls and firm-level controls. Standard errors are two-way clustered on the firm and time levels. For regression table see Table E. *Right:* Investment responses of average healthy firm for positive/ contractionary (green line) and negative/ expansionary (orange line) monetary policy shocks.

Figure E.2. Differential Investment Response of All Financially Weak Firms, Asymmetry
Weak Firms, Hike *Weak Firms, Cut*



Notes: This figure shows the average responses for financially weak firms, i.e. the pooled group of distressed and zombie firms, compared to healthy firms, for a contractionary (left) and an expansionary (right) monetary shock. *Left:* On impact, the negative response of weak firms cancels with the positive response of healthy firms. Thereafter, the response of weak firms to a hike does not differ significantly from that of healthy firms. *Right:* Weak firms do not differ from healthy in their response to a cut until $h = 3$. In $h = 3, 4$, their negative response outweighs some of the positive response of healthy firms, again leading to a response close to zero. The figure suggests that the response of pooled weak firms does not differ from that of healthy firms.

Table E.1. Local Projection Results: All Firms and Healthy Firms

	(1) All firms	(2) Healthy firms
MP shock_h		
$h = 0$	1.05 (0.98)	1.06 (1.00)
$h = 1$	-1.87*** (0.67)	-1.93*** (0.67)
$h = 2$	-3.08*** (1.15)	-3.15*** (1.13)
$h = 3$	-2.84** (1.34)	-2.86** (1.32)
$h = 4$	-3.32*** (1.28)	-3.37*** (1.27)
Firm controls ($h = 0$)		
Tot. assets _{t-1}	-0.00** (0.00)	-0.00** (0.00)
Tot. assets _{t-2}	-0.00*** (0.00)	-0.00*** (0.00)
Std. sales gr. _{t-1}	0.13 (0.09)	0.13 (0.14)
Leverage _{t-1}	-21.85*** (1.87)	-24.60*** (2.08)
Leverage _{t-2}	-8.42*** (0.98)	-8.31*** (1.10)
Log age	-15.21*** (2.93)	-14.35*** (3.00)
Cash flow _{t-1}	0.00*** (0.00)	0.00*** (0.00)
Cash flow _{t-2}	-0.00** (0.00)	-0.00*** (0.00)
Macro controls ($h = 0$)		
GDP gr. _{t-1}	0.62*** (0.20)	0.65*** (0.21)
GDP gr. _{t-2}	1.00** (0.40)	1.06** (0.42)
GDP gr. _{t-3}	0.44** (0.22)	0.43* (0.23)
CPI _{t-1}	-1.22*** (0.22)	-1.32*** (0.23)
CPI _{t-2}	1.46*** (0.29)	1.49*** (0.31)
CPI _{t-3}	1.58*** (0.40)	1.67*** (0.42)
Unempl. rate _{t-1}	-1.04*** (0.23)	-1.05*** (0.24)
Unempl. rate _{t-2}	1.25*** (0.47)	1.36*** (0.51)
Unempl. rate _{t-3}	0.29 (0.39)	0.25 (0.43)
N ($h = 0$)	8,770,898	7,947,531
R^2 ($h = 0$)	0.187	0.191
Firm FE	✓	✓

Notes: Regression table for Equation (1), estimated on the full sample of firms (column (1)) and the sample of healthy firms (Column (2)). Standard errors are two-way clustered on the firm and time levels. Coefficients are scaled by one standard deviation of the monetary shock (8.64bp). Each h row is a separate regression; the control coefficients are those from the $h = 0$ regression only. All specifications include firm fixed effects and lagged firm and macro controls; standard errors are two-way clustered on firm and year-month. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

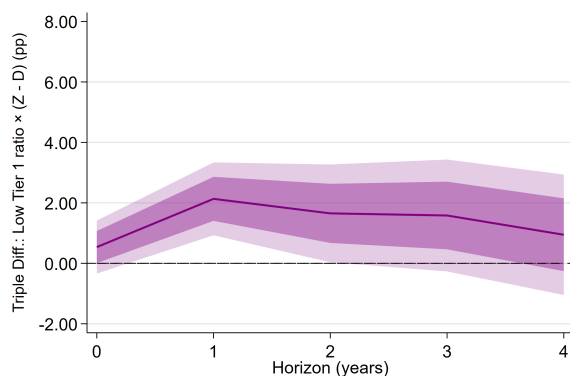
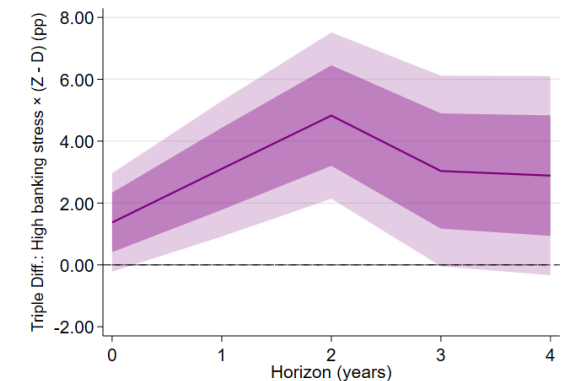
F Further Mechanism Evidence

Table F.1. Summary Statistics for Banking Sector Health Variables (Country-year Level)

	Mean	SD	P25	Median	P75	N
Tier 1 capital ratio (%)	15.03	4.31	11.84	15.28	18.01	301
NPL ratio (%)	7.23	8.67	2.16	4.04	7.89	292
Coverage ratio (%)	54.77	18.47	40.96	51.30	65.62	284
Return on equity (%)	0.94	21.13	1.19	5.72	8.31	301

Notes: This table shows summary statistics for the variables on banking sector health, which vary on the country-time level.

Figure F.1. Triple Interactions: Low Capital Ratios and High Banking Sector Stress
Tier 1 Capital Ratios *Banking Sector Stress*



Notes: The figure plots the triple difference of the zombie-distressed gap in responsiveness between countries with weak banking sectors and those with stronger banking sectors. Specifically, the channels shown are low tier 1 capital ratios (left) and high banking stress due to high NPL ratios and low coverage ratios (right). A positive value indicates that the channel variable widens the zombie-distressed investment gap, while a negative value indicates narrowing. Shaded areas show 68% and 90% confidence intervals; standard errors are clustered at the firm level.

Table F.2. Prevalence of Weak Banking Sectors Across Countries and Time

Panel A: Low Tier 1 capital																
	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22
Austria	–															
Belgium																
Croatia	–	–	–	–	–	–										
Cyprus	–															
Estonia	–															
Finland	–															
France	–															
Germany	–															
Greece	–															
Ireland	–															
Italy																
Latvia	–															
Lithuania																
Luxembourg	–															
Malta																
Netherlands	–															
Portugal																
Slovakia																
Slovenia																
Spain	–															
# flagged	3	9	9	9	9	9	10	10	10	10	10	10	10	10	10	10
# with data	7	19	19	19	18	19	20	20	20	20	20	20	20	20	20	20
Panel B: High stress																
	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22
Austria	–															
Belgium																
Croatia	–	–	–	–	–	–										
Cyprus	–															
Estonia	–															
Finland	–	–	–	–	–	–	–									
France																
Germany	–															
Greece	–															
Ireland	–	–	–	–	–											
Italy																
Latvia	–															
Lithuania																
Luxembourg	–															
Malta																
Netherlands	–															
Portugal																
Slovakia																
Slovenia	–	–	–	–	–											
Spain	–															
# flagged	2	7	4	4	3	3	4	4	4	4	5	5	5	6	6	6
# with data	7	16	15	15	15	17	18	20	20	20	20	20	20	20	20	20
# both criteria	0	3	2	2	1	3	4	3	3	3	3	3	2	2	2	3

Notes: Shaded cells mark country–years in which the national banking sector meets the criterion of below-median tier 1 capital ratios (panel A) or above-median banking sector stress (panel B), indicated by high NPL ratios and low coverage ratios. “# flagged” counts countries meeting the criterion in a given year; “# both criteria” counts countries meeting both criteria in that year. Finland, Luxembourg and Slovakia are in the sample but never meet either criterion in years with available data. Dashes mark country–years with missing data; “# with data” counts the countries with non-missing data in each year. Both indicators vary at the country–year level and enter the regressions at $t - 1$. Source: [ECB Consolidated Banking Data](#).