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Determinants and Consequences of Bank Borrowings of Small Businesses: Is the COVID-19 crisis special?*

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Abstract

We investigate what types of small businesses use bank loans during crisis periods, focusing on the global financial crisis (GFC) and the economic crisis caused by the coronavirus pandemic (COVID-19 crisis). Using comprehensive data on small businesses in Japan, we obtain the following results. First, during these two crisis periods, small businesses with low cash flow, high credit risk, and low sales growth borrowed more from banks. Second, these firms borrowed more during the COVID-19 crisis than during the GFC. Furthermore, ex post profitability of these firms was lower during the COVID-19 crisis, which was special in that vulnerable firms borrowed more from banks. Third, the increases in probability of default were not large during the early stages of the COVID-19 crisis but were economically significant in 2021. These results imply that massive financial support during the COVID-19 crisis delayed firm defaults.

Keywords: small business, bank loan, global financial crisis, COVID-19
JEL classification: G21; G32; G01; G33

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1 Introduction

Small businesses experienced a severe economic crisis commencing in 2020 caused by the coronavirus pandemic (COVID-19 crisis). This crisis caused declines in cash flow and liquidity shortages among small businesses. To mitigate these cash flow and liquidity problems, governments in many countries offered financial support programs to small businesses, such as subsidized loans and public credit guarantees by government financial institutions, (as argued in Core and De Marco, 2021; Gonzalez-Uribe and Wang, 2020; Minoiu et al., 2021; Igan et al., 2023; Honda et al., 2023). By using these programs, small businesses were able to borrow easily from financial institutions to mitigate liquidity shortages. Some studies, (for example, Gonzalez-Uribe and Wang, 2020; Igan et al., 2023) show that these programs had positive effects on firm performance and survival. However, firms were able to borrow easily from banks even if they were vulnerable and uncreditworthy by using financial support programs. For example, in Japan, Hoshi et al. (2023) and Honda et al. (2023) show that vulnerable firms used financial support programs during the COVID-19 crisis. In addition to the COVID-19 crisis, small businesses have experienced economic and financial crises, such as the global financial crisis (GFC) in 2008. Similar to the COVID-19 crisis, small businesses were able to borrow easily from banks through government financial support programs, (as argued by Ono et al., 2013; Bonfim et al., 2023).

In this paper, we investigate what types of small businesses borrowed from banks during the economic crises (GFC and COVID-19 crisis). We also investigate whether the borrowing activities of small businesses differed between crisis and noncrisis periods. During the crisis periods, small businesses were able to borrow easily from banks using public financial support programs. These allowed vulnerable and high-risk firms that faced cash flow shortages to use bank borrowings during the crisis period, although they still faced severe constraints during noncrisis periods. Next, we investigate the differences in the borrowing activities of small businesses between the two crises. Finally, we investigate

whether and to what extent the consequences of bank borrowings of small businesses were different between the COVID-19 crisis, GFC, and noncrisis periods. Based on the estimation results, we show to what extent the credit allocation of small businesses was efficient during the COVID-19 crisis, GFC, and noncrisis periods. To investigate this issue, we compare the crisis and noncrisis periods using over 10 million firm–year observations for 20 years in Japan.

Many previous papers have investigated the bank borrowings of small businesses. Studies of relationship lending (for example Petersen and Rajan, 1994; Berger and Udell, 1995) investigate the effects of the strength of relationships on credit availability in noncrisis periods. Focusing on the GFC, several papers, (for example, Cotugno et al., 2013; Gobbi and Sette, 2014; Dewally and Shao, 2014; Banerjee et al., 2021; Vinas, 2021) find that banks offer larger loans to firms that experience liquidity shocks if they have close relationships. Recently, many papers have investigated the borrowing activities of small businesses during the COVID-19 crisis. For example, Hoshi et al. (2023) find that small and medium enterprises (SMEs) with low credit scores before the COVID-19 crisis were more likely to receive concessional loans from the Japanese government during the COVID-19 crisis, which increased the number of zombie firms. Honda et al. (2023) show that low-performing SMEs were more likely to borrow more using business support programs from the government. We also investigate bank borrowings in the crisis and noncrisis periods. However, few papers investigate the differences between bank borrowings in the COVID-19 crisis, GFC, and noncrisis periods.

Our estimation results are summarized as follows. First, firms with cash flow shortages, zombie firms, highly leveraged firms, and firms that experienced a decline in sales used bank borrowing more during the two crisis periods, compared with the precrisis periods. These results imply that firms that suffered from the crisis and uncreditworthy firms borrowed more during the crisis periods. Second, during the COVID-19 crisis, firms with cash flow shortages, zombie or highly leveraged firms, and firms with declining sales

borrowed more from banks than during the GFC and noncrisis periods. Third, the post performance (in terms of profitability) of these firms was weaker after their increase in bank borrowings during the crisis period. In particular, the post performance of these firms was weakest during the COVID-19 crisis. These results suggest that bank borrowing during the COVID-19 crisis did not enhance post firm performance. Therefore, credit was allocated to inefficient firms, especially during the COVID-19 crisis. Uncreditworthy firms borrowed more during the COVID-19 crisis because they used generous financial support from several policies. Firms could borrow easily, especially during the COVID-19 crisis. Therefore, vulnerable firms borrowed more from financial institutions. Fourth, the probability of default was higher after firms increased bank borrowings during the GFC. The increases in probability were not large during the early period of the COVID-19 crisis but were economically significant in 2021. These results imply that massive financial support during the COVID-19 crisis delayed firm default.

Our paper makes several contributions. First, although several papers, (for example, Gobbi and Sette, 2014; Dewally and Shao, 2014; Banerjee et al., 2021; Core and De Marco, 2021; Vinas, 2021; Bonfim et al., 2023; Igan et al., 2023; Hoshi et al., 2023) investigate the bank borrowing of small businesses during the GFC or COVID-19 crisis, few papers compare the GFC, COVID-19 crisis, and normal periods. In this paper, we use a comprehensive database of small businesses that covers 20 years including the GFC, COVID-19 crisis, and normal periods. Second, we investigate the effects of bank loans using data from small businesses. Some papers, such as Cathcart et al. (2020), use the data of small businesses to investigate the effects of leverage on firm default. However, these papers do not focus on the heterogeneity between crisis and normal periods. We reveal the heterogeneity between the GFC, COVID-19 crisis, and normal periods, which is our contribution to the literature. Third, we show the consequences of bank lending during the two crisis periods. Recently, many papers, (for example, Hoshi et al., 2023; Honda et al., 2023) investigate what types of small businesses borrowed more during the COVID-19

crisis. However, few papers investigate the consequences of bank lending by comparing the COVID-19 crisis and GFC periods. We show the consequences of bank lending using a database including firm default data, which are new findings in the literature.

The remainder of this paper is organized as follows. We review the relevant literature in Section 2. Section 3 describes the financial environment for small businesses after the 2000s and explains our hypothesis. Section 4 describes the dataset. We present the estimation strategy and results for the determinants of bank borrowings in Section 5. In Section 6, we introduce our empirical strategy to estimate the post firm performance and discuss the results. Section 7 describes the estimation strategy and results for the consequences of bank borrowings using a propensity score matching method. Section 8 concludes the paper.

2 Literature Review

In general, small businesses are informationally opaque firms, which causes a severe information gap between small businesses and creditors. Even if small businesses have growth opportunities with positive net present values, the information gap prevents certain firm activities. Theoretically, many papers, (for example, Campbell and Kracaw, 1980; Diamond, 1991) argue that the information production by banks mitigates the credit constraints of firms. Because of the severe information gap, bank loans are the main source of credit for small businesses. Some papers (Berger and Udell, 1998, 2006) focus on several lending technologies by banks, which enhance credit allocation to small businesses by mitigating the information gap. Many previous papers, (for example, Petersen and Rajan, 1994; Berger and Udell, 1995) emphasize the role of relationship lending on small business finance. By establishing close relationships between banks and small businesses, they mitigate the information gap. As the credit availability of small business borrowers is enhanced by relationship lending, small businesses use bank loans when they have profitable growth opportunities.

Some papers focus on the role of relationship lending during crisis periods. As Berlin and Mester (1999) and Boot (2000) argue, the close relationships between banks and small business borrowers enable banks to achieve interest rate smoothing. Banks can offer more loans to small business borrowers when the borrowers experience liquidity shortages during crisis periods, which is an insurance provision by banks. Insurance provision might prevent the exit of small businesses that have investment opportunities with positive net present values. In contrast, as argued by Boot (2000), the close lending relationships might induce forbearance lending because of the soft-budget constraint problem of banks. The soft-budget problem induces banks to offer more loans to inefficient firms during crisis periods, which are more likely to default.

Empirically, many papers investigate bank borrowing during crisis periods. Jiangli et al. (2008) show that a strong lender–borrower relationship enhanced credit availability during the Asian financial crisis. Focusing on the GFC, Cotugno et al. (2013) using Italian data show that close relationships mitigate the credit constraints of borrowers. Gobbi and Sette (2014) show that relationships with fewer banks mitigate the contraction of loans for firms during the GFC. Dewally and Shao (2014), Banerjee et al. (2021), and Vinas (2021) also find benefits of close lending relationships for borrowers during the GFC. Schaefer (2019) and Beatriz et al. (2022) empirically support interest rate smoothing, which shows that banks with close relationships with borrowers offer higher interest rates in good times and lower rates in bad times. Bonfim et al. (2023) investigate the financial and real effects of a government credit certification program during the GFC, showing that the effects on bank borrowings, investment, and employment were positive for eligible firms during the crisis. Tsuruta (2023) investigates the use of bank loans and trade credit during the GFC, suggesting that firms that experience liquidity shortages use more bank loans, not trade credit. Ono et al. (2013) and Saito and Tsuruta (2018) argue that risky firms used public credit guarantee schemes during the GFC.

Many studies investigate the effects of public credit guarantee schemes during the

COVID-19 crisis. They investigate the relationship between the use of policies for COVID-19 and firm activities. Gonzalez-Uribe and Wang (2020) investigate the impact of loan guarantee programs during the COVID-19 crisis in the UK. They find that the guarantees had positive impacts on profitability, survival, labor productivity, and employment growth. Minoiu et al. (2021) show that the Main Street Lending Program in the U.S. enhanced credit availability for small businesses during the COVID-19 crisis. Igan et al. (2023) find that public financial support enhances firm profitability, sales, interest coverage ratio, and default of firms. Core and De Marco (2021) investigate credit allocation by a public guarantee scheme for small businesses during the COVID-19 crisis, showing that public credit guarantees were allocated to financially fragile firms located in areas more affected by the COVID-19 crisis at the beginning of the pandemic. Hoshi et al. (2023) find that SMEs with low credit scores before the COVID-19 crisis were more likely to receive subsidies and concessional loans (including public credit guaranteed loans) from the Japanese government during the COVID-19 crisis. They conclude that these supports increased the number of zombie firms. Honda et al. (2023) investigate what kind of SMEs used the business support programs (including credit guarantee programs) provided by the Japanese government during the COVID-19 crisis. They show that low-performing SMEs (for example, firms with declining sales, firms with low credit scores, zombie firms) were more likely to use the support. In addition, they show that SMEs that used the support programs were less likely to exit, but were more likely to be zombie and low-return firms. Fernández-Cerezo et al. (2022) show that more vulnerable firms (for example, younger, smaller, and less productive firms) were more likely to use public credit guaranteed loans during the COVID-19 crisis.

Other studies also investigate the effects of public support during the COVID-19 crisis. Kawaguchi et al. (2021) investigate the effects of the emergency state declaration and subsidies on SMEs at the beginning of the COVID-19 crisis using a unique survey of small business managers. Morikawa (2021) shows that the productivity of firms using relief

policies was low during the COVID-19 crisis. Fukuda (2022) use monthly firm-level data of SMEs and show that subsidies by the Japanese government had positive policy effects on labor costs, whereas funding support by banks had negative effects. Bighelli et al. (2023) show the positive effects of COVID-19 government subsidies on firm productivity using cross-country data from five European countries. Fasano et al. (2022) use a large dataset of Italian firms to show that government support mitigated the negative impacts of the COVID-19 crisis on firm performance. Olvera et al. (2022) show that government support has positive effects on employment resilience using data from Central American countries.

Many papers investigate the effects of the COVID-19 crisis on firm activities. These papers show that firm performance deteriorated during the COVID-19 crisis. Gourinchas et al. (2021) argue that business failure occurred because of the contraction of credit to the corporate sector during the COVID-19 crisis. Miyakawa et al. (2021) investigate the effects of the COVID-19 crisis on firm exit by estimating a model of optimal stopping time. They also simulate the exit rate during the COVID-19 crisis, showing that firm exits increased by around 20% compared with previous years. Demirgüç-Kunt et al. (2021) focus on banking sector performance, showing that financial support by banks had positive impacts on the stock returns of banks during the COVID-19 crisis. Khan (2022) find that credit-constraint firms suffered large adverse effects from the COVID-19 crisis, and used fewer bank loans during the crisis. Hu and Zhang (2021) show that the adverse effects of the COVID-19 crisis are weak in countries with more advanced financial systems. Shen et al. (2020), using data from Chinese firms, show that the COVID-19 crisis had negative impacts on firm performance if a firm's revenue was small. Ke (2022) shows that the COVID-19 crisis increased the cost of equity capital. Kumar and Zbib (2022) show that the managerial ability of CEOs mitigated the decrease in stock returns during the COVID-19 crisis.

We also investigate what kind of small businesses used more bank loans during the GFC

and the COVID-19 crisis. However, few papers investigate the differences in borrowing activities between the GFC, the COVID-19 crisis, and normal periods, which is the main contribution of our paper.

3 Hypotheses Development

3.1 Financial Environment for Small Businesses after the 2000s

In this subsection, we describe the trends in bank lending after the 2000s in Japan using aggregate data. Figure 1 shows the growth rate of bank loans for SMEs. The growth rate was negative in the early 2000s, after which it increased and became positive until the second quarter of 2007. Between the third quarter of 2007 and the second quarter of 2013, which includes the period of the GFC, the growth rate was negative. After the third quarter of 2013, the growth rate of bank loans was positive; therefore, banks increased their lending to small businesses in this period. After the second quarter of 2020, which is the period of the COVID-19 crisis, the growth rate of bank loans was very high. This suggests that banks offered more loans to small businesses during the COVID-19 crisis.[1]

The increase in bank loans during the COVID-19 crisis was caused by public financial support. Figures 2 and 3 show the growth rate of loans from private-sector and government-affiliated financial institutions (PFIs and GFIs, respectively). Figure 2 shows that the growth rate of loans from GFIs was very high during the COVID-19 crisis. The growth rate ranged from 33% to 50% from the second quarter of 2020 to the first quarter of 2021. The growth rate of loans from PFIs was 7.0% in the fourth quarter of 2020, whereas it was 3.3% in the fourth quarter of 2019. This suggests that PFIs also increased loans to small businesses during the COVID-19 crisis. Figure 3 shows the growth rates before the COVID-19 crisis. The growth rates of loans from GFIs were positive from the third quarter of 2009 to the fourth quarter of 2011. This suggests that GFIs increased

[1]We refer to 2007 to 2010 as the years of the GFC and after 2020 as the years of the COVID-19 crisis.

loans to small businesses during the GFC, which suggests that the trend in loans from GFIs is countercyclical. In contrast, the growth rate of loans from PFIs was low during the GFC and high during the noncrisis periods. Figure 3 suggests that the correlation between loans from PFIs and GFIs is negative.

Figures 4 and 5 show the growth rates of credit guarantee loans for small businesses. These loans are guaranteed by government-affiliated credit guarantee corporations. The credit guarantee corporations (not small business borrowers) repay the debt of the small business borrowers to private financial institutions in the case of borrowers' default. Therefore, banks offer loans to small businesses with low risk even if the credit risk of the borrower is high. Figure 4 shows that the amount of credit guarantee loans increased substantially in 2021, after the COVID-19 crisis. Figure 5 shows the trend in credit guaranteed loans before the COVID-19 crisis, suggesting that the growth rate was high in 2009. The amount of credit guaranteed loans increased during the GFC. Figures 4 and 5 show that the amount of credit guaranteed loans increased during the crisis periods. Figure shows the ratio of GFI and credit guaranteed loans to total bank loans for small businesses. The ratios increased during the GFC and the COVID-19 crisis, implying that dependence on GFI and credit guarantee loans was high during the crises. In sum, these figures suggest that bank loans during the crisis periods were boosted by the GFI loans and credit guarantees. This trend is clearly observed during the COVID-19 crisis.

3.2 Hypotheses

As Petersen and Rajan (1994) argue, the relationships between banks and small businesses mitigate the information gap, which induces loans to firms with a positive net present value. If the relationship lending is effective, high-performing firms (for example, growing firms, firms with high cash flow) use more bank borrowings. We test the following hypothesis.

H1: High-performing firms used more bank loans than low-performing firms.

According to the figures in Section 3.1, financial support by GFI loans and public credit guarantees increased loans to small businesses during the crisis period. This massive financial support implies that firms in trouble (for example, firms with low cash flow, firms with high credit risk, and firms with declining sales) used more bank loans during the crisis period. In addition, as Boot (2000) argue, if banks offered insurance for firms in trouble during the crisis, these firms used more bank loans. In sum, we test the following hypothesis.

H2: Firms with low cash flow, decrease in sales, and high risk used more bank loans during the crisis period.

If the increases in bank loans operate as insurance provisions for small businesses, firms that use bank loans will recover after receiving them. In contrast, if nonperforming and inefficient firms use bank loans to postpone their management issues, firm performance will be lower after receiving the bank loans.

H3A: Sales and profitability were higher for firms after using bank loans if banks offered the insurance provision.
H3B: Sales and profitability were lower for firms after using bank loans if banks offered forbearance lending.

4 Data

To test the hypotheses in the previous section, we use the Credit Risk Database for Small and Medium Enterprises (CRD). The CRD is one of the large firm-level databases

for small business in Japan, which was established by the credit guarantee corporations (CGCs), some financial institutions, and the Small and Medium Enterprise Agency in Japan. The CRD is a database of SMEs defined under the Small and Medium Enterprise Basic Law.[2]

Firm-level data are provided for the CRD by financial institutions and CGCs with regular member status (CRD members). These data mainly reflect clients' financial statements (balance sheets and profit and loss statements), firm default status, and firm characteristics (for example, firm age[3] and number of employees). CRD members provide the data of their small business clients. The data of small businesses that do not borrow from CRD members are not collected. Therefore, our database does not include firms that do not borrow from any financial institutions and those that borrow from non-CRD members only. The data of small business clients are not collected when CRD members cease lending to such client firms. Financial institutions and CGCs are likely to stop lending to clients with high credit risk. Therefore, these firms are likely to be truncated.

In our study, the data are for the period 2002–2022, which includes periods before and after the GFC and the COVID-19 crisis. To accommodate the use of lead variables, we limit our sample to manufacturing firms that appeared in the CRD data for two or more consecutive years. The data of some variables are winsorized at the 0.5% and 99.5% levels. Our dataset comprises 1,998,661 firms and 15,921,960 firm–year observations. The distribution of employees in our data is as follows: the first quartile of employees is 2, the median is 6, and the third quartile is 15, suggesting that our database includes numerous micro- and informationally opaque firms. The 99th percentile of employees is 201, suggesting that our database includes some larger-sized small businesses.

[2]In general, SMEs under the Small and Medium Enterprise Basic Law are firms with capital stock under 300 million yen and/or 300 or fewer regular employees.

[3]Firm age is grouped into five-year categories; for example, the age of 11 to 15 years was categorized as 15 years.

5 Determinants of Bank Borrowing

5.1 Empirical Strategy

In this section, we investigate what types of small businesses use more bank loans, focusing on cash flow, credit risk (proxied by a zombie firm dummy and leverage), and firm growth. To investigate this issue, we estimate the following regression equation:

$$Bank\ Borrowings_{i,t+1} = \beta_1 z_{i,t} \times Year_t + \beta_2 X_{i,t} + \epsilon_i + \zeta_t + \eta_{i,t}, \tag{1}$$

where the dependent variable is bank borrowings for firm i in year t+1; $Year_t$ is a dummy variable for 2002–2022; $X^j_{i,t}$ are control variables (size, age, cash flow, leverage, zombie firm dummy, tangibility, sales growth, cash holdings, and current assets in year t); ϵ_i is firm fixed effects for firm i; ζ_t is year fixed effects for year t; and $\eta_{i,t}$ is the error term for firm i in year t, with year t ranging from 2002 to 2022. We employ cash flow, zombie firm dummy, leverage, and sales growth for $z_{i,t}$. If these variables are employed for $z_{i,t}$, we exclude the variables from the set of $X_{i,t}$. We use three proxies for bank borrowings: the ratio of a firm's bank borrowings to total assets in year t+1 (bank borrowing), the annual change of the ratio of a firm's bank borrowings to total assets from year t to t+1 (Δbank borrowing), and a dummy variable equal to one if the annual change of the ratio of a firm's bank borrowings to total assets is greater than zero (Δbank borrowing$>$ 0).

Following Brown et al. (2021), cash flow is defined as the ratio of a firm's earnings before interest, taxes, depreciation, and amortization (EBITDA) to total assets in year t. Following Caballero et al. (2008) and Fukuda and Nakamura (2011), the zombie firm dummy equals one if the following requirements are satisfied: 1) actual interest payments are less than minimum required interest payments (=prime rate*times* the amount of borrowing of the firm),[4] ii) EBITDA is less than the minimum required interest payments, iii) the change in borrowings from year t–1 to t is positive, and iv) firm leverage in year

[4]The data for short- and long-term prime rate are from the website of the Bank of Japan.

t–1 is 0.5 or greater. [5] According to Caballero et al. (2008), zombie firms are insolvent and unprofitable firms. They cannot survive without financial support from other parties (for example, banks and the government). These firms are uncreditworthy and risky; therefore, we use a zombie firm dummy as a proxy for credit risk. Leverage is defined as the book value of debt divided by the book value of assets in year t. As Opler and Titman (1994) describe, highly leveraged firms are high-risk firms for lenders. Therefore, we employ leverage as a proxy for credit risk. Sales growth is defined as the annual change in firm sales [ln(1+sales in year t) – ln(1+sales in year t–1)], which is a proxy of firm growth. Size is the natural logarithm of total assets in year t. Tangibility is defined as the ratio of fixed tangible assets to total assets in year t. Cash holdings are normalized by total assets in year t. Current assets are defined as the ratio of liquid assets minus cash holdings to total assets in year t.

If banks offer credit to firms that experience a cash flow shortage, the coefficients of cash flow are negative. By contrast, if banks offer credit to firms that create higher cash flow, the coefficients of cash flow are positive. During the crisis period, banks offered more credit to firms with cash flow shortages, and therefore the coefficients of cash flow×year dummies are negative. Zombie firm dummy and leverage are proxies for firm credit risk. If banks offer less credit to these firms, the coefficients of zombie firm dummy and leverage are negative. By contrast, if banks offer more credit to zombie and highly leveraged firms, the coefficients are positive. In this case, credit is allocated more to risky firms, which suggests inefficient credit allocation. We also focus on sales growth as a proxy for firm growth. If banks offer credit to growing firms, the coefficients of sales growth are positive. In this case, bank credit is allocated to growing firms, which suggests efficient credit allocation.

[5] This definition of a zombie firm by Caballero et al. (2008) and Fukuda and Nakamura (2011) is for large firms, not small businesses. Many small businesses depend on external debts and the cash flow of small businesses is not stable. Therefore, this definition of a zombie firm might not be suitable for small businesses. The discussion of a suitable definition of a zombie firm remains for future research.

5.2 Estimation Results

Table 1 presents summary statistics for the dependent and independent variables and Table 2 shows the estimation results using bank borrowing as a dependent variable. In column (1), we show the estimation results using cash flow for $Z_{i,t}$. The estimated coefficient of cash flow is positive and statistically significant at the 1% level before 2006. This result suggests that firms increased bank borrowing if cash flow was high in the early 2000s. By contrast, the estimated coefficients of cash flow×year dummies are negative and statistically significant after 2007. The marginal effects of cash flow were high in 2009 and 2010, suggesting that firms used more bank borrowings if they faced cash flow shortages during the GFC. This result is consistent with the insurance provision hypothesis. The estimated coefficients are negative after the GFC. During the COVID-19 crisis, the marginal effect was the largest, and was –0.51945 in 2022. This implies that firms used more bank borrowings if they faced cash flow shortages during the COVID-19 crisis compared with the GFC.

In column (2), we use the zombie firm dummy for $Z_{i,t}$. The estimated coefficient of the zombie firm dummy is negative and statistically significant at the 1% level until 2006, suggesting that zombie firms decreased bank borrowings in the early 2000s. These coefficients turn positive after 2007. The positive marginal effects are largest during the GFC compared with the pre-GFC period. The estimated coefficients of the zombie firm dummy×year dummies are high after the GFC. The marginal effects of the zombie firm dummy increased substantially in 2021, which is after the COVID-19 crisis. These results imply that zombie firms increased bank borrowings during the crisis period. The marginal effect was larger during the COVID-19 crisis than during the GFC. Firms increased their bank borrowings more if they were classified as zombie firms during the COVID-19 crisis compared with the GFC.

Column (3) shows the estimation results for leverage. The estimated coefficient of leverage is positive and statistically significant at the 1% level. The estimated coefficients

of the leverage×year dummies are around 0.4 before 2004. The marginal effects of leverage increased from 2003 to 2010, which implies that the effects of leverage were high during and after the GFC. This increased to 0.67463 in 2021, which was during the COVID-19 crisis. These results imply that highly leveraged firms (risky firms) used more bank borrowings in the crisis periods than in the noncrisis periods. These results also imply that highly leveraged firms used more bank borrowings during the COVID-19 crisis than during the GFC.

Column (4) shows the estimation results for sales growth. The estimation results of the sales growth×year dummies are positive and statistically significant in the early 2000s, but become negative and statistically significant after 2008. The marginal effects increased during the GFC, suggesting that firms with a decline in sales used more bank borrowings during the GFC. The marginal effects of sales growth are between –0.019 and –0.033 between the GFC and COVID-19 crisis but increase to –0.04925 in 2020 and –0.06474 in 2021 during the COVID-19 crisis. These results imply that firms with a decline in sales used more bank borrowings during the crisis period. This trend is more clearly observed during the COVID-19 crisis.

Figure 7 illustrates the estimated marginal effects of each variable calculated using the estimation results of Table 2. In all figures, the estimated marginal effects change dramatically during the GFC and the COVID-19 crisis. In particular, the changes in the marginal effects are larger during the COVID-19 crisis than those during the GFC. Table 7 also shows that the estimated coefficients of $Z_{i,t}$ do not change significantly after the GFC. These results suggest that despite recovering from the GFC, vulnerable firms still borrowed more from financial institutions. These results imply that H2 is supported if we compare before and during the GFC, but not supported if we compare during and after the GFC. We interpret that these results show the forbearance of lending from financial institutions for vulnerable firms after the GFC.

In summary, firms with cash flow shortages, risky firms, and firms with a decline in

sales used more bank borrowings during the GFC and COVID-19 crisis. Focusing on the magnitudes of the estimated coefficients, these firms used more bank borrowings during the COVID-19 crisis than during the GFC. These results imply that the COVID-19 crisis is unique in that firms in trouble borrowed more from banks.

Figure 8 shows the marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on Δbank borrowing for each year. The estimation results are shown in Table A1 in the Appendix.

Figure 8-1 shows that the marginal effects of cash flow are positive and statistically significant at the 1% level before 2006, suggesting that firms with positive cash flows increased their bank borrowings. From 2007 to 2009, the marginal effects of cash flow fall substantially. The marginal effects are negative after the GFC, suggesting that firms with cash flow shortages still increased their bank borrowings after the GFC. In 2021, the marginal effects of cash flow fall substantially again. Therefore, firms with cash flow shortages increased their bank borrowings during the COVID-19 crisis.

Figure 8-2 shows the marginal effects of the zombie firm dummy. The marginal effects are negative and statistically significant at the 1% level before 2008. This result suggests that zombie firms decreased their bank borrowings before 2008. The magnitude of the marginal effects increased each year between 2003 to 2008. In 2009 and 2010, the marginal effects of the zombie firm dummy are positive and statistically significant, suggesting that zombie firms increased their bank borrowings during the GFC. Positive marginal effects are also observed from 2014 to 2018. In 2021, the marginal effect of the zombie firm dummy increases to 0.02768. This implies that zombie firms increased their bank borrowings more during the COVID-19 crisis than during the GFC.

Figure 8-3 shows the marginal effects of leverage. The trend of the marginal effects is similar to that of the zombie firm dummy. This figure shows that highly leveraged firms decreased their bank borrowings before the GFC. During and after the GFC, the marginal effects are between –0.10 and –0.13. This effect is weakest in 2022, suggesting that highly

leveraged firms decreased their bank borrowings less during the COVID-19 crisis.

Figure 8-4 shows the marginal effects of sales growth. Although the marginal effects decrease before the GFC, they are positive and statistically significant at the 1% level before the COVID-19 crisis. These results suggest that growing firms increased their bank borrowings before the COVID-19 crisis. However, the marginal effect of sales growth is negative (but not statistically significant) in 2022. During the COVID-19 crisis, positive effects of sales growth on Δbank borrowings are not observed.

Figure 9 shows the marginal effects of each variable on the Δbank borrowing$>$ 0 dummy. The estimation results are shown in Table A2 of the Appendix. The trend in Figure 9 is similar to that in Figure 8.

5.3 Effects of Temporary and Permanent Shocks

5.3.1 Cash flow and sales growth

In Subsection , we estimate the effects of Z in year t. However, we cannot interpret whether the changes in cash flow and sales growth are temporary or permanent. It is very important that the cash flow or sales shocks occurred only in year t or continued before year t–1. To investigate this issue, we estimate coefficients of cash flow in year t, by the level of average cash flow in years t–1 and t–2 (named past cash flow). We divide observations into thirds by past cash flow, which are low, middle, and high categories. The category of low past cash flow includes firms with negative and positive cash flows. Therefore, we divide the category of low past cash flow into negative cash flow (low(–)) and positive or zero cash flow (low(+)).

Similarly, we estimate coefficients of sales growth, by the level of average sales growth in years t–1 and t–2 (named past sales growth). We divide observations into thirds by past sales growth, which are low, middle, and high categories. In the middle category, observations with positive and negative past sales growth are included. Therefore, we divide the middle category into two categories, which are negative past sales growth

(middle(–)) and positive or zero past sales growth (middle(+)). Tables 3 and 4 show the minimum, median, and maximum of past cash flow and sales growth. From Table 3, the median of past cash flow is –0.057 in the low(–) category, suggesting that these firms experience permanent cash flow shortages. Similarly, from Table **??**, the median of sales growth in the low category is –0.119, suggesting that the sales of these firms decreased permanently.

Figure 10 shows the estimation results for cash flow and sales growth. Figure 10-1 shows the estimated coefficients of cash flow. The trends of the coefficients in all categories are similar to those in Figure 7-1 before 2019. In 2020, the estimated coefficients in the low(+) cash flow categories are mainly insignificant. In 2021, the estimated marginal effects in the low(–) cash flow categories change dramatically. These results suggest that the estimated coefficients of cash flow are low for firms that experienced permanent cash flow shortages during the COVID-19 crisis. If firms had experienced cash flow shortages in the precrisis period, they increased their bank borrowing to finance cash flow shortages during the COVID-19 crisis.

Figure 10-2 shows the estimated coefficients of sales growth, which are around zero if past sales growth is high during the late 2010s. After 2019, the estimated coefficients are smaller, especially in the categories of low and middle(–) past sales growth. These results suggest that firms that had permanently lower sales increased their bank borrowings more if firms' sales decreased during the COVID-19 crisis. This figure implies that firms increase bank borrowings more to finance cash flow or sales shocks if they have experienced permanent (not temporary) shocks.

5.3.2 Zombie firms by interest coverage ratio

In the previous section, we employed the definition of a zombie firm by Fukuda and Nakamura (2011). However, zombie firms are mainly identified by variables in year t; therefore, this definition reflects conditions prior to year t–1. To deal with this issue,

we estimate the coefficient of $Z_{i,t}$ in equation (1) using the zombie firm definition by **?**. Under this definition, a firm is identified as a zombie firm if it is aged 10 years or older and it had an interest coverage ratio (ICR) of less than one for three consecutive years. This definition includes the condition of ICR in years t–1 and t–2; therefore, zombie firms under this definition are permanently distressed firms. Figure 11 shows the trend in the estimated coefficients of the zombie firm dummy defined by ICR. The estimated coefficients have an upward trend after the GFC. In addition, the estimated coefficients are generally higher between 2020 and 2021, which is during the COVID-19 crisis. These results suggest that permanently distressed firms increased their bank borrowings more, especially during the COVID-19 crisis.

6 Profitability and Default

6.1 Empirical Strategy

In Section 5, we showed that firms with cash flow shortages, risky firms, and firms with a decline in sales used more bank borrowings. In this section, we show the post performance of these firms. If banks offered insurance provisions to firms in trouble during the crisis period, firms quickly recovered even if they suffered from the negative shock of the crisis. To investigate this issue, we estimate regressions using post firm performance, proxied by profitability, and firm default. We estimate the following equation.

$$Firm\ Performance_{i,t+1} = \gamma_1 z_{i,t} \times Year_t + \gamma_2 X_{i,t} + \theta_i + \iota_t + \kappa_{i,t}, \quad (2)$$

where the dependent variable is firm performance (proxied by profitability and default) for firm i in year t+1; $Year_t$ is a dummy variable for 2002–2022; $X_{i,t}$ is a set of control variables (defined in Subsection 5.1); θ_i is firm fixed effects for firm i; ι_t is year fixed effects for year t; and $\kappa_{i,t}$ is the error term for firm i in year t, with year t ranging from

2002 to 2022. Similar to the previous section, if these variables are employed for $z_{i,t}$, we exclude the variables from the set of $X_{i,t}$. Similar to Section 5, we employ cash flow, zombie firm dummy, leverage, and sales growth for $z_{i,t}$. Profitability is defined as the ratio of a firm's operating income to total assets. Default is a dummy variable that equals one if firms delay loan payments by more than three months, are bankrupt or virtually bankrupt borrowers, and/or are borrowers for which CGCs subrogated between years t and t+1.

6.2 Estimation Results

6.2.1 Ex post profitability

Table 5 shows the estimation results for equation (2) using profitability as a proxy for firm performance. Similar to Table 2, we employ cash flow in column (1), zombie firm dummy in column (2), leverage in column (3), and sales growth in column (4) for $z_{i,t}$.

Using the estimation results of Table 5, we calculated the coefficients of each variable shown in Figure 12. Figure 12-1 shows that the estimated coefficient of cash flow is 0.02900 for 2003, and increases subsequently until 2009. In the 2000s, the magnitude of the coefficients of cash flow is highest in 2009. This implies that firms with low cash flow are unprofitable in the next year. This trend is clearer during the GFC because the magnitude of the coefficients of cash flow is high. After the GFC, the magnitude of the estimated coefficients is also high, ranging from 0.12 to 0.16. During the COVID-19 crisis after 2020, the magnitude of the estimated coefficients increased substantially and was 0.25111 in 2020 and 0.30742 in 2021. These results imply that firms with low cash flow were more unprofitable ex post during the COVID-19 crisis than during the GFC.

Figure 12-2 shows that the estimated coefficients of the zombie firm dummy are positive before 2006, suggesting that the ex post profitability of zombie firms is high. These results are consistent with those of Fukuda and Nakamura (2011), who argue that zombie firms are likely to have recovered in the 2000s. However, the magnitude of the coefficients

decreases until 2009. The marginal effect of the zombie firm dummy on ex post profitability was –0.01662 in 2009, suggesting that zombie firms were more unprofitable during the GFC. The marginal effects decrease after the GFC but are still negative. This suggests that ex post profitability was low during 2010. In 2020 and 2021, the marginal effects of the zombie firm dummy increase and are –0.03657 and –0.03857, respectively. These results imply that zombie firms were more unprofitable during the COVID-19 crisis than during the GFC and noncrisis periods.

Figure 12-3 shows that the estimated coefficients of leverage are around 0.08 before 2004. The marginal effects of leverage decrease after 2003 and are lowest for 2009 in the 2000s. Tsuruta (2017) shows that highly leveraged small businesses are high-risk high-return firms. In addition, as Tsuruta (2015) points out, the effects of leverage can be positive because banks and trade creditors monitor their activity and prevent inefficient management. Therefore, the estimated coefficients of leverage are positive. However, this positive effect weakens during the GFC. After the GFC, the marginal effects of leverage increase to around 0.05. During the COVID-19 crisis, the marginal effects of leverage decrease to 0.01147 in 2020 and 0.01449 in 2021. During the COVID-19 crisis, the positive effects of leverage disappeared; and therefore, highly leveraged firms were likely to be more unprofitable during the COVID-19 crisis than during the GFC and noncrisis periods.

Figure 12-4 shows the estimated coefficients of sales growth, which are negative before 2008. This suggests that the ex post profitability of firms with a decline in sales was higher before 2008. In contrast, the marginal effects of sales growth become positive after 2009, suggesting that firms with a decline in sales were unprofitable ex post. The marginal effects of sales growth increase substantially after 2020. This means that firms with a decline in sales were more unprofitable during the COVID-19 crisis than during the GFC and noncrisis periods.

6.2.2 Default

Table 6 shows the estimation results of equation (2) using default as the dependent variable. Using the estimation results, Figure 13 illustrates the estimated marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on default for each year. Figure 13-1 shows the marginal effects of cash flow, which decreased before and during the GFC. This implies that firms with lower cash flow were more likely to default during the GFC than before the GFC. After the GFC, the magnitude of the marginal effects does not change significantly. During the COVID-19 crisis, the estimated coefficients of cash flow are negative in 2021 and 2022. The magnitude of cash flow is the largest in 2022, suggesting that firms with low cash flow were more likely to default after the COVID-19 crisis.

Figure 13-2 illustrates the marginal effects of the zombie firm dummy. The marginal effects are negative and statistically significant during the GFC; however, they are positive before the GFC. Zombie firms were unlikely to default during the GFC, although they were likely to default before the GFC. After the GFC and during the COVID-19 crisis, the estimated marginal effects are not statistically significant, suggesting that firms were unlikely to default even if they were zombie firms.

Figure 13-3 illustrates the marginal effects of leverage on default. The marginal effects during the GFC are larger than those before the GFC. This implies that highly leveraged firms were more likely to default during the GFC. The marginal effects did not change significantly during and after the GFC and COVID-19 crisis. Highly leveraged firms were likely to default during the COVID-19 crisis, which is similar to the results before the COVID-19 crisis.

Figure 13-4 illustrates the marginal effects of sales growth. The trends in the marginal effects are similar to those in the other figures. The marginal effects decrease before and during the GFC. During the GFC, the marginal effects are negative and statistically significant, suggesting that firms with a decline in sales were likely to default. The sizes

of the marginal effects are similar during and after the GFC and the COVID-19 crisis, suggesting that firms with a decline in sales were likely to default in these periods.

In summary, firms were more likely to default during the GFC if they had low cash flow, were zombies, were highly leveraged, and had a decline in sales, compared with before the GFC. Significant changes before and after the GFC are observed. Therefore, the GFC is a special event from the perspective of small business default. Significant changes before and after the COVID-19 crisis are observed in the case of cash flow. During the COVID-19 crisis, firms with cash flow shortages were more likely to default. However, significant changes before and after the COVID-19 crisis are observed for other variables.

7 Propensity Score Matching

7.1 Estimation Strategy

In the previous section, we showed that firms with cash flow shortages, zombie firms, highly leveraged firms, and firms with a decline in sales borrowed more from banks during the crisis periods. In addition, the ex post profitability of these firms was lower during the crisis periods than during the noncrisis periods. In this section, we investigate the effects of bank borrowings using a propensity score method, a technique introduced by Rosenbaum and Rubin (1983).

To estimate the effects of bank borrowings, we define the treatment and control groups. We define the treatment (control) group as a subsample of firms that increased (did not increase) bank borrowings from year t to t+1. In other words, the treatment group is the group of firms with Δbank borrowing> 0. The propensity score (probability of receiving treatment) is the probability that firms increased bank borrowings. To calculate this score $Pr(\mathbf{X}_{i,t})$, we estimate the probability of increasing bank borrowings using the probit

model:

$$Pr(\mathbf{X}_{i,t}) \equiv Pr(\Delta bank\ borrowing > 0 \mid \mathbf{X}_{i,t}) = \Phi(\mathbf{X}_{i,t}\rho), \tag{3}$$

where $\mathbf{X}^{j}_{i,t}$ = (size, age, leverage, zombie firm dummy, tangibility, sales growth, cash holdings, current assets, industry dummies, and regional dummies) in year t. Φ is the cumulative distribution function of the standard normal distribution. To control the year fixed effects, equation (3) is estimated by years.

The estimated propensity score $[\hat{Pr}(\mathbf{Z}_{i,t})]$ for each observation is calculated from the estimated coefficients of equation (3). Based on the scores, the observations of the treatment and control groups are matched using one-to-one nearest-neighbor matching. By matching the observations of the treatment and control groups, we can compare firms that are similar in terms of size, age, leverage, zombie firm dummy, tangibility, sales growth, cash holdings, and current assets.

7.2 Estimation Results

Tables 7–9 show the estimation results of the propensity score matching estimation using default, profitability, and sales as outcome variables. Table 7 shows that the average treatment effects on treatment (ATET) are larger during and after the GFC. During the COVID-19 crisis, large increases in the ATET of default are observed between 2000 and 2021. Table 8 shows that ex post profitability decreased more during the GFC and COVID-19 crisis. These results imply that firm performance decreased because they depended on more bank borrowings during the crisis periods. Similarly, firms' sales decreased more if they depended on more bank borrowings during the crisis period. In particular, column (1) of Table 9 shows that the decrease in firm sales is larger in the COVID-19 crisis than in the GFC. This result also implies that firm performance decreased after the increase in bank borrowings during the crisis periods.

8 Conclusion

We investigated what types of small businesses used bank loans during crisis periods, focusing on the GFC and COVID-19 crisis. In addition, we investigated firm default, ex post profitability, and sales after firms used bank loans. Our results are summarized as follows. First, small businesses increased bank borrowings during the crisis period if they were firms with low cash flow, high risk, and a decline in sales. Second, these trends are more commonly observed during the COVID-19 crisis. Third, post firm performance during the crisis periods is lower than during the noncrisis periods. Focusing on firm default, the probability of default was higher during the GFC, whereas that during the early period of the COVID-19 crisis was not statistically significant compared with the noncrisis periods. Increases in profitability were economically significant during the COVID-19 crisis in 2021. These results imply that massive financial support during the COVID-19 crisis delayed firm default. The COVID-19 crisis is special in that vulnerable firms used more bank borrowings.

Our estimation results have some policy implications. First, firms that experienced liquidity shortages during the crisis periods borrowed more from banks, which mitigated their financial constraint. This result suggests that massive public financial support mitigated financial constraints during the crisis. This is a benefit of the policies. Second, although the financial constraint is mitigated by several public policies, these induced forbearance lending. Banks offered more loans to inefficient firms during crisis periods, which are more likely to default. This is a cost of the policies.

Our paper has some limitations, which suggest directions for future research. First, our database contains firm-level data provided to the CRD by financial institutions and CGCs with CRD membership. Therefore, some small businesses are not included in our database. Although our database includes over 15 million firm–year observations of small businesses, research involving nonborrowing firms would be insightful. Second, our database contains firm-level data, not loan-level data. Therefore, we do not have data

on loan amounts from GFIs. In addition, we cannot identify the amount of borrowings from GFIs and PFIs for each firm. In addition, we do not have data on credit guaranteed loans for each firm. Therefore, we cannot consider the heterogeneous effects of borrowings between PFIs and GFIs.

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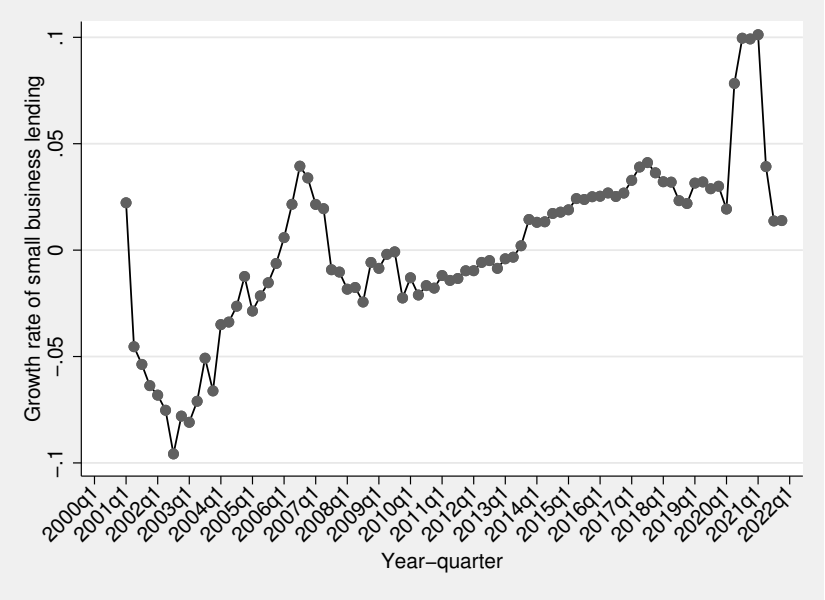
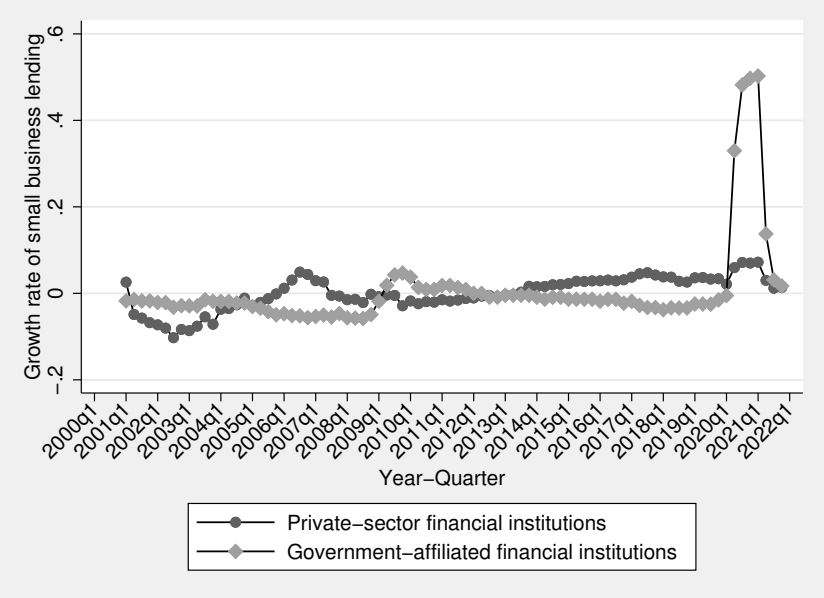
Figure 1: Growth rate of bank loans for small and medium enterprises



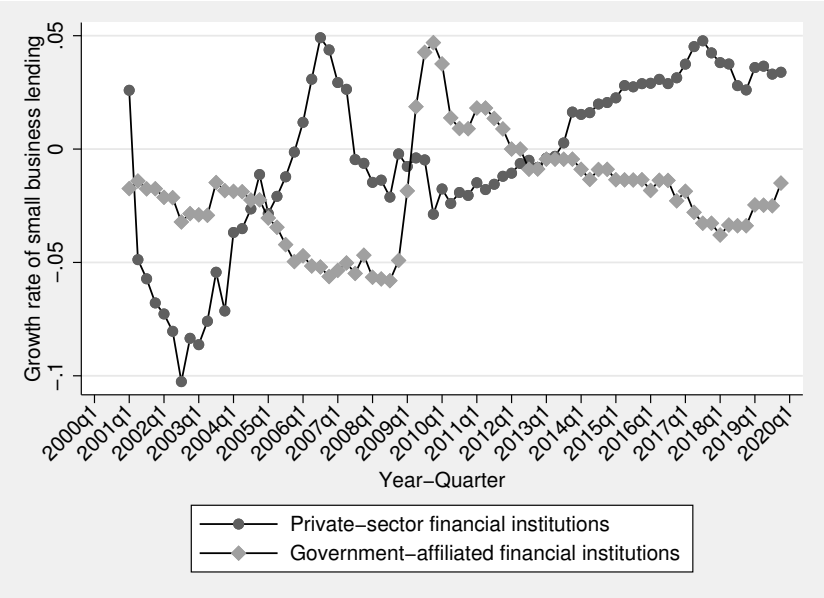
Source: Small and Medium Enterprise Agency, *White Paper on Small and Medium Enterprises in Japan*.
Note: The growth rate of bank loans for SMEs is defined as (bank loans for SMEs in year t – bank loans for SMEs in year t–1)/bank loans for SMEs in year t–1 for each quarter.

Figure 2: Growth rate of bank loans from private-sector and government-affiliated financial institutions



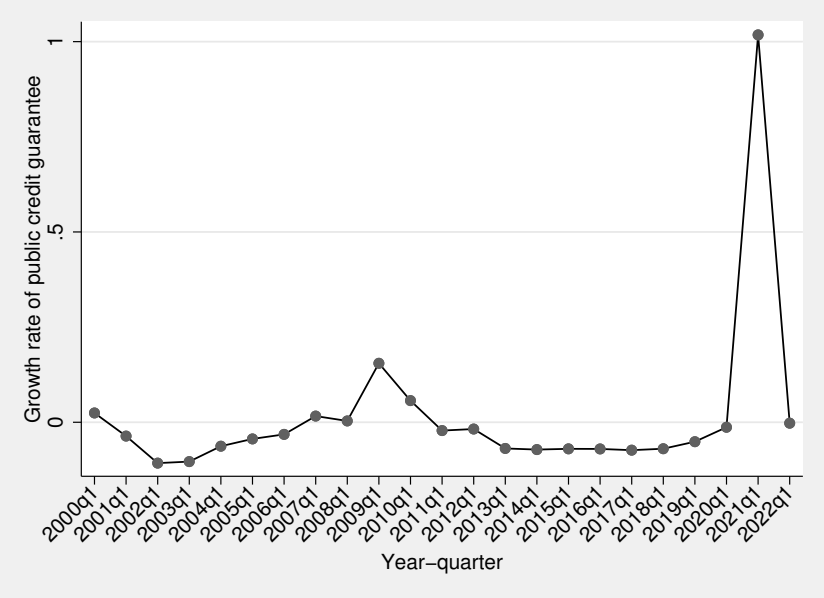
Source: Small and Medium Enterprise Agency, *White Paper on Small and Medium Enterprises in Japan.*
Note: The growth rate of bank loans for SMEs from each financial institution is defined as (bank loans for SMEs in year t – bank loans for SMEs in year t–1)/bank loans for SMEs in year t–1 for each quarter.

Figure 3: Growth rate of bank loans from private-sector and government-affiliated financial institutions (before 2019)



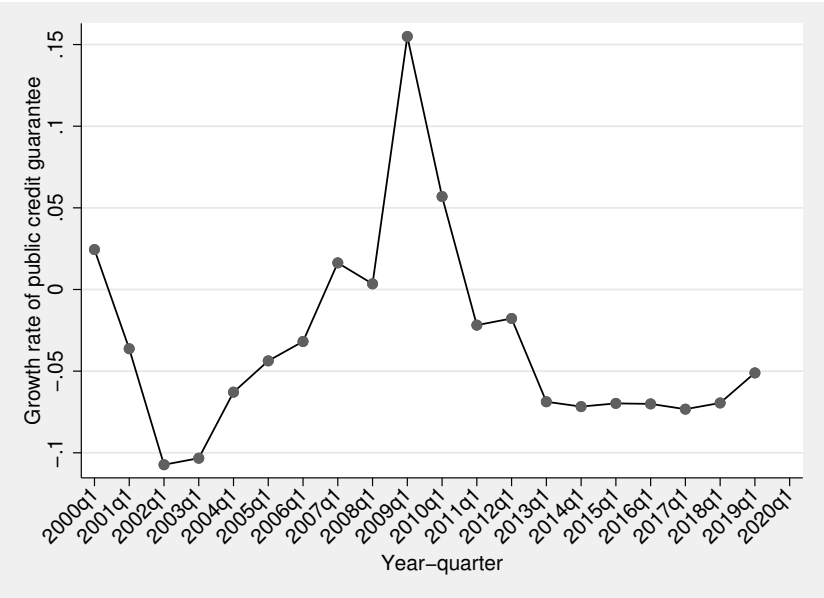
Source: Small and Medium Enterprise Agency, *White Paper on Small and Medium Enterprises in Japan.*
Note: The growth rate of bank loans for SMEs from each financial institution is defined as (bank loans for SMEs in year t – bank loans for SMEs in year t–1)/bank loans for SMEs in year t–1 for each quarter.

Figure 4: Growth rate of credit guaranteed loans



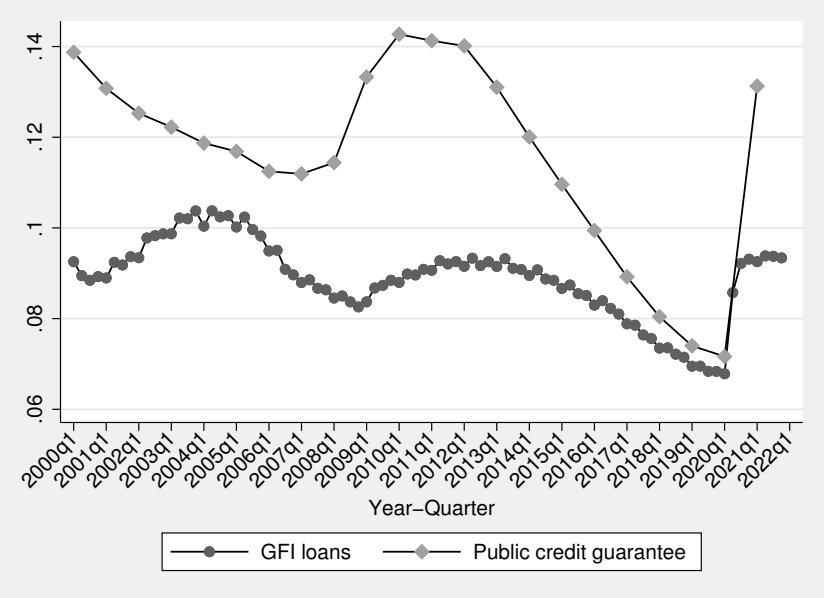
Source: Website of Japan Federation of Credit Guarantee Corporations: https://www.zenshinhoren.or.jp/english/ (last accessed March 2023).
Note: The growth rate of credit guaranteed loans is defined as (credit guaranteed loans in year t – credit guaranteed loans in year t–1)/credit guaranteed loans in year t–1.

Figure 5: Growth rate of credit guaranteed loans (before 2019)



Source: Website of Japan Federation of Credit Guarantee Corporations: https://www.zenshinhoren.or.jp/english/ (last accessed March 2023).
Note: The growth rate of credit guaranteed loans is defined as (credit guaranteed loans in year t – credit guaranteed loans in year t–1)/credit guaranteed loans in year t–1.

Figure 6: Ratio of GFI and credit guaranteed loans



Source: Small and Medium Enterprise Agency, *White Paper on Small and Medium Enterprises in Japan* and Website of Japan Federation of Credit Guarantee Corporations: https://www.zenshinhoren.or.jp/english/ (last accessed March 2023).
Note: The ratio of government-affiliated financial institution (GFI) and credit guaranteed loans is defined as (GFI or credit guaranteed loans in year t/bank loans for SMEs in year t).

Table 1: Summary Statistics

Variable	N	Mean	SD	Min	p1	p50	p99	Max
Bank borrowings	15,921,960	0.78906	0.80807	0.00000	0.00000	0.64615	4.43696	9.91151
ΔBank borrowings	15,854,973	0.02925	0.26233	–1.83193	–0.64815	0.00000	1.03829	2.88670
ΔBank borrowings>0	15,921,960	0.48556	0.49979	0.00000	0.00000	0.00000	1.00000	1.00000
Default	15,689,109	0.00270	0.05188	0.00000	0.00000	0.00000	0.00000	1.00000
Cash flow	15,921,960	0.02571	0.16715	–1.59124	–0.62867	0.03699	0.42577	0.71951
Zombie firm	15,921,960	0.24564	0.43046	0.00000	0.00000	0.00000	1.00000	1.00000
Size	15,921,960	11.45692	1.60040	0.00000	8.20795	11.33260	15.71911	21.30548
Age	15,921,960	3.15656	0.69405	1.60944	1.60944	3.21888	4.31749	6.86693
Leverage	15,921,960	1.04282	0.84129	0.00000	0.11866	0.88592	4.83412	12.00000
Tangibility	15,921,960	0.32370	0.27327	0.00000	0.00000	0.25916	0.96218	1.00000
Sales growth	15,921,960	0.00353	0.28565	–1.48326	–0.84093	–0.00213	0.94445	1.77138
Cash holdings	15,921,960	0.20517	0.17937	0.00000	0.00256	0.15470	0.76812	1.00000
Current assets	15,921,960	0.36429	0.23978	0.00000	0.00000	0.33694	0.92066	1.00000

Note: This table provides summary statistics for the variables used in the econometric analysis.

Table 2: Estimation Results of Cash Flow, Zombie Firm Dummy, Leverage, and Sales Growth on Bank Borrowings

	(1)	(2)	(3)	(4)
	Bank borrowings	Bank borrowings	Bank borrowings	Bank borrowings
Proxy of $Z_{i,t}$	Cash flow	Zombie firm	Leverage	Sales growth
Proxy of $Z_{i,t}$×Year2002	0.09939***	–0.03540***	0.40974***	0.01047***
	(0.008)	(0.001)	(0.004)	(0.002)
Proxy of $Z_{i,t}$×Year2003	0.17683***	–0.05554***	0.39964***	0.03510***
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2004	0.11400***	–0.04276***	0.42026***	0.02292***
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2005	0.09635***	–0.03366***	0.43841***	0.01726***
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2006	0.05314***	–0.01712***	0.46438***	0.01018***
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2007	–0.02001***	0.00249**	0.51400***	0.00252
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2008	–0.10364***	0.02285***	0.55371***	–0.00912***
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2009	–0.19605***	0.04527***	0.58153***	–0.02603***
	(0.006)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2010	–0.19674***	0.05168***	0.59428***	–0.02048***
	(0.006)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2011	–0.14358***	0.04325***	0.58818***	–0.02012***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2012	–0.14644***	0.05299***	0.59625***	–0.02777***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2013	–0.14681***	0.04758***	0.58091***	–0.03015***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2014	–0.16159***	0.05610***	0.59850***	–0.02822***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2015	–0.17257***	0.06411***	0.60556***	–0.03278***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2016	–0.18517***	0.06340***	0.60517***	–0.02755***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2017	–0.19348***	0.06728***	0.60418***	–0.02864***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2018	–0.21044***	0.07138***	0.61019***	–0.02937***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2019	–0.15530***	0.05112***	0.56876***	–0.01966***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2020	–0.27698***	0.06742***	0.58848***	–0.04925***
	(0.007)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2021	–0.43635***	0.10906***	0.67463***	–0.06474***
	(0.007)	(0.001)	(0.003)	(0.002)
Proxy of $Z_{i,t}$×Year2022	–0.51945***	0.10450***	0.68332***	–0.04420***
	(0.015)	(0.002)	(0.005)	(0.005)

[This table continues to the next page.]

Cash flow		–0.13847***	–0.15732***	–0.13823***
		(0.002)	(0.002)	(0.002)
Zombie firm	0.03687***		0.03864***	0.03598***
	(0.000)		(0.000)	(0.000)
Leverage	0.59400***	0.59556***		0.59904***
	(0.001)	(0.001)		(0.001)
Sales growth	–0.01794***	–0.01783***	–0.01698***	
	(0.001)	(0.001)	(0.001)	
Size	0.01171***	0.01001***	0.01195***	0.01051***
	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.03564***	0.03486***	0.03224***	0.03706***
	(0.001)	(0.001)	(0.001)	(0.001)
Tangibility	0.04122***	0.04469***	0.04931***	0.04552***
	(0.003)	(0.003)	(0.003)	(0.003)
Cash holdings	0.02800***	0.03005***	0.01760***	0.02964***
	(0.003)	(0.003)	(0.003)	(0.003)
Current assets	–0.01311***	–0.01055***	–0.01846***	–0.00957***
	(0.003)	(0.003)	(0.003)	(0.003)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	15,921,960	15,921,960	15,921,960	15,921,960
R–squared	0.405	0.404	0.410	0.403

Note: This table presents the estimates from the fixed effects regressions with bank borrowings (normalized by a firm's total assets) as the dependent variable. Cash flow is defined as the ratio of a firm's earnings before interest, taxes, depreciation, and amortization (EBITDA) to total assets in year t. Zombie firm dummy equals one if the following requirements are satisfied: 1) actual interest payments are less than the minimum required interest payments (=prime rate×the amount of borrowing of the firm, ii) EBITDA is less than the minimum required interest payments, iii) the change in borrowings from year t–1 to t is positive, and iv) a firm's leverage in year t–1 is 0.5 or over. Leverage is defined as the book value of debt divided by the book value of assets in year t. Sales growth is defined as the annual change in firm sales [ln(1+sales in year t) – ln(1+sales in year t–1)], which is a proxy for firm growth. Size is the natural logarithm of total assets in year t. Tangibility is defined as the ratio of fixed tangible assets to total assets in year t. Cash holding values are normalized by total assets in year t. Current assets are defined as the ratio of liquid assets minus cash holdings to total assets in year t. The estimation results for the constant term are omitted. The estimated standard errors are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure 7: Marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on bank borrowings

Figure 7-1: Cash flow

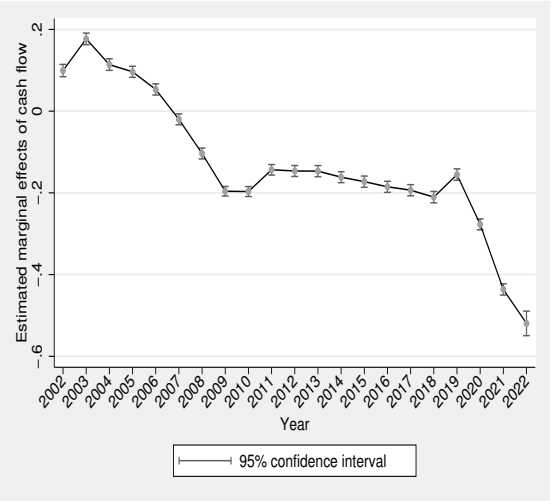


Figure 7-2: Zombie firm dummy

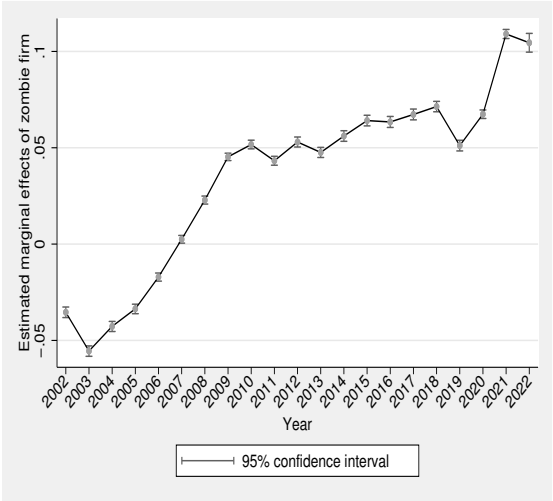


Figure 7-3: Leverage

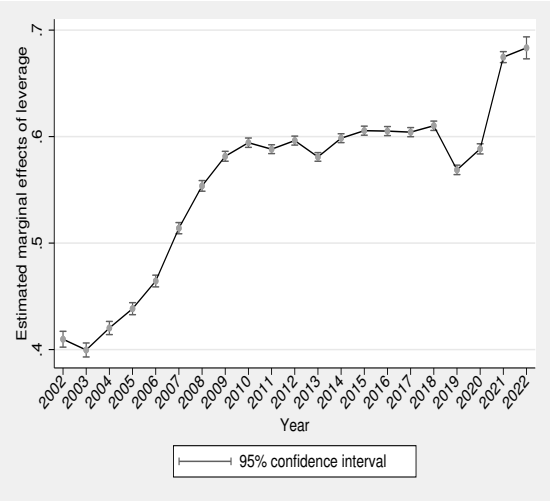
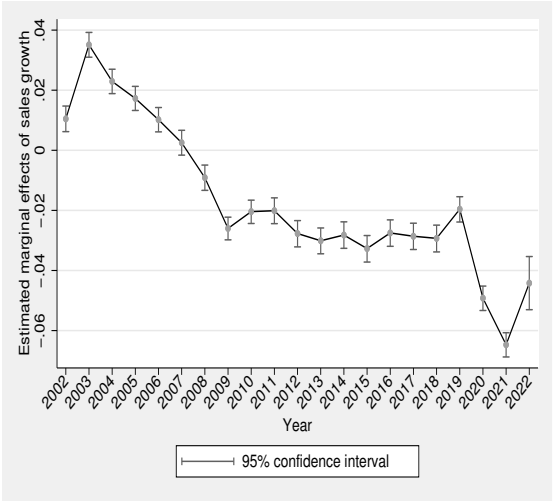


Figure 7-4: Sales growth



Note: These figure parts show the estimated marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on bank borrowings for each year using the estimation results of Table 2.

Figure 8: Marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on ΔBank borrowings

Figure 8-1: Cash flow

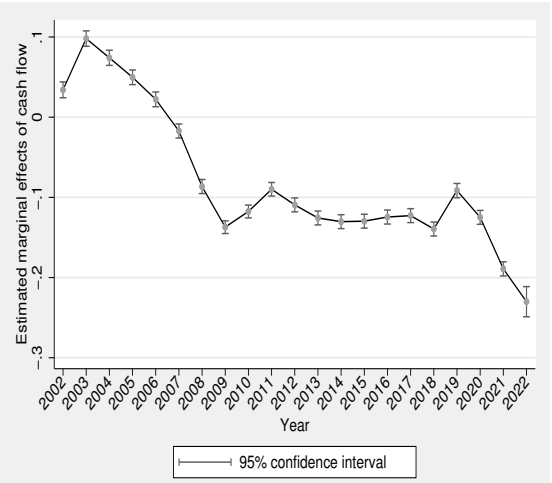


Figure 8-2: Zombie firm dummy

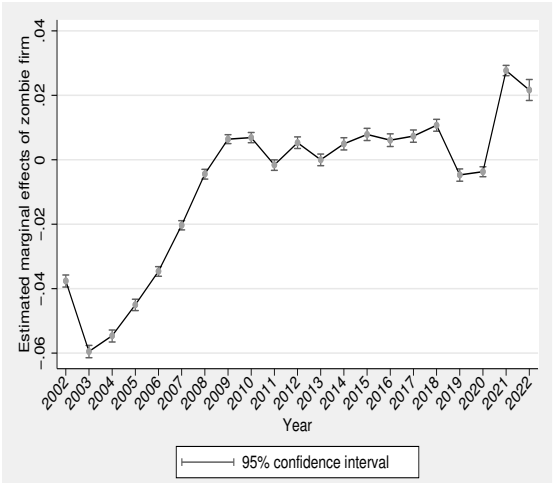


Figure 8-3: Leverage

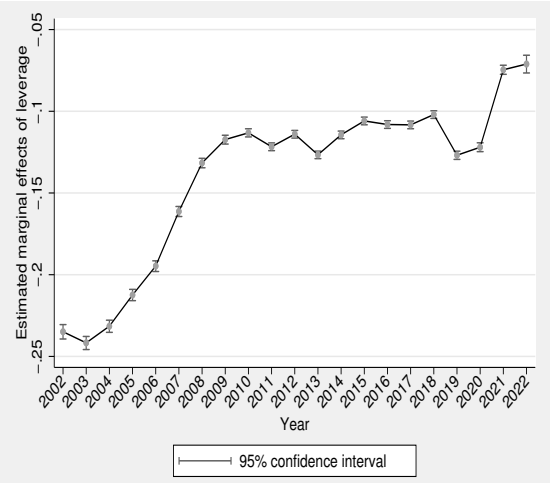
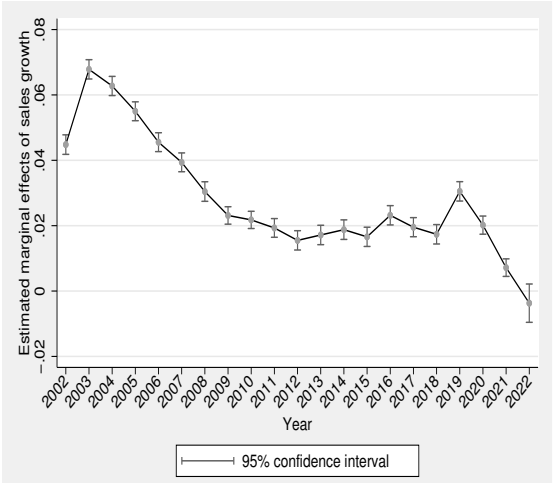


Figure 8-4: Sales growth



Note: These figure parts show the estimated marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on Δbank borrowings for each year using the estimation results of Table A1.

Figure 9: Marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on ΔBank borrowings> 0 dummy

Figure 9-1: Cash flow

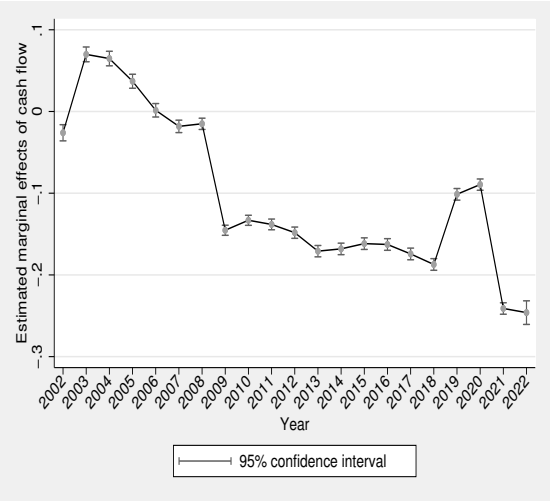


Figure 9-2: Zombie firm dummy

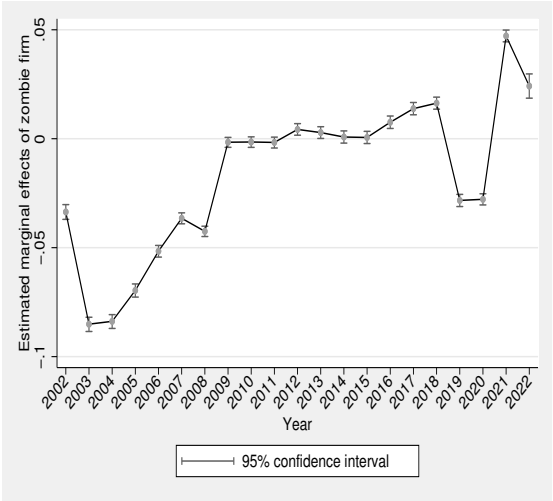


Figure 9-3: Leverage

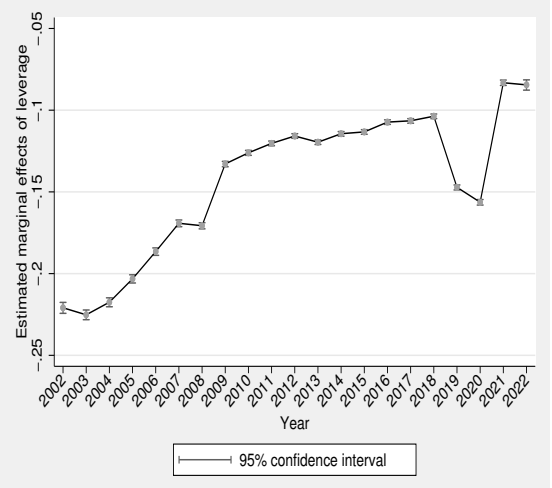
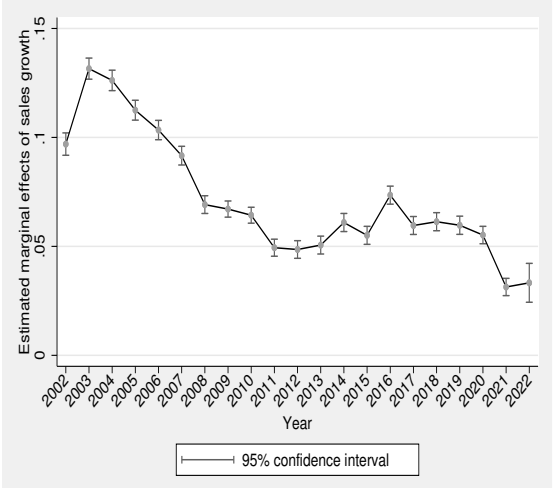


Figure 9-4: Sales growth



Note: These figure parts show the estimated marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on the Δbank borrowings> 0 dummy for each year using the estimation results of Table A2.

Table 3: Maximum, Median, and Minimum of Past Cash Flow

Past Cash Flow	Min	Median	Max	Nob
Low(–)	–1.584	–0.057	–0.000	3,428,443
Low(+)	0.000	0.008	0.014	922,677
Middle	0.014	0.038	0.066	4,351,120
High	0.066	0.114	0.716	4,351,119

Note: This table provides maximum, median, and minimum values for average cash flow in years t–1 and t–2 by four categories.

Table 4: Maximum, Median, and Minimum of Past Sales Growth

Past Sales Growth	Min	Median	Max	Nob
Low	–1.448	–0.119	–0.047	3,935,458
Middle(–)	–0.047	–0.023	–0.001	2,033,215
Middle(+)	0.000	0.019	0.044	1,902,218
High	0.044	0.125	1.759	3,935,441

Note: This table provides maximum, median, and minimum values for average sales growth in years t–1 and t–2 by four categories.

Figure 10: Marginal effects of cash flow and sales growth on bank borrowings, by past cash flow and sales growth

Figure 10-1: Cash flow

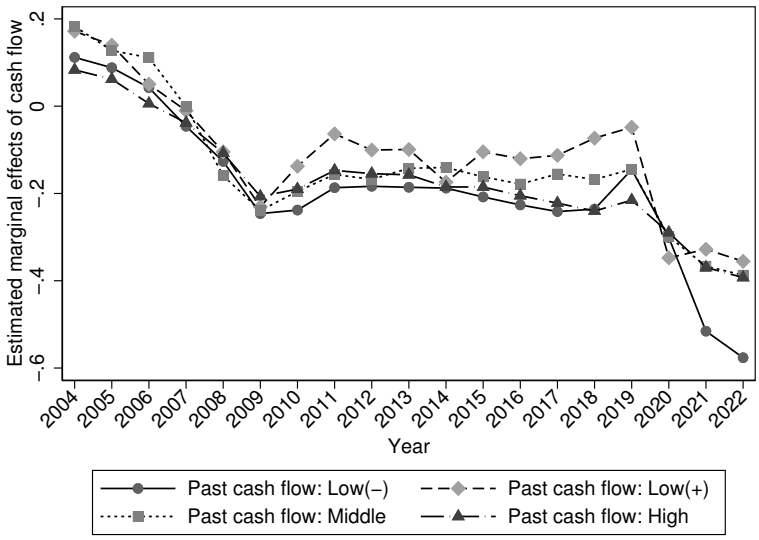
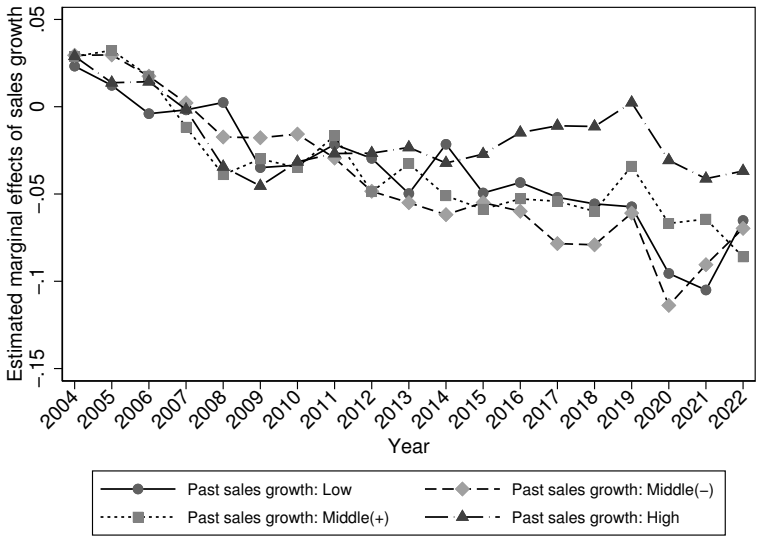
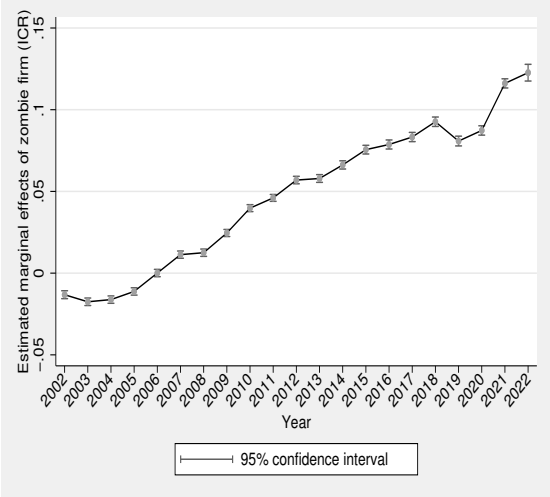


Figure 10-2: Sales Growth



Note: These figures show the estimated marginal effects of cash flow and sales growth on bank borrowings for each year, by past cash flow or sales growth in years t–1 and t–2.

Figure 11: Marginal effects of zombie firm dummy (defined by ICR) on bank borrowings



Note: These figures show the estimated marginal effects of the zombie firm dummy defined by ICR on bank borrowings for each year.

Table 5: Estimation Results of Cash Flow, Zombie Firm Dummy, Leverage, and Sales Growth on Profitability in t+1

	(1)	(2)	(3)	(4)
	Profitability	Profitability	Profitability	Profitability
Proxy of $z_{i,t}$	Cash flow	Zombie firm	Leverage	Sales growth
Proxy of $Z_{i,t}$×Year2002	0.13579***	0.00281***	0.08027***	–0.00875***
	(0.003)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2003	0.02900***	0.01795***	0.08340***	–0.02335***
	(0.003)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2004	0.05131***	0.01429***	0.07758***	–0.01191***
	(0.003)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2005	0.06887***	0.00992***	0.07373***	–0.01077***
	(0.003)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2006	0.07845***	0.00638***	0.07068***	–0.00761***
	(0.003)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2007	0.09955***	–0.00080*	0.06085***	–0.00630***
	(0.003)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2008	0.12018***	–0.00861***	0.04822***	–0.00243***
	(0.003)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2009	0.16770***	–0.01662***	0.04054***	0.00373***
	(0.002)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2010	0.14717***	–0.00892***	0.04516***	–0.00060
	(0.002)	(0.000)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2011	0.12608***	–0.00170***	0.05020***	0.00035
	(0.002)	(0.000)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2012	0.13985***	–0.00503***	0.05056***	0.00508***
	(0.002)	(0.000)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2013	0.15401***	–0.00373***	0.05390***	0.00469***
	(0.002)	(0.000)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2014	0.16298***	–0.00597***	0.05069***	0.00343***
	(0.002)	(0.000)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2015	0.16287***	–0.00815***	0.04920***	0.00441***
	(0.002)	(0.001)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2016	0.15904***	–0.00781***	0.04678***	0.00364***
	(0.002)	(0.001)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2017	0.15797***	–0.00799***	0.04611***	0.00387***
	(0.002)	(0.001)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2018	0.15335***	–0.00563***	0.04703***	0.00411***
	(0.003)	(0.001)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2019	0.15340***	–0.01359***	0.03194***	0.00845***
	(0.003)	(0.001)	(0.000)	(0.001)
Proxy of $Z_{i,t}$×Year2020	0.25111***	–0.03657***	0.01147***	0.03133***
	(0.003)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2021	0.30742***	–0.03857***	0.01449***	0.04708***
	(0.003)	(0.000)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2022	0.23816***	–0.02442***	0.02289***	0.02622***
	(0.005)	(0.001)	(0.001)	(0.002)

[This table continues to the next page.]

	(1)	(2)	(3)	(4)
	Profitability	Profitability	Profitability	Profitability
Cash flow		0.14871***	0.15176***	0.14807***
		(0.001)	(0.001)	(0.001)
Zombie firm	–0.00762***		–0.00818***	–0.00726***
	(0.000)		(0.000)	(0.000)
Leverage	0.04361***	0.04254***		0.04162***
	(0.000)	(0.000)		(0.000)
Sales growth	0.00306***	0.00315***	0.00329***	
	(0.000)	(0.000)	(0.000)	
Size	–0.00290***	–0.00209***	–0.00316***	–0.00275***
	(0.001)	(0.001)	(0.001)	(0.001)
Age	–0.00372***	–0.00368***	–0.00289***	–0.00466***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	0.01272***	0.01126***	0.01157***	0.01116***
	(0.001)	(0.001)	(0.001)	(0.001)
Cash holdings	–0.02838***	–0.02920***	–0.02535***	–0.02931***
	(0.001)	(0.001)	(0.001)	(0.001)
Current assets	–0.00379***	–0.00509***	–0.00259***	–0.00533***
	(0.001)	(0.001)	(0.001)	(0.001)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	15,859,851	15,859,851	15,859,851	15,859,851
R–squared	0.052	0.050	0.054	0.049

This table presents estimates from the fixed effects regressions with firm performance (proxied by a firm's operating income to total assets in year t+1) as the dependent variable. The definitions of the independent variables are the same as those in Table 2. The estimation results for the constant term are omitted. The estimated standard errors are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure 12: Marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on ex post profitability

Figure 12-1: Cash flow

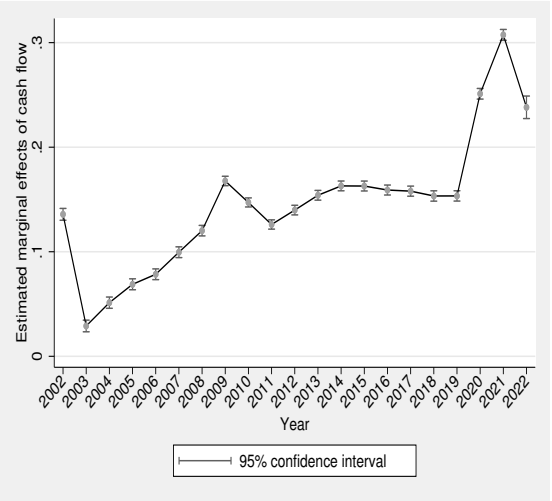


Figure 12-2: Zombie firm dummy

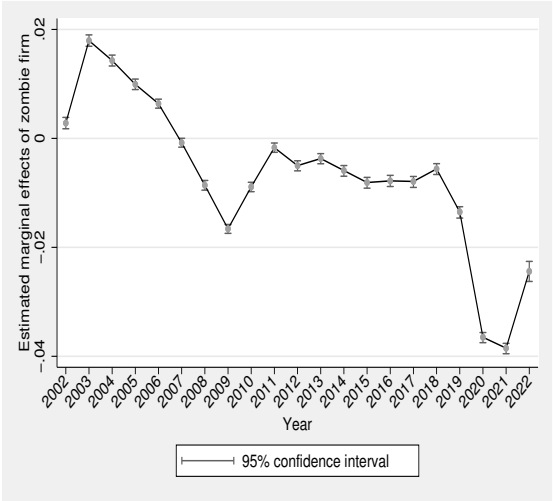


Figure 12-3: Leverage

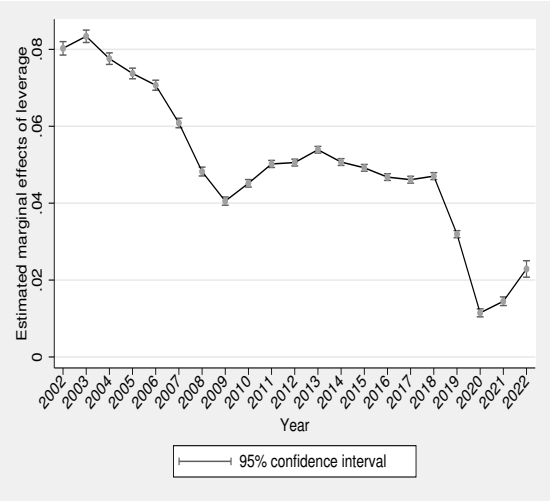
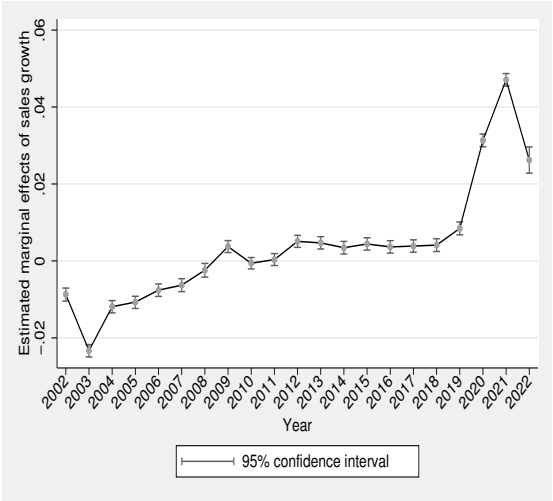


Figure 12-4: Sales growth



Note: These figure parts show the estimated marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on profitability for each year using the estimation results of Table 5.

Table 6: Estimation Results of Cash Flow, Zombie Firm Dummy, Leverage, and Sales Growth on Default in t+1

	(1)	(2)	(3)	(4)
	Default	Default	Default	Default
Proxy of $z_{i,t}$	Cash flow	Zombie firm	Leverage	Sales growth
Proxy of $Z_{i,t}$×Year2002	0.00463***	0.00034**	–0.00263***	0.00321***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2003	0.00207***	0.00043***	0.00004	–0.00020
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2004	0.00120**	0.00019	0.00114***	–0.00104***
	(0.001)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2005	0.00174***	–0.00010	0.00158***	–0.00190***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2006	0.00006	0.00008	0.00241***	–0.00234***
	(0.001)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2007	0.00024	–0.00018	0.00257***	–0.00238***
	(0.001)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2008	–0.00120**	–0.00019	0.00247***	–0.00330***
	(0.001)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2009	–0.00014	–0.00046***	0.00256***	–0.00272***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2010	0.00064	–0.00057***	0.00260***	–0.00290***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2011	0.00051	–0.00057***	0.00269***	–0.00282***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2012	0.00017	–0.00018	0.00263***	–0.00259***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2013	–0.00020	–0.00009	0.00286***	–0.00228***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2014	–0.00024	–0.00006	0.00286***	–0.00219***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2015	–0.00197***	–0.00008	0.00304***	–0.00250***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2016	–0.00041	–0.00005	0.00291***	–0.00186***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2017	–0.00177***	0.00013	0.00311***	–0.00179***
	(0.001)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2018	–0.00004	–0.00029**	0.00292***	–0.00185***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2019	–0.00108**	–0.00001	0.00309***	–0.00162***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2020	–0.00061	0.00002	0.00255***	–0.00145***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2021	–0.00137***	0.00006	0.00290***	–0.00171***
	(0.000)	(0.000)	(0.000)	(0.000)
Proxy of $Z_{i,t}$×Year2022	–0.00280**	–0.00004	0.00305***	–0.00044
	(0.001)	(0.000)	(0.000)	(0.000)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	15,689,109	15,689,109	15,689,109	15,689,109
R–squared	0.004	0.004	0.004	0.004

Note: This table presents estimates from the fixed effects regressions with default as the dependent variable. Default is a dummy variable that equals one if firms delay loan payments by more than three months, are bankrupt or virtually bankrupt borrowers, and/or are borrowers for which credit guarantee corporations subrogated between years t and t+1. The definitions of the independent variables are the same as those in Table 2. The estimation results for the constant term and control variables are omitted. The estimated standard errors are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure 13: Marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on default

Figure 13-1: Cash flow

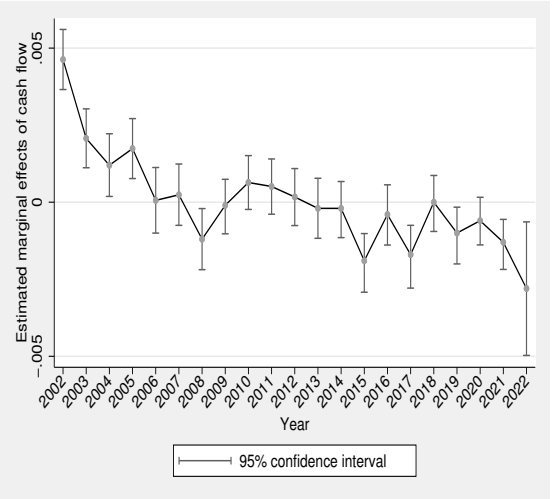


Figure 13-2: Zombie firm dummy

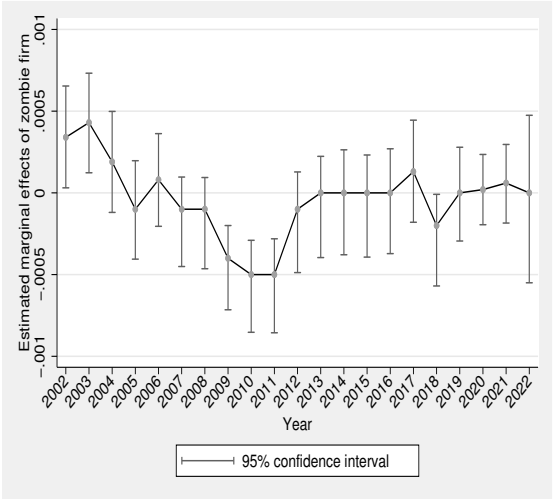


Figure 13-3: Leverage

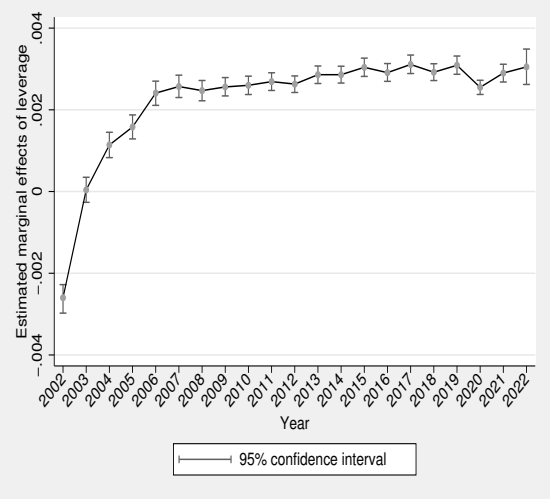
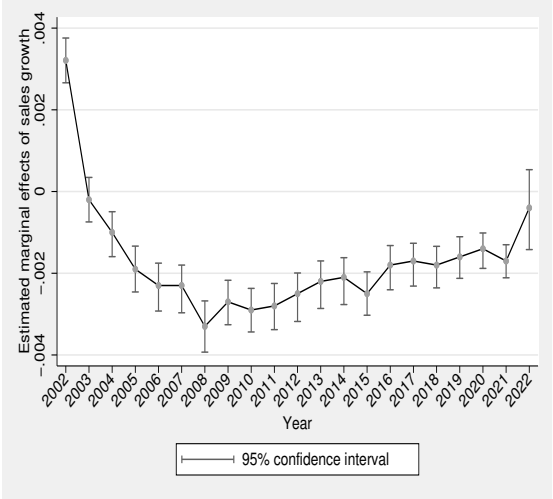


Figure 13-4: Sales growth



Note: These figure parts show the estimated marginal effects of cash flow, zombie firm dummy, leverage, and sales growth on default for each year using the estimation results of Table 6.

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Table 7: Estimated Results for the Propensity Score Matching Method Using Default

	(1)			
	Default			
	Treatment	Control	ATET	S.E.
2002	0.01121	0.00716	0.00404	0.00031
2003	0.01124	0.00677	0.00446	0.00029
2004	0.01141	0.00699	0.00442	0.00029
2005	0.01319	0.00855	0.00464	0.00031
2006	0.01552	0.00949	0.00603	0.00033
2007	0.01692	0.01044	0.00648	0.00033
2008	0.01329	0.00824	0.00505	0.00029
2009	0.01421	0.00737	0.00684	0.00028
2010	0.01386	0.00706	0.00681	0.00027
2011	0.01352	0.00631	0.00721	0.00027
2012	0.01162	0.00579	0.00583	0.00026
2013	0.01162	0.00555	0.00606	0.00026
2014	0.01079	0.00526	0.00553	0.00025
2015	0.00996	0.00480	0.00516	0.00024
2016	0.00988	0.00467	0.00522	0.00024
2017	0.01000	0.00492	0.00508	0.00024
2018	0.00903	0.00401	0.00502	0.00022
2019	0.00471	0.00216	0.00255	0.00016
2020	0.00622	0.00306	0.00316	0.00019
2021	0.01193	0.00578	0.00615	0.00028

Note: This table provides estimates of the treatment effects on default. The "ATET" column shows the average treatment effects on the treated items in year t. The standard errors are presented in the "S.E." column. All ATETs are statistically significant at the 1% level. The definitions of the variables are in the notes accompanying Table 6.

Table 8: Estimated Results for the Propensity Score Matching Method Using Profitability

	(1)				(2)			
	ΔProfitability(t, t+1)				ΔProfitability(t, t+2)			
	Treatment	Control	ATET	S.E.	Treatment	Control	ATET	S.E.
2002	–0.02815	0.03913	–0.0673	0.00055	0.00205	0.02183	–0.0198	0.00062
2003	–0.02509	0.04154	–0.0666	0.00053	–0.00664	0.01381	–0.0205	0.00060
2004	–0.03608	0.03129	–0.0674	0.00051	–0.01730	0.00361	–0.0209	0.00057
2005	–0.03632	0.03398	–0.0703	0.00050	–0.01672	0.00494	–0.0217	0.00058
2006	–0.03804	0.03735	–0.0754	0.00051	–0.02705	–0.00300	–0.0240	0.00059
2007	–0.04967	0.03348	–0.0832	0.00051	–0.05658	–0.02914	–0.0274	0.00065
2008	–0.06963	0.03617	–0.106	0.00057	–0.04286	–0.00677	–0.0361	0.00066
2009	–0.04413	0.06608	–0.110	0.00060	0.00317	0.03444	–0.0313	0.00068
2010	–0.03021	0.07021	–0.100	0.00059	0.01660	0.04623	–0.0296	0.00067
2011	–0.03050	0.06442	–0.0949	0.00057	0.00450	0.03462	–0.0301	0.00065
2012	–0.03928	0.04935	–0.0886	0.00055	0.00178	0.02950	–0.0277	0.00063
2013	–0.03485	0.05338	–0.0882	0.00055	–0.00620	0.02232	–0.0285	0.00063
2014	–0.04880	0.03977	–0.0886	0.00054	–0.01685	0.01129	–0.0281	0.00062
2015	–0.04228	0.04620	–0.0885	0.00054	–0.01381	0.01409	–0.0279	0.00062
2016	–0.04769	0.04417	–0.0919	0.00056	–0.01820	0.01099	–0.0292	0.00063
2017	–0.04932	0.04411	–0.0934	0.00056	–0.01659	0.01439	–0.0310	0.00064
2018	–0.04778	0.04833	–0.0961	0.00056	–0.04795	–0.01656	–0.0314	0.00067
2019	–0.08038	0.02501	–0.105	0.00057	–0.08031	–0.03436	–0.0460	0.00070
2020	–0.07501	0.03034	–0.105	0.00059	–0.04502	0.00322	–0.0482	0.00069
2021	–0.04669	0.06389	–0.111	0.00061	0.00521	0.04567	–0.0405	0.00133
2022	–0.03158	0.06512	–0.0967	0.00119				

Note: This table provides estimates of the treatment effects on default. The "ATET" column shows the average treatment effects on the treated items in year t. The standard errors are presented in the "S.E." column. All ATETs are statistically significant at the 1% level. The definitions of the variables are in the notes accompanying Table 5.

Table 9: Estimated Results for the Propensity Score Matching Method Using Sales

	(1)				(2)			
	Δln(Sales) (t, t+1)				Δln(Sales) (t, t+2)			
	Treatment	Control	ATET	S.E.	Treatment	Control	ATET	S.E.
2002	–0.09330	0.02227	–0.116	0.00115	–0.10300	0.01621	–0.119	0.00160
2003	–0.06288	0.04888	–0.112	0.00116	–0.06427	0.04529	–0.110	0.00151
2004	–0.05365	0.05272	–0.106	0.00112	–0.04590	0.05302	–0.0989	0.00150
2005	–0.04430	0.05809	–0.102	0.00111	–0.03886	0.06137	–0.100	0.00153
2006	–0.04855	0.05962	–0.108	0.00113	–0.07327	0.03172	–0.105	0.00147
2007	–0.07901	0.04161	–0.121	0.00106	–0.18516	–0.06340	–0.122	0.00152
2008	–0.16231	–0.00602	–0.156	0.00118	–0.23399	–0.07932	–0.155	0.00160
2009	–0.14207	0.02053	–0.163	0.00119	–0.13188	0.01834	–0.150	0.00158
2010	–0.06125	0.07742	–0.139	0.00118	–0.04742	0.08923	–0.137	0.00157
2011	–0.05561	0.07566	–0.131	0.00115	–0.05478	0.07429	–0.129	0.00154
2012	–0.06011	0.05893	–0.119	0.00113	–0.02316	0.09168	–0.115	0.00152
2013	–0.02639	0.08889	–0.115	0.00118	–0.02564	0.08303	–0.109	0.00163
2014	–0.06090	0.05199	–0.113	0.00118	–0.06258	0.04444	–0.107	0.00160
2015	–0.06017	0.05453	–0.115	0.00119	–0.05420	0.04852	–0.103	0.00162
2016	–0.05588	0.05789	–0.114	0.00124	–0.03720	0.06623	–0.103	0.00165
2017	–0.04540	0.07079	–0.116	0.00125	–0.02650	0.07632	–0.103	0.00169
2018	–0.04664	0.06993	–0.117	0.00124	–0.09618	0.00722	–0.103	0.00173
2019	–0.11932	0.02786	–0.147	0.00129	–0.18085	–0.04568	–0.135	0.00196
2020	–0.14541	0.03720	–0.183	0.00143	–0.08912	0.06371	–0.153	0.00198
2021	–0.02791	0.11804	–0.146	0.00145	0.05086	0.17436	–0.124	0.00382
2022	–0.00461	0.13761	–0.142	0.00303				

Note: This table provides estimates of the treatment effects on default. The "ATET" column shows the average treatment effects on the treated items in year t. The standard errors are presented in the "S.E." column. All ATETs are statistically significant at the 1% level.

Appendix

Table A1: Estimation Results of Cash Flow, Zombie Firm Dummy, Leverage, and Sales Growth on ΔBank Borrowings

	(1)	(2)	(3)	(4)
	ΔBank borrowings	ΔBank borrowings	ΔBank borrowings	ΔBank borrowings
Proxy of $Z_{i,t}$	Cash flow	Zombie firm	Leverage	Sales growth
Proxy of $Z_{i,t}$×Year2002	0.03407***	–0.03763***	–0.23494***	0.04480***
	(0.005)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2003	0.09801***	–0.05952***	–0.24179***	0.06783***
	(0.005)	(0.001)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2004	0.07405***	–0.05469***	–0.23155***	0.06274***
	(0.005)	(0.001)	(0.002)	(0.001)
Proxy of $Z_{i,t}$×Year2005	0.04974***	–0.04504***	–0.21242***	0.05500***
	(0.005)	(0.001)	(0.002)	(0.001)
Proxy of $Z_{i,t}$×Year2006	0.02224***	–0.03466***	–0.19478***	0.04554***
	(0.005)	(0.001)	(0.002)	(0.001)
Proxy of $Z_{i,t}$×Year2007	–0.01723***	–0.02034***	–0.16133***	0.03938***
	(0.004)	(0.001)	(0.002)	(0.001)
Proxy of $Z_{i,t}$×Year2008	–0.08651***	–0.00448***	–0.13168***	0.03044***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2009	–0.13718***	0.00639***	–0.11737***	0.02313***
	(0.004)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2010	–0.11765***	0.00688***	–0.11320***	0.02177***
	(0.004)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2011	–0.08991***	–0.00166**	–0.12173***	0.01931***
	(0.004)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2012	–0.10940***	0.00529***	–0.11405***	0.01550***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2013	–0.12574***	–0.00004	–0.12669***	0.01715***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2014	–0.13031***	0.00494***	–0.11447***	0.01878***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2015	–0.12971***	0.00786***	–0.10592***	0.01659***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2016	–0.12454***	0.00608***	–0.10813***	0.02318***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2017	–0.12281***	0.00734***	–0.10835***	0.01954***
	(0.004)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2018	–0.13948***	0.01071***	–0.10202***	0.01737***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2019	–0.09153***	–0.00475***	–0.12693***	0.03050***
	(0.005)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2020	–0.12494***	–0.00372***	–0.12200***	0.02017***
	(0.004)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2021	–0.18917***	0.02768***	–0.07461***	0.00716***
	(0.004)	(0.001)	(0.001)	(0.001)
Proxy of $Z_{i,t}$×Year2022	–0.23012***	0.02165***	–0.07113***	–0.00371
	(0.010)	(0.002)	(0.003)	(0.003)
Cash flow		–0.08831***	–0.10077***	–0.08814***
		(0.001)	(0.001)	(0.001)
Zombie firm	–0.00610***		–0.00508***	–0.00659***
	(0.000)		(0.000)	(0.000)
Leverage	–0.11350***	–0.11260***		–0.11072***
	(0.001)	(0.001)		(0.001)
Sales growth	0.02778***	0.02801***	0.02872***	
	(0.000)	(0.000)	(0.000)	
Size	0.00510***	0.00426***	0.00548***	0.00474***
	(0.001)	(0.001)	(0.001)	(0.001)
Age	–0.00480***	–0.00549***	–0.00712***	–0.00447***
	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility	–0.01995***	–0.01828***	–0.01541***	–0.01816***
	(0.002)	(0.002)	(0.002)	(0.002)
Cash holdings	0.10163***	0.10146***	0.09404***	0.10124***
	(0.002)	(0.002)	(0.002)	(0.002)
Current assets	0.11961***	0.12041***	0.11624***	0.12067***
	(0.002)	(0.002)	(0.002)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	15,854,973	15,854,973	15,854,973	15,854,973
R–squared	0.042	0.041	0.048	0.040

This table presents estimates from the fixed effects regressions with trade payables (normalized by a firm's total assets) as the dependent variable. The definitions of the independent variables are the same as those in Table 2. The estimation results for the constant term are omitted. The estimated standard errors are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A2: Estimation Results of Cash Flow, Zombie Firm Dummy, Leverage, and Sales Growth on ΔBank Borrowings> 0 Dummy

	(1)	(2)	(3)	(4)
	ΔBank borrowings> 0	ΔBank borrowings> 0	ΔBank borrowings> 0	ΔBank borrowings> 0
Proxy of $Z_{i,t}$	Cash flow	Zombie firm	Leverage	Sales growth
Proxy of $Z_{i,t}$×Year2002	–0.02605***	–0.03362***	–0.22096***	0.09694***
	(0.005)	(0.002)	(0.002)	(0.003)
Proxy of $Z_{i,t}$×Year2003	0.06988***	–0.08519***	–0.22524***	0.13157***
	(0.005)	(0.002)	(0.002)	(0.002)
Proxy of $Z_{i,t}$×Year2004	0.06478***	–0.08389***	–0.21756***	0.12616***
	(0.005)	(0.002)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2005	0.03702***	–0.06966***	–0.20324***	0.11249***
	(0.004)	(0.002)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2006	0.00148	–0.05164***	–0.18655***	0.10339***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2007	–0.01823***	–0.03653***	–0.16925***	0.09163***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2008	–0.01509***	–0.04251***	–0.17074***	0.06916***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2009	–0.14534***	–0.00167	–0.13297***	0.06712***
	(0.003)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2010	–0.13315***	–0.00155	–0.12611***	0.06430***
	(0.003)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2011	–0.13820***	–0.00176	–0.12034***	0.04939***
	(0.003)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2012	–0.14833***	0.00427***	–0.11580***	0.04857***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2013	–0.17093***	0.00282**	–0.11960***	0.05060***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2014	–0.16817***	0.00079	–0.11449***	0.06095***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2015	–0.16173***	0.00059	–0.11333***	0.05507***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2016	–0.16276***	0.00756***	–0.10730***	0.07350***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2017	–0.17433***	0.01380***	–0.10657***	0.05958***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2018	–0.18720***	0.01632***	–0.10377***	0.06132***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2019	–0.10139***	–0.02833***	–0.14729***	0.05969***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2020	–0.08949***	–0.02782***	–0.15637***	0.05520***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2021	–0.24109***	0.04717***	–0.08321***	0.03136***
	(0.004)	(0.001)	(0.001)	(0.002)
Proxy of $Z_{i,t}$×Year2022	–0.24614***	0.02418***	–0.08459***	0.03328***
	(0.007)	(0.003)	(0.002)	(0.005)
Cash flow		–0.11043***	–0.12314***	–0.11023***
		(0.001)	(0.001)	(0.001)
Zombie firm	–0.01518***		–0.01462***	–0.01601***
	(0.000)		(0.000)	(0.000)
Leverage	–0.12208***	–0.12163***		–0.11937***
	(0.000)	(0.000)		(0.000)
Sales growth	0.07026***	0.07065***	0.07129***	
	(0.001)	(0.001)	(0.001)	
Size	0.00567***	0.00506***	0.00550***	0.00586***
	(0.001)	(0.001)	(0.001)	(0.001)
Age	–0.01297***	–0.01391***	–0.01494***	–0.01232***
	(0.001)	(0.001)	(0.001)	(0.001)
Tangibility	–0.10874***	–0.10719***	–0.10347***	–0.10717***
	(0.002)	(0.002)	(0.002)	(0.002)
Cash holdings	0.04327***	0.04263***	0.03741***	0.04171***
	(0.002)	(0.002)	(0.002)	(0.002)
Current assets	0.13621***	0.13688***	0.13332***	0.13723***
	(0.002)	(0.002)	(0.002)	(0.002)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	15,921,960	15,921,960	15,921,960	15,921,960
R–squared	0.026	0.026	0.028	0.026

This table presents estimates from the fixed effects regressions with trade payables (normalized by a firm's total assets) as the dependent variable. The definitions of independent variables are the same as those in Table 2. The estimation results for the constant term are omitted. The estimated standard errors are shown in parentheses. The symbols *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.