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Abstract

This article examines the effect of government capital injections into financially troubled banks on corporate investment during the Japanese banking crisis of the late 1990s. By helping banks meet the capital requirements imposed by Japanese banking regulation, recapitalization enables banks to respond to loan demands, which could help firms increase their investment. To test this mechanism empirically, we combine the balance sheet data of Japanese manufacturing firms with bank balance sheet data and estimate a linear investment model where the investment rate is a function of not only firm productivity and size but also bank regulatory capital ratios. We find that the coefficient of the interaction between a firm's total factor productivity measure and a bank's capital ratio is positive and significant, implying that the bank's capital ratio affects more productive firms. Counterfactual policy experiments suggest that capital injections made in March 1998 and 1999 had a negligible impact on the average investment rate, although there was a reallocation effect, shifting investments from low- to high-productivity firms.

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1 Introduction

This paper examines the effect of government capital injections into financially troubled banks on the level of firm investment during the Japanese banking crisis. During the banking crisis of 1997, under the risk-based capital requirements imposed on banks, Japan experienced a sharp decline in bank loans to firms and Japanese corporate investments fell in 1998 and 1999. According to the Short-Term Economic Survey of Enterprises in Japan (TANKAN) of the Bank of Japan, there was a sharp deterioration of "banks' willingness to lend" during the first quarter of 1998 (Figure 1). To cope with the banking crisis, the Japanese government made capital injections of 1.8 trillion Japanese yen in March 1998 and 7.5 trillion Japanese yen in March 1999 into the top city, trust, and long-term credit banks and other regional banks in the form of purchases of preferred stock or subordinated debt or as subordinated loans. These capital injections helped many banks improve their capital ratios and attain the capital standard required under the 1988 Basel Accord (Basel I) .[1] As Figure 2 shows, the distribution of the regulatory capital adequacy ratio, which we call the Basel I capital ratio (BCR), weighted by loan supply across banks substantially shifted upward from 1997 to 1999.

One of the primary goals of the capital injection policy in Japan was to promote firm investment by improving bank capital ratios in the hope of increasing bank lending to firms (Montgomery and Shimizutani (2009)). Did the capital injection promote investments in Japan? If so, how large was the effect? Given that over 10 trillion yen of Japanese taxpayer money (roughly 2% of Japan's nominal gross domestic product) was spent on capital injections into troubled banks, these are important policy questions. However, while a large body of research investigates whether the credit crunch in Japan constrained firm investments (Caballero et al. (2008); Hayashi and Prescott (2002); Hori et al. (2006);

[1] More precisely, Japanese banking regulations required banks with international operations to have a capital to risk-weighted asset ratio greater than 8%, as specified by Basel I. The regulations also required banks with only domestic operations to have at least a 4% capital ratio, slightly modifying the regulatory capital ratio. The Japanese government strengthened the enforcement of bank capital requirements by introducing the Prompt Corrective Action in April 1998, which enabled regulators to order troubled banks to take remedial action, depending on the banks' regulatory capital adequacy ratios. See Section 2 for more details.

Hosono (2006); Ito and Sasaki (2002); Motonishi and Yoshikawa (1999); Peek and Rosengren (2000); Woo (2003)), few empirical studies (e.g., Giannetti and Simonov (2013), hereafter GS) quantitatively assess the extent to which government capital injections affected firm investments by relaxing firms' financial constraints.

To examine the firm investment effect of the capital injection into banks, we construct a unique data set, combining Japanese firm-level financial statement data with bank balance sheet data. Using the matched firm–bank data, we first examine whether capital injections affect the supply of credit from banks to firms. To examine the effect on corporate investment, we regress corporate investment on the weighted average of banks' BCR, as well as various firm characteristics. We use the BCR because we are interested in a specific mechanism: the effect of banks' BCR on firm investment through financial constraints under Japanese banking regulations rather than the effect of bank health in general. The use of the BCR is essential for quantifying the counterfactual policy effect of capital injection because we can construct the counterfactual value of the BCR without capital injection from the detailed bank-level information of capital injections in 1998–1999.

Using regression analysis of loan growth on the ratio of the capital injection amount to bank equity and bank BCR as well as various firm- and bank-level covariates, we find that the coefficient of the capital injection and that of the bank's BCR are both positive and significant. Furthermore, by dividing the sample by firm-level TFP, we also find that the positive effects of capital injection and bank BCR become stronger for high TFP firms. These results indicate that the government capital injections and the higher BCR help banks to increase their supply of loans to firms. The positive coefficient of the capital injection is consistent with the improvement in banks' willingness to lend in response to the capital injections as evidenced in the Bank of Japan's TANKAN.[2]

Estimation of a linear investment model shows that the coefficient of the interaction between the weighted average of banks' BCR and the firm-level total factor productivity

[2]Figure 1 shows that the number of firms answering that their banks' lending attitudes are severe (solid line) falls after the capital injections into banks that took place in March 1998 and 1999. On the other hand, the number of firms answering that their banks' lending attitudes are accommodative (dashed line) increases slightly after the 1998 capital injection and sharply after the 1999 capital injection.

(TFP) measure is positive and significant. This result suggests that banks' BCR matters in firms' investment decisions when firms are productive and thus have higher demand for investment. Using the estimated model, we conduct counterfactual experiments to quantify the effect of capital injections that took place in March 1998 and 1999 in Japan. The counterfactual experiments suggest that the capital injections had a negligible impact on the average investment rate, although there is a reallocation effect, with investment shifted from low- to high-productivity firms.

The paper most closely related to ours is that of GS, who also examine the effects of bank recapitalization policies on the supply of credit and client firm performance, including firm investment, using matched firm–bank data from the Japanese banking crisis. The authors find that the size of the capital injection is important for its success: If capital injections are large enough so that recapitalized banks achieve capital requirements, such banks increase the supply of credit and firms that borrow from the recapitalized banks increase their investment. This paper's contribution beyond that of GS is as follows. First, we examine whether firms' loan and investment responses to their banks' recapitalization depend on their TFP. This question naturally arises because, theoretically, the higher firm productivity, the larger firm investment and the demand for external finance tend to be. Therefore, bank lending attitude, which likely depends on BCR under the banking regulation, may be more important for high-productivity firms. The finding that high-productivity firms increase their investments more than low-productivity firms in response to their associated banks' recapitalization would suggest that the resource is allocated toward more productive firms as a result of capital injection.[3] Second, we use the BCR as the main variable to assess the effect of capital injections. Despite the well-known issue of overstating their net wealth when banks report their capital ratios, examining how the *reported* BCR is related to firms' investment decisions is important in this context because it is the reported BCR that matters under the capital requirements for banks. By focusing on the BCR, our analysis examines a specific mechanism through which capital injections affects banks' loan

[3] In their regression analysis, GS examine how investment responses to capital injection differ between non-zombie and zombie firms, where zombie firms are identified based on the gap between their actual interest payments and the "minimum required interest payment" on outstanding debt, as for Caballero et al. (2008).

decisions and firm investment; that is, capital injection helps undercapitalized banks meet the capital ratio requirement specified under Basel I regulations. For a robustness check, we also report the results based on alternative, conservative measures of BCR that take into account deferred tax assets as well as defaulted loans. Furthermore, the use of the BCR facilitates a counterfactual experiment based on the counterfactual value of the BCR without capital injection.

This paper also contributes to the empirical literature on the effect of financial constraints on firm investment (e.g., Fazzari et al. (1988); Hoshi et al. (1991); Kaplan and Zingales (1997)). Empirical papers on the effect of financial constraints use various observed measures of financial constraint, such as cash flow, firm size, and years of establishment, to examine their effect on investment. It is often difficult, however, to interpret these empirical results because such measures of financial constraint can be viewed as endogenous variables and correlated with the firm's efficiency measure, which also explains investment. For example, a positive estimate of the cash flow coefficient could just reflect its positive correlation with firm efficiency. This paper examines how the BCR of the bank with which a firm has a relationship influences the firm's investment decisions. To the extent that the BCR measure is viewed as more exogenous than other measures of financial constraint, this paper's results shed further light on the impact of financial constraints on investment.

The remainder of this paper is organized as follows. Section 2 briefly describes banking regulations and bank recapitalization policies during the Japanese banking crisis of the late 1990s. Section 3 describes our data sources and reports descriptive statistics. Section 4 presents our empirical analysis on the effects of capital injection policies on banks' regulatory capital ratio, the supply of credit, and corporate investment. Section 5 concludes the paper.

2 Banking Regulation and Recapitalization Policies in Japan

This section briefly explains banking regulations, particularly the Prompt Corrective Action scheme and recapitalization policies for banks during Japan's banking crisis in the late

1990s.[4] Recognizing a large amount of non-performing loans accumulated in the financial sector after the collapse of asset prices, as early as 1995, the Ministry of Finance started discussing a Prompt Corrective Action scheme with which the government could order undercapitalized banks to take remedial action.[5] In December 1996, the Ministry of Finance published the basic framework of the Prompt Corrective Action that was set to take effect in April 1998. In preparation, many banks tried to improve their regulatory capital ratio, on which the regulations were based. Because one way to do so was to decrease risky assets such as corporate loans, the government was concerned about creating a credit crunch. Therefore, the government decided to allow some flexibility for banks in the scheme's implementation. For example, banks were allowed to choose between market and book values for their stocks and real estate holdings so that they did not have to report unrealized losses on securities in their trading account or they could include unrealized capital gains in their real estate assets in their capital. With such changes in place, the government officially introduced the Prompt Corrective Action in April 1998.

For banks with international operations, the regulation applies the risk-based capital adequacy ratio specified in the Basel I capital requirements. The BCR is defined as

$$BCR = \frac{\text{Tier I} + \text{Tier II} + \text{Tier III} - \text{Goodwill}}{\text{Risk weighted asset}}.$$

Tier I capital, or core capital, mainly consists of equity capital and capital reserves. Tier II capital consists of 45% of unrealized capital gains on equity, 45% of the difference between any revalued land assets and their book value, general loan loss provisions (up to 1.25% of the risk-weighted asset), nonperpetual subordinated debt, and preferred stocks with more than five years to maturity. Tier III capital consists of (short-term) subordinated debt with more than two years to maturity. The sum of Tier II and Tier III capital cannot exceed Tier I capital. Risk-weighted assets are the weighted sum of bank assets, with weights determined by the credit risk of each asset class plus a market risk component. For banks with only domestic operations, domestic capital standards apply, where the risk-based capital ratio is

[4] See Montgomery and Shimizutani (2009) and Hoshi and Kashyap (2010) for details.

[5] Following Basel I , the Japanese government gradually introduced capital requirements for banks. However, there was no explicit penalty for violating these capital requirements until April 1998, when the Prompt Corrective Action took effect.

modified as follows:

$$BCR_{domestic} = \frac{\text{Tier I} + \text{Tier II} - \text{Goodwill}}{\text{Risk Weighted Asset}}.$$

The definitions of the capital components and risk-weighted assets are the same as above, except that Tier II capital does not include unrealized capital gains from securities, which can now be subtracted from risk-weighted assets, general loan loss reserves can be counted only up to 0.625% of risk-weighted assets, and risk-weighted assets do not include the market risk component.

Banks with international operations are required to keep their BCR above 8%, while the minimum capital requirement for domestic banks is 4%. If banks cannot meet these capital requirements, the Prompt Corrective Action enables the government to order these banks to restructure or terminate business, depending on their capital ratios.

In November 1997, before the introduction of the Prompt Corrective Action, Sanyo Securities, Yamaichi Securities, Hokkaido Takushoku Bank, and Tokuyo City Bank failed.[6] In response to these failures, the Diet passed the Financial Function Stabilization Act, which allowed the government to use 30 trillion yen of public funds. Then, in March 1998, the Japanese government injected 1.8 trillion yen into all of the major (city) banks, as well as several regional banks. In this capital injection, all the major banks received 100 billion yen through subordinated debt, except for Dai-Ichi Kangyo Bank, which received 99 billion yen through preferred shares. In the fall of 1998, the Financial Supervisory Agency conducted an intensive examination of the assets of 19 major banks and concluded that the previous assessment was too optimistic. In October 1998, the Diet passed the Prompt Recapitalization Act, which doubled the amount of funds to 60 trillion yen. In October and December of 1998, however, the Long-Term Credit Bank of Japan (LTCB) and Nippon Credit Bank (NCB) were nationalized. To stabilize the banking sector, the Japanese government conducted a second round of capital injection into banks, with 7.5 trillion yen in March 1999. Detailed data on the amount of capital injection each bank

[6] Yamaichi Securities was one of the largest brokerage companies and Hokkaido Takushoku Bank was one of the major banks in Japan.

received are publicly available.[7] Therefore, we are able to calculate counterfactual capital ratios without capital injections by subtracting the injected amounts from the bank capital.

3 Data Source and Variable Definition

To examine the effect of government capital injections into banks on corporate investment, we combine corporate investment data with bank balance sheet data.[8] For corporate balance sheet information, we use the data set compiled by the Development Bank of Japan (DBJ). Because the DBJ data set does not contain data for financial institutions, we obtain data on bank balance sheet information from Nikkei NEEDS Financial Quest (Nikkei NEEDS) and the "Analysis of Financial Statements of All Banks" by the Japanese Bankers Association (JBA).

The DBJ data set contains detailed financial statement information for (non-financial) firms publicly traded in Japanese stock markets. In particular, it provides data on fixed assets at the component level, such as land, building, and machinery. Furthermore, it provides data on outstanding loans by financial institutions, which we use to combine with the Nikkei NEEDS and JBA data.[9] Nikkei NEEDS and the JBA provide data on bank BCRs and non-performing loans, as well as standard bank balance sheet information.[10]

In a given year, each firm borrows from multiple banks. Table 1 and Figure 3 present, respectively, the statistics and a histogram of the number of banks each firm borrows from in 1998, where we exclude financial institutions other than private banks, such as government financial institutions and insurance companies, from the observations. The number of banks each firm borrows from substantially varies across firms, with some borrowing from only one bank and one firm borrowing from 53 banks. The average number of banks is 8.75 and

[7] See, for example, Table 5 of Hoshi and Kashyap (2010). The original data can be found at the website of the Deposit Insurance Corporation of Japan.

[8] We follow Nagahata and Sekine (2005) in combining the two data sets.

[9] Fiscal year-end months differ across firms, while all banks end their fiscal year in March in our data set. To reflect the timing of capital injections in March of 1998 and 1999, we match firm balance sheet information in year $t + 1$ with bank balance sheet information in year t if the closing month of the firms is January or February and match firm observations in year t with bank observations in year t otherwise.

[10] In some years, the BCR data are missing from the Nikkei NEEDS data and we therefore use BCR data from the JBA in these years.

the number of banks tends to increase with the number of firm employees. The average loan share of the top bank, that is, the bank from which firms borrow the most , is 34%, while the average loan share of the top five banks is 77%, where the loan share of bank k is defined as the ratio of the loan supply from bank k to total outstanding loans from all financial institutions.

Table 2 reports the summary statistics for the variables in 1997–2000 we use in our empirical analysis.[11] For bank k in year t, we define the variable BCR_{kt} as the difference between the bank's BCR and the required ratio under banking regulations in Japan (8% for internationally operating banks and 4% for domestically operating banks). To measure the average BCR of the banks each firm borrows from, for firm i in year t, we define a variable $\overline{\text{BCR}}_{it}$ as the weighted average of BCR_{kt} over the banks from which firm i borrows, using the banks' outstanding loans in the pre-sample period of 1995–1997 as weights.

Peek and Rosengren (2005) argue that bank health is much better reflected by stock returns than by reported risk-based capital ratios, because Japanese banks hid losses on their balance sheets using a variety of techniques during the 1990s.[12] We use the BCR because we are interested in a specific mechanism: the effect of the BCR reported in banks' financial statements on investments amid financial constraint under Japanese banking regulations rather than the effect of bank health in general. In this context, the use of the reported Basel I capital adequacy ratio could be justified to the extent that the banking regulations directly apply to the BCR reported on banks' financial statements. Further, the use of the BCR is essential for quantifying the policy effect of capital injection, because we can construct the counterfactual value of the BCR without capital injection from the detailed bank-level capital injection information in 1998–1999 but constructing counterfactual stock

[11] Appendix A explains in detail how we construct the variables we use in our analysis from the original data.

[12] The LTCB and NCB, which were nationalized in October and December 1998, largely underreported their non-performing loans and losses arising from write-offs of such loans for the 1997 fiscal year. Therefore, we do not use the data on the capital ratios of LTCB and NCB in our analysis. For example, for each firm, we calculate the weighted average of BCR_{kt} over the banks from which the given firm borrows, except for the LTCB and NCB. Then, we exclude firms borrowing mainly from the LTCB or NCB from the benchmark sample while including a dummy variable taking the value of one if outstanding loans from the LTCB and NCB (in the pre-sample period) exceeded 10% of the total loans in the investment regressions. To mitigate the well-known reporting bias of BCR, we also perform a robustness check by adopting conservative measures of BCR that take into account deferred tax assets as well as defaulted loans.

returns would be difficult.[13]

Table 3 describes our benchmark sample for estimating our firm investment model. We focus on manufacturing firms. Our main sample period runs from 1997 to 2000, although we also use data from 1995–1996 to compute the pre-sample period's loan shares. We first drop observations missing investment rates or Basel I capital adequacy ratios. We then drop observations with a machine investment rate (the ratio of machine investment to machine capital stock) greater than 2 or less than −2. We further drop the observations of firms that owe more than 20% of total outstanding long-term loans to banks missing BCR data from Nikkei NEEDS during 1997–2000 . We also drop the observations of firms that borrowed mainly from the LTCB, NCB, insurance companies, and government financial institutions, because the LTCB and NCB were nationalized in 1998 and insurance companies and government financial institutions are not under bank regulations. Finally, we drop observations missing values for explanatory variables, which leads to a final sample of 2552 observations.

4 Empirical Analysis

4.1 Basel I Capital Adequacy Ratio and Capital Injection in 1998 and 1999

The impact of the capital injections of 1998 and 1999 on the distribution of Basel I capital adequacy ratios was substantial. In Figure 4, we attempt to construct counterfactual distributions of BCR_{kt} with no capital injection in 1998 and 1999 and compare them with the actual distributions weighted by loan supply. The counterfactual value of BCR_{kt} in Figure 4(a) is constructed by subtracting the amount of capital injection from the numerator of the definition of the Basel I capital adequacy ratio while keeping the denominator, that is, risk-weighted assets, constant. The counterfactual value of BCR_{kt} in Figure 4(b) is the

[13] On the other hand, bank health in general, such as non-performing loans that were not reported in the balance sheets, could affect bank lending decisions and our results therefore require careful interpretation. In addition, our analysis is limited in scope because capital injections can affect investments through different mechanisms, such as stabilizing the financial system, besides relaxing firms' financial constraints.

predicted value of BCR under no capital injection, based on the estimated regression of BCR_{kt} on BCR_{kt-1} and $\text{Injection}_{kt}/e_{k,t-1}$ (Tier 1 + Tier 2) and year dummies, where the estimated coefficient of $\text{Injection}_{kt}/e_{k,t-1}$, the ratio of the amount of capital injection into bank k in year t to its previous year's equity, is significant at 2.56, with a standard error of 0.45. The comparison of the constructed counterfactual distributions of BCR_{kt} with the actual distribution in Figure 4 suggests that, had there been no capital injection in 1998 and 1999, many more banks would have had trouble meeting capital requirements in 1998 and 1999.

If, indeed, the effect of the capital injections of 1998 and 1999 on the Basel I capital adequacy ratio was substantial, as shown in Figure 4, the capital injection must have made it easier to meet the required capital ratio under Japanese bank regulations, which, in turn, could have increased the supply of bank loans and promoted firm investment. Next, we examine the effect of capital injection on the supply of bank loans and firm investment decisions with regression analysis.

4.2 Bank Loan and Capital Injection

We first examine how capital injection into banks affected the supply of bank loans to firms using the panel data set from 1995 to 2000. In contrast to the analysis by GS, ours highlights the role of the Basel I capital adequacy ratio and uses the sample period after the introduction of Japanese banking regulations on capital ratios. Specifically, we examine how the size of capital injections to bank k relative to bank's capital in the previous year is related to the growth rate of loans firm i receives from bank k by estimating the following regression for $t = 1998$, 1999, and 2000:[14]

$$\begin{aligned}\frac{\Delta \ell_{ikt}}{\ell_{ik,t-1}} = \beta_0 + \beta_1 \left(\frac{\text{Injection}_{kt}}{e_{k,t-1}} \times \omega_{ik}\right) + \beta_2 \omega_{ik} + \left(Z^b_{kt} \times \omega_{ik}\right)' \beta_b + \left(Z^f_{it} \times \omega_{ik}\right)' \beta_f \\ + D^b_k + D^f_i + D^{\text{year}}_t \times D^{\text{closing month}}_i + u_{ikt},\end{aligned} \tag{1}$$

[14] We run this regression for $t = 1998$, 1999, and 2000, which corresponds to the bank's fiscal years 1997, 1998, and 1999, because strict enforcement of the capital requirement was anticipated in fiscal year 1997 and formally started after the introduction of the Prompt Corrective Action in March 1998. Furthermore, we exclude firm–bank pairs with the LTCB or NCB and those missing values for the variables used in the regressions.

where $\Delta\ell_{ikt}/\ell_{ik,t-1}$ is the growth rate of loans from bank k to firm i in year t. The main explanatory variables of interest are the amount of capital injection into bank k in year t relative to its previous year's equity, denoted $\text{Injection}_{kt}/e_{kt-1}$, and the difference between the Basel I capital adequacy ratio and the required ratio under banking regulations at the end of the previous year, denoted BCR_{kt-1}. In Equation (1), we include the average share of bank k's loans among total loans to firm i in the pre-sample years (1995–1997), denoted ω_{ik}, where we use the pre-sample period's weights in our baseline specification to mitigate concerns about the endogenous determination of loan shares. Following GS, we interact ω_{ik} with other explanatory variables.

We include firm and bank dummies, denoted D_i^f and D_k^b, respectively. Because the definition of accounting years differs across firms because of different closing months, we include the interaction term between a year dummy, D_t^{year}, and a firm-level dummy for fiscal year closing months, $D_i^{\text{closing month}}$. In our alternative specification, we include the interaction term between the firm and bank dummies $D_i^f \times D_k^b$ to control for bank-firm-level unobserved heterogeneity arising from endogenous matching.[15]

We also include time-varying bank-level variables $Z_{kt}^b = (\text{BCR}_{kt-1}, \text{Domestic}_{kt-1})'$ and firm-level variables $Z_{it}^f = (\ln TFP_{it-1}, \ln K_{it-1}, \text{Cash}_{it-1}/K_{it-1}, b_{it-1}/\text{Collat.}_{it-1})'$. The variable Domestic_{kt-1} is a dummy variable that takes the unit value if bank k operates only in the domestic market in year $t-1$, $\ln TFP_{it-1}$ is the log of TFP of firm i in year $t-1$,[16] $\ln K_{it-1}$ is the log of capital stock at the end of year $t-1$, $\text{Cash}_{it-1}/K_{it-1}$ is the ratio of cash holdings to capital stock in year $t-1$, and $b_{it-1}/\text{Collat}_{it-1}$ is the ratio of total debt to the collateral value of land and capital stocks, where Collat_{it-1} is defined by $\text{Collat}_{it-1} = 0.1573\tilde{K}_{it-1} + 0.6777Land_{it-1}$ with $\tilde{K}_{it-1}$ representing the sum of machinery,

[15] For a robustness check, we also consider the interaction term between the year dummy and the firm dummy, $D_t^{\text{year}} \times D_i^f$, while dropping the terms $Z_{it}^f \times \omega_{ik}$ and $D_t^{\text{year}} \times D_i^{\text{closing month}}$. The estimation results in the baseline specification are robust to this modification, with the point estimates on $\text{Injection}_{kt}/e_{kt-1}$ slightly smaller with $D_t^{\text{year}} \times D_i^f$. Note, however, that by controlling for time-varying firm-level unobservables, the coefficient of $\text{Injection}_{kt}/e_{kt-1}$ shows the relative effect of capital injection on bank k's loan to firm i, keeping the firm-level loan amount constant. Because the effect on total loan amount is important for firm's investment decision, which is our main focus, we omit this specification in our empirical analysis.

[16] The TFP measure is constructed from the estimated production function, where we follow the estimation procedure proposed by Gandhi et al. (2013). For a robustness check, we also estimate the firm-level TFP by system GMM and by the Solow residual, assuming the Cobb-Douglas production function. The results are similar to the ones presented in Table 4 and available upon request.

instruments and tools, and transportation equipment, $Land_{it-1}$ land stock, and the weights (0.1573 and 0.6777) taken from Ogawa and Suzuki (2000).

Table 4 presents the estimation results. We use the sum of Tier 1 and Tier 2 capital injections to compute the variable $\text{Injection}_{kt}/e_{kt-1}$ in columns (1) to (3), while we only use Tier 1 capital injections in columns (4) to (6). In columns (3) and (6), we include the interaction of the firm and bank dummies to control for bank-firm-level unobserved heterogeneity.[17]

Across different specifications and alternative measures of capital injection in Table 4, we find that the coefficient of $(\text{Injection}_{kt}/e_{kt-1}) \times \omega_{ik}$ is significantly positive, indicating that banks that received government capital injections increased their supply of bank loans to firms. Furthermore, the coefficient of $\text{BCR}_{kt-1} \times \omega_{ik}$ is positive and significant and, therefore, banks with a high BCR increased their supply of loans to firms more than banks with a low BCR did during the financial crisis period of 1998–2000.

Besides a bank's injection ratio and BCR, the coefficient of $b_{it-1}/\text{Collat}_{it-1} \times \omega_{ik}$ is negative and significant. The coefficient of $\ln TFP \times \omega_{ik}$ is significantly negative in column (2), although it is insignificant in other specifications. To further examine the effect of the firm-level TFP, we split the sample into high and low TFP firms and run the same regressions for each sub-sample. Table 5 reports the results of the sub-sample analysis. Columns (1) and (2) report the results for firms whose average TFP over the 1995-1997 period is above the 90th percentile, while columns (3) and (4) are for firms whose average TFP over the 1995-1997 period is below the 10th percentile. We find that the coefficients of $\text{Injection}_{kt}/e_{kt-1} \times \omega_{ik}$ and $BCR_{kt-1} \times \omega_{ik}$ are positive and significant in columns (1) and (2), while the estimates of the same coefficients are insignificant in columns (3) and (4). Furthermore, the estimated coefficients of bank's injection ratio and BCR are larger in Table 5 than those in Table 4, suggesting larger effects of capital injection for high TFP firms.

Although the Prompt Corrective Action regulates the capital ratio of banks, the re-

[17] In columns (3) and (6), we drop ω_{ik} because there is no variation in ω_{ik} after controlling for bank-firm-level unobserved heterogeneity.

ported regulatory capital ratio may not fully capture banks' financial health and could have overstated their net wealth. We examine the robustness of the results by constructing alternative measures of capital ratios to deal with the known issue of reported capital ratios. First, following Hoshi and Kashyap (2010) and Nagahata and Sekine (2005), we subtract from bank capital deferred tax assets, which is future tax deductions that banks can claim for past losses, because deferred tax assets disappear if banks do not have a positive taxable income within five years. Second, we subtract defaulted loans to take into account the future cost of writing off such loans.

Table 6 reports the estimation results of the loan growth model with alternative measures of bank capital ratios. In columns (1) and (2), we modify the regulatory bank capital ratio by subtracting deferred tax assets and defaulted loans from bank capital. The computation of this modified capital ratio requires detailed data on bank capital components such as Tier I and II capital, as well as risk-weighted assets. Because the breakdown data are not available for some banks, the sample size is smaller in columns (1) and (2).[18] Thus, in columns (3) and (4), we calculate an alternative bank capital ratio by using publicly available balance sheet information only so that we can compute the conservative bank capital ratio adjusted to deferred tax assets and defaulted loans for more banks. Because it is not appropriate to subtract the minimum capital requirement from the balance sheet-based capital ratio, we include the variable $\text{BCR}_{kt-1} \times \text{Domestic}_{kt-1} \times \omega_{ik}$ to distinguish between international and domestic banks. The estimation results show that the coefficients of $(\text{Injection}_{kt}/e_{kt-1}) \times \omega_{ik}$ and $\text{BCR}_{kt-1} \times \omega_{ik}$ are positive and significant.

4.3 Machine Investment and Capital Injection

We now examine firm machine investment rates. Given the capital requirements imposed by Japanese banking regulations, financially troubled banks could restrict the supply of credit to increase their regulatory BCR, which could affect corporate investment when firms are financially constrained. Our investment model takes into account this potential dependence

[18] Detailed information on the regulatory capital ratio is not available for banks with only domestic operations. Therefore, in columns (1) and (2), the variable $\text{Domestic}_{kt-1} \times \omega_{ik}$ is dropped.

of investment on bank capital ratio in addition to standard firm characteristics such as size and productivity. Specifically, we estimate the following linear investment model:

$$\frac{I_{m,it}}{K_{m,it-1}} = \alpha_0+\alpha_1\overline{\text{BCR}}_{it-1}+\alpha_2 \ln TFP_{it-1}\times\overline{\text{BCR}}_{it-1}+Z'_{it}\alpha_f+D_i^f+D_t^{\text{year}}\times D_i^{\text{closing month}}+\epsilon_{it}, \tag{2}$$

where the dependent variable $\frac{I_{m,it}}{K_{m,it}}$ is the ratio of machine investment in year t to machine capital stock in year $t-1$. The variable $\overline{\text{BCR}}_{it-1}$ is the weighted average of BCR less the required capital ratio in year $t-1$ across the banks firm i borrows from, where the weights are constructed from the pre-sample loan shares in 1995–1997, computed as $\overline{\text{BCR}}_{it-1} := \sum_k \omega_{ik}\text{BCR}_{kt-1}$. We also include the interaction of $\overline{\text{BCR}}_{it-1}$ with $\ln TFP_{it-1}$ to examine how the effect of a bank's BCR depends on firm productivity. The vector Z_{it} contains $\omega_i^{bankrupt}\times D_{99,00}^{year}$, $\ln TFP_{it-1}$, $\ln K_{it-1}$, $\text{Cash}_{it-1}/K_{it-1}$, $b_{it-1}/\text{Collat.}_{it-1}$, and $\overline{\text{Domestic}}_{it-1}$, where $\omega_i^{bankrupt}$ is the pre-sample share of the LTCB and NCB among firm i's total loans, $D_{99,00}^{year}$ is the dummy variable for the period 1999–2000, and $\overline{\text{Domestic}}_{it-1}$ is the weighted average of a domestically operating bank's dummy variable in year $t-1$, computed as $\overline{\text{Domestic}}_{it-1} := \sum_k \omega_{ik}\text{Domestic}_{kt-1}$. In the benchmark analysis, we construct data on $\ln TFP_{it-1}$ by estimating a firm-level production function with the method proposed by Gandhi et al. (2013). As a robustness check, we also report the results with TFP estimates from the system GMM and the Solow residual in Table 8.[19]

Columns (1) and (2) of Table 7 presents the estimates of equation (2). The coefficient of $\overline{\text{BCR}}_{it-1}$ is not significant in column (1), perhaps due to a lack of statistical power, given that we control for firm fixed effects with a short panel of three years. On the other hand, in column (2), the significantly positive interaction term between $\overline{\text{BCR}}_{it-1}$ and the logarithm of TFP implies that improvements in bank capital ratios could induce larger investments among firms with higher productivity. Conditioning on capital stock levels, whose estimated coefficient is significantly negative, we find an increase in productivity to be associated with higher demand for capital investment but firms are able to invest only if banks are healthy and willing to supply loans.

[19] Appendix B explains the estimation method proposed by Gandhi et al. (2013) and the system GMM. To obtain the firm-level Solow residual, we assume constant returns to scale in a Cobb–Douglas specification and set the coefficients for labor and intermediate inputs to the observed cost shares of the respective inputs.

We also examine the effect of capital injections on investments by estimating the following model:

$$
\begin{aligned}
\frac{I_{m,it}}{K_{m,it-1}} = \alpha_0 + \alpha_1 \overline{\left(\frac{\text{Injection}}{e}\right)}_{it-1} + \alpha_2 \ln TFP_{it-1} \times \overline{\left(\frac{\text{Injection}}{e}\right)}_{it-1} + Z'_{it}\alpha_f \\
+ D_i^f + D_t^{\text{year}} \times D_i^{\text{closing month}} + \epsilon_{it},
\end{aligned}
\tag{3}
$$

where the variable $\overline{(\text{Injection}/e)}_{it} := \sum_k \omega_{ik}(\text{Injection}_{kt}/e_{it-1})$ is the weighted average of the ratio of the sum of Tier 1 and Tier 2 capital injections in year t to bank k's equity in year $t-1$ across banks firm i borrows from, using weights constructed from pre-sample year loan shares in column (3) of Table 7 and Tier 1 capital injection in place of the sum of Tier 1 and Tier 2 capital injections in column (4). As shown in columns (3) and (4), across different specifications and different measures of capital injections, the interaction of $\overline{(\text{Injection}/e)}_{it}$ with the logarithm of TFP is significantly positive, indicating that the effect of capital injections into associated banks on firm investment is larger among firms with higher productivity. This finding suggests that banks that received capital injections improved their capital ratios and became more willing to lend, which led to an increase in investments among firms with high productivity growth.

Table 8 reports the estimation results with alternative bank capital ratios and firm-level TFP measures. In columns (1) and (2), we examine the effects of the alternative bank capital ratios adjusted to deferred tax assets and defaulted loans, as in Table 6. Although the coefficient of $\ln \text{TFP}_{it-1} \times \overline{\text{BCR}}_{it-1}$ becomes slightly smaller and, likely because of the smaller sample size, statistically insignificant in column (1), the effect of the interaction term is larger and statistically significant in column (2). Columns (3) and (4) report results with alternative firm-level TFP measures constructed by the system GMM and Solow residual, respectively. These two columns show that the empirical patterns found in Table 7 are robust, with a positive and significant coefficient of $\ln \text{TFP}_{it-1} \times \overline{\text{BCR}}_{it-1}$.

Using the estimated models (2) and (3), we quantify the effect on corporate investment of capital injections that took place in March 1998 and 1999 in Japan. Specifically, we first compute the counterfactual BCR without capital injections and then calculate the counterfactual changes in investment rates by taking the difference between the predicted investment rates based on the actual and counterfactual BCR values.

Table 9 reports the mean changes in the investment rates for the whole sample and by percentiles of $\ln \text{TFP}_{it-1}$. In this table, we use the estimates reported in column (2) of Table 7 and construct the counterfactual BCR by simply subtracting the injection amounts from a bank's Tier I and Tier II capital while keeping risk-weighted assets constant. The results show that, for firms with TFP above the 90th percentile, the investment rates would have been 0.2% lower in 1998 and 1.1% lower in 1999 without the capital injections in those years. For the rest of the firms, however, the investment rates would have been *higher*. Table 9 also reports the results for alternative measures of bank capital ratios, where we subtract deferred tax assets and defaulted loans from the regulatory bank capital. With the alternative measures of the bank capital ratios, the effects of capital injections tend to be larger. In particular, in the panel labelled *Adjusted BCR 2* where we compute the bank capital ratio by using publicly available balance sheet information with the adjustment to deferred tax assets and defaulted loans, the investment rates would have been lower for firms with TFP above the 25th percentile in both 1998 and 1999 and, for firms with TFP above the 90th percentile, the investment rates would have dropped by 2.5% in 1999.

Table 10 reports the results of the same counterfactual experiments, except that we now construct the counterfactual BCR without capital injections based on the estimated regression of the BCR on the lagged capital ratio, the ratio of the injection amount to equity and year dummies. Table 11 reports the results of the counterfactual experiments from investment model (3) based on the estimates reported in column (3) of Table (7). The quantitative effects are similar to those reported in Table 9.

5 Conclusion

In this study, we examine the effect of government capital injections into financially troubled banks on the level of corporate investment during the Japanese banking crisis of the late 1990s. By combining the balance sheet data of Japanese manufacturing firms with banks' balance sheet data, we first estimate the effects of capital injections and bank regulatory capital ratios on the growth of loans to firms and confirm that the effects are positive and significant. Recapitalization policies can promote the investment of client firms if capital injections help banks respond to loan demands. To test this mechanism empirically, we model corporate investment as a function of not only standard firm characteristics, such as size and productivity, but also banks' regulatory capital ratio. By estimating a linear investment model, we find that the coefficient of the interaction between firm TFP and bank capital ratios is positive and significant, suggesting that a bank's capital ratio matters for more productive firms. Furthermore, we conduct counterfactual experiments to quantify the effect of capital injections that took place in March 1998 and 1999 in Japan. The counterfactual experiments suggest that the capital injections had a negligible impact on the average investment rate, although there is a reallocation effect, with investment shifting from low- to high-productivity firms.

Our analysis differs in two important ways from that of GS, who also examine the effects of bank recapitalization policies on the supply of credit and client firms' performance, including firm investment, using data from the Japanese banking crisis. First, we uncover empirical patterns of how capital injections affect corporate investment by interacting banks' regulatory capital ratio and capital injection amounts with firms' TFP. Our estimation results show that the coefficients of these interaction terms are positive and significant in the investment regressions. Second, we focus on the specific mechanism of capital injections helping undercapitalized banks meet the capital requirements imposed by Japanese banking regulations. To do so, we use banks' regulatory capital ratio as the main variable to assess the effect of capital injections. Use of the regulatory capital ratio also enables us to conduct counterfactual experiments based on the counterfactual values of the regulatory capital ratio without capital injections.

It is worth noting that the objective of this paper is limited and does not aim to examine the effect of capital injection in general. This is an important limitation, because capital injections are likely to have had important impacts on the Japanese economy through other mechanisms, such as by promoting the write-off of non-performing loans and stabilizing the financial system.

Appendix A: Development Bank of Japan Data

The data set compiled by the Development Bank of Japan (DBJ) contains detailed corporate balance sheet/ income statement data for firms listed on the stock markets in Japan. In our analysis, we deflate all nominal variables by the monthly Corporate Goods Price Index (CGPI) for all goods. If firms change their closing dates, the data after the change may refer to fewer than 12 months. When this occurs, we multiply the data x_{it} by $12/m$, where m represents the number of months to which the data refer. The rest of this section explains how we construct variables from the original data.

A.1 Variable Construction

Capital Stock (other than Land)

The DBJ data set provides a breakdown of capital stock data between six capital goods: (1) nonresidential buildings; (2) structures; (3) machinery; (4) transportation equipments; (5) instruments and tools; (6) land. This section explains a perpetual inventory method to construct real stock data for each capital good, except for land.[20] First, we construct a series of nominal investments in each capital good. Let $(pI)_{it}$ denote firm i's nominal investment in period t. Let K_{it}^{book} denote the book value of the stock of a given capital good at the *end* of period t. Let δK_{it}^{book} denote a depreciated value. Then, we compute $(pI)_{it}$ by the following formula: $(pI)_{it} = K_{it}^{book} - K_{it-1}^{book} + \delta K_{it-1}^{book}$.

Second, we deflate the nominal investment data by the CGPI corresponding to each capital good. Denote the real investment by I_{it}. Third, we construct data on real capital stock by the perpetual inventory method. Let K_{it} denote firm i's real capital stock in period t. Then we compute $\{K_{it}\}_t$ by $K_{it+} = (1-\delta)K_{it} + I_{it}$, where the depreciation rate, δ, is taken from Hayashi and Inoue (1991). The initial base year is 1969. For firms entering the sample after 1969, we set the base year to their first year in the sample. We assume that the book value is equal to the market value for the base year and deflate the book value by the corresponding CGPI. If the stock value becomes negative in the perpetual

[20] See Hayashi and Inoue (1991) for more details.

inventory method, we reset the stock value to the book value for the year. We multiply real capital stock by the corresponding CGPI series to obtain data on capital stock in current yen. In our analysis, we define machine capital by the sum of machinery and transportation equipment.

Land

Setting the land depreciation rate to zero and using the last in, first out method to evaluate inventory, we construct nominal investment as follows:

$$(pI)_{it} \quad = \quad \begin{cases} K_{it}^{book} - K_{it-1}^{book} & \text{if} \quad K_{it}^{book} \geq K_{it-1}^{book} \\ (K_{it}^{book} - K_{it-1}^{book})(p_t^{land}/p_s^{land}) & \text{if} \quad K_{it}^{book} < K_{it-1}^{book}, \end{cases}$$

where p_s^{land} is the price of land at which land was last bought (Hoshi and Kashyap (1990); Hayashi and Inoue (1991)).

With the nominal investment series and the depreciation rate, which is set to zero, we construct data on the nominal stock of land through the perpetual inventory method, $(pK)_{it} = (p_t/p_{t-1})(pK)_{it-1} + (pI)_{it}$, where $(pK)_{it}$ represents the value of firm i's land stock in current yen in period t, $(pI)_{it}$ is the value of land investment in current yen, and p_t is the price of land in period t. For the base year, we use a book-to-market ratio to convert the book value of land stocks into their market value. For the book-to-market ratio, following Hayashi and Inoue (1991), we use an estimate of the market value of land owned by non-financial corporations from the National Income Accounts and the book value from Corporate Statistics Annual.

Net Debt

For debt, we use the sum of short- and long-term borrowing and corporate bonds. Net debt is then computed by subtracting the amount of deposits from the debt.

Output

The nominal output for period t is total sales plus changes in the inventories of finished goods.

Appendix B: Estimation of Production Function

B.1 Gandhi, Navarro, and Rivers, 2013 (GNR)

This section briefly explains the estimation procedure proposed by GNR . Consider

$$\begin{aligned} Y_{it} &= \exp(\epsilon_{it})Q_{it} \\ Q_{it} &= \exp(\omega_{it})F_t(L_{it}, K_{it}, M_{it}) \end{aligned}$$

with $\omega_{it} = h(\omega_{it-1}) + \eta_{it}$, where Y_{it} is realized output, L_{it} is labor input, K_{it} is capital stock, M_{it} is intermediate input, ϵ_{it} is an unexpected idiosyncratic shock that is unknown when the input choice M_{it} is made in period t, and η_{it} is an innovation to ω_{it} that is unknown in period $t-1$ but known when the input choice M_{it} is made in period t. The shocks ϵ_{it} and η_{it} are independent and identically distributed, with mean zero and standard deviations σ_ϵ and σ_η, respectively. In what follows, we denote the logarithmic values of $(Y_{it}, L_{it}, K_{it}, M_{it})$ by $(y_{it}, \ell_{it}, k_{it}, m_{it})$.

We assume that M_{it} is a flexible input. As GNR discuss, the identification problem arises because m_{it} is a deterministic function of $(\omega_{it}, k_{it}, \ell_{it})$ and there is no cross-sectional variation that will allow us to identify the coefficient of m_{it} once $(\omega_{it}, k_{it}, \ell_{it})$ is conditioned on. To deal with the identification problem, we exploit the first-order condition with respect to M_{it}. The first-order condition is written as follows:

$$\ln\left(\frac{P_{Mt}M_{it}}{Y_{it}}\right) = \ln\Big(G_t(L_{it}, K_{it}, M_{it})E[e^{\epsilon_{it}}]\Big) - \epsilon_{it}, \tag{4}$$

where $G_t(L_{it}, K_{it}, M_{it}) = \frac{F_{M,t}(L_{it},K_{it},M_{it})M_{it}}{F_t(L_{it},K_{it},M_{it})}$. From $G_t(L_{it}, K_{it}, M_{it}) = \frac{F_{M,t}(L_{it},K_{it},M_{it})M_{it}}{F_t(L_{it},K_{it},M_{it})}$, it follows that

$$\begin{aligned} & F_t(L_{it}, K_{it}, M_{it})e^{-\mathcal{C}_t(L_{it},K_{it})} = e^{\int G_t(L_{it},K_{it},M_{it})\frac{dM_{it}}{M_{it}}} \\ \Leftrightarrow \quad & F_t(L_{it}, K_{it}, M_{it}) = e^{\int G_t(L_{it},K_{it},M_{it})\frac{dM_{it}}{M_{it}} + \mathcal{C}_t(L_{it},K_{it})}. \end{aligned}$$

Then, we have

$$\omega_{it} = y_{it} - \int G_t(L_{it}, K_{it}, M_{it})\frac{dM_{it}}{M_{it}} - \mathcal{C}_t(L_{it}, K_{it}) - \epsilon_{it}.$$

Following GNR, we estimate (4) by nonlinear least squares. In the estimation, we approximate $G(L_{it}, K_{it}, M_{it})$ by a polynomial of order two, denoted G_2; that is,

$$G_2(L_{it}, K_{it}, M_{it}) = \sum_{r_l + r_k + r_m \leq 2} \gamma_{r_l, r_k, r_m} l_{it}^{r_l} k_{it}^{r_k} m_{it}^{r_m} \text{ with } r_l, r_k, r_m \geq 0. \quad (5)$$

Using estimates of γ_{r_l, r_k, r_m}, we obtain the estimate of the residual, denoted $\hat{\epsilon}_{it}$. Note that, if G is a polynomial of order r, the integral of G has the following closed-form solution:

$$\mathcal{G}_r(L_{it}, K_{it}, M_{it}) \equiv \int G_r(L_{it}, K_{it}, M_{it}) \frac{dM_{it}}{M_{it}} = \sum_{r_l + r_k + r_m \leq r} \frac{\gamma_{r_l, r_k, r_m}}{r_m + 1} l_{it}^{r_l} k_{it}^{r_k} m_{it}^{r_m + 1}.$$

As GNR, we approximate $\mathcal{C}(L_{it}, K_{it})$ by a polynomial of order two; that is,

$$\mathcal{C}_2(L_{it}, K_{it}) = \alpha_\ell \ell_{it} + \alpha_k k_{it} + \alpha_{\ell\ell} \ell_{it}^2 + \alpha_{kk} k_{it}^2 + \alpha_{\ell k} l_{it} k_{it}$$

Let $\alpha = (\alpha_\ell, \alpha_k, \alpha_{\ell\ell}, \alpha_{kk}, \alpha_{\ell k})$. Define $\omega_{it}(\alpha)$ by

$$\omega_{it}(\alpha) = \left(y_{it} - \sum_{r_l + r_k + r_m \leq 2} \frac{\hat{\gamma}_{r_l, r_k, r_m}}{r_m + 1} l_{it}^{r_l} k_{it}^{r_k} m_{it}^{r_m + 1} - \hat{\epsilon}_{it} \right) - (\alpha_\ell \ell_{it} + \alpha_k k_{it} + \alpha_{\ell\ell} \ell_{it}^2 + \alpha_{kk} k_{it}^2 + \alpha_{\ell k} l_{it} k_{it}).$$

Using $\omega_{it}(\alpha)$, we define $\hat{\eta}_{it}(\alpha)$ by[21]

$$\hat{\eta}_{it}(\alpha) = \omega_{it}(\alpha) - \rho_{0t} - \rho_1 \omega_{it-1}(\alpha).$$

To estimate α, we use the following moment conditions:

$$E[\mathbf{z}_{it} \eta_{it}] = \mathbf{0},$$

where $\mathbf{z}_{it} = (\ell_{it}, k_{it}, \ell_{it}^2, k_{it}^2, \ell_{it} k_{it})$.

B.2 System GMM à la Blundell and Bond (1998, 2000)

We consider the following production function:

$$y_{it} = \alpha_0 + \alpha_\ell \ell_{it} + \alpha_k k_{it} + \alpha_m m_{it} + \mu_i + \eta_t + \omega_{it} + \epsilon_{it} \quad (6)$$

$$\omega_{it} = \rho \omega_{i,t-1} + \eta_{it} \quad (7)$$

[21]For the benchmark analysis, we use the AR(1) specification. However, the results remain unchanged when we approximate the conditional expectation by a stationary third-order polynomial.

where y_{it} is the logarithm of the total gross output, ℓ_{it} is the logarithm of labor input, k_{it} is the logarithm of capital input, and m_it is the logarithm of intermediate input. The variable ω_{it} represents the persistent component of TFP and follows the AR(1) process, where η_{it} is independent of $\omega_{i,t-1}$. The variable ϵ_{it} is a measurement error.

One of the main econometric issues in estimating the production function (6)-(7) is the simultaneity of a productivity shock ω_{it} and input decisions. All the input variables, ℓ_{it}, k_{it}, and m_{it}, are likely to be correlated with productivity shock ω_{it} and the ordinary least squares estimate will be biased.

To estimate the production function consistently, we first take a "quasi-difference," $y_{it} - \rho y_{i,t-1}$, to eliminate ω_{it} and $\omega_{i,t-1}$ as

$$\begin{aligned} y_{it} &= \rho y_{i,t-1} + \alpha_\ell \ell_{it} - \rho\alpha_\ell \ell_{i,t-1} + \alpha_k k_{it} - \rho\alpha_k k_{i,t-1} + \alpha_m m_{it} - \rho\alpha_m m_{i,t-1} + \mu_i + \eta_{it} \\ &= \pi_1 y_{i,t-1} + \pi_2 \ell_{it} + \pi_3 \ell_{i,t-1} + \pi_4 k_{it} + \pi_5 k_{i,t-1} + \pi_6 m_{it} + \pi_7 m_{i,t-1} + \mu_i + \eta_{it}. \end{aligned}$$

Then, we apply the system GMM estimator of Blundell and Bond (1998) to estimate the parameter vector $\pi = (\pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6, \pi_7)$ without imposing cross-parameter constraints. We also include the year dummies. Here, k_{it} is a predetermined variable so that $E[\Delta\omega_{it}k_{i,t-s}] = 0$ holds for $s = 1, 2, ...$, while ℓ_{it} and m_{it} are endogenous variables, where $E[\Delta\omega_{it}\ell_{i,t-s}] = 0$ and $E[\Delta\omega_{it}m_{i,t-s}] = 0$ hold for $s = 2, 3, ...$ We also use additional moment conditions implied by initial conditions under stationarity. After estimating π by the GMM estimation procedure, we impose cross-parameter restrictions, such as $\pi_5 = -\rho\alpha_k$, by using minimum distance to obtain consistent estimates of $(\alpha_\ell, \alpha_k, \alpha_m, \rho)$.

Figures and Tables

Figure 1: Bank Attitudes toward Lending (TANKAN, Bank of Japan)

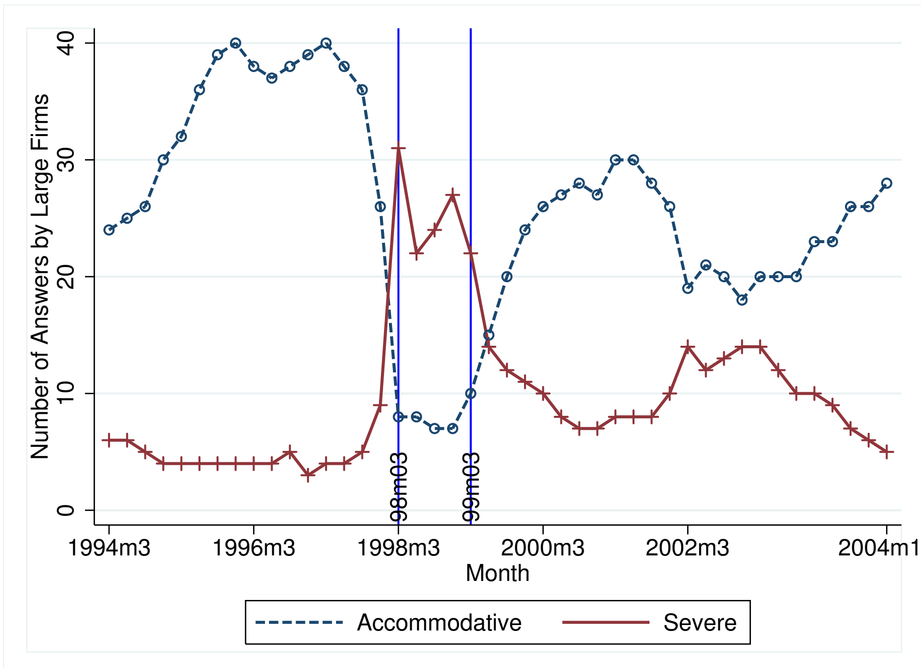
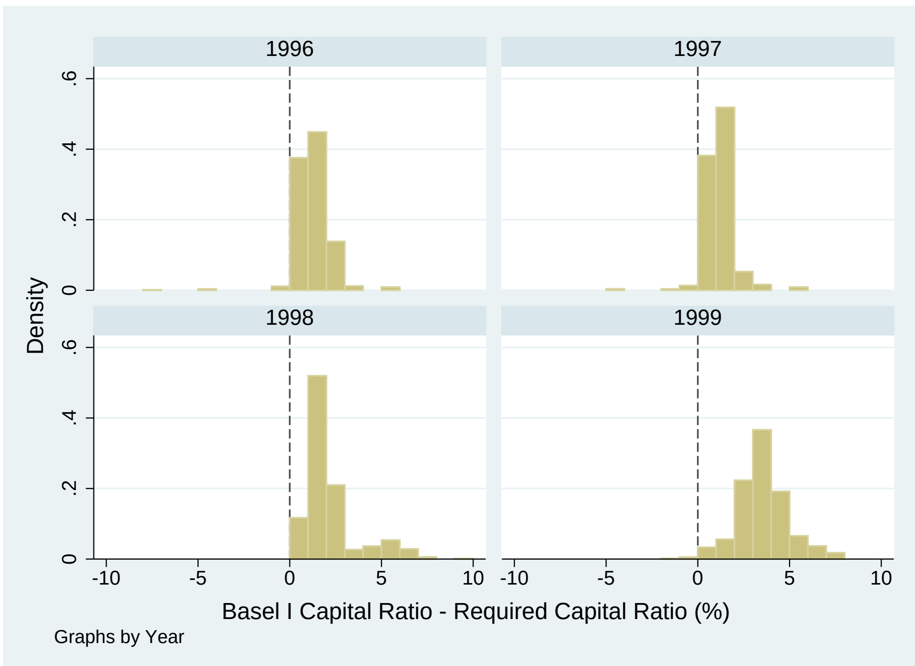


Figure 2: Distribution of Basel I Capital Adequacy Ratios, 1996-1999



Notes: Weighted by the loan supply.

Figure 3: Distribution of the Number of Banks Each Firm Borrows from in 1998

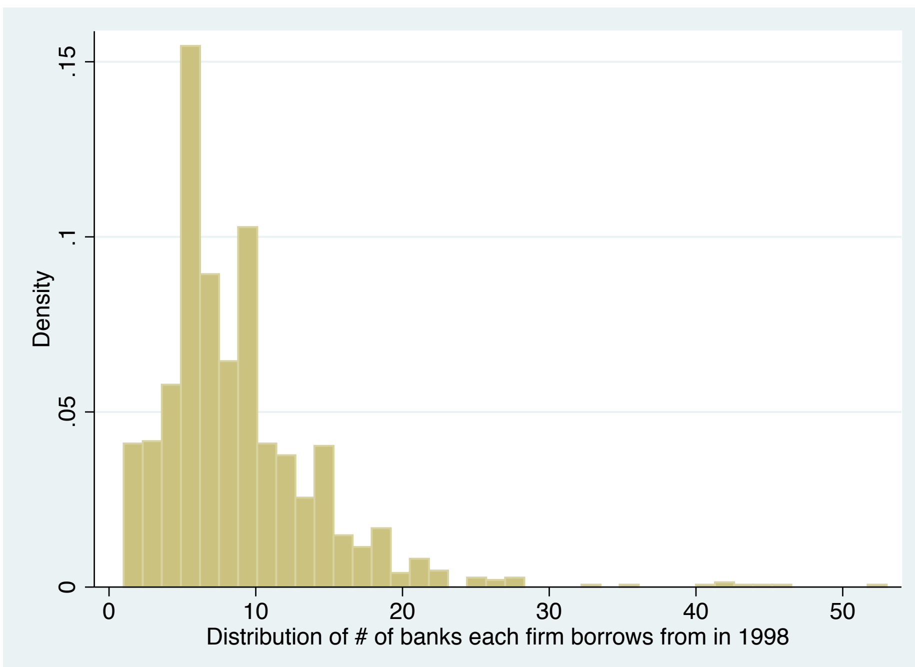
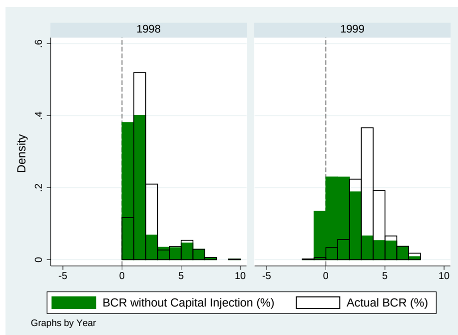
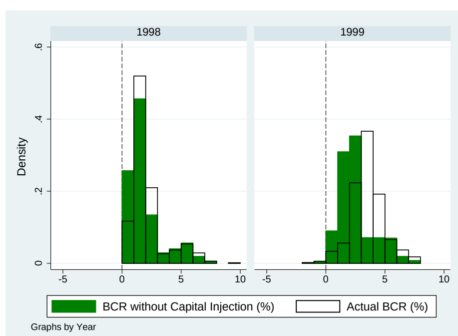


Figure 4: Basel I Capital Adequacy Ratios (BCRs) without Capital Injections, 1998 and 1999



(a) Counterfactual BCRs with No Adjustment in Risk-Weighted Assets



(b) Counterfactual BCR Based on Regression Estimates

Notes: Weighted by the loan supply. The x-axis is the Basel I capital adequacy ratio less the required capital ratio.

Table 1: Number of Banks Each Firm Borrows from and Top Bank Loan Shares in 1998

		Obs	Mean	Std. Dev.	Min	Max
# of banks	All firms	1145	8.75	5.61	1	53
each firm	Small	113	6.68	6.47	1	43
borrows from	Medium	769	7.96	3.85	1	26
	Large	263	11.95	7.90	1	53
Loan share of the top bank		1145	0.34	0.17	0.06	1.00
Loan share of top 5 banks		1145	0.77	0.19	0.07	1.00

Notes: Small, medium, and large firms are those with fewer than 200 employees, between 200 and 2000 employees, and more than 2000 employees, respectively.

Table 2: Summary Statistics ($t = 1998, 1999, 2000$)

Variable	Obs	Mean	Std. Dev.	Min	Max
Firm–bank-level variable					
$\Delta\ell_{ikt}/\ell_{ik,t-1}$	24685	0.166	1.342	-0.999	60.127
ω_{ik}	24685	0.102	0.124	0.000	1.000
Bank-level variable					
$\text{Injection}_{kt}/e_{k,t-1}$ (Tier 1 + Tier 2)	338	0.051	0.180	0.000	1.257
$\text{Injection}_{kt}/e_{k,t-1}$ (Tier 1 Only)	338	0.039	0.161	0.000	1.257
BCR_{kt-1}	338	2.595	1.954	-1.150	9.480
Domestic_{kt-1}	338	0.536	0.499	0.000	1.000
Firm-level variable					
$I_{m,it}/K_{m,it-1}$	2552	0.092	0.113	-0.580	1.647
$\overline{\text{BCR}}_{it-1}$	2552	2.219	1.179	-0.535	7.592
$\overline{(\text{Injection}/e)}_{it-1}$ (Tier 1 + Tier 2)	2552	0.170	0.216	0.000	0.840
$\overline{(\text{Injection}/e)}_{it-1}$ (Tier 1 Only)	2552	0.121	0.193	0.000	0.840
$\ln \text{TFP}_{it-1}$	2552	0.006	0.331	-1.056	1.879
$\ln K_{m,t-1}$	2552	15.370	1.543	10.354	20.128
$b_{it-1}/\text{Collat.}_{it-1}$	2552	1.772	1.750	0.013	22.305
$\text{Cash}_{it-1}/K_{it-1}$	2552	0.313	0.379	0.001	3.561
$\overline{\text{Domestic}}_{it-1}$	2552	0.065	0.130	0.000	1.000

Notes: The summary statistics for *Firm–bank-level variable* and *Bank-level variable* are computed from the firm–bank observations and bank observations used in estimating column (3) of Table 4. The summary statistics for the other firm-level variables are computed from the firm-level observations used in estimating Table 7 that satisfy the sample selection criteria reported in Table 3. The variable $\Delta\ell_{ikt}/\ell_{ik,t-1}$ denotes the growth of loans of bank k to firm i between years $t-1$ and t; ω_{ik} is the average share of bank k's loans among total loans to firm i in the pre-sample years (1995–1997); $\text{Injection}_{kt}/e_{k,t-1}$ (Tier 1 + Tier 2) is the amount of capital injection into bank k' Tier 1 and Tier 2 capital in year t relative to its previous year's equity; $\text{Injection}_{kt}/e_{k,t-1}$ (Tier 1 only) is the ratio of the capital injection amount into Tier 1 capital to the bank's previous year's equity; BCR_{kt-1} is the difference between the bank's BCR and the required ratio under Japanese banking regulations; Domestic_{kt-1} is a dummy variable that takes the value of one if bank k operates only in the domestic market in year $t-1$; $I_{m,it}/K_{m,it-1}$ is the ratio of firm i's investment to its previous year's assets; $\overline{\text{BCR}}_{it-1}$ is the weighted average of BCR_{kt} over the banks from which firm i borrows; $\overline{(\text{Injection}/e)}_{it-1}$ (Tier 1 + Tier 2) is the ratio of the weighted average of Tier 1 and Tier 2 injections to equity; $\overline{(\text{Injection}/e)}_{it-1}$ (Tier 1 only) is the ratio of the weighted average of Tier 1 injection to equity; $\ln \text{TFP}_{it-1}$ is the logarithm of firm i's TFP in year $t-1$; $b_{it-1}/\text{Collat.}_{it-1}$ is the ratio of total debt to the collateral value of land and capital stocks of firm i in year $t-1$; $\text{Cash}_{it-1}/K_{it-1}$ is the ratio of firm i's cash holdings to capital stock in year $t-1$; and $\overline{\text{Domestic}}_{it-1}$ is the weighted average of Domestic_{kt-1} over the banks from which firm i borrows.

Table 3: Benchmark Sample Selection for Firm Investments Model

	Observations deleted	Remaining observations
Initial data for 1997-2000 (manufacturing)		3300
Missing data (I_m/K_m, BCR)	188	3112
$I_m/K_m > 2$ or $I_m/K_m < -2$	1	3111
Large long-term loan with missing Basel I capital ratio	7	3104
More loans from other banks	274	2830
Missing $\ln TFP$	144	2686
Missing regressors other than $\ln TFP$	134	2552
Benchmark sample		**2552**

Notes: The term I_m/K_m represents the ratio of machine investment to machine capital stock. The large long-term loans missing the BCR omits firms that owe more than 20% of total outstanding long-term loans to banks whose BCR data are missing from the Nikkei NEEDS data. The so-called other banks include the LTCB, NCB, insurance companies, and government financial institutions such as the DBJ. (Sources: DBJ and Nikkei NEEDS)

Table 4: Effect of Capital Injections on Bank Loans (Dependent Variable $\frac{\Delta \ell_{ikt}}{\ell_{ik,t-1}}$)

	(1)	(2)	(3)	(4)	(5)	(6)
Definition of Injection	Tier 1 + Tier 2			Tier 1 Only		
$\text{Injection}_{kt}/e_{k,t-1} \times \omega_{ik}$	0.6132***	0.7839***	1.0253**	0.7487***	0.9646***	1.0934**
	[0.217]	[0.237]	[0.441]	[0.269]	[0.292]	[0.509]
ω_{ik}	-1.0641***	-0.8473		-1.0473***	-0.8807	
	[0.132]	[1.931]		[0.134]	[1.918]	
$\text{BCR}_{kt-1} \times \omega_{ik}$	0.1936***	0.2078***	0.2874***	0.1903***	0.2039***	0.2667***
	[0.038]	[0.035]	[0.088]	[0.038]	[0.036]	[0.082]
$\text{Domestic}_{kt-1} \times \omega_{ik}$	-0.5681**	-0.5486**	-0.8736***	-0.5745**	-0.5550**	-0.8110***
	[0.261]	[0.273]	[0.289]	[0.258]	[0.269]	[0.279]
$\ln(\text{TFP}_{it-1}) \times \omega_{ik}$		-0.3093*	-1.7702		-0.3008	-1.7199
		[0.186]	[1.945]		[0.187]	[1.929]
$\ln K_{it-1} \times \omega_{ik}$		-0.0201	-0.2436		-0.0164	-0.2376
		[0.110]	[0.315]		[0.110]	[0.313]
$b_{it-1}/\text{Collat.}_{it-1} \times \omega_{ik}$		-0.1050***	-0.6920*		-0.1047***	-0.6896*
		[0.034]	[0.353]		[0.034]	[0.353]
$\text{Cash}_{it-1}/K_{it-1} \times \omega_{ik}$		0.0949	0.2041		0.0952	0.2094
		[0.244]	[0.639]		[0.245]	[0.645]
Bank Fixed Effects	Yes	Yes	No	Yes	Yes	No
Firm Fixed Effects	Yes	Yes	No	Yes	Yes	No
Bank × Firm Fixed Effects	No	No	Yes	No	No	Yes
Year × Closing Month	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,685	22,436	22,436	24,685	22,436	22,436

Notes: The matched firm–bank observations for $t = 1998$, 19999, and 2000 are used for estimation, where the numbers of observations are unbalanced across different specifications because of missing values for some regressors. The dependent variable is the growth rate of loans from bank k to firm i. The variable ω_{ik} is the average share of bank k's loans among firm i's total loans in the pre-sample years from 1995 to 1997. The variable $\text{Injection}_{kt}/e_{k,t-1}$ is the ratio of the sum of Tier 1 and Tier 2 capital injections in year t to bank k's equity in year $t-1$ in columns (1) to (5), while we use Tier 1 capital injections in place of the sum of Tier 1 and Tier 2 capital injections in columns (6) to (10). The variable $\text{BCR}_{k,t-1}$ is defined as the BCR less the required capital ratio (8% for internationally operated banks and 4% for domestic banks) in year $t-1$; Domestic_{kt-1} is a dummy variable that takes the unit value if bank k is a domestically operating bank in year $t-1$; $\ln TFP$ is the logarithm of firm i's TFP in year $t-1$; $\ln K_{it-1}$ is the logarithm of capital stock for firm i in year $t-1$; $b_{it-1}/\text{Collat.}_{it-1}$ is the ratio of total debt to the collateral values of land and capital stocks for firm i in year $t-1$; and $\text{Cash}_{it-1}/K_{it-1}$ is the ratio of cash holdings to capital stocks for firm i in year $t-1$. Standard errors adjusted for clustering at the bank level are in brackets. *** 1%, ** 5%, * 10%.

Table 5: Effect of Capital Injections on Bank Loans (Dependent Variable $\frac{\Delta \ell_{ikt}}{\ell_{ik,t-1}}$)

	(1)	(2)	(3)	(4)
Definition of Injection	Tier 1 + Tier 2		Tier 1 + Tier 2	
Sample	$TFP > P90$		$TFP < P10$	
$\text{Injection}_{kt}/e_{k,t-1} \times \omega_{ik}$	2.5685**	3.4194**	0.4463	0.3497
	[1.246]	[1.308]	[0.518]	[0.736]
ω_{ik}	-24.3396		5.3684	
	[14.936]		[4.823]	
$\text{BCR}_{kt-1} \times \omega_{ik}$	0.7367**	1.2474***	0.1068	0.1416
	[0.289]	[0.309]	[0.102]	[0.155]
$\text{Domestic}_{kt-1} \times \omega_{ik}$	0.5185	-2.2264	-0.1487	-0.2406
	[0.900]	[2.009]	[0.547]	[0.868]
$\ln(\text{TFP}_{it-1}) \times \omega_{ik}$	4.2619	1.7355	1.007	0.6102
	[2.961]	[3.545]	[1.164]	[3.835]
$\ln K_{it-1} \times \omega_{ik}$	1.2918	-4.2035***	-0.2939	0.0164
	[0.827]	[1.195]	[0.237]	[0.272]
$b_{it-1}/\text{Collat.}_{it-1} \times \omega_{ik}$	-0.5681*	-1.0943	-0.0412	0.7244
	[0.291]	[1.060]	[0.160]	[0.935]
$\text{Cash}_{it-1}/K_{it-1} \times \omega_{ik}$	1.5226	4.677	-1.127	-3.2835*
	[1.574]	[3.855]	[1.147]	[1.681]
Bank Fixed Effects	Yes	No	Yes	No
Firm Fixed Effects	Yes	No	Yes	No
Bank × Firm Fixed Effects	No	Yes	No	Yes
Year × Closing Month	Yes	Yes	Yes	Yes
Observations	2,016	2,016	2,230	2,230

Notes: The matched firm–bank observations for t = 1998, 19999, and 2000 are used for estimation, where the numbers of observations are unbalanced across different specifications because of missing values for some regressors. The dependent variable is the growth rate of loans from bank k to firm i. Columns (1) and (2) report the results for firms whose average TFP over the 1995-1997 period is above the 90th percentile. Columns (3) and (4) report the results for firms whose average TFP over the 1995-1997 period is below the 10th percentile. Standard errors adjusted for clustering at the bank level are in brackets. *** 1%, ** 5%, * 10%.

Table 6: Effect of Capital Injections on Bank Loans (Dependent Variable $\frac{\Delta \ell_{ikt}}{\ell_{ik,t-1}}$)

	(1)	(2)	(3)	(4)
Definition of Injection	Tier 1 + Tier 2		Tier 1 + Tier 2	
Definition of BCR	Deferred Tax Assets, Risk Loan		Balance Sheet Based	
$\text{Injection}_{kt}/e_{k,t-1} \times \omega_{ik}$	0.7036**	0.9397*	0.6711***	1.0195**
	[0.268]	[0.530]	[0.247]	[0.483]
ω_{ik}	-1.1859		-1.4295	
	[2.197]		[1.970]	
$\text{BCR}_{kt-1} \times \omega_{ik}$	0.1873***	0.2494**	0.2194***	0.3113***
	[0.046]	[0.099]	[0.052]	[0.099]
$\text{BCR}_{kt-1} \times \text{Domestic}_{kt-1} \times \omega_{ik}$			-0.4979***	-0.3210***
			[0.133]	[0.122]
$\text{Domestic}_{kt-1} \times \omega_{ik}$			1.7973***	1.1696**
			[0.547]	[0.532]
$\ln(\text{TFP}_{it-1}) \times \omega_{ik}$	-0.3256	-2.0851	-0.3409*	-1.6976
	[0.207]	[2.166]	[0.185]	[1.950]
$\ln K_{it-1} \times \omega_{ik}$	0.0118	-0.2462	-0.0084	-0.2752
	[0.124]	[0.341]	[0.111]	[0.323]
$b_{it-1}/\text{Collat.}_{it-1} \times \omega_{ik}$	-0.1100***	-0.7405*	-0.1023***	-0.6733*
	[0.033]	[0.406]	[0.034]	[0.347]
$\text{Cash}_{it-1}/K_{it-1} \times \omega_{ik}$	0.1089	0.2636	0.0942	0.2009
	[0.264]	[0.676]	[0.244]	[0.632]
Bank Fixed Effects	Yes	No	Yes	No
Firm Fixed Effects	Yes	No	Yes	No
Bank × Firm Fixed Effects	No	Yes	No	Yes
Year × Closing Month	Yes	Yes	Yes	Yes
Observations	20,077	20,077	22,431	22,431

Notes: The matched firm–bank observations for t = 1998, 19999, and 2000 are used for estimation, where the numbers of observations are unbalanced across different specifications because of missing values for some regressors. The dependent variable is the growth rate of loans from bank k to firm i. Columns (1) and (2) report the results for a modified BCR of bank k, with deferred tax assets and defaulted loans subtracted from the bank capital. Columns (3) and (4) use the capital ratio based on the balance sheet data in which deferred tax assets and defaulted loans are subtracted from the bank capital. Other covariates are the same as those used in Table 4. Standard errors adjusted for clustering at the bank level are in brackets. *** 1%, ** 5%, * 10%.

Table 7: Firm Machine Investment Rates, Basel I Capital Adequacy Ratios, and Capital Injections (Dependent Variable $\frac{I_{m,it}}{K_{m,it-1}}$)

			Injection = Tier 1 + Tier 2	Injection = Tier 1 Only
	(1)	(2)	(3)	(4)
$\overline{\text{BCR}}_{it-1}$	-0.0026	-0.0026		
	[0.006]	[0.006]		
$\ln \text{TFP}_{it-1} \times \overline{\text{BCR}}_{it-1}$		0.0153**		
		[0.007]		
$\overline{(\text{Injection}/e)}_{it-1}$			-0.0181	-0.0013
			[0.034]	[0.035]
$\ln \text{TFP}_{it-1} \times \overline{(\text{Injection}/e)}_{it-1}$			0.0616*	0.0658*
			[0.033]	[0.039]
$\omega_i^{bankrupt} \times D_{99,00}^{\text{year}}$	-0.0419	-0.042	-0.0417	-0.0421
	[0.067]	[0.067]	[0.067]	[0.067]
$\ln \text{TFP}_{it-1}$	0.0798	0.0344	0.0607	0.0635
	[0.056]	[0.056]	[0.055]	[0.055]
$\ln K_{m,it-1}$	-0.6498***	-0.6550***	-0.6534***	-0.6534***
	[0.080]	[0.080]	[0.080]	[0.080]
$b_{it-1}/\text{Collat}_{it-1}$	-0.005	-0.0043	-0.0045	-0.0045
	[0.008]	[0.008]	[0.008]	[0.008]
$\text{Cash}_{it-1}/K_{it-1}$	0.0059	0.005	0.0051	0.0043
	[0.031]	[0.031]	[0.031]	[0.031]
$\overline{\text{Domestic}}_{it-1}$	-0.0446	-0.0367	-0.0536	-0.0483
	[0.035]	[0.034]	[0.034]	[0.034]
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year×Closing Month	Yes	Yes	Yes	Yes
Observations	2552	2552	2552	2552

Notes: The matched firm–bank observations for 1998–2000 are used for estimation, where the numbers of observations are unbalanced across different specifications because of missing values for some regressors. The dependent variable is the ratio of machine investment in year t to the beginning-of-period machine capital stock in year t. The variable $\overline{\text{BCR}}_{it-1}$ is the weighted average of the BCR less the required capital ratio in year $t-1$ across the banks firm i borrows from, where the weight is constructed by the loan share in 1995–1997. The variable $\overline{(\text{Injection}/e)}_{it}$ is the weighted average of the ratio of the sum of Tier 1 and Tier 2 capital injections in year t to bank k's equity in year $t-1$ across the banks firm i borrows from, using weights constructed from pre-sample year loan shares in column (3), while we use Tier 1 capital injections in place of the sum of Tier 1 and Tier 2 capital injections in columns (4). The variable z_{it-1} is the logarithm of firm i's TFP in year $t-1$; $\ln K_{m,it}$ is the logarithm of machine capital stock for firm i in year $t-1$; $b_{it-1}/\text{Collat.}_{it-1}$ is the ratio of debt to the collateral value of land and capital stocks for firm i in year $t-1$; $\text{Cash}_{it-1}/K_{it-1}$ is the ratio of cash holdings to capital stocks for firm i in year $t-1$; $\overline{\text{Domestic}}_{it-1}$ is the weighted average of a domestically operating bank's dummy variable in year $t-1$ using the loan share of firm i as weights. Standard errors adjusted for clustering at the firm level are in brackets. *** 1%, ** 5%, * 10%.

Table 8: Firm Machine Investment Rates, Basel I Capital Adequacy Ratios, and Capital Injections (Dependent Variable $\frac{I_{m,it}}{K_{m,it-1}}$)

	(1)	(2)	(3)	(4)
	Adjusted BCR 1	Adjusted BCR 2	System GMM	Solow Residual
$\overline{\text{BCR}}_{it-1}$	-0.0042	0.0002	-0.0017	-0.0022
	[0.008]	[0.010]	[0.006]	[0.006]
$\ln \text{TFP}_{it-1} \times \overline{\text{BCR}}_{it-1}$	0.011	0.0177*	0.0144**	0.0144**
	[0.007]	[0.011]	[0.006]	[0.006]
$\overline{\text{BCR} \times \text{Domestic}}_{it-1}$		0.0145		
		[0.021]		
$\ln \text{TFP}_{it-1} \times \overline{\text{BCR} \times \text{Domestic}}_{it-1}$		0.0153		
		[0.021]		
$\omega_i^{bankrupt} \times D_{99,00}^{\text{year}}$	-0.0377	-0.0456	-0.0458	-0.0365
	[0.070]	[0.069]	[0.068]	[0.067]
$\ln \text{TFP}_{it-1}$	0.0879	-0.0051	-0.0098	-0.0108
	[0.057]	[0.059]	[0.065]	[0.059]
$\ln K_{m,it-1}$	-0.5962***	-0.6534***	-0.6611***	-0.6540***
	[0.079]	[0.081]	[0.080]	[0.080]
$b_{it-1}/\text{Collat}_{it-1}$	-0.0026	-0.0049	-0.0045	-0.0043
	[0.009]	[0.008]	[0.008]	[0.008]
$\text{Cash}_{it-1}/K_{it-1}$	-0.0127	0.0024	0.0102	0.0094
	[0.031]	[0.031]	[0.031]	[0.032]
$\overline{\text{Domestic}}_{it-1}$	-0.0645	-0.0921	-0.0359	-0.0402
	[0.052]	[0.093]	[0.033]	[0.033]
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year×Closing Month	Yes	Yes	Yes	Yes
Observations	2,418	2,543	2,552	2,552

Notes: The matched firm–bank observations for accounting year 1998–2000 are used for estimation, where the numbers of observations are unbalanced across different specifications because of missing values for some regressors. The dependent variable is the ratio of machine investment in year t to the beginning-of-period machine capital stock in year t. Column (1) reports results with a modified BCR for bank k, with deferred tax assets and defaulted loans subtracted from the bank capital. Column (3) uses the capital ratio based on the balance sheet data in which deferred tax assets and defaulted loans are subtracted from the bank capital. Other covariates are the same as those used in Table 7. Standard errors adjusted for clustering at the firm level are in brackets. *** 1%, ** 5%, * 10%.

Table 9: Effects of Capital Injections on Average Investment Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln \text{TFP}_{it-1}$	All	$\leq 10\%$	(10% 25%]	(25% 50%]	(50% 75%]	(75% 90%]	$> 90\%$
$\overline{\text{BCR}}_{it-1}$							
No 1998 Injection	0.0017	0.0043	0.0035	0.0025	0.0013	0.0001	-0.0021
No 1999 Injection	0.0114	0.0261	0.0201	0.0139	0.0079	0.0003	-0.0113
Adjusted BCR 1							
No 1998 Injection	0.0002	0.0008	0.0005	0.0004	0.0002	-0.0002	-0.0011
No 1999 Injection	0.0041	0.0139	0.0096	0.0059	0.0019	-0.0029	-0.0106
Adjusted BCR 2							
No 1998 Injection	-0.0009	0.0005	0.0001	-0.0004	-0.0010	-0.0017	-0.0028
No 1999 Injection	-0.0068	0.0052	0.0001	-0.0043	-0.0100	-0.0163	-0.0245

Notes: Columns (1) to (7) report mean changes in the investment rates by percentile of $\ln \text{TFP}_{it-1}$. We construct the counterfactual BCR without capital injections by simply subtracting the amount of capital injections from banks' Tier I and Tier II capital. The sample for 1998–2000 is used to compute the percentiles of $\ln \text{TFP}_{it-1}$. The rows designated No 1998 Injection report the counterfactual mean changes in the investment rates if there was no capital injection in March 1998, while the rows designated No 1999 Injection report the counterfactual mean changes in the investment rates without the March 1999 capital injection.

Table 10: Effects of Capital Injections on Average Investment Rates (Regression-Based)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln \text{TFP}_{it-1}$	All	$\leq 10\%$	(10% 25%]	(25% 50%]	(50% 75%]	(75% 90%]	$> 90\%$
No 1998 Injection	0.0010	0.0027	0.0023	0.0015	0.0008	0.0001	-0.0013
No 1999 Injection	0.0066	0.0151	0.0118	0.0079	0.0045	0.0001	-0.0063
Adjusted BCR 1							
No 1998 Injection	0.0004	0.0018	0.0014	0.0008	0.0002	-0.0004	-0.0016
No 1999 Injection	0.0032	0.0107	0.0074	0.0045	0.0014	-0.0023	-0.0078
Adjusted BCR 2							
No 1998 Injection	-0.0016	0.0010	0.0001	-0.0008	-0.0019	-0.0032	-0.0054
No 1999 Injection	-0.0074	0.0055	0.0000	-0.0047	-0.0109	-0.0176	-0.0263

Notes: Columns (1) to (7) report mean changes in the investment rates by the percentile of $\ln \text{TFP}_{it-1}$. We construct the counterfactual BCR without capital injections based on the estimated regression of the BCR on the lagged capital ratio, the ratio of the injection amount to equity, year dummies, and bank fixed effects. The sample for 1998–2000 is used to compute the percentiles of $\ln \text{TFP}_{it-1}$. The rows designated No 1998 Injection report the counterfactual mean changes in the investment rates if there was no capital injection in March 1998, while the rows designated No 1999 Injection report the counterfactual mean changes in the investment rates without the March 1999 capital injection.

Table 11: Effects of Capital Injections on Average Investment Rates (Column (3), Table 7)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln \text{TFP}_{it-1}$	All	$\leq 10\%$	(10% 25%]	(25% 50%]	(50% 75%]	(75% 90%]	$> 90\%$
Based on Col.(3), Table 7							
No 1998 Injection	0.0001	0.0029	0.0019	0.0009	-0.0002	-0.0015	-0.0037
No 1999 Injection	0.0024	0.0163	0.0105	0.0049	-0.0011	-0.0082	-0.0185

Notes: Columns (1) to (7) report mean changes in the investment rates by the percentile of $\ln \text{TFP}_{it-1}$. The sample for 1998–2000 is used to compute the percentiles of $\ln \text{TFP}_{it-1}$. The rows designated No 1998 Injection report the counterfactual mean changes in the investment rates if there was no capital injection in March 1998, while the rows designated No 1999 Injection report the counterfactual mean changes in the investment rates without the March 1999 capital injection.

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