The Effect of Government Bank Lending: Evidence from the Financial Crisis in Japan

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Abstract

We find that increases in lending by Japanese Government Owned Bank (GOB) during the crisis in early 1990's had a strong incremental impact on firm level investment, especially for credit constrained firms. Firms have better future accounting performance when their investment is associated with increases in GOB lending. The impact of increases in private bank lending on real investment is much smaller than that of GOB lending. This is partly driven by the tendency of private banks to support zombie firms and partly due to an increase in precautionary cash holdings of firms receiving private bank credit. Thus, our results show that direct intervention by GOBs can be effective in mitigating credit constraints and stimulating investment during a crisis, even for publicly traded companies.

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1. Introduction

During the financial crisis of 2008-2009, most governments around the world aggressively moved to mitigate the effects of the crisis by providing guarantees on bank debt and/or injecting capital into banks. The immediate aim of such bailouts was to avoid a systemic crisis; however, one important longer-term goal was to promote bank lending to the real economy. While these governmental actions undoubtedly achieved the first objective, the impact of such bailouts on the second objective has been questioned. In particular, the recapitalizations may have induced banks to hoard liquidity (Acharya, Shin and Yorulmazer, 2011) or even reduce credit to borrowers in order to inflate their capital ratio during a crisis (Giannetti and Simonov, 2013).

An alternative governmental policy to promote lending to the real sector is for the government to act directly as a lender. Theoretically, Mankiw (1986) and Bebchuk and Goldstein (2011) show that a policy where the government directly supplies credit to the real sector as 'lender of last resort' during a crisis can have beneficial effects on the real economy. Consistent with the perceived beneficial impact of such a policy, the US government provided direct loans to non-financial firms such as General Motors as part of the government's Troubled Asset Relief Program (TARP) during the financial crisis of 2008-2009. Despite the importance of direct lending by the government as a potential policy tool, there are very few studies that have empirically examined the effectiveness of such a policy in stimulating firm level investment during a crisis.[1]

We examine this question using the period immediately after the burst of the asset price bubble in Japan in the early 1990's. The burst of this bubble led to a banking crisis as well as a stagnant economy. With the onset of the crisis period, we find that the increases in lending by Japanese Government Owned Banks (GOBs, henceforth), partially offset the decline in lending by private banks. We focus on the effects of this increase in GOB lending on firm investment. Our main result shows a strong incremental effect of increases in GOB lending on corporate investment during the crisis period compared with a normal period. In particular, firms that receive an increase of 1 Yen in GOB lending expand corporate investment by ¥0.86 during a normal period, and further increase investment by ¥0.66 during the crisis, relative to firms that do not receive any increase in GOB lending. Our results show that the impact of GOB lending has a multiplicative effect on investment during the crisis period. Our results also suggest that GOB lending mitigate financial constraints during a crisis, which is consistent with the predictions by Mankiw (1986), Bebchuk and Goldstein (2011), and Stiglitz (1989a, 1989b).

Since the onset of the crisis was definitely an unanticipated event, the results above are more consistent with a causal effect. To further sharpen our identification strategy, we examine the effects of increases in GOB lending across firms with different credit constraints using two measures. First, we use the Rajan–Zingales measure of industry-level financial constraints of external financing using US data to compute these measures. As a second measure of credit constraint, we compute the health of

[1] Among the few studies, see Coleman and Feler (2015) and Ru (2017).

relationship banks for each firm. We use the method by Caballero, Hoshi and Kashayp (2008) to identify zombie firms, compute the exposure to zombie firms for each bank and aggregate the exposure for the relationship banks at the firm level. Using both these measures of financial constraints, we find that investment of more financially constrained firms respond by a larger magnitude to increases in GOB lending, particularly during the crisis. As an auxiliary analysis, we examine the cash flow sensitivity of corporate investment and find that an increase in GOB lending reduces the sensitivity. Our overall results show that GOB lending, particularly during the crisis, is effective in mitigating firms' financial constraints.

It is possible that the positive effect of increases in GOB lending on corporate investment could be biased due to the self-selection of certain firms or industries by the GOBs. We address this in several ways. First, we add a dummy variable for increases in GOB lending (an extensive margin) along with the dollar value of increase (an intensive margin). We find that the main effects continue to hold, with a marginal effect of ¥0.58 during the crisis. We further rely on the instrumental variable "Amakudari", which is defined as the number of retired government officers sitting on the corporate board, and employ a dynamic GMM estimation by Arellano and Bond (1991). All results consistently show a positive effect of government bank lending on private investment both during the non-crisis and the crisis period, with a larger effect during the crisis period.

In the next part of the analysis, we examine if the positive effect of increases in GOB lending on investment is an efficient allocation of credit. We have two types of tests in this category. First, to explore if increases in GOB lending allowed firms to capture better investment opportunities, we examine if the sensitivity of investment to investment opportunities (measured by Tobin's Q) increases with increases in GOB lending. If the increases in GOB lending were made otherwise for political reasons, a firm should increase investment regardless of the firm's future investment opportunities. Our result shows that increases in GOB lending allows firms to capitalize better on investment opportunities. To further test the efficiency of GOB lending, we examine the impact on future accounting and stock return performance. We find that future accounting performance (ROA) of companies increases when corporate investment is associated with increases in GOB lending. From a shareholder's perspective, we examine calendar-time event portfolio returns for firms that received increases in GOB lending. We find small and positive abnormal returns for value weighted portfolios, and insignificant positive returns for equally weighted portfolios, suggesting that increases in GOB lending were generally beneficial to shareholders.

While our results generally suggest the efficiency of GOB lending, Japanese private bank lending to zombie firms has been one of the major distortions of efficiency during the Japanese financial crisis (Peek and Rosengren, 2005; Caballero, Hoshi and Kashayp, 2008). The empirical literature on state owned banks in many countries suggests that their lending is often motivated by political factors that can be value-reducing from an economic perspective (La Porta et al, 2002; Sapienza 2004; Dinç, 2005;

Imai, 2009; Carvalho, 2014).[2] These empirical findings support the model by Shleifer and Vishny (1994) where government lending is motivated by political factors. To test the above, we examine differential effects of increases in GOB lending on investment for zombie and non-zombie firms. We find that the effect is present only for non-zombie firms, suggesting that the increases in investment are not inefficient.

If Japanese private banks had strong incentives to extend credit to otherwise insolvent borrowers to inflate their capital ratio due to the concern over the capital adequacy ratios during the crisis (Peek and Rosengren, 2005; Hoshi and Kashyap, 2010), the impact of private bank lending on investment is expected to be weak. As expected, we find that the impact of the increases in private bank lending on investment is significantly smaller than that of GOB lending. In particular, we find that an increase of private bank lending by one yen merely results in ¥0.028 increase in investment during a normal period and no further increase during the crisis. Further, our result suggests that increases in private bank lending induce firms to accumulate more precautionary cash holdings and invest less in real assets. In contrast, increases in GOB lending are associated with lower cash holdings for recipient firms during the crisis. This may be one explanation for the multiplicative effect of GOB lending on investment during crisis.

Collectively, our results are best explained by the argument that GOB lending is efficiently allocated to help companies mitigate credit constraints arising from market failures during the crisis period. Horiuchi and Sui (1993) argue that government owned banks in Japan were an effective instrument by which the Japanese government stimulated long-term economic growth. Our results show that the Japanese GOB system can also have positive real effects during crisis periods, particularly for firms facing credit constraints from private banks. The crisis of Japan in the 1990's provides a good laboratory for understanding the effect of direct government lending vis-à-vis the crisis of 2008 in the US, particularly due to the similarity of the two crises (Hoshi and Kashyap, 2010). Thus, our findings may also be applicable to other advanced economies. Although we cannot rule out the fact that political decisions might affect GOB decisions, our results clearly point to the positive effects of GOB lending in response to market failures and credit constraints, which have not been emphasized in the previous literature.

Only a few studies have examined the impact of direct lending of government on the real economy. Our results are in line with the findings by Coleman and Feler (2015) who examine the aggregate local economic performance in Brazil during and after the financial crisis following the collapse of Lehman Brothers in 2008. They find that firms located in districts with a higher share of government owned banks receive more loans and experience better economic outcomes, relative to firms in districts with a lower share of government owned banks. Focusing on the externality of government credit, Ru (2017)

[2] Morck, Yavuz and Yeung (2013) find that, where larger fraction of the banking system is state controlled, government policy targets fixed capital growth, suggesting some short run benefits of state control.

finds that credit from China Development Bank (CDB) has positive spillover effects in related industries in terms of investment by examining state level data in China.

The remainder of this paper is organized as follows; Section 2 provides institutional details of the 1990's crisis in Japan, as well as an overview of government owned banks in Japan. We describe our data set and variables in Section 3. Section 4 presents our main empirical analysis of the impact of GOB lending on corporate investment. Section 5 examines the efficiency of GOB lending and Section 6 compares the impact of GOB lending with that of private bank lending on real investment and cash holdings. Section 7 concludes with directions for future research.

2. Institutional Details of the Japanese Banking Market

2.1 The Japanese Financial Crisis of the 1990's

From 1984 to 1989, the Japanese capital markets and the real economy expanded rapidly. The Nikkei 225 Stock Index level was around 10,000 in 1984 and reached a peak level of 38,916 on December 29, 1989. Similarly, the land price index rose rapidly during the late 1980s. Meanwhile, private investment also expanded dramatically. The business press has extensively referred to this period as a bubble period. Concerned with overheating in the asset markets, the Bank of Japan increased the official discount rate and imposed limits on the growth of commercial bank lending to real estate related projects. These policies resulted in significantly tighter credit market conditions. As a consequence, both stock and real estate prices fell sharply during 1990-1992.

The Nikkei 225 Stock Index started to fall in early 1990, reaching 20,222 by October 1, 1990. This was followed by large declines in real estate prices. This deflation in asset prices severely damaged the collateral value and caused the Japanese economy to contract significantly (Gan, 2007a, 2007b; Goyal and Yamada, 2004). Concerned with the potential for default risk, private banks in Japan reduced or suspended their lending, imposing a large negative impact on bank loan supply.[3] According to a survey by the Japanese Banking Association, private banks suspended 6,956 transactions for firms with capitalization over 1 million yen in 1989. In 1992, this number reached as high as 15,854, which was more than twice the number of suspensions as in 1989.

Meanwhile, macroeconomic evidence suggests GOBs stepped in and provided funds to fill in the financing gap during the crisis period. Figure 1 compares aggregate private lending and GOB lending to the Japanese private non-financial sector, using the flow of funds data from the Bank of Japan. This figure shows a large net increase in GOB lending after 1990, as private lending decreased sharply during the crisis. This suggests that GOBs intervened to mitigate the effect of shrinking private lending. Also, according to a statistic compiled by the Bank of Japan, the fraction of aggregate long term loans

[3] A suspension is defined as non-renewal of an existing loan contract.

extended by GOBs increased from 2% of the total annual long term funds in 1989 to more than 30% in 1993.[4]

Figure 2 shows the time series pattern of the increase in GOB lending, both in terms of the number of firms and the magnitude for listed non-financial corporations in our data sample. We find that there is a sharp increase in the number of firms that experienced an increase in GOB lending after the onset of the crisis in 1990. We also observe that the magnitude of GOB lending increased throughout the crisis.[5,6]

Based on the level of the stock market index around its peak at the end of 1989, we define the 'bubble period' from 1987 to 1990 and the 'collapse year' as 1991. We define the period starting from 1991 to 1994, as the crisis period - since industrial production growth slowed markedly from 4.04% in 1990 to 1.80% in 1991, and further to negative growths in 1993 (-6.04%) and 1994 (-3.76%). (See Figure 1.) We define the period from 1995 to 1997, as the post crisis period since the production growth in 1995 increased to 2.95% and the economy temporarily recovered until 1997, after which the growth turned negative again in 1998 at -6.04%.[7] The growth in production is also consistent with the recovery of capital investment that started in 1995.

We exclude the data after the end of 1996 in our main empirical tests to avoid any confounding effects of recapitalization of Japanese banks in the late 1990's and the effects of restructuring of the GOBs, which started in 1998. Particularly, the recapitalizations of private banks by the government should have decreased funding constraints at private banks, and in turn, their borrowing firms. Giannetti and Simonov (2013) show that, if capital injections were large enough, they had positive real effects on private bank lending and firm investment as capital injection to banks decreased financial constraints in the private banking sector. To check the robustness of our main results, we use data until 2007 which includes the period of bank recapitalization as well as the economic downturn from 1997 to 2000 as the second crisis period. We find that all our results are robust to the inclusion of the period after 1997.

2.2 Government Owned Banks in Japan

Japan has various types of government banks that provide loans to different sets of borrowers.[8] These government banks, which do not take deposits from the public, have received most of their funds

[4] Long term funds include equity, long term bonds and long term bank debt.

[5] Coleman and Feler (2015) document a similar pattern in Brazil during the 2007-08 financial crisis in the US.

[6] In unreported results, we regress GOB lending on crisis and find a positive and significant coefficient on the crisis dummy, suggesting that government owned banks increased lending during the crisis period.

[7] The increase in the consumption tax rate from 3% to 5% and the termination of special tax reduction program in 1997 are considered major factors that killed the nascent economic recovery, which started in 1995.

[8] They are Japan Development Bank, People's Finance Corporation, Agricultural Forestry and Fisheries Finance Corporation, Hokkaido and Tohoku Development Corporation, Local Public Enterprise Finance Corporation, Environmental Sanitation Business Finance Corporation, Export Import Bank of Japan, Housing Loan Corporation, Small Business Finance Corporation, Small Business Credit Insurance Corporation, Commerce and Industry Finance Corporation and Okinawa Development Finance Corporation. Local Public Enterprise Finance Corp and Housing Loan Corporation are most likely not included in our sample as they are less likely to lend to private corporations. For details, see Imai (2009).

from the Fiscal Investment and Loan Program (FILP). The FILP had been mainly funded by the postal savings and insurance systems until 2000.[9] Similar to the general accounting budgets of the government, the FILP budgets are proposed by the Ministry of Finance.

The GOBs supply long term credit to firms whose projects are regarded as important for the economic development (Horiuchi and Sui, 1993). The Ministry of International Trade and Industry (MITI) actively recommends potential borrowers to these government owned banks.[10] For example, Japan Development Bank and Export-Import Bank were established to provide long-term loans to large firms in industries that the Japanese Government considers important for its policy objectives. Government banks that provide loans to smaller firms, such as Japan Finance Corporation for Small Business and People's Finance Corporation, have been established mainly aiming to provide credit for firms that might have difficulty receiving loans from private banks. There are also a few government banks that have been established to provide credit for the development of certain regions such as the Hokkaido and Tohoku Development Corporation and the Okinawa Development Finance Corporation (See Imai, 2009).[11]

Although the GOBs provide credit in line with the Japanese Government's policy objectives, they are also very active in searching for business, can decide credit allocations independent from the government, and can also act like private commercial banks to supply loans in the form of syndicated loans. They also monitor the performance of borrowers during the loan period regularly by requiring financial and operational reports from their borrowers, or consulting other private banks to obtain information. Due to the dominance of the private banking sector, the proportion of financing provided by GOBs is relatively small in terms of outstanding loans. Although the average value of GOB lending is around 15% of the total corporate borrowing from banks for our sample of listed non-financial firms (see Figure 3), the penetration of GOB lending is quite significant even among listed firms, with more than 40% of the firms having outstanding loans from the GOBs (Table 1 Panel A).

3. Data and Summary Statistics

3.1 Data and Key Variables

Our main sample consists of all listed companies in Japan, excluding financial institutions and utility companies. Accounting information, bank loan information, and historical stock prices are obtained from the Nikkei Corporate Financial Database (Nikkei), Nikkei Bank Loan Database and Pacific-Basin Capital Markets Research Center (PACAP), respectively. The Nikkei Bank Loan database includes loans that are outstanding from individual banks for each company at the fiscal-year-

[9] FILP is no longer funded by the postal savings system since 2001. It is financed by issuing bonds that are considered equivalent to government bonds.

[10] MITI has been reorganized and changed its name to Ministry of Economics, Trade and Industry in 2001.

[11] The reorganization of Japanese government owned banks resulted in three banks (Development Bank of Japan, Japan Finance Corporation and Shoko Chukin Bank) and Japan International Cooperation Agency, as of 2008.

end. We obtain 22,009 firm-year observations with adequate loan information and 19,076 firm-year observations with both loan and stock price information from 1978 to 1996 for our main analysis.[12]

We identify nine major government owned banks in Japan that supply credit to the publicly traded companies in our data sample. These banks are 100% owned by the Japanese government during our sample period of study. We construct a variable 'GOBI,' that is computed as the ratio of the positive net annual increase of the total amount of GOB loans to the total capital of the borrowing firm in the previous year. Total capital is defined as the total amount of tangible fixed assets of the firm. Specifically, if $TL_{i,t}$ is the total amount of outstanding GOB loans of a given borrowing firm 'i' in year 't, and $K_{i,t}$ is the total capital of the same borrowing firm 'i' in year 't', then $GOBI_{i,t}$ is defined as follows:

$$GOBI_{i,t} = Max[\ (TL_{i,t} - TL_{i,t-1})/K_{i,t-1},\ 0]$$

This is the principal measure that we use in the empirical analysis to measure the effect of increases in GOB lending on investment as we are interested in the effect of increase in GOB lending at the firm level. Following prior literature on investment in Japan (Kang and Stultz, 2000, Goyal and Yamada, 2004), we define investment as the change in tangible fixed assets plus depreciation. The important variables used in the empirical analysis are cash by assets, size, book leverage, ROA, cash flow and Tobin's Q. Tobin's Q is proxied by the ratio of the market value of assets to total book assets (Chung and Pruitt, 1994). A detailed definition of all variables is presented in the Appendix.

3.2 Summary statistics

Table 1 presents summary statistics for the key variables for our entire data sample. Table 1, Panel A shows that the average proportion of GOB loans to total borrowing is around 6.7%, suggesting that the market share of GOBs is small compared to that of private banks. However, from Panel B, we observe that 12,176 out of 22,009 firm-years, record loans outstanding from GOBs, suggesting that the penetration of GOBs is broad (55.3%) in public firms. In addition, Panel B shows that the fraction of firms with increases in GOB lending, i.e., positive GOBI, goes from 10% (446/4489) to 17 % (648/1671) in the contraction period. This is consistent with the notion that GOBs actively step in to mitigate the detrimental effects of the crisis.

Panel C shows the changes in firm fundamentals before and after the collapse of the equity market in 1991. We document a sharp decline in capital investment, cash holding, growth opportunity and profitability (ROA) after 1991. In particular, the results in Panel C show a 46% reduction in capital investment and a 31.8% decline in profitability after the collapse of the equity market. We further split our sample into sub-samples of firms that receive increases in GOB lending and those that do not. Firms with positive values of GOBI have the average investment level of 7.3% in the pre-collapse period, which was maintained at the level of 7.2% in the post-collapse period. In contrast, firms with non-

[12] We delete firms that do not have any information on the borrowing from banks.

positive values of GOBI's reduce their investment from 6.1% in the pre-collapse period to 2.5% in the post-collapse period. Thus, firms with an increase in GOB lending are able to maintain their investment levels during the contraction period relative to the firms that did not receive any increase in lending. This provides strong univariate evidence that an increase in GOB loans is associated with significantly lower investment reduction during the crisis.

We also find that firms with positive values of GOBI tend to have greater leverage than other firms. These firms have a higher Tobin's Q (1.432 vs. 1.361), lower cash flow to capital ratio (0.129 vs. 0.245) and lower cash by asset ratio (0.109 vs. 0.151) during the pre-collapse period. We also observe similar differences in the firm characteristics between the two groups of firms during the post-collapse period. Thus, firms with increases in GOB lending have lower corporate liquidity but have greater growth opportunities.

Figure 3 plots the increase in GOB loans to our sample of publicly traded non-financial firms during our sample period. In contrast to the large aggregate change in GOB lending to the corporate sector in Figure 1, the share of GOB loans in total bank loans for publicly traded companies increases only by around 4% from 1991 to 1994 (the crisis period), which implies that the large increase in aggregate GOB lending was concentrated on SME's and private enterprises.

In Figure 4, we compute the correlation between increases in GOB lending and increases in private bank (PB, henceforth) lending in our sample for each year to examine if GOB lending substitutes for PB lending. To the extent that GOBs seek to mitigate credit constraints on account of reduction in private lending during the crisis, we should find a negative correlation, particularly during the crisis. We find that this correlation is strongly *positive* until 1987. The correlation falls dramatically during the bubble period followed by negative correlations during the crisis. Such pattern suggests a counter-cyclical policy of GOB lending which is less prone to over-lending in the bubble period and substitutes private bank loans in the crisis.

In sum, since our summary statistics suggest that an increase in GOB lending, which is negatively correlated with PB lending during the crisis, is associated with an increase in firm investment, GOB lending might have mitigated the tighter financial constraints arising from the contraction of PB lending. We examine this question in detail in the following section.

4. Empirical Results

4.1 Effect of GOB Lending on Capital Investment

Our principal empirical tests examine the effect of increases in GOB lending on real investment. We use a specification based on the Q-theory of investment, where investment is a function of Tobin's Q ratio, which is augmented with internal cash flow (Fazzari, Hubbard, and Petersen 1988). We also include other firm specific variables as well as year and firm fixed effects to account for unobservable time and firm level heterogeneity.

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha\, GOBI_{i,t} + \beta \frac{CF_{i,t}}{K_{i,t-1}} + \delta Q_{i,t-1} + \gamma F_{i,t} + v_i + u_t + e_{i,t} \quad (1)$$

In the above equation, suffix *i* refers to firm *i* and *t* refers to fiscal year *t*. We compute the industry adjusted investment to capital ratio by taking the difference of this variable from its industry median value in the given year. This industry adjustment is motivated in part by the Japanese government's policies to support certain industries (Hoshi and Kashyap, 2001).[13] Such policy induced investment changes should be reflected in the industry median. Therefore, taking the difference of the firm level investment and industry level investment should isolate the impact of firm specific factors.[14] As defined earlier $GOBI_{i,t}$ is the net increase in outstanding GOB loans from the previous year scaled by the capital at the end of the previous year, $K_{i,t-1}$. By scaling by capital, we estimate the marginal increase in investment for a unit increase in the value of a GOB loan. We define cash flow ($CF_{i,t}$) as net income before extraordinary items and depreciation, and *Q* is Tobin's Q. The vector F consists of firm specific financial variables, v_i is the firm fixed effect, u_t is the year fixed effect, and $e_{i,t}$ is the idiosyncratic error. (See the appendix for a detailed definition of all variables used in the empirical analysis.)

Table 2 reports the results for the baseline specification in equation 1. The reported t-statistics and p-values are based on robust standard errors clustered at the firm level. All regressions, unless otherwise mentioned, have firm and year fixed effects as well. In column (1) of Table 2, the estimated coefficient of GOBI is positive and significant at the 1% level, suggesting that an increase in GOB lending is associated with increased firm investment. In particular, the coefficient value of 0.973 suggests that a ¥1 increase in GOB lending is associated with an increase in firm investment of ¥0.973. The coefficients on Tobin's Q are positive and significant at the 1% level. This regression suggests that government owned bank lending can help boost investment, regardless of whether the given period is a crisis period or a non-crisis period.

As our first identification strategy, we augment equation (1) by interacting *GOBI* with the crisis dummy to examine the effect of GOB lending on corporate investment during crisis relative to normal times. Coleman and Feler (2015) use a similar identification strategy to examine the impact of government bank penetration on real economic activity, comparing crisis and post-crisis periods. Column (2) shows that the coefficient on GOBI interacted with the crisis dummy is positive and significant; suggesting that an increase in GOB lending has a greater impact on investment during the crisis. More specifically, an increase of one yen in GOB lending results in an increase of investment between ¥0.864 in normal times, and additional impact of ¥0.660 during the crisis, suggesting a multiplier effect of GOB lending on investment which is particularly strong during the crisis. These values are highly significant in economic terms.

[13] For example, in the early 1990s, the Japanese Government considered the animation and cartoon industries as important export industries.

[14] Our results are qualitatively the same if we do not adjust the firm investment by the industry median value.

In column (3), we examine the robustness of these results by including other control variables in the regression. The role of additional control variables is to account for time varying firm characteristics that might impact investment. Firms with high leverage are more likely to be financially constrained or distressed, or both, relative to firms with lower leverage. We posit that firm size is inversely related to financial constraints, and *ROA* is an alternative proxy for future growth opportunities, although a high *ROA* could also mean that the firm has more cash at its disposal and is less financially constrained. Under both interpretations of *ROA*, one would still expect a positive impact on investment. Although we find that these additional control variables have the expected effects on investment, the magnitude and statistical significance of GOBI on investment is not affected by the inclusion of these additional control variables. Although the net effect of GOBI on investment in column (3) reduces to 0.84 compared with that of Model (1), the coefficient continues to be both statistically and economically significant.

In column (4), we add dummy variables for periods of bubble, collapse and contraction to investigate the differential impact of increases in government bank lending during these different periods. We find that the coefficient on the interaction term between *GOBI* and *Bubble* is insignificant, while those on the interaction terms *Collapse*×*GOBI* and *Contraction*×*GOBI* are both positive and significant. This result suggests that GOBs step in to support corporate investment during periods when the PB lending market dries up. Markedly, the insignificant coefficient on *Bubble*×*GOBI* implies that GOB lending did not contribute to higher rates of corporate investment during the bubble period, which contrasts with the increase in lending from private banks to real estate related projects during the period (Goyal and Yamada, 2004), suggesting that GOB lending decisions were not affected by the euphoria of the bubble period.

4.2 Government Bank Lending and Financial Constraints

To sharpen our identification strategy, we study the differential effect of increases in GOB lending for firms with different financial constraints. We use proxies of financial constraints that are considered sufficiently exogenous to the firm. Recent studies by Cingano et al. (2016), Chedorow-Reich (2014) and Laeven and Valencia (2010) use various measures of financial constraints to examine their impact on real economic activity. While these studies examine the real effects on firms with different financial constraints only during the crisis period, our approach not only compares the difference in real effects for firms with different financial constraints, but also compares the difference in the real effects between the crisis and normal periods. Thus, our identification strategy is similar to a triple difference strategy used by Duygan-Bump et at. (2014).[15]

[15] Duygan-Bump et al (2014) use the recession of 2007-2007, firm size and a firm's dependence on external financing as the identifying variables.

First, we use the measure of a firm's external financial dependence by Rajan and Zingales (1998) or the RZ measure. Specifically, the RZ ratio measures the gap between internal cash flow and capital expenditures, capturing the extent to which a firm relies on external financing. We use industry level data from the US to compute the RZ measure.[16] We define a firm as a high RZ firm if its value of the RZ ratio is larger than the sample median RZ ratio in year t.

Second, we construct a variable that measures the degree to which a firm's relationship banks have credit problems. To the extent that the firm's relationship banks themselves have constraints, this should also make the borrowing firm financially constrained. Specifically, we construct a variable called *"Troubled Relationship Banks,"* which is a weighted average of the exposure of a firm's relationship banks to zombie borrowers. After the onset of the Japanese financial crisis, it is well documented that Japanese private banks allocated credit to insolvent borrowers to keep them afloat, hoping that these borrowers might turn around in the future. Further, by keeping zombie firms alive, banks hoped to prevent their regulatory capital ratios from deteriorating (Hoshi, 2000; Caballero, Hoshi and Kashyap, 2008). Therefore, when these relationship banks had a large exposure to zombie firms, it would have been difficult for other borrowing firms with the same relationship banks to obtain loans for new investment, making such firms financially constrained. There are four steps in constructing the variable *Troubled Relationship Banks*. First, we classify each firm-year between 1990 and 1996 in our sample as a zombie or non-zombie observation. Second, we obtain the exposure of each bank in each year to zombie borrowers. Third, we construct a weighted average of the zombie exposures of all relationship banks of a given borrower in each year. Fourth, we construct a dummy variable for high zombie exposure for each borrowing firm for each year.

For the first step, the classification of a firm as a zombie (insolvent borrower) follows the method suggested by Caballero, Hoshi and Kashyap (2008). Specifically, we create a lower bound for interest that a firm should pay during a given fiscal year:

$$R^{*}_{i,t} = rs_{t-1} \times BS_{i,t-1} + 1/5(\sum_{j=1}^{5} rl_{t-1}) \times BL_{i,t-1} + rcb_{\text{min last 5 year},t} \times Bond_{i,t-1}. \qquad (2)$$

where rs is the short term loan prime rate, BS is the short term loan outstanding, rl is the long term prime rate, BL is the long term loan outstanding, rcb is the observed minimum coupon rate for convertible bonds and Bond is outstanding bonds. If the interest expenditure of the firm during that fiscal year is below the lower bound, this suggests that the firm is heavily subsidized by its banks. A firm-year where the firm's interest cost is below its imputed lower bound is classified as a zombie firm-

[16] Rajan and Zingales (1998) similarly use constraint measures computed using US data for measuring the causal effect of financial development on economic growth in a panel of global countries, to avoid the potential reverse causality of financial development being caused by economic growth. Using constraint measures computed using US data for Japanese firms bias against finding significant results for our study.

year observation.[17] To implement the second step, for each bank 'j' in year 't', we define its zombie exposure as follows:

$$Zombie\ Exposure_{j,t} = \frac{Total\ lending\ to\ zombie\ borrowers\ by\ bank\ j\ in\ year\ t}{Total\ \ lending\ by\ bank\ j\ in\ year\ t}$$

To implement the third step, for each borrowing firm 'i', we define *RelBank Constraints*$_i$ as the *mean value* of the weighted average of its relationship bank's zombie exposure, where the weighting is the fraction of its lending of the borrower coming from a given bank as shown below.

$$RelBank\ Constraints_i = \frac{1}{7}\sum_{t=90}^{t=96}\sum_{j=1}^{J}\frac{Borrowings\ by\ firm\ i\ from\ bank\ j\ in\ year\ t}{Borrowings\ by\ firm\ i\ from\ all\ banks\ in\ year\ t} \times Zombie\ Exposure_{j,t}$$

Finally, we define a firm-year observation as having *'Troubled relationships banks'* if the measured value of *RelBank Constraints*$_i$ is larger than its sample median, and having *'Healthy relationship banks'* if the measured value of *RelBank Constraints*$_i$, is less than its sample median.

Table 3 shows the result for the pair samples that are classified into constrained and non-constrained firm-years, using each of the two measures (RZ measure and Troubled Relationship Banks). For both measures, the results in the table show that the impact of GOB lending in investment is greater for constrained firms relative to unconstrained firms during a normal period. In all cases, the incremental impact of GOB lending during the crisis is also larger for constrained firms relative to unconstrained firms. For example, for firms with a high RZ measure, the coefficient on the interaction term between GOB and Crisis is 0.821 in Column (2). This effect is less pronounced for firms with a lower RZ ratio (0.513, t =1.697). Likewise, for firms with Troubled Relationship Banks, an increase of ¥1 in GOB lending leads to additional increase of ¥1.434 in investment. In contrast, for firms with Healthy Relationship banks, an increase of ¥1 in GOB lending leads to additional increase of ¥0.792.[18]

In Panel B of Table 3, we examine the effect of increases in GOB lending on the cash flow sensitivity of investment. We find a strong reduction in the sensitivity of investment to cash flow when the borrowing firm receives an increase in GOB lending, especially during the crisis. At the same time,

[17]As documented by Fukuda and Nakamura (2011), Caballero, Hoshi and Kashyap (2008)'s measure could possible classify a good firm as zombie firm, since a healthy firm's interest rate could be lower than the prime lending rate. In unreported tables, we modify the measure by Caballero, Hoshi and Kashyap (2008) with two additional criteria. In particular, firms whose earnings before interest and taxes (EBIT) exceeded the hypothetical risk-free interest payments were excluded from being classified as zombies. In addition, those that were unprofitable and highly leveraged (higher than 0.5) and had increased their external borrowings were classified as zombies. However, our results remain the same using this alternative measure.

[18]Virtually all the results in Table 3 have been replicated using a single regression using interaction variables for combined sub-samples. As we find consistent results, we choose a sub-sample presentation for the ease of interpretation. The additional advantage of the sub-sample representation is that it allows for differential effect of the all other independent variables in the regression on investment.

we do recognize that the validity of cash flow as a measure of financial constraints has been questioned in prior literature.[19]

An alternative explanation for the stronger GOB effect on firms with troubled relationship banks is that GOBs might keep zombie firms afloat for political reasons such as maintaining employment (Shleifer and Vishny, 1994). If the above argument is correct, we expect a stronger impact of increases in GOB lending on investment for zombie firms. To examine this proposition, we stratify firms based on measures of zombie firms and investigate whether the GOB effects are mainly concentrated in zombie firms. In addition, we create industry level zombie measures to alleviate any measurement error in the firm level measure. In particular, we classify construction, wholesale, retail sale, real estate and service industries as high zombie industries, since these industries are more likely to include firms that have received 'ever-greening' loans from private banks (Hoshi, 2000; Hoshi and Kashyap, 2004; Caballero, Hoshi and Kashyap, 2008). In Table 4, we find that the GOB effect in investment is mainly concentrated in non-zombie firms and non-zombie industries. We also find that the effect of an increase in GOB lending on investment is insignificant for zombie firms or high zombie industries. Thus, our result supports the argument that GOBs stimulate investment mainly through the channel of easing the credit crunch. It also mitigates the concern that the increase in lending of GOBs might be allocated for ever-greening zombie firms.

4.3 Risk Shifting: Alternative Explanation

Using US data, Duchin and Sosyura (2014) find that government guarantees associated with GOB lending can motivate firms to undertake excessive risks. Our findings may also be attributed to risk shifting behavior when firms increase investment in response to increased GOB lending. To examine this alternative explanation, we stratify our sample into sub-groups of high and low leverage firms using the median leverage value every year. To the extent that highly levered firms have a stronger incentive to undertake risk-shifting relative to lower leverage firms, we should observe a stronger GOB effect on firms with higher leverage if the increased investment is the result of excessive risk taking by borrowing firms (Jensen and Meckling, 1976). In contrast, our results in Columns (1) and (2) of Table 5 show that the GOB effect is more pronounced for firms with low leverage. Specifically, in response to a ¥ 1 increase in GOB lending, the investment of low leverage firms increases by ¥ 1.65 (0.327+1.328), whereas the investment of high leverage firms increases only ¥1.36 (1.028+0.281). Further, we do not find any significant incremental GOB effect during the crisis period for high leverage firms, while we find significant effects for low leverage firms.

[19]While there are many questions on the validity of investment cash flow sensitivity as a measure of financial constraints (Kaplan and Zingales, 1997 and Erickson and Whited, 2000), it continues to be used a measure of financial constraints in several studies. We view this test as a secondary test of the GOB effect on financial constraints, the primary ones being those in Panels A that are less subject to the criticism of measurement error or cash flow being a proxy for future growth opportunities.

We also use default risk (or distant-to-default) measured by the KMV model as book leverage may not correctly measure the incentive for risk shifting. Similarly, we stratify our sample around the median default probability every year. The results in Column (3) and (4) of Table 5 show that the impact of increases in GOB lending is more pronounced for less risky firms relative to more risky firms. Thus, our results in Table 5 rule out the possibility that risk-shifting behavior drives the increases in investment associated with GOB lending.

4.4 Selection Effect in GOB Lending

The estimated GOB effect might reflect the ability of the GOBs to select good firms that invest more rather than the role of GOBs in mitigating credit constraints, potentially resulting in a biased estimate of the impact of GOB lending on investment. To address this issue, we employ two approaches as follows.

4.4.1 Effects within a sample of firms with GOB lending

We first re-estimate the baseline regression in Table 2 including a GOB increase dummy variable and its interaction with the crisis, in addition to the GOBI continuous variable, as additional independent variables The GOBI dummy variable should capture most of the selection effect (the extensive margin), and the GOBI continuous variable should capture additional incremental effect of increases in GOB lending, i.e., the intensive margin effect.

Table 6, Panel A presents the results of this analysis. We find some evidence of unconditional selection effect – Model 1 in this panel shows that the coefficient for the dummy variable for GOBI is 0.014, which is quite small relative to the intensive margin effect of 0.72. Thus, in a normal period, the selection effect has an order of magnitude lower impact relative to the actual value of the increase in GOB lending.

More importantly, the interaction of GOBI dummy variable with the crisis is not significant, which suggests that the selection effect (which is economically small relative to the intensive margin effect) did not change during the crisis. Further, when comparing the incremental effect of the interaction of GOBI and the crisis, we do find it to be highly significant economically. The incremental effect of GOBI is 0.576 in this model relative to the measured effect of 0.64 in Model 3, Table 3.

If GOB's were selecting fundamentally better firms, we should not observe a GOB effect in the intensive margin within the sub-sample of firms that have a GOB relationship. As a further validation, we re-estimate Model 1 using only the set of firms that had a GOB loan outstanding in the previous year (Models 2 and 3, Table 3, Panel A). In both cases, the continuous GOBI measure is highly significant with similar magnitude as in Model 1. The above strongly suggests that selection effects in GOB lending do not drive the empirical results.

4.4.2. Arellano-Bond estimation

Next, we apply the Arellano-Bond estimation method (1991) to further rule out the potential biases caused by the endogenous variables. The Arellano-Bond (1991) GMM estimator allows for more flexibility in specifying which variables are to be taken as endogenous or truly exogenous and to assign appropriate instruments to endogenous variables. Moreover, the qualities of all the designations can be tested by different standard tests and we can evaluate whether the variables of interest are independent of the error term. The Arellano-Bond (1991) method also enables us to take into account the possible auto correlation in the dependent variables.

As most of independent variables can be potentially jointly determined with investment, we use a conservative approach and designate all other independent variables as being endogenous. We use these variables, lagged 3 to lagged 4 periods, as instruments.

To increase the power of our estimation, we include "Amakudari" as an additional IV in the estimation. "Amakudari" is a practice to employ retired bureaucrats on the board of directors of Japanese private and public corporations. Because the retired bureaucrats can provide a channel to get access to critical information within the government, "Amakudari" is viewed as a connection between the government and private corporations. Consistent with this conjecture, prior studies document that "Amakudari directors" help to bridge communications between government and firms (Horiuchi and Shimizu, 2001). Thus, we argue that "Amakudari" can be viewed as good instrument for government owned bank lending that should be positively related to increases in GOB lending.

In Panel B, the unconditional correlation matrix shows that the Amakudari is positively related to the GOB lending. In addition, in Panel C, we employ a multivariate approach and show that Amakudari has a significant impact on the increases in GOB lending. One may argue that Amakudari also has a direct effect on investment. However, we show that this is not the case in our baseline empirical specification. For example, in Panel B, we find that there is no unconditional correlation between Amakudari and investment. In panel C, once we include the GOBI into the investment regression, we find that Amakudari does not have any direct effect on investment. As discussed later, we conduct a Hansen test to further verify the exclusion condition in the Arellano- Bond estimation.

More specifically, the stability of our regression is evaluated in four tests. First, we test whether the idiosyncratic disturbance is auto correlated at the second lag following Arellano and Bond (1991). This test enables us to justify the number of order in auto correlations. If the second order autocorrelation is significant, the second lagged value of an endogenous variable cannot be used as an instrument because the error term will be correlated with the instrument. In such a case, we have to use the third lagged value of the endogenous variables as an instrument. Second, we examine the Hansen J-statistic of over identification restrictions for all instruments. A significant J-statistic indicates improper instrumentation for endogeneity. Third, we conduct test for the exogeneity of firm size, Tobin's Q and 'Amakudari.' Lastly, we test for the exogeneity of difference of the additional instrumental variables. We report the results of the four tests discussed here in a row titled "regression diagnostics" and indicate each test is

passed using "a," "b," "c," and "d" in panel C. Consistent with earlier multivariate results, we find that an increase in GOB lending effectively stimulates firm investment.

For the investment regression, we find that the effect of GOB lending is significant only during crisis period. The regression diagnostics suggests that the instruments are valid, as J-statistic for all instruments and additional instruments are insignificant.

4.4.3 Summary of results from endogeneity corrections

The results of this section broadly support the notion that GOB lending has a positive effect on investment. Both the intensive margin test and the Arellano-Bond estimation suggest that this incremental effect for investment is more pronounced during the crisis. Taken together with our earlier panel regression results, the above results confirm that investment is positively impacted by GOB lending both during crisis and non-crisis periods, with strong evidence for incremental effects during crisis periods.

5 Efficiency of GOB lending

The previous sections provided evidence that increases in GOB lending increases investment, particularly for firms that are more financially constrained. In this section we examine if the positive effect of GOB lending on investment supports efficient allocation of credit from multiple angles.

5.1 GOB lending and Q

If firms are credit constrained during the crisis, an increase in GOB lending should enable firms to better capture growth opportunities. Thus, we should expect the investment sensitivity to Q to be higher for firms with increases in GOB lending. On the other hand, if GOB lending is simply directed to politically motivated investment projects, there should be no incremental effect of GOB lending on high growth firms. To examine these effects, we interact GOBI with Tobin's Q in our investment regressions. The results of this estimation are presented in Table 7, where we find increasing investment sensitivity to Tobin's Q that is associated with increase in GOB lending for the entire period. Our result shows that an increase in GOB lending results in an increased investment of ¥.0067 for every 0.01 increase in the Q ratio (column 1). However, we do not find any incremental effects during the crisis period (column 2).

5.2 Impact of GOB lending on firm performance

To directly test the efficiency of GOB lending, we examine the future accounting performance of companies that increase investment due to GOB lending. Specifically, we regress the future ROA of the firm on an interaction term between *GOBI* and *Investment*. The result, reported in column (1) of Table 8 Panel A, shows a positive and significant coefficient on the interaction term *GOBI* × *Investment.* We further stratify the periods into crisis and non-crisis periods. The results show that the positive effect

of the investment arising from increased GOB lending on firm ROA is more pronounced in the crisis period relative to the non-crisis period. This suggests that the increase in investment associated with increases in GOB lending is beneficial to shareholders.

If the increases in GOB lending were directed to inefficient investments, shareholders of such firms should have negative abnormal returns. We use the calendar time-based regression approach to estimate abnormal return of firms that receive increases in GOB lending. As we cannot observe the announcement date of the loan, we assume that the end of June of each year is the event date. Since most Japanese firms have a fiscal-year-end at the end of March, accounting information from the previous fiscal year should be available by the end of June. For each month, we form a portfolio consisting of all firms that participated in the event within the previous 1 year (3 years). We calculate monthly value-weighted (VW) and equally weighted (EW) returns for each portfolio, regress the portfolio returns on the Fama-French factors and examine the intercept.[20]

The results are reported in Panel B and C of Table 8. We find that none of the intercepts (alphas) are significantly negative, suggesting that the shareholders are not negatively impacted by increases in GOB lending. For the value weighted portfolio, we find positive abnormal returns from 0.3% to 0.7% in three of the four regressions, whereas for the equally weighted portfolio, the abnormal returns are generally zero. This suggests that larger firms derive greater benefits from increases in GOB lending. Collectively, our results suggest that the increase in investment associated with increased GOB lending is efficient not only from the perspective of the shareholders but also from that of other stakeholders of the borrowing firms.

6. Government Owned Bank Effect versus Private Bank Effect

While our results suggest the efficiency of GOB lending during crisis, Japanese PB loans to zombie firms have been one of the major distortions of efficiency during the Japanese financial crisis (Peek and Rosengren, 2005; Caballero, Hoshi and Kashayp, 2008). In this section, we compare the effects of GOB and PB lending and examine why GOB lending has been efficient.

6.1 Lending to Zombie Firms

First, we compare the future health of firms that are associated with an increase in either GOB or PB lending in a given year. In particular, we compare the future likelihood of becoming a zombie firm for firms that receive increase in GOB lending and those that receive increases in PB lending. Panel A

[20] For June of each year from 1977 to 1997, we sorted all the stocks listed on the Tokyo Stock Exchange, excluding those of financial companies, into two groups according to the market value of their equity (small [S] and big [B]); we also classified them into three groups (low [L], medium [M], and high [H]) based on their book-to-market ratios. We formed six portfolios (S/L, S/M, S/H, B/L, B/M, and B/H) from the intersections of the two size groups and the three book-to-market groups. We calculated monthly value-weighted returns on the six portfolios from July of year t to June of year t + 1 and rebalanced the portfolios in June of year t + 1. Our SMB (HML) portfolio is the difference between the simple average returns on the S/L, S/M, and S/H (S/H and B/H) portfolios and the simple average returns on the B/L, B/M, and B/H (S/L and B/L) portfolios.

of Table 9 shows that, while 3.87% of firms with increases in GOB lending become zombie firms in the subsequent year, 4.52% of firms with increases in PB lending become zombie firms. The difference in likelihood further widens during the post crisis period; 5.90% for firms with increases in GOB lending versus 9.05% for those with increases in PB lending.

In Panel B of Table 9, we employ a logistic regression to further examine the likelihood of being a zombie firm when a company heavily depends on either PB loans or GOB loans. We use the total borrowing from PBs and GOBs, each scaled by a firm's total liabilities, to proxy for the dependence on PBs and GOBs respectively. By controlling for other firm characteristics and various fixed effects, we find that firms depending on PBs are more likely to be zombie firms. In contrast, we do not find any significant association between GOB dependence and the likelihood of being a zombie firm. Thus, our evidence is consistent with the notion that borrowers of PBs tend to undertake more ever-greening loans. Thus, new PB loans are more likely to be used for repayment of existing loans, thereby resulting in a weaker effect of such loans on stimulating investment.[21]

6.2 Impact on Investment

A natural question arising from the previous findings is whether an increase in PB lending is associated with similar effects on corporate investment. We run a regression specification similar to equation (1) by including an additional variable (*PBI*), that measures the positive increase in PB loans between year t and year t-1, scaled by total capital in year t-1. Further, we add interactions between *PBI* and *Crisis*, to see if there is any incremental effect of private bank lending on investment during crisis.

Our results in Table 10 show that PBs do not have the same effect as GOBs on investment. In particular, increases in PB lending have no incremental effect on investment during the crisis. Although we find that an increase in PB lending has a positive effect on investment in the normal period, its magnitude is much smaller than that of an increase in GOB lending. In particular, an increase of ¥1 in PB lending only leads to a statistically non-significant ¥0.013 increase in investment compared with a statistically significant ¥0.686 for GOB lending during crisis.[22]

We further interact *PBI* with *Q* and *Cashflow* in columns (2) and (3), respectively. We find that the lending by PBs does not have a significant impact on the investment sensitivity to *Q*. Although increases in PB lending reduces the investment sensitivity to cash flows (easing the financial constraints), the magnitude of this impact is smaller than that of increases in GOB lending. In contrast, the economic effects of GOB lending are much stronger when interacted with *Q* and *Cash flow*.

We propose two explanations for the significantly higher effect of GOB lending relative to PB lending on investment during the crisis. First, during the Japanese crisis in the early 1990's, PBs had strong incentives to engage in ever-greening zombie borrowers since they were more constrained by

[21] In unreported results, we run a reverse regression and find a consistent result that GOBs tend to lend more to high RZ firms but less to zombie firms.

[22] In unreported tables, we decompose the total lending into short-term lending and long-term lending. The results consistently show that GOB lending has a stronger impact on investment than PB lending does, regardless of the loan tenors.

the regulatory capital ratio. A large body of literature has shown the PBs' exposure to the real estate market resulted in a sharp decline in their regulatory capital ratio (Hoshi, 2000; Hoshi and Kashyap, 2004; Caballero, Hoshi and Kashyap, 2008). To avoid regulatory scrutiny and hope that the non-performing borrowers can turn around and repay the loans, many PBs chose to extend credit to fundamentally insolvent borrowers (Boot, Greenbaum, and Thakor, 1991; Dewatripont and Maskin, 1995; Hoshi and Kashyap, 2004; Caballero, Hoshi, and Kashyap, 2008).If PBs are capital constrained, they would generally prefer that their borrowers invest in less risky or even safe assets, which is one possible reason for the small impact of increases in PB lending on investment. In contrast, GOBs were not affected by concerns over the capital ratio due to government ownership as GOBs were fully owned by the Japanese Government during our observation period.

Our second explanation relates to firms' cash holdings as GOB lending can effectively mitigate excess cash holdings during a crisis period (Giannetti and Simonov, 2013). Our findings not only show that increased GOB lending eases current financial constraints but also signals to the market that a company has a lower likelihood of future cash flow constraints on account of implicit funding from the Japanese Government. Therefore, firms receiving new loans from GOBs may have a lower incentive to hold precautionary cash savings to prepare for future liquidity constraints and economic shocks. To the extent that hoarding liquidity blunts the effect of increased lending on investment, the mitigating effect of GOB lending on borrowers' precautionary cash holdings may explain the larger impact on firm investment, which we examine in next sub-section.

6.3 Mitigating precautionary savings

Excess savings arise with a liquidity constraint, motivating firms to save more than the optimal level in the face of increased risk (Bates, Kahle and Stulz, 2009). Acharya, Davydenko and Strebulaev (2012) show that precautionary holding of cash is positively related to longer-term probability of default. We regress cash holdings on *GOBI* and the interaction term between *GOBI* and *Crisis*. The result reported in Column (1) of Table 11 shows that the coefficient on the interaction term between *GOBI* and *Crisis* is negative and significant, suggesting that an increase in GOB lending can effectively mitigate excess precautionary cash holdings of borrowing firms during the crisis. In contrast, we do not find a significant impact of increases in GOB lending on firms' cash holding during the normal period. In Column (2), we further include the variables of *PBI* and the interaction term between *PBI* and *Crisis*. Although we find a statistically significant effect of PB lending that reduces the precautionary saving during the crisis period, the magnitude of the PBI effect is much smaller than that of GOBI. Therefore, our evidence is consistent with the conjecture that the stronger GOB effect on investment can be partially attributed to GOB lending altering borrowing firm behavior in terms of their excess precautionary cash holdings for investment.

6.4 Subsidization

One concern may be that the documented GOB effects on investment are driven by the possibility that GOB loans are subsidized relative to PB loans. Although we cannot directly address this question as we do not have the loan spreads for GOB loans, our findings point to the fact that this is unlikely. First, if subsidization stimulated investment, PB loans to zombie firms at below market interest rates should also result in similar effects. In fact, we find the opposite. Second, an OECD study by Ford and Suyker (1990) suggests that the degree of subsidy of GOB loans relative to PB loans in Japan was around 0.5% in 1987. Fukao (2003) also estimates a degree of subsidy for GOB loans to be 0.6% as of 2001. It should also be noted that most of these subsidies are targeted at small and medium size enterprises.[23] Hanazaki and Hachisuga (1997) provide a summary of studies that examined the subsidy effects of Japan Development Bank lending, and report that the direct subsidy effects are relatively small. A subsidy that is far less than 1% on a 1¥ loan, is unlikely to lead to a stimulus in terms of investment well above the principal value of the loan, i.e., well above 1¥. Since we find a ¥0.52 (0.86+0.66-1) increase in investment during the crisis period, this suggests that the impact of GOB lending on investment is unlikely to be driven by subsidized loans.

Veronesi and Zingales (2010) who studied the US Government intervention in the credit crisis of 2007-08, also find a large multiplicative effect of the bailout. They found that the net cost of the bailout was between $25 billion to $47 billion, while the net benefit was much larger -between $84 billion to $107 billion. The authors attribute this net benefit as arising from a reduction in the probability of bankruptcy, which they estimate would reduce the enterprise value by 22%. Here, our findings also suggest similar channels that GOB lending contributes to real investment – a reduction of credit constraints, an ability to better leverage growth opportunities, and a reduction of precautionary savings, which collectively has multiplicative effect on investment.

7 Conclusion

Using Japanese firm-level data that cover the period of the Japanese financial crisis in the 1990's, we examine the impact of increases in government bank lending to mitigate private credit contraction, and their effects on corporate investment. Theory suggests the beneficial effects of direct government lending on the real economy when the state acts as "lender of last resort" during a crisis. In line with the theory, we find a positive effect of GOB lending on corporate investment during the financial crisis, which contrasts with the limited impact of bank recapitalization policies adopted during the Japanese crisis (Giannetti and Simonov, 2013). We also compare the impact of government bank lending and private banks lending on corporate investment during the crisis. Our results suggest that private banks maintained credit to otherwise insolvent (zombie) firms and that firms used private bank credit to hoard

[23] Our conversations with the officials from the Ministry of Finance, Government of Japan suggest that subsidies are even lower for publicly traded firms.

liquidity during the crisis, while government credits induced real investment and reduced firms' cash holdings.

Some caveats are in order. Prior empirical literature found that political considerations may dominate any positive effects of government lending. To the extent that publicly traded firms in our sample have access to several sources of financing, the results of this study are likely to provide a lower bound on the potential benefits of GOB loans during a crisis. In contrast with previous studies that examined the impact of GOBs in emerging markets that have a weak institutional environment, and where GOBs often dominate the banking sector, our study examines a market where GOBs co-exist with a well-developed private banking sector. Further, GOBs in Japan have relatively long history, having likely the same expertise in lending as private banks. As such, the strong positive GOB effect documented in our paper can be partially attributed to the special institutional structure in Japan. Despite this caveat, our study provides strong evidence of a positive real impact of GOB loans which achieves the general social objective of GOB lending, namely stimulating the efficiency-improving investment. Future research would examine more micro effects of GOB lending in countries with weaker institutions, which will shed light on the degree to which these results are generalizable.

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Table 1
Summary Statistics

Panel A reports the summary statistics of key variables for all observations during the entire sample period. Panel B reports the summary statistics of variables for firm-year observations before and after the stock market collapse in 1991, those with increases in government owned bank lending, and observations without increases in government owned bank lending. Investment is defined as changes in tangible fixed assets plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. The sample period is from 1978 to 1996. Details of variable definitions are stated in the appendix. ***, ** and * indicate statistically significant at 1%, 5% and 10% level respectively.

Panel A – Overall Sample

	N	Mean	Std	25%	50%	75%
Investment	20441	0.085	0.182	-0.017	0.044	0.135
GOBI	20110	-0.0003	0.0218	-0.002	0	0
Total asset	22009	1.805	4.489	0.207	0.467	1.27
Cash flow	20441	0.33	0.634	0.075	0.188	0.404
Book leverage	22009	0.28	0.182	0.139	0.261	0.402
Cash by asset	22009	0.144	0.085	0.085	0.13	0.186
Tobin's Q	19076	1.009	0.788	0.559	0.834	1.229
GOB Loans / Total loans	19992	0.0674	0.142	0	0.0072	0.0661
ROA	22009	0.021	0.027	0.009	0.019	0.034
Quick Ratio	22009	1.571	0.974	1.054	1.28	1.738

Panel B

	Whole sample (1978-1996)	Bubble (1987-1990)	Collapse (1991)	Contraction (1992-1994)
Firm-years with GOB loans outstanding	12176 (55.3%)	2143 (47.7%)	548 (44.8%)	1617 (42.8%)
Firm-years with increases in GOB loans outstanding	3350 (15.2%)	466 (10.3%)	165 (13.5%)	648 (17.2%)
Total firm-year observations	22009	4489	1223	3777

Panel C

	Pre-Collapse(1987-1990)		Post-Collapse(1992-1994)		Post-Pre	
	N	Median	N	Median		
Investment	4385	0.063	3725	0.034	-0.029	***
Cash flow	4385	0.228	3725	0.127	-0.100	***
Book leverage	4489	0.247	3777	0.265	0.017	***
Cash by asset	4489	0.147	3777	0.109	-0.039	***
Tobin's Q	3949	1.367	3380	0.835	-0.532	***
ROA	4489	0.022	3777	0.014	-0.007	***
Observations with increase in government owned bank loan (*GOBI* > 0)						
Investment	466	0.073	648	0.072	-0.001	
Cash flow	466	0.129	648	0.068	-0.062	***
Book leverage	466	0.379	648	0.382	0.002	
Cash by asset	466	0.109	648	0.079	-0.030	***
Tobin's Q	415	1.432	620	0.868	-0.563	***
ROA	466	0.015	648	0.010	-0.005	***
Observations without increase in government owned bank loan (*GOBI*≤ 0)						
Investment	3919	0.061	3077	0.025	-0.037	***
Cash flow	3919	0.245	3077	0.146	-0.099	***
Book leverage	4023	0.235	3129	0.242	0.007	***
Cash by asset	4023	0.151	3129	0.115	-0.036	***
Tobin's Q	3534	1.361	2760	0.826	-0.536	***
ROA	4023	0.023	3129	0.016	-0.007	***

Table 2
Government Owned Bank Effect on Investment

The dependent variable is the investment for firm i at year t, adjusted by the industry's median investment in that year. All regressions include year, firm dummies, and constant term. Investment is defined as changes in tangible fixed assets plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. *Bubble* takes a value of 1 for observations in years 1987 to 1990. *Collapse* takes a value of 1 for observations in year 1991. *Contraction* takes a value of 1 for observations in years 1992 to 1994. The sample period is from 1978 to 1996. See Appendix for a detailed definition of all variables. Standard errors are corrected for within-firm clustering and T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10 %level respectively.

	Investment regression			
	(1)	(2)	(3)	(4)
Cash flow	0.081***	0.081***	0.074***	0.074***
	(5.609)	(5.616)	(4.976)	(4.974)
Q	0.031***	0.031***	0.031***	0.031***
	(6.169)	(6.200)	(6.514)	(6.519)
GOBI	0.973***	0.864***	0.840***	0.782***
	(8.840)	(7.090)	(6.994)	(5.906)
Crisis×GOBI		0.660***	0.635***	
		(3.041)	(2.901)	
Size			0.059***	0.058***
			(6.590)	(6.551)
Book leverage			-0.064**	-0.064**
			(-2.570)	(-2.547)
ROA			0.268**	0.268**
			(2.427)	(2.427)
Contraction×GOBI				0.529**
				(2.034)
Bubble×GOBI				0.280
				(0.963)
Collapse×GOBI				1.190***
				(2.835)
Constant	-0.025***	-0.025***	-0.619***	-0.616***
	(-2.688)	(-2.741)	(-6.766)	(-6.729)
Firm Fixed	Y	Y	Y	Y
Year Fixed	Y	Y	Y	Y
N	17629	17629	17629	17629
adj. R-sq	0.090	0.091	0.099	0.099

Table 3
GOB Lending and Mitigation of Financial Constraints

The dependent variable is the investment for firm i at year t, adjusted by the industry's median investment in that year. All regressions include year, firm dummies and constant term. Investment is defined as changes in tangible fixed assets plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994.The sample period in Panels A and C is from 1978 to 1996. Other control variables include *ROA, Size, Cash Flow, Q* and *Leverage*, which are the same as those included in column (3) of Table 2. The sample period in Panel B is from 1990 to 1996. See Appendix for a detailed definition of all variables. Standard errors are corrected for within-firm clustering and T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10 %level respectively

Panel A

	(1)	(2)	(3)	(4)
	Low RZ Industry	High RZ Industry	Healthy Relationship Banks(1990-1996)	Troubled Relationship Banks (1990-1996)
GOBI	0.966***	0.532***	0.677***	0.195
	(5.967)	(2.855)	(2.589)	(0.274)
Crisis×G	0.513*	0.821*	0.792***	1.434*
	(1.697)	(1.874)	(2.676)	(1.723)
N	9308	7052	3585	2966
Other	Y	Y	Y	Y
Firm	Y	Y	Y	Y
Year	Y	Y	Y	Y
adj. R-sq	0.115	0.083	0.135	0.136

Panel B

	(1)	(2)
GOBI	1.117***	1.007***
	(8.676)	(7.166)
GOBI×Cash flow	-0.585**	-0.538*
	(-2.174)	(-1.946)
Crisis×GOBI		0.631**
		(2.244)
Crisis×GOBI×Cash flow		-0.272
		(-0.344)
Crisis×Cash flow		-0.006
		(-0.408)
Constant	-0.621***	-0.624***
	(-6.790)	(-6.784)
N	17629	17629
Other Controls	Y	Y
Firm Fixed	Y	Y
Year Fixed	Y	Y
adj. R-sq	0.100	0.100

Table 4
GOB Lending and Zombie Firms

The dependent variable is the investment for firm i at year t, adjusted by the industry's median investment in that year. All regressions include year, firm dummies and constant term. Investment is defined as changes in tangible fixed assets plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994.The sample period in Panels A is from 1978 to 1996. Other control variables include *ROA, Size, Cash Flow, Q* and *Leverage*, which are the same as those included in column (3) of Table 2. The sample period in Panel B is from 1990 to 1996. See Appendix for a detailed definition of all variables. Standard errors are corrected for within-firm clustering and T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10 %level respectively

Panel A

	(1)	(2)	(3)	(4)
	Non-Zombie firms	Zombie firms	Low Zombie industries	High Zombie industries
GOBI	0.735***	8.286	0.869***	0.436
	(2.688)	(1.414)	(2.740)	(0.933)
Crisis×GOBI	0.743**	-7.341	0.701**	0.792
	(2.436)	(-1.303)	(1.997)	(1.200)
N	7323	370	5748	1945
Other Controls	Y	Y	Y	Y
Firm Fixed	Y	Y	Y	Y
Year Fixed	Y	Y	Y	Y
adj. R-sq	0.127	0.155	0.129	0.092

Table 5
Risk Shifting Effect

The dependent variable is investment for firm i at year t, adjusted by the industrial median investment in that year. *GOBI* is defined as the net increase in government owned bank loan outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. *High leverage* is defined as the one if the firm's leverage is higher than the median value of leverage in that year. *High risk* is defined as one if the probability of default is higher than the median value in that year. All regressions include year dummies, firm dummy, and a constant term. The sample period is from 1978 to 1996. Detailed variable definitions are provided in the appendix. Standard errors are corrected for within-firm clustering and. T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10% level respectively.

	(1)	(2)	(3)	(4)
	Investment			
	Low leverage	High leverage	Low risk	High risk
	(1)	(2)	(3)	(4)
Cash flow	0.066***	0.082***	0.174***	0.088***
	(3.696)	(3.049)	(8.123)	(3.333)
Tobin's Q	0.030***	0.034***	0.021***	0.023**
	(5.095)	(4.079)	(2.977)	(2.517)
Size	0.065***	0.076***	0.038***	0.082***
	(4.073)	(6.715)	(2.614)	(6.330)
Booklev	-0.037	-0.071	-0.061*	-0.080*
	(-0.767)	(-1.605)	(-1.710)	(-1.766)
ROA	0.370**	0.147	0.141	0.171
	(1.976)	(0.994)	(0.715)	(1.076)
GOBI	0.327*	1.028***	0.576***	0.924***
	(1.864)	(6.864)	(3.529)	(5.705)
Crisis×GOBI	1.328***	0.281	0.796***	0.478
	(2.980)	(1.099)	(2.584)	(1.557)
Constant	-0.750***	-0.899***	-0.431***	-0.938***
	(-4.199)	(-6.830)	(-2.863)	(-6.376)
N	8502	9127	7536	7622
Firm Fixed	Y	Y	Y	Y
Year Fixed	Y	Y	Y	Y
adj. R-sq	0.130	0.114	0.213	0.075

Table 6
Selection Effects in GOB Lending

Panel A: Subsample of loans with GOB outstanding

The dependent variable is the investment for firm i at year t, adjusted by the industry's median investment in that year. All regressions include year, firm dummies, and constant term. Investment is defined as changes in tangible fixed assets plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *GOBI Dummy* is defined as 1 if the government owned bank loans outstanding of a firm in the given year is larger relative to that in previous year, and 0 otherwise. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. See Appendix for a detailed definition of all variables. Standard errors are corrected for within-firm clustering and T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10 %level respectively

	Full sample	Conditional on having positive GOB loan outstanding.	
	(1)	(2)	(3)
GOBI	0.722***	0.744***	0.875***
	(5.174)	(5.191)	(7.230)
Crisis×GOBI	0.576**	0.581**	0.557**
	(2.207)	(2.134)	(2.487)
GOBI Dummy	0.014**	0.015**	
	(2.373)	(2.478)	
Crisis×GOBI Dummy	0.001	-0.005	
	(0.167)	(-0.541)	
Cash flow	0.074***	0.190***	0.191***
	(4.973)	(9.668)	(9.721)
Q	0.031***	0.028***	0.029***
	(6.500)	(3.713)	(3.738)
Size	0.058***	0.059***	0.059***
	(6.593)	(5.004)	(5.005)
Book leverage	-0.066***	-0.020	-0.016
	(-2.657)	(-0.557)	(-0.450)
ROA	0.268**	-0.170	-0.169
	(2.430)	(-1.242)	(-1.241)
Constant	-0.621***	-0.738***	-0.750***
	(-6.797)	(-5.351)	(-5.480)
Firm Fixed	Y	Y	Y
Year Fixed	Y	Y	Y
N	17629	9902	9902
adj. R-sq	0.099	0.153	0.152

Table 6 (continued)

Panel B: Unconditional correlation matrix

This table reports correlation matrix. Investment for firm i at year t, is adjusted by the industrial median investment in that year. Investment is defined as changes in tangible fixed asset plus depreciation divided by total capital in the previous year. "*No. Amakudari/No. Directors*" is defined the number of Amakudari director scaled by the total number of directors in the board. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10% level respectively.

	No. Amakudari/ No. Directors	GOBI	Investment
No. Amakudari/ No. Directors	1		
GOBI	0.024***	1	
Investment	-0.002	0.085***	1

Panel C: Conditional correlation

Investment for firm i at year t, is adjusted by the industrial median investment in that year. Investment is defined as changes in tangible fixed asset plus depreciation divided by total capital in the previous year. "*No. Amakudari/No. Directors*" is defined the number of Amakudari director scaled by the total number of directors in the board. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10% level respectively.

	GOBI	Investment Investment
GOBI		1.165***
		(8.507)
No. Amakudari/No. Directors	0.013**	-0.007
	(1.965)	(-0.177)
Q	-0.000	0.023***
	(-0.014)	(3.703)
Cash flow	-0.000	0.071***
	(-1.346)	(4.552)
Book leverage	-0.007**	-0.211***
	(-2.158)	(-4.842)
Size	0.009***	0.169***
	(5.658)	(7.263)
ROA	-0.001	-0.121
	(-0.139)	(-0.941)
N	9653	9653
adj. R-sq	0.114	0.127
Year Fixed Effects	YES	YES
Firm Fixed Effects	YES	YES

Table 6 (continued)

Panel D: Arellano – Bond GMM Estimators

This table reports the results of Arellano and Bond (1991) estimation for the effect of government owned bank lending on investment as well as employment growth. A specification includes the letter "a" if the idiosyncratic disturbance is not autocorrelated at the second lag at the 1% level, following Arellano and Bond (1991). A specification includes the letter "b" if the Hansen J statistic of overidentifying restrictions is not significant at the 1% level. A specification includes the letter "c" if the additional instruments have a Hansen statistic that is not significant at the 1% level. A specification includes the letter "d" if the difference of additional instruments have a Hansen statistic that is not significant at the 1% level. Which is consistent with a failure to reject their being exogenous. Detailed variable definitions are provided in the Appendix. ***, ** and * indicates significantly different than zero at 1%, 5% and 10% level, respectively.

	Investment
GOBI	0.337
	(0.690)
GOBI × Crisis	1.684**
	(2.380)
Lagged.1 Dep. Var.	0.158***
	(3.206)
Q	0.035**
	(2.034)
Cash flow	0.037***
	(4.691)
Book leverage	0.057
	(1.435)
Size	-0.001
	(-0.116)
ROA	0.906**
	(2.227)
N	9479
Regression Diagnostics	a,b,c,d
Instruments	Lag 3 and 4; and No. Amakudari/No. Directors
Firm and Year Fixed Effects	YES

Table 7
Efficiency of GOB Lending: Investment Sensitivity to Q

The dependent variable is the investment for firm i at year t, adjusted by the industrial median investment in that year. Investment is defined as changes in tangible fixed asset plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. Other control variables include *ROA, Size, Cash Flow, Q* and *Leverage*, which are the same as those included in column (3) of Table 2. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. All regressions include year dummies, firm dummy and a constant term. The sample period is from 1978 to 1996. Detailed variable definitions are provided in the appendix. Standard errors are corrected for within-firm clustering and. T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10% level respectively.

	(1)	(2)
	Investment	
GOBI	0.373**	0.314*
	(2.401)	(1.824)
GOBI×Q	0.670***	0.662***
	(4.543)	(3.853)
Crisis×GOBI		0.473
		(1.118)
Crisis×GOBI×Q		-0.057
		(-0.170)
Crisis×Q		-0.013*
		(-1.894)
Constant	-0.604***	-0.606***
	(-6.583)	(-6.634)
N	17629	17629
Other Controls	Y	Y
Firm Fixed	Y	Y
Year Fixed	Y	Y
adj. R-sq	0.102	0.102

Table 8
Efficiency of GOB Lending: Future Firm Performance

The dependent variable in Panel A is the ROA for firm i at year t+1. Investment is defined as changes in tangible fixed asset plus depreciation divided by total capital in the previous year. Panels B(C) report the Calendar time-based regressions of one (three) year long-run stock return performance of firms that experience increases in government owned bank lending. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. All regressions include year dummies, firm dummy and a constant term. The sample period is from 1978 to 1996. Detailed variable definitions are provided in the appendix. Standard errors are corrected for within-firm clustering and. T statistics are reported in parentheses. ***, ** and * indicate statistically significant at 1%, 5% and 10% level respectively.

Panel A:

	(1)	(2)	(3)
	ROA(t+1)	Non-CRISIS ROA(t+1)	CRISIS ROA(t+1)
GOBI×Investment	0.098**	0.075*	0.219*
	(2.283)	(1.748)	(1.725)
GOBI	-0.021**	-0.014	-0.037
	(-2.431)	(-1.530)	(-1.485)
Investment	0.007***	0.007***	-0.001
	(4.968)	(4.416)	(-0.490)
Industry ROA	0.520***	0.406***	0.498***
	(9.352)	(7.217)	(3.266)
Size	-0.005***	-0.007***	0.002
	(-4.511)	(-5.209)	(0.199)
Q	0.006***	0.005***	0.015***
	(8.487)	(7.525)	(7.599)
Constant	0.073***	0.094***	-0.028
	(5.621)	(6.415)	(-0.318)
N	17470	13099	4371
Firm Fixed	Y	Y	Y
Year Fixed	Y	Y	Y
adj. R-sq	0.398	0.416	0.514

Panel B: Abnormal returns (1 Year)

	(1)	(2)	(3)	(4)
	Non-crisis period EW	Crisis period EW	Non-crisis period VW	Crisis period VW
Intercept	-0.0001	0.002	0.006***	0.003
	(-0.09)	(1.44)	(3.07)	(1.57)
RMRF	0.973***	1.04***	0.973***	1.008***
	(27.12)	(33.97)	(22.51)	(27.03)
SMB	0.549***	0.347***	-0.174***	-0.196***
	(13.36)	(6.61)	(-3.35)	(-3.07)
HML	0.076	-0.146	-0.002	-0.181
	(1.414)	(1.16)	(-0.03)	(-0.12)
adj. R-sq	0.839	0.96	0.77	0.92

Panel C: Abnormal returns (3 Year)

	(1) Non-crisis period EW	(2) Crisis period EW	(3) Non-crisis period VW	(4) Crisis period VW
Intercept	0.0001	0.002	0.007***	0.003*
	0.09	(1.35)	(3.89)	(1.67)
RMRF	0.992***	1.039***	0.987***	1.006***
	(29.29)	(36.43)	(25.81)	(28.06)
SMB	0.568***	0.363***	-0.198***	-0.185***
	(14.15)	(7.43)	(-4.27)	(3.02)
HML	0.086*	-0.134	0.0205	-0.005
	(1.60)	(1.15)	(0.33)	(-0.04)
adj. R-sq	0.85	0.97	0.82	0.94

Table 9
Government Owned Bank versus Private Bank: Lending to Zombie Firms

Panel A of this table provides the summary of the statistics of the number of firms that receive increases in GOB (PB) lending in year t, but become zombie firms in year t+1 as a percentage of total number of firms that receive GOB (PB) lending in year t. Panel B of this regression models the likelihood of a firm being a zombie firm. The dependent variable is defined as one if firm i at year t is defined as zombie firm. The definition of zombies follows Caballero et.al (2008). *GOB dependency* is defined as the government owned bank loan outstanding to a firm's total liability. *PB dependency* is defined as the private bank loan outstanding to a firm's total liability. Details of variable definitions are stated in the appendix. The sample period is from 1990 to 1996. The standard errors are corrected for within-firm clustering. ***, ** and * indicate statistically significant at 1%, 5% and 10%level respectively. The table also report t statistics

Panel A

	GOBI	PBI
Crisis(1990-1994)	3.87%	4.52%
Post-Crisis(1995-1996)	5.90%	9.05%

Panel B

	(1) Zombie	(2) Zombie
GOB Dependency	-2.861	-7.728
	(-0.412)	(-1.170)
PB Dependency	2.517***	1.056*
	(2.989)	(1.696)
Book leverage	-2.106	
	(-1.610)	
Size	-1.478***	
	(-2.966)	
Sales Growth	-1.915***	
	(-4.973)	
Cash flow	0.451***	
	(2.927)	
ROA	4.347	
	(1.533)	
N	1662	1713
Firm Fixed	Y	Y
Year Fixed	Y	Y
adj. R-sq	0.103	0.003

Table 10
Government Owned Bank versus Private Bank: Effect on Investment

The dependent variable is the investment for firm i at year t, adjusted by the industrial median investment in that year. Investment is defined as changes in tangible fixed asset plus depreciation divided by total capital in the previous year. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in the previous year. Other control variables include *ROA*, *Size*, *Cash Flow*, *Q* and *Leverage*, which are the same as those included in column (3) of Table 2. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. *PBI* is defined as the net increase in private bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. Details of variable definitions are stated in the appendix. The sample period in this table is from 1978 to 1996. The standard errors are corrected for within-firm clustering. ***, ** and * indicate statistically significant at 1%, 5% and 10%level respectively. The table also report t statistics

	(1)	(2)	(3)
		Investment	
GOBI	0.828***	0.346**	0.957***
	(7.120)	(2.033)	(7.093)
PBI	0.028***	0.022**	0.045***
	(3.575)	(2.521)	(6.434)
Crisis×GOBI	0.686***	0.535	0.682**
	(3.080)	(1.233)	(2.439)
Crisis×PBI	0.013		
	(0.864)		
GOBI×Q		0.598***	
		(3.394)	
GOBI×Q×Crisis		-0.059	
		(-0.174)	
PBI×Q		0.008	
		(1.201)	
PBI×Q×Crisis		0.010	
		(0.718)	
Q×Crisis		-0.011	
		(-1.620)	
GOBI×Cash flow			-0.481*
			(-1.849)
GOBI×Cash flow×Crisis			-0.135
			(-0.161)
PBI×Cash flow			-0.017***
			(-3.238)
PBI×Cash flow×Crisis			0.012
			(1.557)
Cash flow×Crisis			-0.015
			(-1.236)
Constant	-0.551***	-0.534***	-0.547***
	(-6.088)	(-5.856)	(-6.131)
N	17629	17629	17629
Other Controls	Y	Y	Y
Firm Fixed	Y	Y	Y
Year Fixed	Y	Y	Y
adj. R-sq	0.108	0.112	0.116

Table 11
Government Owned Bank versus Private Bank: Precautionary Saving

The dependent variable is the cash holding of the firm scaled by total asset. *GOBI* is defined as the net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital in previous year. *PBI* takes a value of 1 if the borrowing from private bank increases in the given year and 0 otherwise. *Crisis* is a dummy variable that takes a value of 1 for observations in years 1991 to 1994. The sample period in Panel A is from 1978 to 1996. The standard errors are corrected for within-firm clustering. ***, ** and * indicate statistically significant at 1%, 5% and 10%level respectively. The table also report t statistics

	(1) Cash holding	(2) Cash holding
Cash flow	0.019***	0.019***
	(3.793)	(3.773)
Tobin'sQ	-0.001	-0.001
	(-0.212)	(-0.214)
Size	-0.006***	-0.006***
	(-4.944)	(-4.960)
Booklev	-0.036***	-0.037***
	(-3.572)	(-3.654)
GOBI	0.001	-0.002
	(0.017)	(-0.085)
Crisis×GOBI	-0.135*	-0.137*
	(-1.722)	(-1.779)
PBI		0.004**
		(2.063)
Crisis×PBI		-0.016***
		(-4.191)
Constant	0.215***	0.215***
	(15.527)	(15.676)
N	17470	17470
Industry Fixed	Y	Y
Year Fixed	Y	Y
adj. R-sq	0.174	0.176

Figure 1
Government Owned Bank Lending and Private Bank Lending

Aggregate corporate loan outstanding from private banks and government owned banks during 1979 to 1996 in Japan. Source: Bank lending, Flow of Funds, The Bank of Japan. Industrial production growth, METI.

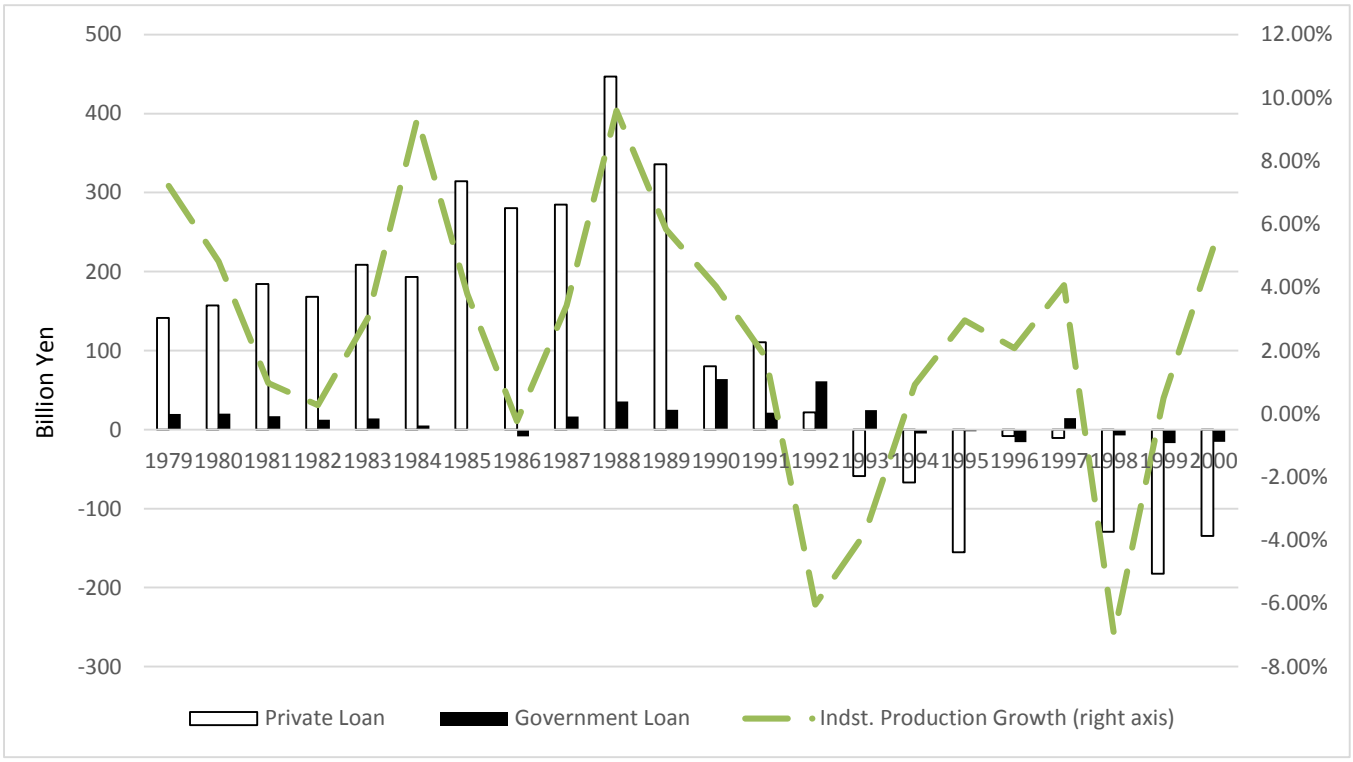


Figure 2
Time Series Pattern of Increases in Government Owned Bank Lending

This figure plots the time series pattern of increases in government owned bank lending (mean value million Yen) of the firm (right axis) and the total number of firms in a given year that receive an increases in GOB lending based on our data sample of publicly traded firms. .

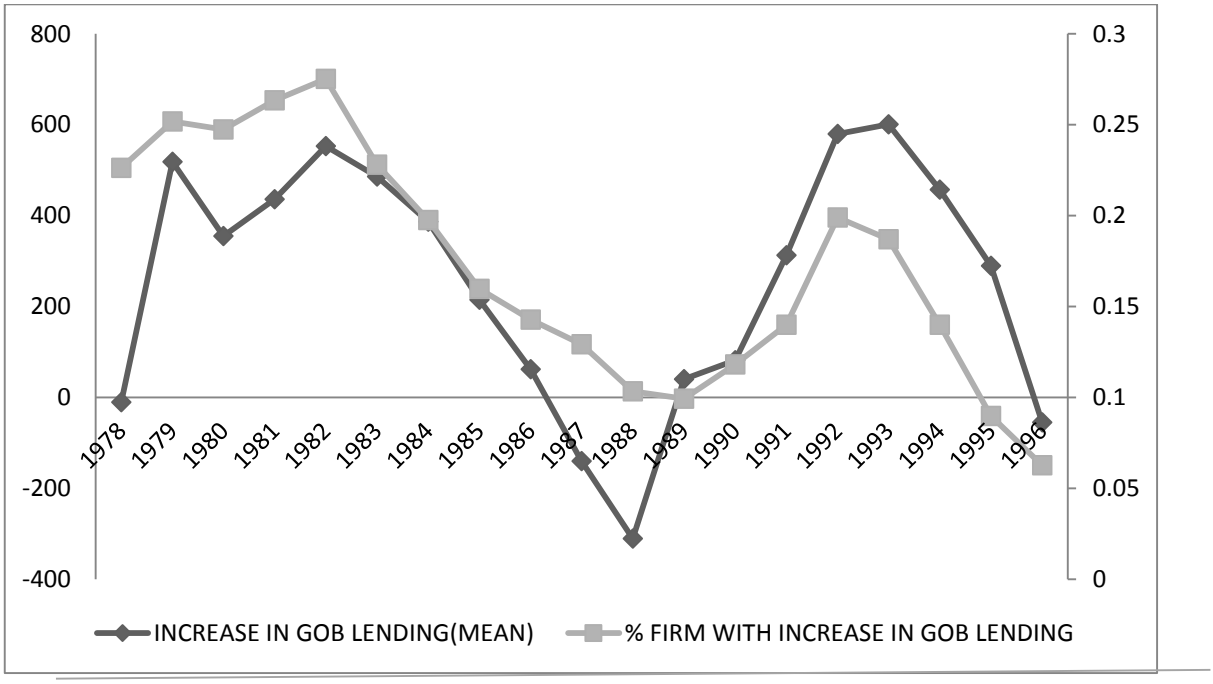


Figure 3
Market Share of Government Owned Banks

Market share of government owned banks (GOB) for listed firms in our sample.

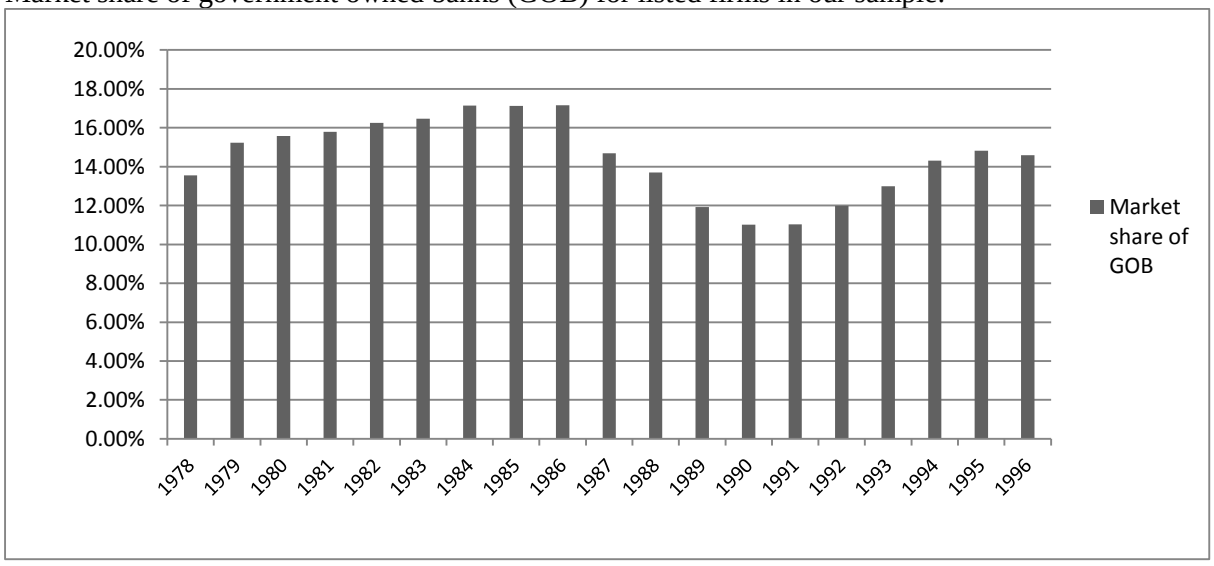
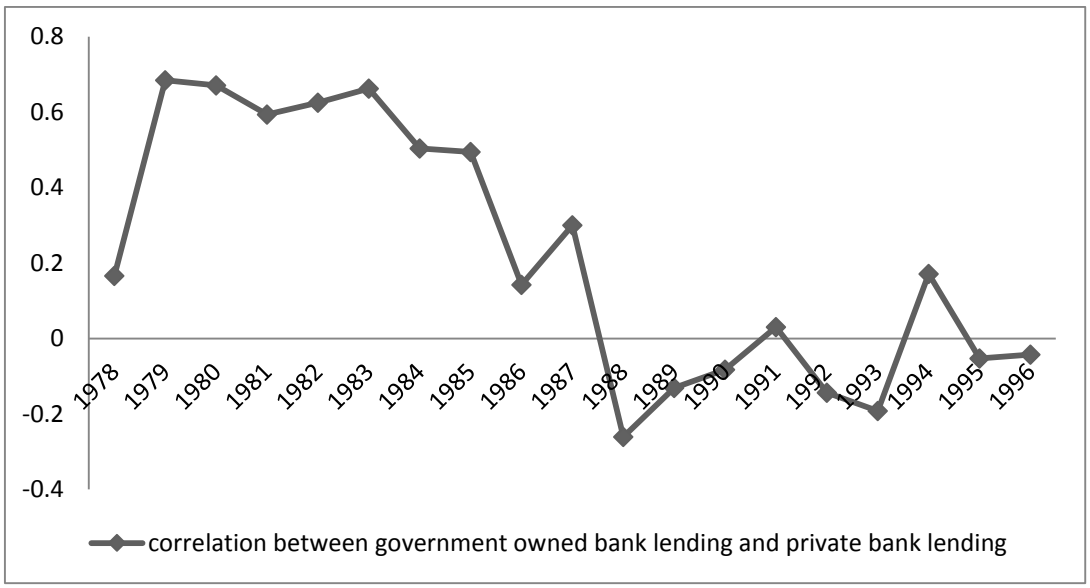


Figure 4
Correlation between Government Owned Bank Lending and Private Bank Lending

The following graph depicts the cross-sectional correlation between increases in lending from government owned banks and increases in lending by private banks for publicly traded firms in our sample.



Appendix: Definition of variables

All variables are obtained from the Nikkei Needs database, except for the market value of equity and the stock return. The source of the data items is provided in their respective definitions.

Book Leverage: Total Debt divided by Total Asset (FB067). Total Debt is defined as the sum of short term debt and long term debt. We define short term debt as the sum of the following: Short Term loans, bank overdraft and due loan within a year (FB074), Commercial Paper (FB075), Long term debt that matures within one year (FB076), Corporate Bonds and Convertible Bonds redeemable within one year (FB077), and Derivative Debt (FB0159). We define long term debt as the sum of the following data items: Corporate Bonds and Convertible Bonds with maturity more than one year (FB098), Long Term Loan (FB101) and Unconsolidated affiliate long term debt (FB102).

Book to Market: The ratio of the Book Value of Common Equity (FB126) plus total debt in the previous fiscal year to the sum of Market Value of Common Equity (6 Month after filing date) and total debt.

Cash Flow: The Net Income before Extraordinary Items and Depreciation (FC029), scaled by Capital (FB032) in the previous year.

Cash by Asset: The Amount of Cash available (FB003) scaled by Total Assets (FB067).

Capital: Tangible Fixed Asset (FB032).

Collapse: A dummy variable that takes a value of 1 for the year 1991.

Contraction: A dummy variable that takes a value of 1 for years 1992 to 1994.

Crisis: A dummy variable that takes a value of 1 for observations in years 1991-1994.

Employment: The Total Number of Employees including part time employees of the firm at the end of the year (FE056).

GOB dependence: The ratio of total outstanding GOB loans to the total liabilities of the firm.

GOBI: The net increase in government owned bank loans outstanding to a firm in the given year relative to the previous year divided by the total capital (FB032) in the previous year. The total loans outstanding for government owned bank in each year is given by total lending by all institutions with financial institution code 299999, which corresponds to total lending by all government financial institutions.

Investment: Changes in Tangible Fixed Asset (FB032) plus Depreciation (FE011).

PB Dependency: The ratio of total Private Banks outstanding loans to Total Liabilities.

PBI: The net increase in loans outstanding to a firm by all private banks in the given year relative to the total capital (FB032) in the previous year.

Q (Tobin's Q): The Market Value of Assets scaled by their replacement values. It is computed by taking the sum of Market Value of Common Equity, Value of Preferred Stock (FB123), Long term debt, Short Term debt minus Current Assets, divided by Total Assets.

Quick Ratio: Ratio of Current Asset (FB068) to Current Liabilities (FB121).

Rajan and Zingales (RZ) ratio: Investment minus cash flow from operations divided by capital expenditures. We first estimate the sum of the difference between investment and cash flow for each

firm during the whole sample period (Investment – Cash flow). Then, we divide this total difference by the total investment by the given firm over the entire period. We compute the median of this ratio for all firms in the industry as the RZ ratio for the given firm. As computed above, positive values represent industries with high external finance requirements and negative value show industries that do not depend on external finance.

ROA: Net Income (FC051) divided by Total Asset (FB067).

Sales Growth: Sales in current year – Sales in previous year, scaled by the sales in the previous year. Data item for Sales is FC001.

Stock Return: Annual return over the fiscal year, computed using PACAP data for the common equity of the firm.

Total Asset: Total Asset (FB067) in 100 billion Yen.

Troubled (Healthy) Relationship banks: We define a firm as having 'Troubled relationships banks' if the measured value of *Relationship Bank Constraints*$_{i,t}$ is larger than its sample median in year t, and having 'Healthy Relationship banks' if the measured value of *Relationship Bank Constraints*$_{i,t}$ is less than its sample median in year t. The definition of relationship bank constraints is given below. First, for each bank 'j' in year 't', we define its zombie exposure as follows (See definition of zombie below):

$$Zombie\ Exposure_{j,t} = \frac{The\ lending\ to\ zombie\ borrowers\ by\ bank\ j\ in\ year\ t}{Total\ \ lending\ by\ bank\ j\ in\ year\ t}$$

For each borrowing firm 'i', we define *RelBank constraints*$_{i,}$ as the average value of the weighted average of its relationship bank's zombie exposure during year 1990 to 1996, where the weighting is the fraction of lending of the borrower coming from a given bank.

$$RelBank\ Constraints_{i,t} = \frac{1}{7}\sum_{1990}^{1996}\sum_{j=1}^{J}\frac{Borrowings\ \ by\ firm\ i\ from\ bank\ j\ in\ year\ t}{Borrowings\ by\ firm\ i\ from\ all\ banks\ in\ year\ t} \times Zombie\ Exposure_{j,t}$$

Zombie (Non-zombie): A Firm-year is classified as a zombie as per the definition of Caballero, Hoshi and Kashyap (2008). The classification of a firm as a zombie (insolvent borrower) follows the method suggested by Caballero, Hoshi and Kashyap (2008). Specifically, we create a lower bound for interest that a firm could pay during the fiscal year:

$$R^{*}_{i,t} = rs_{t-1} \times BS_{i,t-1} + 1/5(\sum_{j=1}^{5} rl_{t-1}) \times BL_{i,t-1} + rcb_{\min \text{ last 5 year},t} \times Bond_{i,t-1}.$$

where rs is short term loan prime rate, BS is the short term loan outstanding, rl is long term prime rate, BL is the long term loan outstanding , rcb is the observed minimum coupon rate for convertible bonds and Bond is outstanding bonds. If the interest expenditure of the firm during that fiscal year is lower than the lower bound, which implies that the firm is heavily subsidized, we define the firm to be a zombie firm.

A firm-year not classified as zombie year is a **non-zombie** year.

High (low) zombie industry: Construction, wholesale, retail sale, real estate and service industries are classified as high zombie industries (Hoshi, 2000; Hoshi and Kashyap, 2004; Caballero, Hoshi and Kashyap, 2008). The remaining industries are defined as low zombie industries.

High (low) risk: It is a dummy variable that takes value one if the probability of default (estimated by the KMV model), is higher than the median value in a given year.