The Long-term Effects of Bank Bailouts on Corporate Financing Policies

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Abstract

This paper examines the long-term effects of bank bailouts on the financing policies of borrower firms, using episodes of Japanese bank bailouts in the 1990s as a case study. I find that bank bailouts exert a significant impact on the financial strategies of borrower firms, leading to a persistent increase in the long-term debt-to-asset ratio and a sustained decrease in the cash-to-asset ratio. When analyzing non-zombie and zombie firms separately, it is observed that these structural changes in capital structure are more conspicuous among zombie borrower firms, which exhibit an enhanced bank dependency post-bailouts. These findings underscore the potential unintended consequences of bank bailouts, suggesting they may inadvertently impede the recovery of zombie firms in the long term.

Keywords: Capital injection; Banking crisis; Corporate borrowing; Cash holdings; Bank relationships.

JEL Classification: E44; G21; G31; G32.

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1 Introduction

Past financial crises have highlighted the significance of healthy financial institutions for the overall economy, including sectors far removed from banking. When banks' balance sheets deteriorate, borrower firms are found to face credit supply contraction and reduce employment and investment (Chodorow-Reich (2014), Almeida et al. (2011), and Bentolila et al. (2018)).[1] To mitigate the impact of such balance sheet deterioration, governments often recapitalize troubled banks in the wake of financial crises, despite the deep public unpopularity of these recapitalizations. The recent empirical literature on the effects of bank bailouts demonstrates that sufficient capital injections into troubled banks effectively stimulate them to increase credit supply, which in turn helps boost borrower firms' investment in the short-run (Giannetti and Simonov (2013) and Kasahara et al. (2019)).[2] While previous work has highlighted the short-term effect of bank bailouts on borrower firms, few studies have examined their long-term effects.

This paper estimates the long-term impacts of bank bailouts on borrower firms' financing policies. Specifically, I exploit the Japanese banking crisis and subsequent bank bailouts in the 1990s to examine the long-term impact of the bailouts on borrower firms' cash-holding behaviors and financial debt positions. Following the 1997 banking crisis, the Japanese government conducted consecutive bank recapitalizations in March 1998 (1.8 trillion yen) and March 1999 (7.5 trillion yen). I exploit the variation in the strength of the pre-existing financial relationships between firms and the bailed-out banks to understand the long-term impact of bank bailouts on borrower firms' financing policies.

This paper uses the "exposure to injection" measure compiled by Giannetti and Simonov (2013) as an indicator of the strength of firms' financial ties with bailed-out banks. This measure calculates the proportion of loans that each firm received from any of the bailed-out banks in the year preceding the recapitalizations. Using this exposure measure as the treat-

[1] Other studies that show real effects of credit supply contraction include Alfaro et al. (2021), Cingano et al. (2016), Peek and Rosengren (1997), Kashyap and Stein (2000), Amiti and Weinstein (2018), and Acharya et al. (2018).

[2] In addition, capital injections are found to be effective in the growth of bank-dependent firms amid crises (Laeven and Valencia (2013)).

ment indicator, I employ a two-way fixed-effects estimator to estimate the long-term effects of bank bailouts on borrower firms' financing policies. The estimated results reveal two patterns. First, borrower firms' long-term debt as a share of total assets significantly increased after the bank recapitalization and remained persistently high even after two decades. Second, borrower firms' cash-to-asset ratio declined immediately after the recapitalizations and remained persistently low. The baseline results suggest a sustained shift towards borrowing in the corporate financing strategies of firms that benefited from the bank bailout. The baseline results are robust to different specifications, such as the inclusion of various controls, the use of the propensity score matching difference-in-difference estimator, and an alternative definition of the treatment group.

This study also differentiates between non-zombie and zombie firms to extend the analysis. Adopting the approach of Giannetti and Simonov (2013), I identify zombie firms as those whose interest payments were lower than the 'required minimum interest rate expenses' at any point between 1998 and 2004.[3] Non-zombie firms affected by bailouts exhibited a consistent decrease in the cash ratio without significant long-term debt growth. There was also a negligible response in retained earnings, suggesting no substantial shift in the capital structure for these borrower firms. In contrast, the bailout-affected zombie firms demonstrated a pronounced long-term increase in the debt ratio, coupled with a concurrent decrease in both the cash ratio and retained earnings.

For both non-zombie and zombie firms, I find that borrower firms are more likely to maintain banking relationships with the same main banks from the pre-recapitalization periods. This finding suggests that firms reduced cash holding and increased bank loans partly because of their sustained (and thus closer) relationship with the banks, which is consistent with existing literature that discusses banks' role in mitigating financial constraints. Hu et al. (2016) reported that firms with more intense relationships with banks have lower levels of cash. Chauhan et al. (2018) used Indian data to show that firms with bank-appointed

[3]The minimum interest rate expense is calculated under the assumption that the borrower pays the average short-term prime rate on short-term bank loans, the average long-term prime rate on long-term bank loans, and bears no coupon expenses on total bonds outstanding.

directors have lower cash holdings.[4]

The findings suggest that bank bailouts fostered resilient relationships between borrower firms and their main banks. In the case of non-zombie firms, these relationships resulted in decreased cash holdings, while zombie firms, bolstered by these relationships, saw a rise in their long-term debt and a simultaneous reduction in cash reserves. These findings suggest the unanticipated long-term consequence of bailouts, which may have unintentionally prolonged the zombie status of zombie borrower firms over extended durations. Zombie firms are known to have adverse effects on the real economy by consuming a disproportionate amount of available credit, thus diminishing opportunities for healthier competitors and reducing aggregate productivity and investment. Zombie lending is perceived as one of the primary contributors to Japan's 'lost decade' in the 1990s (Caballero et al. (2008), Peek and Rosengren (2005)). More recent studies by Acharya et al. (2019) and Blattner et al. (2023) suggest that zombie lending has also hampered Europe's economic recovery from the debt crisis.[5]

This paper contributes to the literature on the effects of bank bailouts. Giannetti and Simonov (2013) examined the Japanese bank bailouts in 1998, 1999, and 2002 and showed that the first two recapitalizations were successful at stimulating bailed-out banks to extend loans to their borrower firms. Furthermore, Giannetti and Simonov (2013) show that having received a greater amount of loans, these borrower firms increased investment in the year following the recapitalizations. Kasahara et al. (2019) found a similarly positive effect of bank bailouts using the same Japanese bailout episodes.[6] While existing literature mostly focuses on short-term effects, this paper examines the long-term effects of bank bailouts on banks' client firms.

This paper also contributes to the literature on the determinants of corporate cash holding. According to Keynes (1936), there are two reasons for corporate cash holdings: the

[4]However, their findings are in contrast to Nakajima and Sasaki (2016) and Shikimi (2019), who find that bank-dependent firms hold more cash.

[5]According to Banerjee and Hofmann (2018), approximately 12% of all publicly traded firms across 14 developed economies are identified as zombie firms.

[6]In addition, Veronesi and Zingales (2010) and Bayazitova and Shivdasani (2012) examine the impacts of the US government's equity infusion on the value of banks' financial claims.

reduction of transaction costs and the precautionary motive.[7] In particular, the precautionary demand for cash theory states that firms accumulate cash to protect themselves against adverse cash flow shocks that increase external financing costs. Without sufficient cash on hand, firms hit by adverse cash flow shocks could be forced to forgo profitable investment opportunities. Empirical papers such as Opler et al. (1999), Kahle and Stulz (2013), and Duchin (2010) generally find the existence of this precautionary motive.

The findings in this paper are consistent with the precautionary motive for cash holding, especially in the context of financial constraints. Previous studies have documented that financially constrained firms hold higher levels of cash (e.g., Almeida et al., 2004; Faulkender and Wang, 2006; Acharya et al., 2007; Denis et al., 2010; Harford et al., 2014). In particular, banks play an important role in alleviating borrower firms' financial constraints. Sasaki (2019) finds that worsening bank health causes firms to increase their cash holdings from their cash flows. In line with this, my study reveals that bank bailouts encourage borrower firms to maintain enduring relationships with their main banks. Such relationships can reduce informational asymmetry and ease external financing costs, facilitating reduced cash holdings.

The rest of the paper proceeds as follows: Section 2 discusses the background of the Japanese banking crisis of the 1990s and the following successive bank bailouts. Section 3 delineates the empirical approach employed in this paper. Section 4 explains the data used in the study. Section 5 summarizes the main results and investigates the potential mechanism that drives the main results. Section 6 presents various robustness checks of the main results. Finally, Section 7 discusses the results and concludes this paper.

2 Background of the Japanese banking crisis and bailouts in the 1990s

Hoshi and Kashyap (2010) noted that the banking crisis in Japan during the 1990s bears many similarities to the 2008 global financial crisis. The experience of Japan, particularly in

[7] Other theories include the agency costs of free cash flow (Jensen (1986); Ozkan and Ozkan (2004)) and the corporate governance structure (Dittmar et al. (2003); Harford et al. (2008); Pinkowitz et al. (2006)).

terms of the long-term impact of bank bailouts on borrower firms' financing strategies, offers valuable insights into the potential repercussions of financial institutions' recapitalizations.

This section offers a brief overview of the Japanese banking crisis and the subsequent bank bailouts that occurred during the 1990s. Japan's stock market hit its peak in late 1989, which was then followed by the burst of the housing and real estate bubble. This sequence of events gradually destabilized the financial system. By 1991, smaller financial institutions began to falter, triggering the use of the deposit insurance system for the first time in Japanese history. Despite these interventions, these smaller institutions continued to face hardships, with many banks accumulating an increasing volume of non-performing loans.

Around 1995, public concern over the potential systemic implications of non-bank companies specializing in housing finance defaulting began to grow. By 1996, seven housing finance companies had declared bankruptcy, with public funds being utilized to address some of these bankruptcies. This use of public money drew heavy criticism toward the government and the ruling party.

In November 1997, both the largest bank in northern Japan, Hokkaido Takushoku Bank, and Japan's fourth largest securities company, Yamaichi Securities, declared bankruptcy. The following year saw the bankruptcy of two major banks: the Long-Term Credit Bank of Japan and the Nippon Credit Bank. To counter these events, the government initiated a series of public capital injections into the major banks from 1998 to 1999.

The first round of recapitalization in 1998 saw an injection of 1.8 trillion yen, with most banks receiving 100 billion yen and smaller banks receiving between 20 and 60 billion yen. On average, this represented 1.9 percent of banks' risk-weighted assets. Given the intense public criticism over the use of public funds, recapitalization was kept to a minimum. Furthermore, the capital injection was structured to avoid revealing the health of the financial institutions to the market. According to Giannetti and Simonov (2013), the size of the injection each bank received was solely based on the size of the banks.

The second round of recapitalization took place in March 1999 to aid banks that remained

undercapitalized due to the modest size of the first recapitalization. This round injected 7.5 trillion yen, with individual banks receiving different amounts ranging from 200 to 1,000 billion yen. On average, each bank received approximately 5.1 percent of bank risk-weighted assets. As Kasahara et al. (2019) noted, these injections were conducted by the government's purchase of preferred stock or subordinated debt and helped many banks to achieve the capital standard required under the 1988 Basel Accord.

I mainly exploit the second recapitalization for the construction of the treatment variable[8] because of its larger size.[9] The analysis using the first recapitalization delivers similar results, as the indicators of firms' exposure to the first and second recapitalizations are highly correlated.

3 Empirical approach

This paper investigates the long-term impact of bank bailouts on the financing policies of borrower firms. To facilitate this, I utilize a two-way fixed effects estimator. The principal variable is a firm's capital injection exposure, denoted as Exposure Intervention$_i$. As defined by Giannetti and Simonov (2013), this is the proportion of loans that firm i received from any banks benefiting from the second recapitalization in the year preceding the recapitalization. Specifically, Exposure Intervention$_i$ is calculated as follows:

$$\text{Exposure Intervention}_i = \sum_k \text{loans}_{i,k}/\text{total amount of loans}_i, \tag{1}$$

Here, loans$_{i,k}$ signifies the loan amount that firm i received from the bailed-out bank k in the year before the recapitalization. The term total amount of loans$_i$ represents the total

[8] Approximately 58% of the firms in the sample are deemed "treated" ($T_i = 0$) under this specification.

[9] The sample in our study can be classified into four groups: 1) firms that are never affected, 2) firms that are only affected by the first round of recapitalization, 3) firms that are only affected by the second round of recapitalization, and 4) firms that are affected by both the first and second rounds of recapitalization. The baseline analysis uses the first and second groups (firms that are never affected and firms that are affected by the first round only) as the control group and the third and fourth groups (firms that are affected by the second round only and firms that are affected by both rounds) as the treatment group. In Section 6, I check the robustness of the baseline results to a different definition of the control and treatment groups, where the control group consists of only the firms that are never treated, and the treatment group consists of only the firms that are affected by both rounds of recapitalizations. The baseline results are robust to this alternative definition of control and treatment groups.

loan amount that firm i received from any bank in the same period. Utilizing this variable, I define T_i as a treatment indicator that is assigned the value of 1 if Exposure Intervention$_i > 0$ and 0 otherwise.

I choose to use the indicator variable rather than directly using Exposure Intervention$_i$ in the regression because the estimated effects of the bank bailout present some non-linear patterns, as depicted in Appendix 8.1. For instance, with respect to the long-term debt-over-asset ratio, the impact of the bailout is as pronounced among the bottom 25 percentile of firms (those with the weakest links to the bailed-out banks) as it is among the top 25 percentile of firms. Although substituting Exposure Intervention$_i$ for T_i as a treatment variable yields qualitatively similar results, its direct use in the regression increases the standard errors. The model is estimated as follows:

$$Y_{i,t} = \sum_{t=1990}^{2016} \beta_t \left(\text{Year}_t \times T_i\right) + \psi \mathbf{X}_{i,t} + \text{Firm}_i + \text{Industry}_h \times \text{Year}_t + u_{i,t}, \tag{2}$$

Where $Y_{i,t}$ is a dependent variable, and $\mathbf{X}_{i,t}$ are the time-variant control variables. The recapitalizations primarily targeted larger banks, which generally extend loans to larger firms. Therefore, a possible concern is that the baseline results may simply be capturing the distinct progression of financing policies of firms of different sizes. To address this, I have included the log of total assets and log of employment as control variables within $\mathbf{X}_{i,t}$.[10]

In estimating equation 2, β_{1990} to β_{1996} are expected to be insignificant if the parallel trend assumption holds true. I have designated the year 1996 as the base year. The short and long-term effects of capital injection on the dependent variables are encapsulated by β_{1997} to β_{2016}, as the first recapitalization was implemented in March 1998, which falls within the 1997 fiscal year in Japan. Firm$_i$ denotes the firm-level fixed effects. The model also includes the interaction term between industry fixed effects and year fixed effects to absorb any unobserved industry time-varying effects. The standard errors are clustered at the firm level.

[10] I also executed the model estimation excluding any time-variant control variables. The exclusion did not appreciably modify the outcomes, reinforcing that our findings do not disproportionately hinge on the specific assembly of control variables.

4 Data

The primary data source is Nikkei NEEDS FinancialQUEST. Utilizing the NEEDS database, I gather accounting and loan data for all listed companies in Japan spanning the period from 1990 to 2016. Key variables for our analysis are the ratios of long-term debt to total assets and cash to total assets. Long-term financial debt is characterized as obligations with a maturity period exceeding one year. Cash is defined as the sum of cash holdings and deposits. Other variables utilized in the analysis, including total assets and the number of employees, are all retrieved from the Nikkei NEEDS data. Specifically, the NEEDS data includes loan amounts and the names of the banks for all listed companies in Japan.

Furthermore, I employ the data compiled by Giannetti and Simonov (2013) to measure the strength of each firm's pre-existing relationship with the bailed-out banks during the pre-bailout period as defined in equation 1. After constructing the exposure to intervention measure using Giannetti and Simonov (2013)'s methodology, I restrict the sample to firms that were operational during the bailout periods in the 1990s and were recorded in Giannetti and Simonov (2013)'s dataset. Table 1 lists the main variables employed in the analysis.

5 Results

In this section, I first present the results of the baseline model, and next show the results separately by zombie and non-zombie firms. I then consider mechanism relating to the formation of long-term relationship with the banks due to the bailouts.

5.1 Baseline results

The study aims to investigate the long-term effects of the bank bailout. To achieve this, I estimate equation 2 by first setting the long-term debt over total assets ratio as the dependent variable, and second, by setting cash over total assets ratio as the dependent variable. Figure 1 presents the results.

Panel (a) of Figure 1 displays the estimates for $\widehat{\beta}_t$'s from 1990 through 2016 using equation 2 where the dependent variable is the long-term debt over total assets. The dark shaded area denotes 90% firm-cluster-robust confidence intervals, whereas the lightly shaded area

Table 1: Descriptive Statistics

	Observations	Mean	SD	Median	1st	99th
T_i	45,700	0.586	0.492	1	0	1
Long-term debt/TA	39,250	0.100	0.100	0.071	0	0.447
Cash/TA	44,954	0.134	0.094	0.113	0.011	0.458
log(total assets)	44,958	11.090	1.563	10.901	7.868	15.474
log(employees)	44,943	7.309	1.467	7.154	4.127	11.218
Interest Coverage ratio	44,284	0.680	6.016	0.061	0	10.342
Corporate tax/TA	44,958	0.021	0.019	0.016	0	0.084
Investment	45,700	0.0790	0.208	0.026	-0.267	0.906
Retained Earnings/TA	27,295	0.265	0.261	0.227	0.006	0.756

Notes. The table reports descriptive statistics for the main variables.
T_i is the treatment variable of firm i that is used in the baseline analysis. Long-term debt/TA is the long-term financial debt of firm i in time t divided by the firm's total assets in year t. Cash/TA is the cash of firm i in year t divided by the firm's total assets in year t. Log(total assets) and log(employees) are the natural logarithm of total assets and the number of employees, respectively. I remove observations with negative asset values. Interest Rate Coverage is the interest rate coverage ratio of firm i in year t, defined as earnings before interest and taxes divided by interest expense of the firm in year t. Corporate tax/TA is the corporate tax payment by firm i in year t divided by the firm's total assets in year t. Investment represents the growth rate of firm i's fixed assets between periods t and $t+1$. To limit the impact of potential outliers, a winsorization process was applied whereby all values exceeding the top 1 percentile were set to the 99th percentile value, and all values below the bottom 1 percentile were replaced with the 1st percentile value. Retained Earnings/TA for a given firm i at time t is calculated as the ratio of retained earnings to the total assets of the firm.

represents the 95% confidence intervals. The dotted vertical lines mark the first and second recapitalizations in 1997 and 1998.[11] The long-term debt over asset ratio experiences a sharp increase during and immediately after the two recapitalizations. On average, the long-term debt-to-asset ratio for the borrower firms increases by 1 percentage points after the bailouts. Moreover, the level of the long-term debt over asset ratio remains persistently high years after the recapitalizations. The estimated responses of the debt to asset ratio after the recapitalizations are statistically significant for most years. Importantly, the $\widehat{\beta}_t$'s during the pre-recapitalization period (1990 through 1995) are all statistically insignificant, lending credence to the validity of the parallel trend assumption in this analysis.

Panel (b) of Figure 1 displays $\widehat{\beta}_t$'s when the dependent variable is specified as the cash over total assets ratio. The cash to asset ratio drops immediately following the second recapitalization and continues to decrease for a prolonged period post-recapitalization. The cash to asset ratio for the borrower firms is about 2 percentage points lower than that of the non-borrower firms by 2013. The estimated results are statistically significant in most years following the recapitalization. Once again, the $\widehat{\beta}_t$'s during the pre-recapitalization period are all statistically insignificant, suggesting the legitimacy of the key parallel trend assumption.

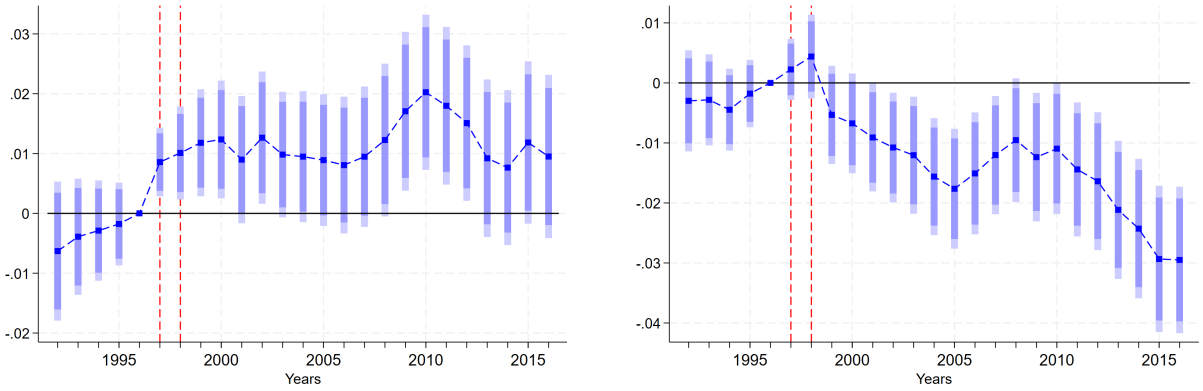
Collectively, Figure 1 suggests that firms that had a pre-existing relationship with the bailed-out banks underwent a persistent shift in their financing policies.

5.2 Heterogeneity: non-zombie and zombie firms

To investigate the mechanisms influencing shifts in corporate financing policies, I divide the sample into two cohorts: non-zombie and zombie firms. These were categorized during the period between 1998 and 2004. Zombie firms are identified using Giannetti and Simonov (2013)'s approach, which defines a firm as a zombie in year t if its interest payments in that year were lower than the 'required minimum interest rate expenses.' This minimum interest rate expense for year t is calculated assuming that the borrower pays the average short-term prime rate on short-term bank loans, the average long-term prime rate on long-term bank

[11] In addition to the second recapitalization, I depict the timing of the first recapitalization in the figures due to many firms exposed to the second recapitalization also having exposure to the first. Thus, the effect of the bailout could appear shortly after the first recapitalization.

Figure 1: Baseline results



(a) Long-term debt/TA

(b) Cash/TA

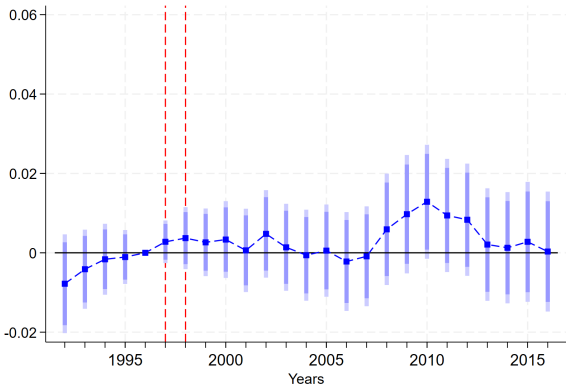
Notes. The figure shows the coefficients on the interaction term between the treatment indicator and the year fixed effect, $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$, using equation 2, when the dependent variable is long-term financial debt over total assets (TA) in Panel (a) and cash over total assets (TA) in Panel (b). The base year is 1996. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of employees). The bank bailout occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

loans, and holds zero coupons on total bonds outstanding for that year. Following this definition, non-zombie firms are those that do not meet these criteria at any point during the 1998-2004 period. Conversely, firms that meet these criteria at any point during this period are identified as zombie firms. I estimate equation 2 separately for these two groups.

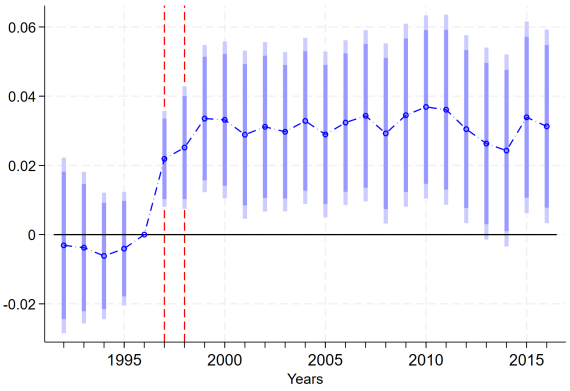
Figure 2 partitions the estimated effects of bank bailouts on the long-term debt-to-asset ratio for non-zombie (Panel a) and zombie firms (Panel b). Among non-zombie firms, the long-term debt-to-asset ratio remains unaltered post-bailouts. In contrast, the long-term debt-to-asset ratio for zombie firms increases by approximately 3 percentage points immediately following the bailouts and remains persistently high for two decades. Panel (c) and Panel (d) of Figure 2 depict the estimated effects of the bailouts on the cash-to-asset ratio for non-zombie and zombie firms, respectively. Notably, this ratio declines immediately after the second recapitalization and persists in a decreasing trend for an extended period after recapitalization, applicable to both non-zombie and zombie firms.

In summary, Figure 2 illustrates that the bailouts appear to exert a significant impact on

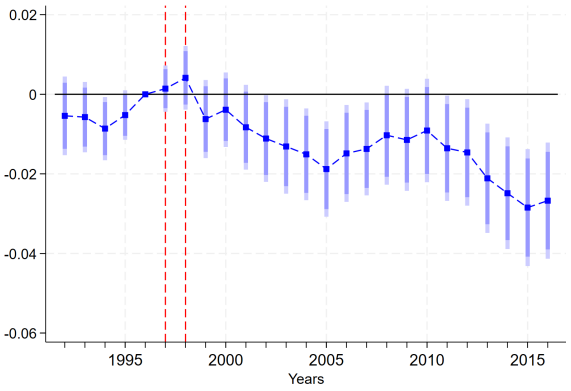
Figure 2: Responses of debt and cash holdings for non-zombie and zombie firms



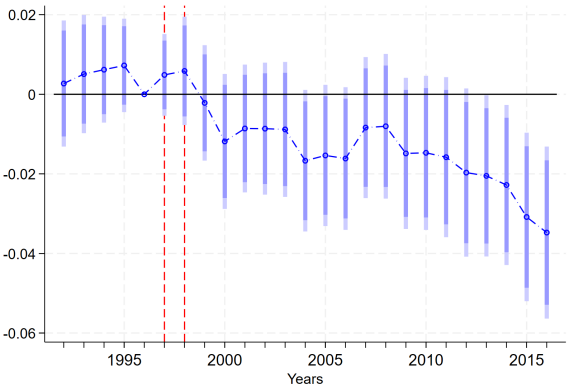
(a) Long-term debt/TA for non-zombie firms



(b) Long-term debt/TA for zombie firms



(c) Cash/TA for non-zombie firms



(d) Cash/TA for zombie firms

Notes. The figure shows the coefficients on the interaction term between the treatment indicator and the year fixed effect, $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$, using equation 2, when the dependent variable is long-term financial debt over total assets (TA) in Panel (a) and cash over total assets (TA) in Panel (b). The base year is 1996. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of employees). The bank bailout occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

the financing policies of zombie firms, particularly with respect to their long-term debt-to-asset ratio. Additionally, the bailouts lead to a decrease in cash holdings across both types of firms.

5.3 Mechanism

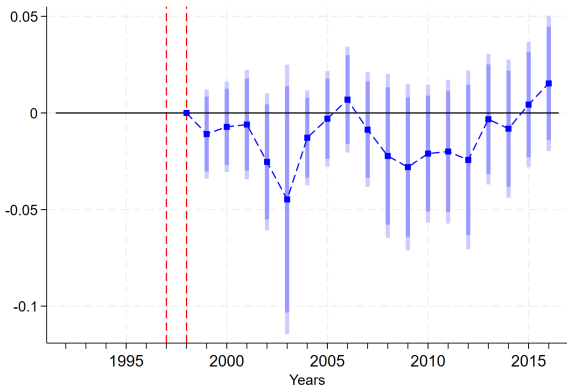
To examine the underlying mechanism more closely, I evaluate the impact of the bailouts on other relevant variables, starting with the retained earnings over total assets. The results thus far suggest that the bailouts prompt firms to increase debt on the liabilities side of their balance sheet and deplete cash reserves on the asset side. This consequently implies a contraction in retained earnings, which forms part of the net worth segment of the balance sheet.

Panels (a) and (b) in Figure 3 represent the responses of the retained earnings-to-asset ratio for non-zombie and zombie firms, respectively. Unfortunately, our ability to evaluate the behavior of the retained earnings-to-total asset ratio during the pre-bailout periods is hindered, as the consistently available data on retained earnings only starts from 1998. Consequently, our estimations are benchmarked to 1998. However, as Figure 3 demonstrates, the results seem to align with our expectations, indicating a decrease in the retained earnings-to-asset ratio, particularly for zombie firms.

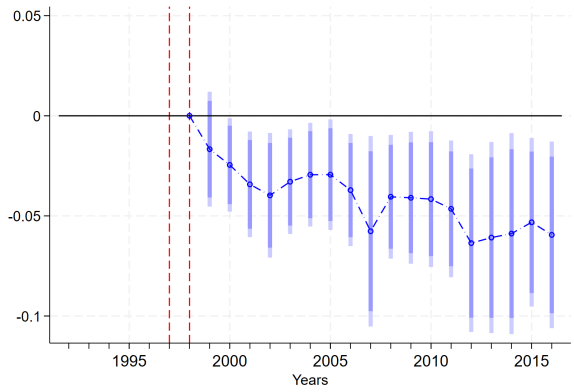
I also explored the responses of the corporate bond-to-asset ratio. The baseline results suggest that the bailouts encouraged an increase in long-term debt for zombie borrower firms. If accurate, this might have simultaneously prompted these firms to reduce corporate bond issuance, given that debt and bond issuance often act as substitutes. Panels (c) and (d) of Figure 3 illustrate the responses of corporate bond-to-asset ratio for non-zombie and zombie firms, respectively. As expected, there appears to be a reduction in the corporate bond-to-asset ratio for zombie firms, in line with the substantial increase in long-term debts discussed in Section 5.2. On the other hand, non-zombie firms did not show a significant change in the corporate bond ratio. This observation supports the earlier finding that bank bailouts did not result in increased borrowing for non-zombie firms.

What led borrower firms, impacted by the bailouts, to alter their corporate financing

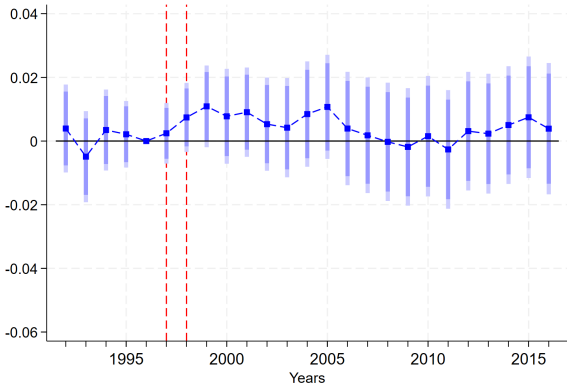
Figure 3: Responses of other variables for non-zombie and zombie firms



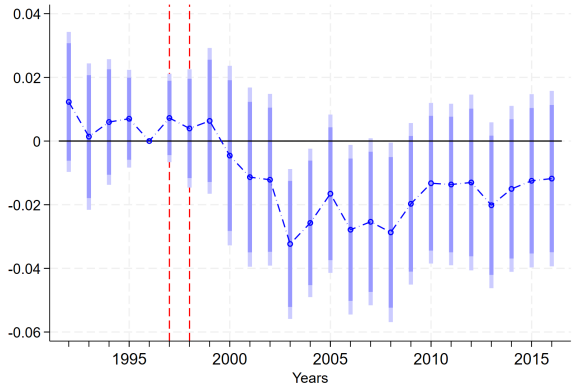
(a) Retained earnings/TA for non-zombie firms



(b) Retained earnings/TA for zombie firms



(c) Bond/TA for non-zombie firms



(d) Bond/TA for zombie firms

Notes. The figure shows the coefficients on the interaction term between the treatment indicator and the year fixed effect, $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$, using equation 2, when the dependent variable is retained earnings over total assets in Panels (a) and (b), and outstanding bonds over total assets in Panels (c) and (d). The base year is 1996. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of employees). The bank bailouts occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

policies over a prolonged period? One possible explanation could lie in these firms' relationships with their main banks. Past empirical studies suggest that financial constraints are crucial determinants of firms' cash holding behaviors,[12] and that relationships with main banks significantly help alleviate these constraints. Considering that the bailouts gave the treated firms access to extra loans during the financial crisis, these firms may have been able to maintain their existing bank relationships for longer durations. This in turn could help reduce informational asymmetry and financial constraints. To investigate this mechanism, I study the conditional probabilities of preserving a relationship with the main bank (i.e., the bank extending the most substantial amount of loans) from the pre-bailout period for each following year. Specifically, I estimate the subsequent linear probability model:

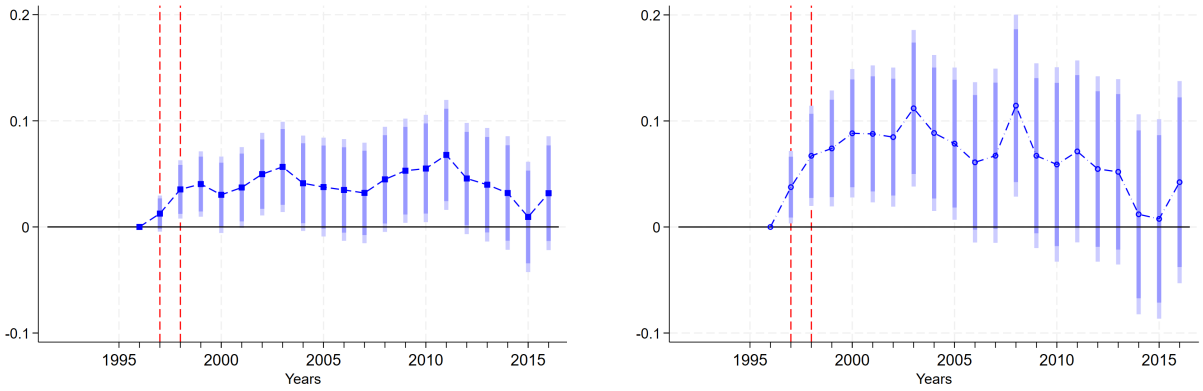
$$I_{i,t}^{\text{same bank}} = \sum_{t=1990}^{2016} \beta_t \left(\text{Year}_t \times T_i\right) + \psi \mathbf{X}_{i,t} + \text{Firm}_i + \text{Industry}_h \times \text{Year}_t + u_{i,t}, \tag{3}$$

where $I_{i,t}^{\text{same bank}}$ is an indicator that equals 1 if firm i's main bank in year t is the same as its main bank between 1990 and 1996, and $\mathbf{X}_{i,t}$ contains the same control variables as in equation 2.

Panels (a) and (b) of Figure 4 respectively depict the conditional probability of non-zombie and zombie firms maintaining their pre-bailout main bank. Zombie firms tied to bailed-out banks show an increased likelihood—peaking at approximately a 10 percentage point difference—of retaining their primary bank relationship compared to their untreated counterparts. Non-zombie firms affected by the bailouts also exhibit a trend toward sustaining their banking relationships, although the probabilities are less significant than those for zombie firms. This statistically notable effect lasts until after 2014 for both types of firms. The persistence of these banking relationships echoes prior research highlighting the role of banks in alleviating firms' financial constraints. Thus, the sustained banking relationship could have made taking on debt more attractive while simultaneously reducing the need for holding substantial cash reserves for the borrower firms.

[12]For instance, refer to Almeida et al. (2004), Faulkender and Wang (2006), Acharya et al. (2007), Denis and Sibilkov (2010), and Harford et al. (2014).

Figure 4: Results for non-zombie and zombie firms



(a) Non-zombie firms' main bank retention prob.

(b) Zombie firms' main bank retention prob.

Notes. The figure shows the coefficients on the interaction term between the treatment indicator and the year fixed effect, $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$, using equation 3, when the dependent variable is specified as the indicator for maintaining the same top 1 bank as the pre-bailout period in Panels (a) and (b). The base year is 1996. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of employees). The bank bailout occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

5.4 Effects on the probability of exit

A potentially relevant mechanism that could explain the baseline results is the shift in the composition of firms in the treated and untreated groups. For example, because the untreated firms did not receive extra bank loans during the crisis, they may have exited from the stock exchange more frequently than the treated firms. In such a case, a greater number of unhealthy firms might have disappeared from the untreated group, which helps explain why the untreated firms that remain in the sample accumulate less debt and more cash.

To investigate the relevance of this composition effect, I calculate the predicted probabilities of becoming unlisted from the stock exchange for the treated and untreated firms. Specifically, I run the following regression:

$$I^{\text{unlisted}}_{i,2017} = \mathbf{f}(\alpha + \gamma T_i + \Phi \mathbf{W}_{i,1997 \ldots 2004} + \epsilon_{i,2017}), \tag{4}$$

where $I^{\text{unlisted}}_{i,2017}$ is an indicator for firms that became unlisted by 2017. I include a number of control variables in $\mathbf{W}_{i,1997...2004}$ to examine the effect of the bailout on the eventual un-listing that is not caused by the initial difference in firms' characteristics across treated and untreated groups. $\mathbf{W}_{i,1997...2004}$ include industry fixed effects, current and two lags of zombie index, log of market capitalization, investment, interest coverage ratio, financial debt over total assets, and cash over total assets from 1997 to 2004. I estimate equation 4 using the linear probability model and the probit model. Table 2 shows the result. I find that the probability of becoming unlisted from the stock exchange by 2017 is slightly lower for the treated firms, but the effect is statistically indistinguishable from zero. The finding suggests that the main findings are unlikely to be caused by the mechanical shift in the compositions of firms due to un-listing from the stock market.

Table 2: Probability of Unlisted

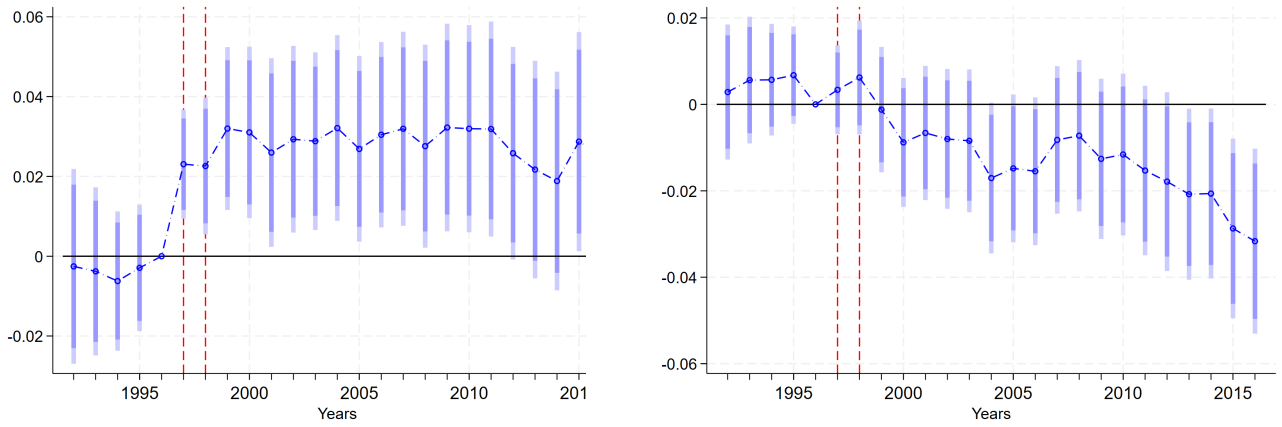
	(1) Linear Prob. Model	(2) Probit Model
d(Prob. Unlist)$/dT$	-0.033 (0.023)	-0.033 (0.022)
Number of obs.	1391	1362
R^2	0.130	0.055

Notes. The table reports the marginal effects of injection exposure on the probability of being unlisted in 2017 using the linear probability model in column (1) and the Probit model in column (2). Both models include industry fixed effects, current and two lags of zombie index, log of market capitalization, investment, interest coverage ratio, financial debt over total assets, and cash over total assets from 1997 to 2004 as control variables. Robust standard errors in parentheses. R^2 for Probit model is a pseudo-R^2.

6 Robustness check

In this section, I examine the robustness of the main results through the following strategies: First, I incorporate additional firm-specific time-varying variables into the controls. Second, I conduct a placebo test using an alternative treatment indicator. Third, I apply a propensity score matching difference-in-difference estimator. Finally, I use an alternative definition of control and treatment groups. For brevity, I only show results for zombie firms. The results are robust to all these adjustments.

Figure 5: Robustness: additional controls



(a) Long-term debt/TA for zombie firms

(b) Cash/TA for zombie firms

Notes. The figure shows $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$ using equation 2 when the dependent variable is long-term financial debt over total assets in Panel (a) and cash over total assets in Panel (b). The base year is 1995. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets, log of the number of employees, interest coverage ratio, total liquid liability over total assets, firm age and age squared, corporate income tax over total assets, a lagged investment, and a lagged employee growth rate). The bank bailout occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

6.1 Adding control variables

In order to assess the robustness of the baseline results, I first incorporate several additional control variables into the baseline model. Specifically, I introduce the following eight variables into $\mathbf{X}_{i,t}$ in equation 2: interest coverage ratio, total liquid liability over total assets, firm age and age squared, corporate income tax payment over total assets, a lag of investment, and a lag of employee growth rate. Firm age serves as an indicator of the firm's growth opportunities and the degree of uncertainty the firms faced, both of which influence external financing costs and the need for cash holding. The interest coverage ratio, liquid liability, tax-to-asset ratio, investment, and employee growth rate are included to reflect the firm's need to accumulate cash, given that these factors often necessitate cash payments. Figure 5 illustrates the results for zombie firms.

Panel (a) of Figure 5 presents the estimated effects of bailouts on the long-term debt-to-asset ratio. The pattern of a significant and enduring rise in the debt-to-asset ratio remains

evident. Panel (b) displays the estimated effects on the cash-to-asset ratio. Again, the integration of additional control variables does not significantly alter the estimated result. Overall, the baseline results demonstrate robustness in light of the inclusion of the added control variables.

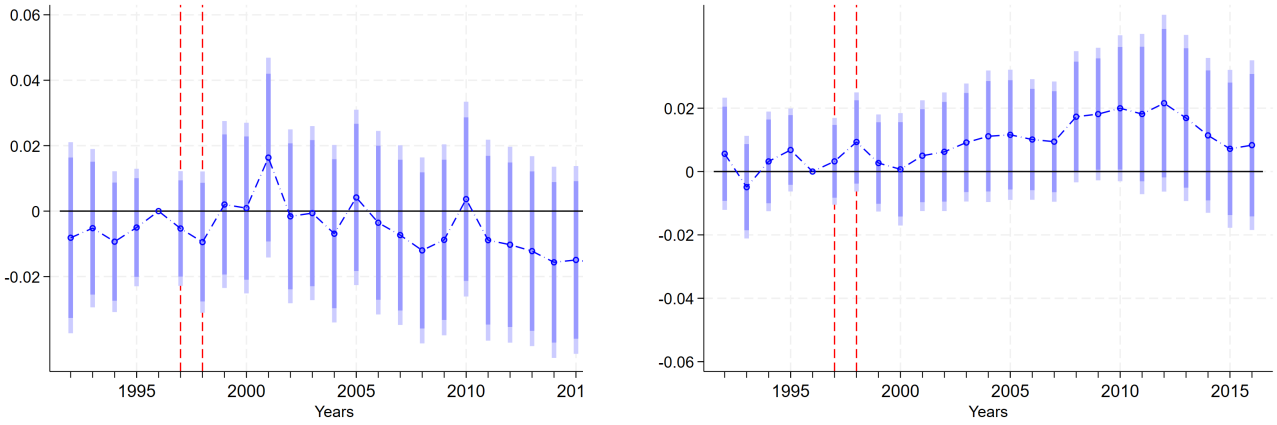
6.2 Placebo test

In this section, I conduct a placebo test by estimating equation 2 using a placebo treatment indicator. The placebo treatment indicator is constructed based on the third recapitalization episode in June 2003, when the Japanese government nationalized Resona Bank by injecting approximately 2 trillion yen through preferred and common shares. The third recapitalization's nature differs from the previous two recapitalizations. This recapitalization was prompted when the auditing corporation responsible for Resona Bank informed the institution in May 2003 that it would only allow deferred tax assets for three years, instead of five, which had been the prevailing auditing guideline for major banks. This resulted in Resona Bank's capital adequacy ratio for the fiscal year ending March 2003 falling below the domestic bank's standard of 4%. The announcement came as a surprise to the public, given that Resona Bank had just been established as a result of the merger of four banks in March of the same year. I utilize this round of recapitalization for constructing a placebo treatment indicator as Giannetti and Simonov (2013) demonstrated that, unlike the prior two recapitalizations, it did not lead the bailed-out bank to extend loans to borrower firms. Consequently, we should not anticipate any long-term effects of this bailout on borrower firms' financing policies.

The placebo treatment indicator, T_i^{placebo}, is defined as an indicator for firm i that borrowed from Resona Bank in the year preceding the 2002 recapitalization. Firms meeting this criterion constitute approximately 16% of the entire sample of firms. I estimate regression equation 2 using T_i^{placebo} as the treatment variable instead of T_i. The results are presented in Figure 6.

Figure 6, Panel (a), displays the placebo regression outcome for zombie firms, featuring the long-term debt-to-asset ratio as the dependent variable. Contrary to the pattern evident

Figure 6: Placebo test



(a) Long-term debt/TA for zombie firms

(b) Cash/TA for zombie firms

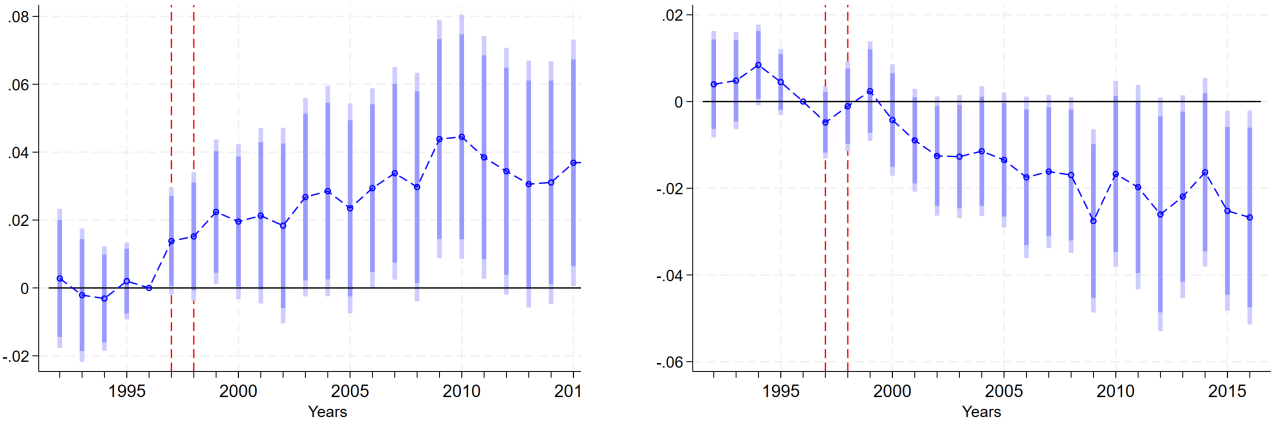
Notes. The figure shows $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$ using equation 2 when the placebo treatment indicator is used. The dependent variable is long-term financial debt over total assets in Panel (a) and cash over total assets in Panel (b). The base year is 1996. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of the number of employees). The first two recapitalizations occurred in 1997 and in 1998, followed by the third in 2003. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

in the baseline results in Figure 3, no significant increase in this ratio emerges throughout the period. Panel (b) of Figure 6 demonstrates a similar divergence from baseline results, showing no discernible decreasing trend in the cash-to-asset ratio. Echoing Giannetti and Simonov (2013), the 2003 recapitalization neither noticeably increased the debt-to-asset ratio for borrower firms nor induced any major changes in corporate financing policies in both the short and long term. In other words, these placebo regressions don't mirror our initial findings, highlighting that the original results were specifically tied to the conditions related to the initial two bank bailouts that were shown to be effective in inducing banks to increase lending during the financial crisis.

6.3 Propensity score matching difference-in-differences

For further robustness checks, I employ the propensity score matching difference-in-differences (PSM DiD) estimator. The combination of a difference-in-differences model with propensity score matching facilitates enhanced comparability between the treated (borrower zombie firms) and untreated (non-borrower zombie firms) groups by providing more flexibility in the

Figure 7: Propensity Score Matching DiD estimator



(a) Long-term debt/TA for zombie firms

(b) Cash/TA for zombie firms

Notes. The figure shows $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$ using equation 2 weighted by the propensity scores when the dependent variable is long-term financial debt over total assets (TA) in Panel (a) and cash over total assets (TA) in Panel (b). The base year is 1995. Specifications include firm fixed effects, industry-by-year fixed effects, and log of total assets, and log of the number of employees. The propensity score is calculated based on the outcome variables (debt to asset and cash to asset ratios), the log of total assets, and the log of the number of employees between 1990 and 1996. The bank bailouts occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

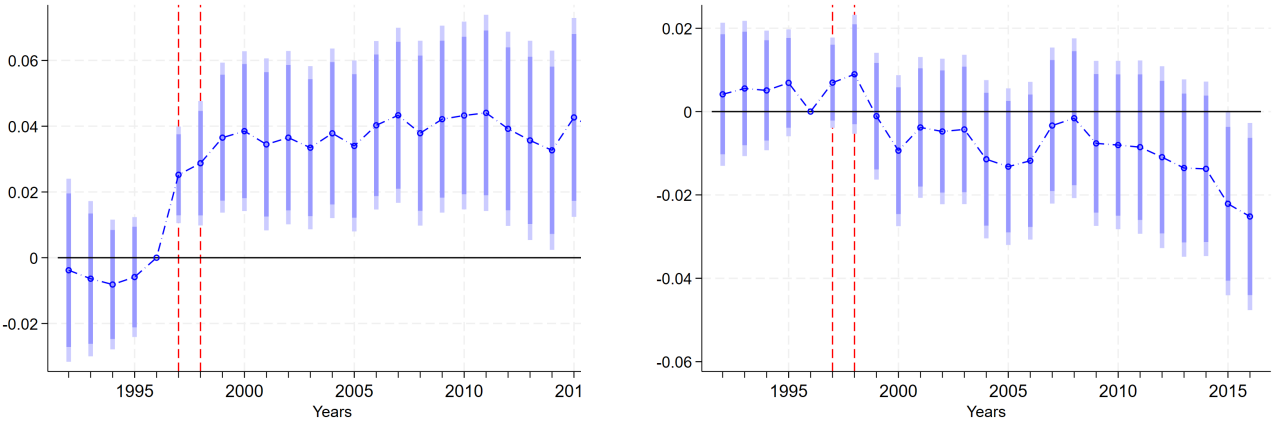
functional form. The propensity scores are derived from the debt-to-asset and cash-to-asset ratios, the logarithm of total assets, and the logarithm of the number of employees from 1990 to 1996. The estimation employs the kernel matching method, followed by an estimation of the propensity score-weighted version of equation 2, as described by Heckman et al. (1997).

The results, depicted in Figure 7, demonstrate the significant effects of the bank bailouts for zombie firms, aligning with the baseline results. I also performed the PSM-DiD using nearest-neighbor matching. The results are robust to varying choices of matching algorithms.

6.4 Using an alternative definition of treatment and control groups

The sample used for the baseline results can be segmented into four categories: 1) firms that were never impacted, 2) firms that were impacted exclusively by the initial 1997 recapitalization, 3) firms that were impacted solely by the second round of recapitalization in 1998, and 4) firms that were affected by both 1997 and 1998 rounds of recapitalization. In my primary analysis, I used the first and second categories as my control group, while the third

Figure 8: Alternative definitions of treated and control group:
treated twice v.s. never treated



(a) Long-term debt/TA for zombie firms

(b) Cash/TA for zombie firms

Notes. The figure shows the estimated coefficients on the interaction term between the treatment indicator and the year fixed effect for different quartiles, $\widehat{\beta}_t$ for $t = 1990 \ldots 2016$, using equation 2 when the dependent variable is long-term financial debt over total assets in Panel (a) and cash over total assets in Panel (b). The base year is 1996. The sample in the treatment group are restricted to firms that are affected by both first and second rounds of recapitalization in 1997 and 19998 (treatment group) and firms that were never affected (control group). Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of the number of employees). The bank bailout occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

and fourth categories formed my treatment group. This section aims to explore if altering these control and treatment definitions influences the baseline outcomes.

I define the alternative control group as the first category, comprising firms that were never under the treatment. The alternative treatment group, on the other hand, is the fourth category, including firms affected by both rounds of recapitalization. Consequently, I exclude the groups of firms that were impacted only by either the first or second recapitalization round. Implementing this refined sample of zombie firms, I re-estimate equation 2. The results are presented in Figure 8. Compared to the baseline findings, the bailout's influence on the debt-to-asset ratio mildly intensifies, while its effects on the cash-to-asset ratio diminish slightly. Generally, the outcomes mirror the baseline results for zombie firms. Therefore, employing this alternative definition of the control and treatment groups does not alter our primary conclusions.

7 Conclusion

This study uncovers the far-reaching consequences of bank bailouts on corporate financing policies. Specifically, it reveals a persistent increase in the long-term debt-to-asset ratio and a corresponding decrease in the cash-to-asset ratio for firms associated with bailed-out banks, suggesting a lasting shift in firms' financing strategies post-bailout.

Particularly noteworthy is the dichotomy between non-zombie and zombie firms. Among non-zombie firms, those impacted by the bailouts exhibited a steady cash ratio reduction but no appreciable long-term debt escalation. Additionally, the lack of response in retained earnings suggests these firms did not undergo significant capital structure modifications. In investigating the mechanism behind the observed cash ratio reduction, I found that the affected firms had a higher likelihood of sustaining their primary banking relationships long after the financial crisis. As shown by Opler et al. (1999) and Kahle and Stulz (2013), precautionary motives are among the important reasons for firms maintaining cash reserves. The ability to maintain banking relationships following the crisis may have alleviated uncertainties associated with securing necessary funding, thereby potentially reducing the cash ratio for non-zombie firms affected by the bank bailouts.

The impacts on zombie firms were more profound, with evident increases in long-term debt ratios and decreases in cash ratios. Additionally, the simultaneous decrease in retained earnings implies that bank bailouts set off persistent changes in their capital structures. Significantly, the likelihood of these zombie firms maintaining relationships with their main banks was considerably high. These findings illustrate the unintended, long-term consequences of bank bailouts, especially capital structure transformation and the promotion of bank dependency among zombie firms. Given the indispensable role of bank support for zombie firms to sustain their zombie status, this paper suggests that bank bailouts may have inadvertently impeded the revitalization of zombie firms over time. The findings in this study emphasize the importance of considering long-term outcomes when implementing measures such as bank bailouts, particularly given their potential to inadvertently perpetuate zombie firm phenomena and create dependencies.

8 Appendix

8.1 Strength of effects

In this section, I estimate the potentially different effects of the bailout on corporate financing policies, depending on the strength of the firms' pre-existing connections with the bailed-out banks. To do this, I define T_i^q, which takes the value of 1 if the firm i belongs to the q-th quartile of the Exposure Intervention$_i^j > 0$ with $q = 1$ being the bottom 25 percentile (the weakest exposure to the bailed-out banks among firms that had pre-existing relationships with the bailed-out banks) and $q = 4$ denoting the top 25 percentile (the strongest exposure). I estimate the following model:

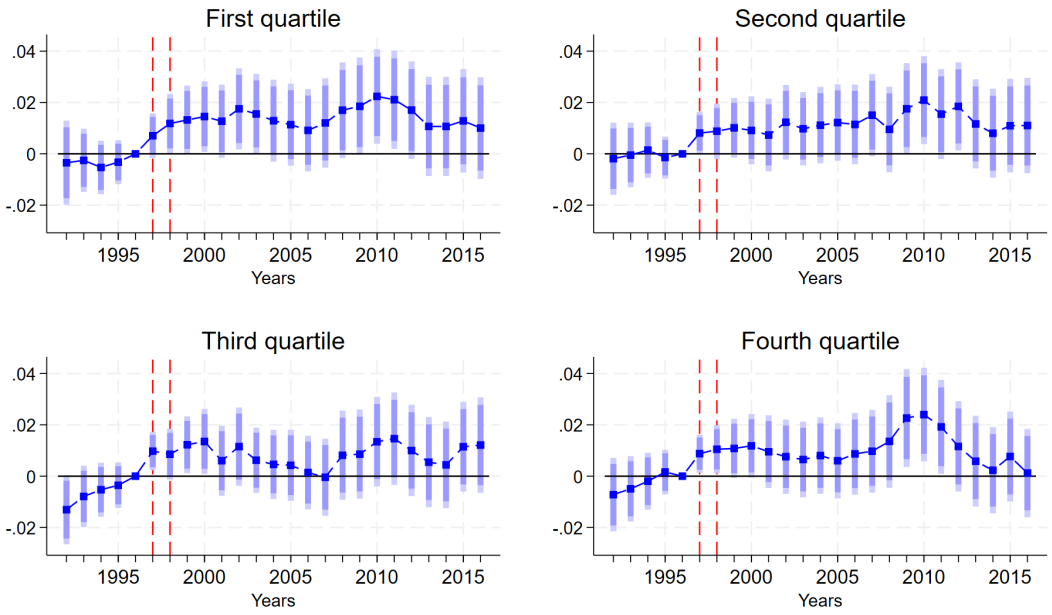
$$Y_{i,t} = \sum_{q=1}^{4} \sum_{t=1990}^{2016} \beta_t^q \left(\text{Year}_t \times T_i^q\right) + \psi \mathbf{X}_{i,t} + \text{Firm}_i + \text{Industry}_h \times \text{Year}_t + u_{i,t}, \tag{5}$$

where $\mathbf{X}_{i,t}$ includes the same control variables as in equation 2. If the effect of bailout increases according to the strength of the relationships with the bailed-out banks, we expect the absolute values of β_t^q to be greater as q increases. Figure 9 shows the results.

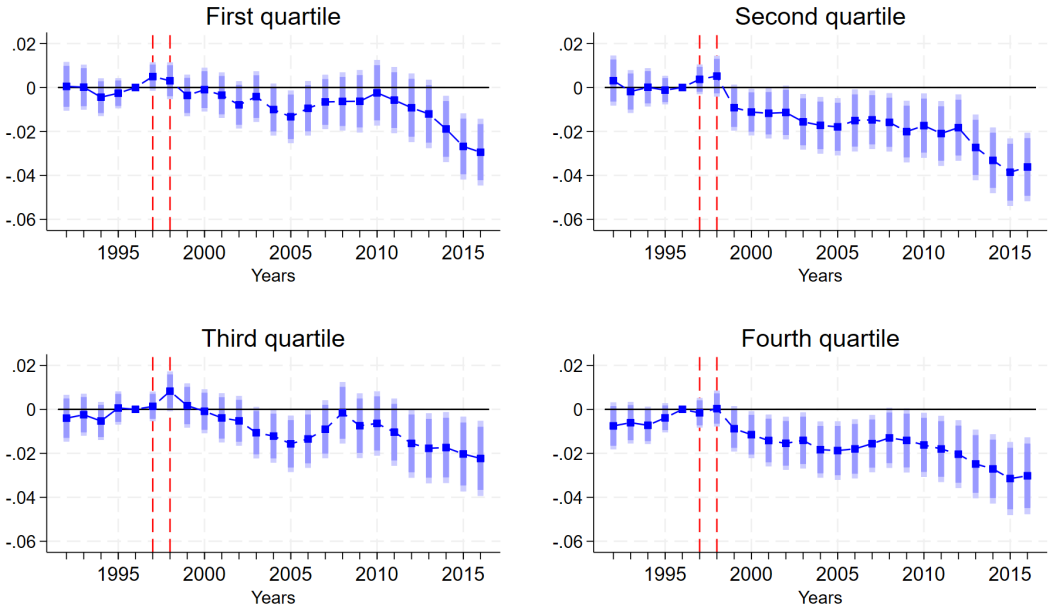
Panel (a) of Figure 9 shows the effects of the bailout on the long-term debt-over-asset ratio for different quartiles of borrower firms according to the intensities of the firms' connections with the bailed-out banks. First, the effects of bailouts on the debt-over-asset ratio are visible across all quartiles. Second, the strength of the effect does not seem to correlate well with the intensity of the firms' connection to the bailed-out banks. The firms with the weakest exposure to the bailed-out banks ($q = 1$) experienced as strong increase in the debt to asset ratio as the firms with the strongest exposure to the bailed-out banks ($q = 4$). The finding suggests that the strength of the bailout's effect on the debt over asset ratio does not linearly depend on the intensities of the firms' exposure to the bailout.

Panel (b) of Figure 9 shows the treatment effects on the cash over asset ratio for different quartiles of borrower firms. Again, the effects of the bailout on cash holding are significant across all groups of firms. The strength of the bailout's effect on cash holding appears to be weakly correlated with the intensities of the firms' connection with the bailed-out banks.

Figure 9: Results for different quartiles



(a) Long-term debt/TA



(b) Cash/TA

Notes. The figure shows the estimated coefficients on the interaction term between the treatment indicator and the year fixed effect for different quartiles, $\widehat{\beta_t^q}$ for $t = 1990 \ldots 2016$ and $q = \{1, 2, 3, 4\}$, using equation 2 when the dependent variable is long-term financial debt over total assets (TA) in Panel (a) and cash over total assets (TA) in Panel (b). The base year is 1996. Specifications include firm fixed effects, industry-by-year fixed effects, and firm-level covariates (log of total assets and log of the number of employees). The bank bailout occurred in 1997 and in 1998. The dark shaded area represents 90%, and the lightly shaded area 95% firm-cluster-robust confidence intervals, respectively.

The effects generally become stronger as the exposure to bailed-out banks increases.

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