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Finance Working Paper N° 260/2009
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ECGI Working Paper Series in Finance

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Abstract

Exploiting the Japanese banking crisis of the 1990s as a laboratory, we investigate the effects of bank bailouts on the supply of credit and on the valuations and the real performance of banks' clients. Consistent with recent theories, our findings indicate that the size of the capital injections relative to the banks' initial financial conditions is crucial for the success of bank bailouts. Capital injections that are sufficiently large to reestablish bank capital requirements increase the supply of credit and spur investment. In contrast, not only do capital injections that are too small fail to increase the supply of credit, but they also encourage the evergreening of non-performing loans and favor investment by unviable "zombie" firms.

Keywords: Recapitalization, merger, banking crisis

JEL Classifications: G21, G34

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Abstract. Exploiting the Japanese banking crisis of the 1990s as a laboratory, we investigate the effects of bank bailouts on the supply of credit and the performance of banks' clients. Consistent with recent theories, our findings indicate that the size of the capital injections relative to the banks' initial financial conditions is crucial for the success of bank bailouts. Capital injections that are sufficiently large to reestablish bank capital requirements increase the supply of credit and spur investment. In contrast, not only do capital injections that are too small fail to increase the supply of credit, but they also encourage the evergreening of non-performing loans and favor investment by unviable "zombie" firms.

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Bank bailouts face stiff resistance because of their fiscal implications and their long-term moral hazard costs. Nevertheless, during financial crises, few governments refrain from bailing out banks. The potential benefits from doing so include guaranteeing the functioning of the payment system, systemic stability, and the flow of credit to the real economy. The beneficial effects on the real economy are often mentioned by governments to justify their interventions. However, not only is the magnitude of these benefits widely disputed, but also the structure of bank bailouts is the subject of long-standing debates.

Theory suggests that the real effects of bailouts depend on the size of the recapitalizations, the banks' ex post ability of meeting the capital requirements and the quality of the banks' clients. Bagehot (1873) argues that any government support to bad banks would be an encouragement to even worse lending decisions. Recent theories help to qualify these statements. Government support is desirable only to the extent that banks have specific loan collection skills and information about their clients, which would not have access to external finance for funding profitable investment if their bank failed. Under these conditions, as Philippon and Schnabl (2010) and Bhattacharya and Nyborg (2011) highlight, in order to be effective, recapitalizations have to be sufficiently large to solve banks' debt overhang problems. Bank recapitalizations would be ineffective in spurring bank lending otherwise. Diamond and Rajan (2000) and Diamond (2001) point out that too small recapitalizations may even be damaging for bank lending policies. In their setting, while recapitalizations that reinstate bank capital requirements also restore incentives to sound lending policies, banks that remain undercapitalized evergreen bad loans to avoid writing them off and becoming officially insolvent. Importantly, the capital injections would allow the undercapitalized banks to increase even more their loans to impaired borrowers. These banks may even be inclined to recall the loans to creditworthy borrowers as the capital injection makes the goal of meeting the capital requirements within reach. Thus, too small recapitalizations encourage banks' bad lending policies and may even decrease the availability of loans for borrowers with valuable investment opportunities.

Empirical evidence on whether and under what circumstances bank bailouts benefit the real economy is scarce. In this paper, we exploit the Japanese banking crisis of the 1990s to evaluate the effects of government recapitalizations. Abstracting from any possible systemic effects, we evaluate whether borrowers benefit from the bailouts of their banks. Not only we quantify the effects of government recapitalizations on firms' access to credit, stock market valuations,

employment and investment, but we also investigate the characteristics of the firms that benefit most. These distributional issues are crucial to evaluate the effects of bank bailouts on capital allocation.

Japan represents an ideal laboratory for several reasons. First, there are some analogies between the 1990s Japanese banking crisis and the 2008 financial crisis in the U.S. (Hoshi and Kashyap, 2010). Not only did both crises originate from the burst of a real estate bubble, but also, in the response to the banking crisis, the Japanese government intervened to recapitalize banks, similarly to the U.S. administration. Importantly, the size of the recapitalizations that were enacted as well as the affected banks' financial conditions differ enabling us to test the predictions of the theories on the real effects of the interventions.

Second, there are publicly accessible data on all loans that Japanese listed companies receive from different lenders, together with extensive financial information on banks and firms. Thus, we can ask whether non-financial firms with closer relationships with the banks receiving the capital injections indirectly benefit to a larger extent than similar firms. This allows us to quantify the benefits of specific interventions, abstracting from concurrent events and macroeconomic news whose effects may be confounded with those of the bailouts. Even more importantly, we are able to isolate the effects of the bailouts on the supply of credit by focusing on firms borrowing from multiple banks and by evaluating to what extent, after the bailouts, the same firm receive larger loans from the affected banks in comparison to the unaffected ones.[1]

Our results show that the effects of recapitalizations differ dramatically depending on the size of the capital injections relative to the banks' initial financial conditions. If they receive large capital injections, banks extend larger loans to creditworthy borrowers with which they entertain closer relationships, but decrease their exposure to low quality firms, which we identify as the "zombie" firms in Caballero, Hoshi and Kashyap (2008). However, these effects are reversed for banks that are likely to have remained undercapitalized after the interventions. These banks extend larger loans to zombie firms, but much less –or not at all– to other borrowers. These findings indicate that ill-designed capital injections may aggravate problems of loan ever-greening and are consistent with the theory of Diamond and Rajan (2000) and Diamond (2001), who show that too small recapitalizations may encourage perverse lending policies and even decrease the supply of credit for borrowers with valuable investment opportunities.

[1] In other words, our results on the supply of credit cannot be biased by selection problems.

The effects of capital injections on firm performance largely mirror our findings on the supply of credit. Large recapitalizations increase the value of the firms with closer relationships with the bailed out banks as well as their investment; however, if the capital injections are too small and the bank is still undercapitalized after the intervention, not only do the positive real effects fail to materialize, but there are also negative effects on capital allocation. Having more credit available, zombie firms invest more. Thus, too small recapitalizations may have favored the survival of zombie firms, which as Caballero, Hoshi and Kashyap (2008) argue, contributed to Japan's poor economic performance.

To the best of our knowledge, this paper provides the first microeconomic evidence on the real effects of bank bailouts. Existing literature analyzes the macroeconomic implications of bank bailouts through case studies, without aiming to establish causal effects (Calomiris, Klingebiel, and Laeven, 2005). Notable exceptions are Bayazitova and Shivdasani (2009), Ng, Vasvari, and Wittenberg Moerman (2010), and Veronesi and Zingales (2010) who investigate the effects of the U.S. government's capital infusions on the value of banks' financial claims. Differently from these papers, we consider the effects on the banks' clients.

This paper is also related to a growing literature exploring how shocks to bank health affect the supply of credit and the banks' borrowers (see, for instance, Khwaja and Mian, 2008; Paravisini, 2008; Schnabl, 2011). In particular, Slovin, Sushka and Polonchek (1993), Bae, Kang and Lim (2002) and Ongena, Smith and Michalsen (2003) investigate the stock price reaction of the borrowers to bank failures. A number of papers explore the effect of negative shocks to the banking system in the context of the Japanese banking crisis. These papers investigate to what extent shocks to firm collateral and bank assets affect firm investment (Gibson, 1995; Kang and Stulz, 2000; Gan 2007a and 2007b) or bank lending policies (Peek and Rosengren, 2005; Caballero, Hoshi and Kashyap, 2008).[2] Existing literature mostly focuses on negative shocks to the banking system and finds that they decrease the supply of credit and affect negatively borrowers' valuation and investment.[3] Our contribution is to explore the effectiveness of different interventions to restore bank health (that is, a positive shock) on the supply of credit and banks' borrowers during a systemic banking crisis. This is a relevant exercise as existing theories

[2] Yamori and Murakami (1999) and Brewer, Genay, Hunter, and Kaufman (2003) document borrowers' negative abnormal returns upon the announcement of Japanese banks' failures.

[3] Only Slovin, Sushka and Polonchek (1993) also explore the reaction to the announcement of a bank bailout, but their sample includes the borrowers of just one large U.S. bank and can shed no light on the effectiveness of different measures to resolve systemic banking crises.

suggest that incomplete information and agency problems may create asymmetries in the transmission of shocks to bank capital (Holmstrom and Tirole, 1997).

The remainder of this paper is organized as follows. Section I describes the bank bailouts during the Japanese banking crisis. Section II and III illustrate the empirical approach and the data, respectively. Section IV presents the results. Finally, Section V concludes.

I. Background

A. The Japanese Banking Crisis

The Japanese banking crisis of the 1990s stemmed from a sharp decline in asset prices, especially land and real estate, in the early nineties. Banks were severely hit not only because real estate was often used as collateral, but also because they held stocks and land directly and real estate loans were a large fraction of their balance sheets. Although export-oriented firms' growth opportunities are believed to have remained sound, banks contracted lending (Gan, 2007a). As a consequence, firms cut investment (see, for instance, Kang and Stulz, 2000).

Peek and Rosengren (2005) and Caballero, Hoshi, and Kashyap (2009) document that not only banks reduced the supply of loans, but also misallocated credit by funding the weakest firms. The structure of bank-firm relationships in Japan may have exacerbated this problem, because Japanese firms typically have a particularly close relationship with their main bank, which involves bank shareholdings, board seats for bank representatives as well as a lending relationship. In addition, the main bank takes a leading role in restructuring firms in financial distress (Hoshi, Kashyap and Scharfstein, 1990).

While social and economic incentives may have strengthened Japanese banks' incentives to allocate credit to severely impaired borrowers, empirical evidence suggests that Japanese banks, being forbidden to hold equity stakes in excess of 5 percent by the law, are interested in protecting the value of their loans and not shareholders or other stakeholders (Morck, Nakamura and Shivdasani, 2000). For instance, low current earnings and liquidity are more significant than poor stock market performance in explaining the appointment of bank directors to the board (Morck and Nakamura, 1999). [4]

[4] Empirical evidence also shows that the fortunes of Japanese top executives are positively related to stock performance and earnings like in the U.S. (Kaplan, 1994; Kaplan and Minton, 1994; Kaplan and Ramseyer, 1996). Anderson and Campbell (2004) show that the negative relation between performance and turnover was particularly

In addition, credit misallocation during banking crises is not unique to Japan. Banks renewed loans to non-performing borrowers in the Nordic countries during the banking crisis of the early nineties (Drees and Pazarbasioglu, 1995) and in the U.S. during the Savings and Loan crisis (Akerlof and Romer, 1993). For this reason, we believe that the Japanese experience of bank bailouts can offer insights that go beyond the Japanese economy (we address this issue empirically in Section IV).

B. Capital Injections

Our focus is to explore whether the government recapitalizations were successful in increasing the supply of credit and in improving its allocation. We believe that the Japanese experience provides a unique laboratory to explore the effects of bank bailouts for the following reasons. First, the government recapitalizations were mostly directed to the larger banks. However, no differences were made on the basis of borrower characteristics or lending specialization of the banks. Thus, there is no reason to believe that the recapitalization announcements revealed market participants positive (or negative) information about the borrowers, besides the fact that the borrowers may have benefited from the improved health of their lending banks. Second, the recapitalizations were heterogeneous in their size and affected banks with different ex ante financial conditions. Thus, we can test whether the effects of recapitalizations vary in line with existing theories.

Here, we describe the events that we explore in our empirical analysis. We refer the reader to Nakaso (2001) and Hoshi and Kashyap (2010) for a more comprehensive description of the government interventions. The government started to recapitalize banks in 1998, amid political opposition, after the failures of two securities companies and a regional bank. On February 16, 1998, the Diet approved the use of JPY 30 trillion of public funds, of which JPY 13 trillion were dedicated to bank recapitalizations. In the following days, JPY 1.8 trillion were used for the recapitalization of 20 major banks through subordinated debt and preferred shares.

Most of the banks received a capital injection of 100 billion Yen, although some of the smaller banks involved in the program received between 20 and 60 billion Yen. This was, on average, 1.9% of bank risk-weighted assets. The main objective in the design of the recapitalizations was not to signal to market participants any differences in financial health

high for banks during the financial crisis. Thus, it appears that Japanese executives face incentives to maximize profits as those who fail risk losing their jobs.

between financial institutions. Thus, all systemically important banks were recapitalized and the amount of capital injected was only subordinated to bank size.[5] Due to the small size of the capital injections, most of banks remained undercapitalized. However, there was considerable heterogeneity. Some banks reported tier 1 capital ratios above their capital requirements (which is 8% for Japanese banks with international branches and 4% for the remaining banks), even before the capital injections. Other banks were severely undercapitalized. Since the size of the recapitalizations was on average less that 2% of the bank' risk-weighted assets, most of the banks with lowest capital ratios remained undercapitalized. Even in this respect, however, there is heterogeneity as few banks received a capital infusion of over 4% of their risk-weighted capital and afterwards were likely to meet the capital requirements.

The first recapitalization was followed in March 1999 by a second recapitalization (through preferred shares) that benefited 15 of the banks that had already been recapitalized during the previous year, a confirmation that banks affected by the first recapitalization had different financial conditions. The amount injected was more than four times as large as the previous injection. Each bank received between 200 and 1,000 billion Yen, which was approximately 5.1% of bank risk-weighted assets, and the amount of capital injected differed across banks. For its larger size, the second recapitalization produced a large decrease in the premium paid by Japanese banks in the interbank market (Peek and Rosengren, 2001). Finally, a third recapitalization occurred in June 2003 when the government took Resona bank over by injecting nearly 2 trillion Yen of new capital, over 17.5% of the bank's risk-weighted assets, through preferred and common shares. Notwithstanding these recapitalizations were larger, they hardly solved all the banking problems. In fact, some Japanese banks continued to show serious signs of undercapitalization (Kashyap, 2002; Hoshi and Kashyap, 2010).

In what follows, not only do we exploit heterogeneity (across and within) different rounds of government recapitalizations, but we also consider private recapitalizations. Between 1998 and 2005, 64 banks made 98 equity issues to private investors. The average (median) amount of capital injected was 75 (28) billion Yen. This was on average slightly more than 2.07% of bank risk-weighted assets. The equity issues were generally performed by the existing shareholders, which were invited to provide capital by the authorities and the banks themselves. Not only were most often these capital injections performed by reluctant investors, as is apparent from their

[5] In particular, no restrictions were imposed on bank lending policies or corporate governance.

small size, but the capital infusions did not alter banks' control structure and corporate governance.[6]

C. Other Events

Finally, a number of bank mergers occurred after 2000. Our sample includes 71 banks mergers affecting 58 banks. In a few instances, the central bank induced banks to acquire weaker banks to avoid failures (Harada and Ito, 2008). Other banks merged with the aim of becoming too big to fail. The mergers did not improve bank capitalization (Hosono, Sakai, and Tsuru, 2007). In what follows, we control for bank mergers because they may have weakened the relationships with the clients of target banks (this is unlikely to affect our results because the mergers mostly occurred after the first two rounds of government recapitalizations), but the analysis of their effects remains largely outside the scope of the paper.

II. Empirical Approach

Our objective is to test whether firms with stronger lending relationships with recapitalized banks obtain larger loans and whether the effects depend on the size of the recapitalizations relative to the banks' financial conditions. The main challenge is that the firms maintaining stronger relationships with the recapitalized banks may have different demand for credit, which may affect their response to the recapitalizations.

Luckily, we are able to design our main tests on the supply of credit in a way that the estimates are unaffected by firms' unobserved heterogeneity and allow us to quantify the extent of selection problems, which appear to be limited. Being able to identify the effects of capital injections on the supply of credit helps us to interpret the rest of our findings. The implementation of the different tests and the identifying assumptions are discussed below.

[6] Japanese banks have diffuse ownership (with the top holders holding around 5 percent of the shares and the top 10 holders less that 30 percent). Their stocks are mostly held by other financial institutions and industrial companies. Financial institutions predominate among the top five shareholders.

A. The Supply of Credit

Our first step is to examine whether the supply of bank loans increases after the bailouts. This is generally a challenging task because the events that prompt the bailouts may be accompanied by changes in the demand for credit. We pursue the same identification strategy that Khwaja and Mian (2008) suggest to isolate the effect of negative liquidity shocks on bank lending. Since we observe multiple bank relationships for each firm in a given year, we can evaluate the effects of bank bailouts using a within-firm estimator that compares the amount of funding provided by the affected and the unaffected banks, before and after the bailouts, to the same firm. This allows us to hold constant the loan demand.

We estimate the following equation:

$$\frac{\Delta Loan_{ikt+1}}{Loan_{ikt}} = a^L + \sum_{j \in J} b_j^L * Intervention\text{-}j_{ikt} * \%Loans_{ikt} +$$
$$+ c^L * \%Loans_{ikt} + Firm_i^L * Year_{t+1}^L + Bank_k + u_{ikt+1}^L .$$

The dependent variable, $\frac{\Delta Loan_{ikt+1}}{Loan_{ikt}}$, is the increase in bank loans that firm *i* receives from bank *k* during the year following the recapitalization. In all equations, our unit of analysis is the bank-firm-year and we include interactions of firm ($Firm_i^L$) and year ($Year_t^L$) fixed effects. In this way, we fully absorb firm heterogeneity. In these specifications, we also include bank fixed effects ($Bank_k$) to control for systematic differences across banks, including bank health, and cluster errors at the firm level. Our sample spans from 1998 to 2004.

The variable $Intervention\text{-}j_{ikt}$ is a dummy that takes value one if the *k*-th bank of firm *i* benefits from intervention *j* in year *t* and value zero otherwise. We capture the strength of the relationship of firm *i* with bank *k*, using the proportion of loans that firm *i* has received from bank *k* in the past ($\%Loans_{ikt}$) and include this variable as a control because the intensity of the relationship with the bank may affect loan provision. We test whether firms with closer relationships benefit more from the recapitalizations by interacting the intervention dummies with the proportion of bank loans that firm *i* receives from bank *k* in the year prior to the recapitalization. In other words, we allow the effects of the interventions to vary continuously with the prior intensity of the relationships: A positive coefficient b_j^L indicates that firms with a larger proportion of loans from bank *k* in the past receive larger loans from bank *k* if this has been

affected by intervention *j* during the past year. Our results are invariant if we simply consider whether a firm received loans from bank *k* prior to the recapitalization instead of the strength of the lending relationship. However, using a continuous measure for the intensity of the bank relationships gives us more cross-sectional variation because most of the firms borrow from the banks recapitalized by the government, but the proportion of loans they receive from these banks varies greatly. This helps us to identify the effects of interventions especially in the tests described below where the unit of observation is the firm, instead of the firm-bank.

While in the above specifications we allow the impact of the different rounds of capital injections to differ estimating different coefficients b_j^L for each intervention *j*, to have a more systematic understanding of any differences, within the same econometric framework, we test the theoretical predictions on the importance of the size of the recapitalizations and of the banks' ex post ability to meet the capital requirements. We surmise that any heterogeneity in the impact of the capital injections on the supply of credit depends on the size of the capital injections (relative to the banks' risk-weighted assets). In particular, banks that benefit from larger capital injections should be able to increase the supply of loans to their most important borrowers to a larger extent.

We estimate the following equations:

$$\frac{\Delta Loan_{ikt+1}}{Loan_{ikt}} = a^{L'} + b^{L'} Injection\ Size_{kt} * \%Loans_{ikt} +$$
$$+ c^{L'} Injection\ Size_{kt} * \%Loans_{ikt} * Undercapitalized\ Bank_{kt} +$$
$$+ d^{L'} * \%Loans_{ikt} + Firm_i^{L'} * Year_{t+1}^{L'} + Bank_k{}' + u_{ikt+1}^{L'}.$$

The interaction term $\%Loans_{ikt} * Injection\ Size_{kt}$ measures how the size of the capital injection relative to the risk-weighted assets of bank *k* affects firms that are more or less related to the bank. We expect that $b^{L'} > 0$. Furthermore, we conjecture that banks that still fail to meet the capital requirements after the recapitalization are less inclined to lend. To assess the relevance of this mechanism, we interact $\%Loans_{ikt} * Injection\ Size_{kt}$ with $Undercapitalized\ Bank_{kt}$, a dummy variable that takes value 1 if bank *k* is still undercapitalized after the capital injection and value zero otherwise. We expect that $c^{L'} < 0$.

We then test whether undercapitalized banks extend larger loans to impaired borrowers, as theories would predict. As we explain in Section III.B, we denote impaired borrowers as zombie

and identify them with a dummy variable, $zombie_{it}$, which takes value one for impaired borrowers and value zero otherwise We estimate the following equation:

$$\frac{\Delta Loan_{ikt+1}}{Loan_{ikt}} = a^{L"} + b_1^{L"} Injection\ Size_{kt} * \%Loans_{ikt} + b_2^{L"} zombie_{it} * Injection\ Size_{kt} * \%Loans_{ikt} +$$
$$+c_1^{L"} Injection\ Size_{kt} * \%Loans_{ikt} * Undercapitalized\ Bank_{kt} +$$
$$+c_2^{L"} zombie_{it} * Injection\ Size_{kt} * \%Loans_{ikt} * Undercapitalized\ Bank_{kt} +$$
$$+d^{L"} * \%Loans_{ikt} + Firm_i^{L"} * Year_{t+1}^{L"} + Bank_k^{"} + u_{ikt+1}^{L"}.$$

If bank capitalization matters for the allocation of credit after the capital injections, as the theories of Diamond and Rajan (2000) and Diamond (2001) imply, we expect that we expect that banks that are able to meet the capital requirements after the recapitalization increase the supply of loans to all borrowers ($b_1^{L"} > 0$) with the exception of zombie firms ($b_2^{L"} \leq -b_1^{L"}$). We expect the opposite to hold for banks that are still undercapitalized (i.e., $c_2^{L"} > 0$ and $c_1^{L"} \leq -c_2^{L"}$).

B. Firms' valuations

We investigate the announcement effects of bank bailouts on firms' valuations using an event study. As argued in Section I, the implementation of the bailouts was such that, besides the capital infusion in their lending banks, no new information about banks' borrowers was communicated to market participants. Thus, as firms' pre-announcement stock prices reflect any differences across borrowers known to market participants, the announcement abnormal returns can only capture the (average) effect of the bailouts on firm's expected discounted cash flows. In what follows, we explore how borrowers react to the announcements and whether the effects depend on the characteristics of the recapitalizations and of the borrowers in a way that is consistent with the effects on the supply of credit.

The government recapitalizations were preceded by lengthy discussions; however, the identity of the banks participating in the program was announced only shortly before the actual capital injections. For this reason and to avoid the contaminations from other events, in most of the analysis, we use an event window starting 3 days before the capital injections and ending 1 day after the capital injections. We explore the robustness of our results to the use of event windows of [-10,+1] and [-5,+1].

For any firm *i*, we estimate daily expected returns using the standard market model: $R_{it} - R_{ft} = \alpha_i + \beta_i \left(R_{mt} - R_{ft} \right) + \varepsilon_{it}$, where R_{it} and R_{mt} are the day *t* returns on firm *i* and the market portfolio, respectively, R_{ft} is the return on the risk free asset, which we measure with the return of 60 days Japanese Treasury Bills, and ε_{it} is a zero-mean disturbance term. Abnormal returns of firm *i* on day *t* are computed as firm *i*'s actual return on day *t* minus its expected return on day *t*: $AR_{i,t} \equiv \hat{\varepsilon}_{it} = R_{it} - R_{ft} - \hat{\alpha}_i - \hat{\beta}_i \left(R_{it} - R_{ft} \right)$. The parameters $\hat{\alpha}_i$ and $\hat{\beta}_i$ are estimated using ordinary least squares in the window [t-280,t-20] as long as we have at least 100 observations for daily returns.[7]

We regress firms' daily abnormal returns on proxies for the firm's exposure to the intervention and controls as follows:

$$AR_{it} = a^{AR} + \sum_{j \in J} b_j^{AR} * Exposure\ Intervention\text{-}j_i + c^{AR} X_{it-1} + u_{it}^{AR},$$

where $Exposure\ Intervention\text{-}j_i$ is the proportion of loans that in the year preceding the intervention firm *i* received from any of the banks benefiting from intervention *j*. This variable measuring the intensity of all these relationships captures firm *i*'s exposure to intervention *j*; it is allowed to differ from zero only for days within the relevant event window.[8] By construction abnormal returns are expected to be equal to zero outside the event window. A statistically significant coefficient b_j^{AR} indicates that firms that receive more loans from banks affected by intervention *j* experience large abnormal returns upon the announcement of intervention *j*. We also include a vector of firm controls, X_{it-1}, which are measured at the end of each year. We include these controls because exposure to systematic risk factors may vary with firm characteristics (such as size and market to book) in a way that systematically affects firm returns. Furthermore, news affecting firm abnormal returns may be revealed during the sample period, especially for firms with certain characteristics, such as low interest rate coverage. Our controls

[7] In unreported specifications, we estimate the market model using Scholes-Williams (1977) betas. The results are virtually identical to the ones we report.

[8] In unreported alternative specifications, we capture the effects of intervention *j* using a dummy variable that captures whether the firm has a relation with any of the banks benefiting from intervention *j* or the proportion of loans from the main bank if this is affected by intervention *j*. The results are qualitatively similar to the ones we report.

account for these effects, but the results we report hereafter would be invariant if we excluded these controls.

In the same vein of the tests on the supply of credit, we consider the role of the size of the recapitalizations and of the banks' ex post ability to meet the capital requirements by estimating the following equation:

$$AR_{it} = a^{AR'} + b^{AR'} * Injection\ Exposure_{it} + \\ + c^{AR'} * Undercapitalized\ Injection\ Exposure_{it} + d^{AR'} * X_{it-1} + u_{it}^{AR'}.$$

In the above equation, we test whether the most closely related firms experience larger abnormal returns when recapitalized banks receive on average larger capital injections using the following proxy: $Injection\ Exposure_{it} \equiv \sum_k \%Loans_{ikt} * Injection\ Size_{kt}$. We expect that $b^{AR'} > 0$. We also test whether firms benefit less when due the banks' poor initial financial conditions, the capital injections are unsuccessful in reestablishing banks' capital requirements with the following proxy:

$Undercapitalized\ Injection\ Exposure_{it} \equiv \sum_k \%Loans_{ikt} * Injection\ Size_{kt} * Undercapitalized\ Bank_{kt}$.

Here, we expect that $c^{AR'} < 0$. As before, these two variables are allowed to differ from zero only for days included in the relevant event window.

Within this empirical framework, we can then investigate whether the announcement effects differ across subsamples of firms, as follows:

$$AR_{it} = a^{AR''} + b_1^{AR''} * Injection\ Exposure_{it} + b_2^{AR''} * zombie_{it} * Injection\ Exposure_{it} + \\ + c_1^{AR''} * Undercapitalized\ Injection\ Exposure_{it} + \\ + c_2^{AR''} * zombie_{it} * Undercapitalized\ Injection\ Exposure_{it} + d^{AR'} * X_{it-1} + u_{it}^{AR'}.$$

Also here if bank capitalization matters for the allocation of credit after the capital injections we expect: $b_1^{AR''} > 0,\ b_2^{AR''} < 0,\ c_1^{AR''} < 0$ and $c_2^{AR''} > 0$.

Our sample period goes from 1998 to 2004. Since the cross-sectional correlation of the events could inflate our t-statistics, we cluster standard errors across months as well as across firms, as suggested by Petersen (2009).

C. Firms' corporate policies

Finally, we investigate the effects of the bank bailouts on bank clients' corporate policies (such as changes in the use of financial debt and cash holdings, investment and employment growth). Conditionally on the bailed out banks increasing the supply of credit, we should observe an increase in investment or employment only if firms are financially constrained and unable to substitute bank loans to pursue their investment opportunities. Also in this case, our sample spans from 1998 to 2004, but our unit of analysis is the firm-year. We estimate the following equation:

$$y_{it+1} = a^{y} + \sum_{j \in J} b_{j}^{y} * Exposure\ Intervention\text{-}\ j_{it} + c^{y} X_{it} + Firm_{i}^{y} + Year_{t+1}^{y} + u_{it+1}^{y},$$

The dependent variable y_{it+1} is any of the firm outcomes we consider in turn. Year fixed effects ($Year_{t+1}^{y}$) control for systematic shocks affecting all firms in a given year, while firm fixed effects ($Firm_{i}^{y}$) capture systematic differences across firms. We also include a vector of time-variant firm controls, X_{it}, and in some specifications, interactions of industry and year fixed effects to capture industry time-varying growth opportunities. The variables $Exposure\ Intervention\text{-}\ j_{it}$ capturing the firms' exposure to intervention *j* are defined as in Subsection II.B., but now the frequency is yearly. In particular, a firm's exposure to an intervention is different from zero only in the year following the intervention. Also here we test whether the effects of the interventions depend on the size of the capital injections and the banks' ex post ability of meeting the capital requirements by estimating the following equation:

$$y_{it+1} = a^{y'} + b^{y'} * Injection\ Exposure_{it} +$$
$$+ c^{y'} * Undercapitalized\ Injection\ Exposure_{it} + d^{y'} * X_{it} + Firm_{i}^{y'} + Year_{t+1}^{y'} + u_{it+1}^{y'},$$

where the variables $Injection\ Exposure_{it}$ and $Undercapitalized\ Injection\ Exposure_{it}$ are defined similarly to the event study. Also, as in the event study, we test whether the effect of the exposure to capital injections differ for impaired borrowers by estimating the following equation:

$$y_{it+1} = a^{y'} + b_{1}^{y''} * Injection\ Exposure_{it} + b_{2}^{y''} * zombie_{it} * Injection\ Exposure_{it} +$$
$$+ c_{1}^{y''} * Undercapitalized\ Injection\ Exposure_{it} +$$
$$+ c_{2}^{y''} * zombie_{it} * Undercapitalized\ Injection\ Exposure_{it} + d^{y''} * X_{it} + Firm_{i}^{y''} + Year_{t+1}^{y''} + u_{it+1}^{y''}.$$

Since we include firm fixed effects, our specifications capture whether in the year following the interventions, the firms with closer relationships with the banks benefiting from the

interventions have temporarily stronger performance in the variables of interest (such as investment or employment growth).[9]

In these tests, the validity of the estimates is subject to the assumption, typical of difference-in-difference estimates, that the strength of a firm's relationships with the recapitalized banks is not related to unobserved firm characteristics affecting the changes in firm performance after the interventions. This assumption can be problematic if firms that receive different proportions of loans from the recapitalized banks are dissimilar on observable (and potentially unobservable) characteristics.

This is a common problem in studies attempting to evaluate the real effects of shocks to bank capital (see, for instance, Khwaja and Mian, 2008; Paravisini, 2008; Schnabl, 2011). Similarly to these papers, we present empirical evidence that the strength of the relationships with the recapitalized banks affects firm performance in the year of the recapitalizations, but is unrelated to firm performance in the years preceding and following the recapitalizations suggesting that unobserved heterogeneity is unlikely to bias our estimates. Furthermore, using the loan regressions, in which we are able to fully absorb firm heterogeneity, we are able to quantify the extent of possible biases. The tests described below suggest that any biases are small. Finally, and perhaps most importantly, we are able to interpret the effects on firm outcomes in the light of our findings on the credit supply that do not suffer from selection problems. The consistency of the findings indicates that the difference-in-difference estimates are reliable.

III. Data

A. Data sources and sample

Our main data source is the Nikkei NEEDS Financial dataset. We obtain price, accounting, and loan information for all listed companies in Japan. Crucially for our study, NEEDS Bank Loan data allow us to observe loans outstanding to individual firms from each lender at the end of the firm's fiscal year. We also obtain bank financial statements, bank merger announcement dates, major shareholders, firms' and banks' shareholdings, and information on capital increases. From Bankscope, we extract information on tier 1 capital ratios, total capital ratios and risk weighted assets for all Japanese banks. Finally, we reconstruct the sequence of government

[9] Unreported tests reveal, as it is plausible, that there are no permanent effects on these growth rates.

interventions and obtain the list of recapitalized banks from Nasako (2001), Kashyap and Hoshi (2010) and the website of the deposit insurance corporation of Japan.[10]

Our sample includes a maximum of 3,160 non-financial companies and 239 banks and other lending institutions. The panel is unbalanced as the sample includes currently listed companies as well as companies that used to be listed but ceased to exist (together with their banks). Most of firms in Japan end the fiscal year in March. Approximately 20 percent of the sample firms, however, terminate their fiscal years in other months of the year. To avoid timing problems, when we consider changes of variables based on the firms' financial statements (i.e., financial debt, sales, cash, employment, and investment), we limit the sample to those firms with a fiscal year that ends in March. Also the data for loans outstanding to individual firms from each lender are based on the firm's fiscal year. Since in those specifications we compare the loans offered by different banks to the same firm, we keep the whole sample. Our results are, however, invariant if we exclude the firms whose fiscal year does not end in March. Furthermore, since the first and second government recapitalization happened in the first quarter, we explore the effect of interventions in year *t* on investment and growth, including loan growth, between fiscal year *t-1* and fiscal year *t*.[11] For clarity, in the paper, we refer to calendar years.

B. Main variables

Our first challenge is to characterize the capital injections in a way that is consistent with the theories described in the Introduction. Table 1 summarizes the main features of the recapitalizations and of the affected banks. Unsurprisingly, banks receiving government and private capital injections have lower tier 1 capital ratios than other banks. Most importantly, financial conditions, as measured by the tier 1 capital ratio, differ markedly even for the banks that were recapitalized, with some banks starting from significantly better ex ante conditions, even for the first recapitalization. Private capital injections are smaller than government capital injections, suggesting that they may leave many of the banks in which they occur unable to meet the capital requirements.

In what follows, we exploit heterogeneity in the amount of capital injected and the banks' ability to meet the capital requirements after the capital injections (both across and within

[10] See http://www.dic.go.jp/english/.
[11] Our results are also invariant if in the tests concerning loans and corporate policies, where timing issues may arise, we restrict our attention to interventions occurred in the first quarter of each year.

different rounds of recapitalizations) and study whether these factors influence the real effects of bank bailouts as theories would predict. First, we measure the size of the recapitalization using the size of the capital infusion relative to the bank's risk weighted assets. We expect that larger capital infusions yield more benefits for related firms in terms of a higher supply of credit.

Second, we distinguish the effects between banks that after the recapitalizations are more or less likely to meet the capital requirements. Banks' ability to meet the capital requirements is difficult to measure as during banking crises banks tend to report capital ratios that most likely overstate their net wealth. This was particularly true in Japan, where banks were known to under-provide for nonperforming loans and to include deferred tax credit (which given their dire economic conditions they were unlikely to ever be able to exploit) in the computation of bank capital.

For this reason, in our tests, we use three alternative proxies to capture the likelihood that banks are still undercapitalized after the capital infusions. Our first two measures rely on tier 1 capital only, as creative accounting is more likely to make the tier 2 capital entering in the total capital ratio uninformative. We conjecture that a bank is still undercapitalized after the capital infusion if the tier 1 capital ratio year is at least 2 percent lower than the banks capital requirements that we obtain from Peek and Rosengren (2005). Since the capital injections were performed as preferred shares or subordinated debt, their amount did not enter in the tier 1 capital ratio. If the latter is sufficiently small, given the relatively small size of the recapitalizations and the banks' underprovisioning for nonperforming loans, we can conjecture that the capital infusion leaves the bank below its capital requirement. The second definition adds the size of the capital injection relative to the bank's risk-weighted assets to the bank's tier 1 capital ratio. A bank is defined to be still undercapitalized if this quantity is below the capital requirements. The third definition uses the total capital ratio, which includes any funds obtained in the recapitalization. To take into account that tier 2 capital often includes dubious items such as deferred tax credit, similarly to Peek and Rosengren (2005), we define a bank to be undercapitalized, if the total capital ratio is below the bank's capital requirements plus 2 percent.

As Table 1 shows, whether a bank is classified as able or unable to meet the capital requirements is not highly sensitive to the definition we use. Furthermore, the results we present below are similar for the different classifications. Table 1 also shows how important recapitalized banks are for their clients, using the proportion of loans that firms receive from the recapitalized

banks in the year prior to the recapitalization. Government recapitalizations affect banks that on average provide a larger share of loans to their clients and may have larger benefits. Depending on the strength of the lending relationships with the recapitalized banks, firms have different exposures to the recapitalizations. As we discuss in Section II, these cross-sectional differences help us to identify the effects of the recapitalizations.

Table 2 lists the main variables we use in the analysis distinguishing between variables that refer to the bank-firm relationships and firm-specific variables. The latter include the proxies for the firms' exposure to the various interventions, which we measure using the proportion of loans a firm receives from the affected banks. Clearly, a firm can be considered exposed to the intervention only when the intervention occurs. We also consider the firms' exposure to banks that benefit from capital injections and are still likely to be undercapitalized afterwards. For brevity, we present only descriptive statistics (and most of the results) based on the first definition of undercapitalized banks reported in Table 1.

Table 2 also describes firm performance measures and characteristics. In particular, it introduces our proxy for low quality firms, the zombie firm dummy, which we define as in Caballero, Hoshi and Kashyap (2008). We could try to capture firm quality using profitability, productivity or dependence on bank loans. However, all these characteristics vary across industries and may just end up capturing industry effects. The classification proposed by Caballero, Hoshi and Kashyap (2008) aims to identify firms that are receiving subsidized credit, based on publicly available information. It is based on anecdotal evidence showing that Japanese banks granted interest rate concessions, moratoriums on loan principal or interest and other direct interest subsidies to non-performing borrowers in order to keep their loans on the books and avoiding writing off capital.

The construction of the zombie firm dummy involves the following steps. First, we compute the "required minimum interest rate expenses", a lower bound, assuming that the borrower pays the average short-term prime rate at year *t*, the average long-term prime rate at year *t* and zero coupons, respectively, on the short-term bank loans, the long-term bank loans and the total bonds outstanding during year *t*. We define a firm as zombie if the actual interest payments are lower than this lower bound. As Caballero, Hoshi and Kashyap (2008) argue, this measure is conservative because the minimum interest rates are extremely advantageous to the firm and because the actual interest payments include interest expenses on items such as trade

credit, which are not even considered in the computation of the required minimum interest rate expenses.

In what follows, we ask to what extent the recapitalizations of related banks increase or reduce credit for zombie firms and the extent to which the conclusion depends on the size of the capital injections and the banks' ex post ability to meet the capital requirements.

IV. Results

A. Supply of Credit

We start by exploring the effects of capital injections on the supply of credit. Estimates in Panel A of Table 3 show that not all the interventions increase the availability of credit. The first two recapitalizations unambiguously increase the supply of bank loans. The effect is not only statistically significant, but also sizable as in the year following each of the first two government recapitalizations, the growth rate of loans obtained from a recapitalized bank is 10 percent higher for a firm receiving 20 percent of its loans from that bank prior to the recapitalization. This effect is present also when we focus on the probability that a loan is increased, as Peek and Rosengren (2005) do, instead of the growth rates. However, the effect of the recapitalization of Resona bank (Third recapitalization) and of private recapitalizations on the supply of loans are insignificant or even negative.[12]

The difference from the first two government recapitalizations cannot be interpreted to depend on borrower heterogeneity –which is fully controlled for– or on time-invariant bank characteristics, captured by bank fixed effects. Differences may rather depend on the size of the capital injections and the banks' ex post ability of meeting the capital requirements. Due to the persistence of debt overhang problems, after the private capital injections and the third recapitalization, most of banks may not have found it optimal to lend, as Philippon and Schnabl (2010) suggest. Diamond and Rajan (2000) and Diamond (2001) indicate that undercapitalized

[12] The coefficient of *% Loan k* suggests that loans from banks that provided more loans in the past grow to a lower extent. This contrast s with the result reported by Peek and Rosengren (2005). However, the specifications used in that paper include neither firm nor interactions of firm and year fixed effects and could be driven by the fact that loans to firms with a closer relationship with a single bank grow faster. Furthermore, we use a different and longer sample period. For simple arithmetic, it would be unreasonable to expect that loans from banks that provided a larger fraction of loans continued to increase faster, because ultimately all firms should have only one bank. This is clearly counterfactual.

banks may even decrease their loans to viable borrowers. For these banks, the recapitalizations may make the objective of meeting the capital requirements more within reach. In these cases, banks may attempt to shrink their balance sheets by recalling loans to viable borrowers, even if this is inefficient from a social point of view.

In Panel B of Table 3, we directly test the above theories considering the size of the recapitalizations and the banks' ex post ability to meet the capital requirements. We surmise that borrowers with stronger lending relationships should have more access to credit when banks receive a larger capital injection. However, this effect should be smaller or even absent for banks that are likely to have remained undercapitalized. The estimates are strongly supportive of the theory and indicate that only capital injections to banks that end up to be able to meet the capital requirements increase the supply of credit. The estimates in column 2 imply that a firm that in the past received 8.1% of the loans (the sample mean) from a recapitalized bank benefitting from an average government capital injection of 4.13% of risk weighted bank assets would receive 2.9% more loans from the recapitalized bank in the year following the recapitalization. However, the effect on the supply of credit is statistically indifferent from zero if this same bank is still severely undercapitalized.

Not only differences across government recapitalizations (columns 1 and 2) can be explained by the size of the capital injections and the banks' ex post ability to meet the capital requirements, but also the differences across government and private capital injections (columns 3 to 6). While the magnitude of coefficients capturing the effects of the capital injections appears to decrease when we lump together government and private recapitalizations, this is partially due to the increase in the standard deviation of the corresponding variable which increases by about 20 percent. Private recapitalizations may have somewhat smaller effects also because they are perceived to insure banks against future financial difficulties to a lower extent than government assistance. Importantly, the effects of recapitalizations are qualitatively similar across specifications regardless of whether we include interaction of firm and year fixed effects, to completely absorb firm heterogeneity, or only firm and year fixed effects as in column 4 of Panel B. The effects are invariant also when we model the probability of a loan increase (column 6), using a linear probability model, instead of the loan growth rate as in the remaining equations.

So far we have defined undercapitalized banks considering only the tier 1 capital ratio, the first definition in Table 1. In columns 7 and 8, similar patterns emerge when we use the two

alternative definitions of undercapitalized banks, which we report in Table 1. In particular, in column 7, where we define a bank as undercapitalized if the tier 1 capital ratio plus the injected capital relative to the risk-weighted assets is less than the capital requirements, we do not let the effect of the intervention to depend on the size of the recapitalizations. The estimates imply that a firm that in the past received 8.1% of the loans from a recapitalized bank would receive 4.1% more loans from the recapitalized banks in the year following the recapitalization, but effect is statistically indifferent from zero if this same bank is still severely undercapitalized.

Across different specifications, it emerges clearly that banks that are still likely to be undercapitalized do not increase the supply of credit. In other words, capital injections that are too small relative to the banks' ex ante financial conditions appear ineffective, as is consistent with theories of debt overhang (Philippon and Schnabl, 2010; Bhattacharya and Nyborg, 2011) as well as with Diamond (2001) and Diamond and Rajan (2000).

We also consider the effects of recapitalizations on capital allocation. This allows us to distinguish between theories implying that large capital injections are needed to solve debt overhang problems and the model of Diamond and Rajan (2000) and Diamond (2001), which focuses on bank capital and lending policies. This model implies that capital injections may encourage loan evergreening of insolvent borrowers when banks fail to meet the capital requirements and want to avoid capital write-downs. To test whether banks allocate more or less credit to insolvent borrowers after a capital injection, we focus on zombie firms.

Columns 1 and 2 in Panel C of Table 3 show that after the capital injection, banks that meet the capital requirements decrease the amount of loans they extend to zombie firms, while extending more credit to the remaining borrowers. The coefficients have opposite signs for undercapitalized banks, which appear to lend more only to zombie firms, most likely in order not to write off their loans and further decrease their reported capitalizations. Importantly, the effects are not only highly statistically significant, but also economically large. The estimates in column 1 imply that for a firm that in the past received 8.1% of the loans from a bank benefitting from an average recapitalization of 4.13% of the risk-weighted bank assets and which is ex post well capitalized, the supply of loans in the year after the recapitalization increases by 1.6%. However, if the bank is still undercapitalized, the effect on the supply of loans is not distinguishable from zero, because we cannot reject the null that the coefficients of *%Loans k * Injection Size *Undercapitalized Bank-Def 1* are equal. More importantly, recapitalized banks offer

2.35%(=(4.755-11.789)*0.0413*0.081) less loans to zombie firms after the recapitalization, while banks that are still undercapitalized increase credit to zombie firms by 0.18%(=(4.755-4.091-11.789+11.67)* 0.0413*0.081).

These results strongly indicate that capitalization matters for lending policies above and beyond the effects that it may have on debt overhang problems and support the model of Diamond and Rajan (2000) and Diamond (2001). In particular, capital infusions that are sufficiently large not only reach the goal of increasing the supply of credit, but also make its allocation more efficient as banks that are able to meet the capital requirements withdraw loans from zombie firms. The opposite is true if the capital injected is too small.

Finally, it may be interesting to note that the process of consolidation appears to benefit the clients of the bidders. As is often discussed in the literature (e.g., Sapienza, 2002), after bank mergers, bidders favor their clients over the clients of the target bank. Our results, however, do not depend on the fact that some recapitalizations affect the target of bank mergers, as parameter estimates (not reported) are invariant if we exclude all clients of these firms.

The estimates reported in Table 3 are qualitatively invariant when we perform a number of robustness checks. First, we compare the estimates obtained with the within-firm estimator with the ones obtained including only firm fixed effects. The point estimates of the effects of recapitalizations are similar when we only include firm (together with year and bank) fixed effects in columns 1 and 2 of Panel A and column 4 of Panel B and when we fully control for firm time-varying heterogeneity by including interactions of firm and year fixed effects (together with bank fixed effects) in column in columns 3 and 4 of Panel A and the rest of Panel B and C.

The small differences that arise can give us some insights on the direction of selection biases caused by borrowers' unobserved heterogeneity in the specifications on corporate policies, where we are unable to use the within-firm estimator. For the first two government recapitalizations (Panel A) and capital injections to relatively well capitalized banks (Panel B), there appear to be a (small) negative correlation between being a firm related to the banks affected by the interventions and the error term in the loan equation, as the estimated effects of recapitalizations are slightly larger when we fully control for firm heterogeneity. This means that these banks have closer relationships with borrowers with lower demand for credit. Therefore, we expect the estimates of the effects of these recapitalizations on employment and investment in Subsection IV.C to be slightly downward biased. The contrary is true for the third

recapitalization, the private recapitalizations and the recapitalizations of undercapitalized banks, for which we expect our estimates of the effects on corporate policies to be, if anything, upward biased. These biases make our estimates of the effects of recapitalizations on investment in Subsection IV.C conservative and our findings even more remarkable.

Second, the magnitude of the effects of the recapitalizations obtained using the within-firm estimator represents the proportional credit supply increase from the affected banks in comparison to the other banks. This is the actual increase in the supply of credit as long as the unaffected banks do not decrease the supply in response to the interventions. If not, the estimated effect on the actual supply would be upward biased. The bias can cause the estimated coefficient to be at worse double of the actual effect in the, probably unlikely, case in which the affected banks' loan increase is fully wiped out by the loans' decrease of the unaffected banks. We find, however, that the supply of loans from the unaffected banks does not change. In specifications that we omit for brevity, we exclude the loans from the affected banks and estimate equations like those presented in Panel A of Table 3 to evaluate if after the recapitalizations the unaffected banks change the supply of credit to the clients of the affected banks. In these specifications, besides bank fixed effects, we are able to include firm and year fixed effects, but not their interactions. We find that the loans from the unaffected banks do not change after the bailouts indicating that our estimates in Table 3 capture the actual effect of the interventions on the firm's access to bank loans. We confirm this result exploring firms' overall access to financial debt in Subsection IV.C.[13]

Third, we explore to what extent our results may be driven by the peculiarity of bank-firm relationships in Japan, where banks and firms are often part of the same business group (keiretsu). Banks may be more inclined to support their clients if these belong to the same keiretsu. In fact, it is often claimed that in Japan, banks and firms within the same keiretsu sustain each other without necessarily taking into account the profitability of their actions (Aoki, 1990). To check this, we identify the sample firms belonging to keiretsu in 1998 using data from Peek

[13] Arguments that the bailouts may have harmed the banks that were not bailed out are implausible in this context for several reasons. First, these arguments apply to normal times expectations of bank bailouts, which decrease the ex ante cost of credit for banks that benefit from guarantees. When bailouts occur, if anything, they may be perceived as a negative signal on the health of the banks being bailed out. Second, the bailouts were announced as part of a wider program that signaled that no bank would have been allowed to fail thus implicitly benefiting all banks. Finally, we show that the supply of bank credit increases for the clients of bailed out banks.

and Rosengren (2005).[14] In our sample, 289 firms belong to a keiretsu; none of the keiretsu banks can be classified as undercapitalized using the first definition. If we exclude all observations related to firms belonging to keiretsu, our results are unaffected, indicating that the peculiar structure of Japanese business groups is not driving our results.

Furthermore, we include an interaction of the variable capturing the size of the recapitalization with a dummy that takes value 1 for firms that belong to the same keiretsu of the bank and value zero otherwise. In column 3 of Panel C, our estimates are invariant. Interestingly, like Peek and Rosengren (2005), we find that firms belonging to the same keiretsu of the bank are granted larger loans; however, keiretsu relationships do not affect changes in the supply of credit after the recapitalizations.

We similarly investigate whether the fact that firms own bank shares and vice versa may be driving our results. Also in this case, we first include interactions of our main variables of interest with the firm's shareholdings in the bank. In column 4 of Panel C, the newly added interaction terms are insignificant, indicating that our results are driven by the strength of lending relationships and bank capitalizations. Results are once again invariant and indicate that lending relationships are more important than stockholdings if we consider in the same way the bank's shareholdings in the firm (column 5).

B. Firm Valuations

The announcement effect of the recapitalizations on firm valuations largely mirrors the effect on the supply of credit. Columns 1 and 2 of Table 4 clearly show that the first government recapitalization produced significantly positive abnormal returns for the clients of recapitalized banks, while the third one, which brought a decrease in the supply of credit, was associated with negative abnormal returns. We find no statistical significant effects for the private recapitalizations and perhaps more surprisingly for the second recapitalization. However, given our relatively short event window, the effects of the latter may have been anticipated by market participants. The effect of the first recapitalization on firm valuation is economically large: The cumulative abnormal returns of a firm receiving 20 percent of its loans from banks receiving a capital infusion equal to 1 percent of their assets are 75 basis points over our 5 days event

[14] We focus on keiretsu centered around banks (financial keiretsu) and exclude keiretsu centered around industrial companies (industrial keiretsu) as only in the former it can be argued that the nature of bank-firm relationships is different in Japan (Morck and Nakamura, 1999).

window (0.75*0.2*1*5). The cumulative abnormal return is 1.9 percent for a similar firm receiving half of the loans from the recapitalized banks.

In column 3, we explore whether the size of capital injections and banks' ex post ability to meet the capital requirements produce announcement effects that are consistent with the evidence on the supply of credit. It emerges clearly that the positive announcement effect increases with the size of the capital injections and that the effects are weaker for firms with closer relationships with banks that remain undercapitalized. The difference in cumulative abnormal returns between a firm receiving all loans from a bank benefitting from an average capital injection of 4.13%, and a firm with no loans from recapitalized banks over the five days event window is 6.5%(=0.0413*31.52*5); the cumulative abnormal returns are only 3.25% if the firm receives only half of its loans from such a bank. Furthermore, for a firm receiving all its loans from a bank benefitting from an average recapitalization, but that remains still undercapitalized, the cumulative abnormal returns are only 0.56% (and are not statistically different from zero).

Estimates in column 4 also suggest that the announcement effect of large recapitalizations of banks that succeed in meeting the capital requirements is smaller for zombie firms. While the effect is not statistically significant at conventional levels, we cannot reject the hypothesis that the announcement effect is zero for zombie firms (the null that the coefficient of *Zombie Firm* Injection Exposure* is equal in absolute value to the coefficient of *Injection Exposure* cannot be rejected with a confidence level of 0.8142). The opposite appears to be true if the banks remain undercapitalized; their clients that we classify as zombie benefit the most, while the remaining borrowers do not benefit at all from recapitalizations (the null that the coefficient of *Undercapitalized Injection Exposure* is equal in absolute value to the coefficient of *Zombie Firm* Undercapitalized Injection Exposure* cannot be rejected with a confidence level of 0.9433).

We conclude by evaluating the robustness of our results to changes in the event window. In particular, since the government recapitalizations were widely discussed and the effects may have been anticipated, we extend the window to 5 and 10 days before the official announcement in columns 5 and 6, respectively. Our estimates are largely invariant and strongly indicate that the effects of capital injections on firm valuations depend on their size and the banks' ex post ability to meet the capital requirements.

C. Corporate Policies

We finally explore to what extent the capital injections affect corporate policies. Column 1 in Panel A of Table 5 shows that the larger loans indeed translate in higher access to financial loans. A firm receiving half of its loans from banks benefiting from the first or second recapitalization is able to increase its access to financial loans, while as indicated in the descriptive statistics most of the sample firms decrease their leverage. The effect of recapitalizations on access to financial loans is also economically large: After the first recapitalization, firms with average exposure to recapitalized banks (0.04) experienced an increase in financial debt relative to their total assets equal to 0.42%. This result also indicates that unaffected banks do not decrease the supply of loans in response to the capital injections; it also indicates that larger bank loans do not substitute for market debt. The increase in the use of financial debt also suggests that before the recapitalizations firms are financially constrained. In fact, we find no evidence that the increase in financial debt is accompanied by a decrease in the average interest rate expenses, suggesting that the interest rate does not decrease. Under these conditions, and holding constant growth opportunities, unconstrained borrowers should not respond to recapitalizations by increasing the use of financial debt.

When we simply distinguish across the rounds of recapitalizations, we find some evidence that firms use the larger loans to increase their cash holdings (although the effects are not statistically significant at conventional levels), but we find no evidence of real effects. Our empirical models gain statistical power once we exploit the heterogeneity of the capital injections with respect to the banks' risk-weighted assets and the banks' ex post ability of meeting the capital requirements. This indicates, as we notice before, that there is significant heterogeneity in the effects of recapitalizations even within the same round and that the heterogeneity in the banks' financial conditions after the capital injections plays an important role.

In Panel B of Table 5, it is apparent that firms with closer lending relations with banks receiving larger capital injections are able to increase their use of financial loans. Also in this case, the effect appears smaller for the clients of banks that remain undercapitalized after the capital injections. Firms obtaining half of their loans from banks benefiting from an average capital injection of 4.13% are able to increase their financial loans by 9.2%. However, if those banks are still undercapitalized after the capital injection, consistently with our previous findings the ability to access financial loans decreases by -2.9%.

We find similar effects on cash-holdings, which are however insignificant at conventional levels.[15] Most importantly, although we continue to find no effect on employment, larger recapitalizations are associated with higher investment if the bank is able to meet the capital requirements after the capital infusion. The effects are large: A firm with average investment receiving 50 percent of its loans from a bank benefiting from an average capital injection increases its investment by approximately 1.6 percent. The effect increases to 3.2 percent if the size of the capital injection doubles. However, this effect is statistically indistinguishable from zero if the exposure is to banks that fail to meet the capital requirements after the capital injection (the hypothesis that the sum of the coefficients of *Injection Exposure* and *Undercapitalized Injection Exposure* in column 5 is zero cannot be rejected at the 37% level).

Also differences in investment across firms are consistent with our previous findings on the allocation of credit. Zombie firms more exposed to banks that benefit from capital injections and remain undercapitalized appear to invest more. The contrary is true for the rest of the bank clients. In contrast, large capital injections reestablishing bank capital requirements decrease the investment of zombie firms whose survival, as Caballero, Hoshi and Kashyap (2008) argue, may decrease the productivity and growth of the economy. The effects are large: Using the estimates in column 6, non-zombie firms with half of their loans from banks receiving an average capital injection and no exposure to undercapitalized banks are able to increase their investments by 1.73%, whereas firms with similar exposure to undercapitalized banks shrink their investment by 1.71%. Most importantly, the effects on the allocation of investment of injecting capital in banks that are ex post able to meet the capital requirements or not are different: zombie firms that are only exposed to banks that are able to meet the capital requirements after the capital injection increase their investment by only increase their investment by just 0.12%; the effect is somewhat larger for zombie firms with similar exposure to banks that fail to meet the capital requirements ex post that increase their investment by 0.50%.

Since in these specifications we are able to control for firm heterogeneity simply by including firm fixed effects, concerns arise that our results are driven by unobserved heterogeneity. Undercapitalized banks may have worse borrowers which for this reason benefit less from the recapitalization. However, our findings are fully consistent with the effects of the capital injections on the supply of credit, which cannot be driven by selection problems because

[15] The effects become statistically significant if we use any of the other two definitions of undercapitalized banks presented in Table 1.

firm heterogeneity is fully absorbed by the interaction of firm and year fixed effects. In addition, when we quantify unobserved borrower heterogeneity by comparing the estimates obtained with the within estimator and with firm fixed effects, it emerges that the effects of unobserved heterogeneity are small and that depending on the specific episode lead to (small) upward or downward biases. In particular, those estimates imply an attenuation bias for the (positive) effects of capital injections when the lending banks meet the capital requirements and an upward bias for the effect of recapitalizations of banks that remain undercapitalized. Thus, our conclusion that capital injections have positive real effects only as long as they do not leave the banks undercapitalized is based on conservative estimates.

To further mitigate any doubts that our results may be biased by selection problems, we re-estimate all models in Panel B by including interactions of industry and year fixed effects. The point estimates of our variable of interest are invariant (for brevity, we report only the investment equation). Our estimates are also invariant if we sort firms in size quintiles and include size quintile dummies and year interactions in the above equations (estimates omitted). Any unobserved heterogeneity correlated with industry or size quintile dynamics should lead to large changes in our estimates. It is thus comforting that our results are unchanged when we compare firms within the same industry (or size quintile) in a give year.

We finally run a placebo test. In particular, we re-estimate all the equations in Panel B fictitiously assuming that the effects of our main variables of interest, *Injection Exposure* and *Undercapitalized Injection Exposure*, occur two years later (in other words, we use the two-year lags of these variables and set their values equal to zero in the first two years of the sample). For brevity, we report only the investment equation (column 8 in Panel B of Table 5). In all cases, we find that our variables of interest are statistically insignificant. In unreported specifications, we fictitiously assume that the recapitalizations occur two years earlier and again we cannot find significant differences in performance. This confirms that the conclusions based on our estimates of the effects of capital injections are conservative and unlikely to be driven by selection problems.

D. Aggregate implications

So far we have shown that on average the capital injections were successful in increasing the supply of credit and investment. However, our analysis also highlights the importance of considering bank heterogeneity and the effects on capital allocation. Hereafter, we consider: 1) the aggregate effects of the first two governments recapitalizations that are the ones that involved more banks; and, more importantly, 2) how much larger the cost of the recapitalizations and the increase in the supply of credit would have been if no bank had been left undercapitalized in 1998. While answering these questions is challenging, even a tentative back-of-the-envelope calculation based on our micro-evidence is quite revealing.

For a firm with an average strength of relationship (as mentioned before, 8.1%) with a recapitalized bank that benefited from an average capital injection in 1998 and 1999 (respectively, 1.89% and 5.08% of the bank's risk-weighted assets), the estimates in column 5 in Panel B of Table 3 imply that an increase in bank loan of 0.57% in 1998 and 1.85% in 1999 if the bank meets the capital requirement after the recapitalization and 0.03% in 1998 and 0.08% in 1999 if the bank does not meet the capital requirements after the recapitalizations. Since the average amount of a loan in both in 1998 and 1999 was approximately 4 billion Yen, this translates in an actual increases in the loan that a recapitalized bank offers to each firm of 23 (74) million Yen in 1998 (1999). The actual increase in the loan from a bank that is still undercapitalized after the capital injection is only 1.2 million Yen (3 million Yen) in 1998 (1999). Since in 1998 (1999) we have 6,828 (6,743) relationships with banks that meet capital requirements after the recapitalization and 1,388 (761) with banks that are still undercapitalized, the aggregate increase in bank loans is: 158 billion Yen (503 billion Yen).

Clearly, these estimates largely understate the aggregate effects on the supply of credit especially because we observe only loans to listed companies and many of the firms benefitting from the capital injections may have been unlisted. However, since the total amount of capital that the government injected in the banking system was 1.8 (2) trillion in 1998 (1999), the increase in the supply of credit to listed companies appears quite small in both instances.

In what follows, in order to have a better idea of the macroeconomic effects of the government capital injections on the allocation of credit, we further use the estimates in column 1 of Panel C of Table 3. Then we perform a counterfactual analysis to explore how much larger the effects on the supply of credit could have been by improving the design of recapitalizations.

To take into account the effect on the allocation of credit we note that in 1998 (1999), the number of bank-firm relationships that were affected, distinguishing between "good" firms and zombie firms were, respectively, 6,560 (6,462) and 268 (281) with banks that met the capital requirements after the capital injections and 1333 (720) and 55 (41) with banks that did not meet the capital requirements after the capital injections. In the year prior to the recapitalization of 1998 (1999), normal firms received from the recapitalized banks 0.099 (0.088) of their loans. Similarly, zombie firms received 0.075 (0.063) of their loans from the recapitalized banks.

These implies that in 1998 (1999) the average loan increased by 0.62% (2.01%) for a good firm borrowing from an adequately capitalized bank and a mere 0.08% (0.32%) if the same firm borrowed from a still undercapitalized bank. Zombie firms borrowing from adequately capitalized banks experienced a decrease in credit of 0.93% (2.38%) in 1998 (1999), but their loans increased by 0.06% (0.14%) in 1998 (1999) if they borrowed from a still undercapitalized bank.

Considering that in both years a loan was approximately 4 billion Yen and the number of bank firm relationships involved, this translated in an increase of loans from banks to that met the capital requirements to good firms of 163 (520) billion Yen and a decrease in the loans that these banks offered to zombie firms of 10 (2.68) billion Yen. However, the total increase in loans to good firms from banks that still failed to meet the capital requirements was only 4.27 (9.22) billion Yen; these banks even increased loans to zombie firms by 132 (230) million Yen.

Thus it appears that the effectiveness of capital injections on the supply of credit was reduced by the fact that many banks remained undercapitalized. While in the aggregate the amount of credit that these banks allocated to zombie firms is relatively small, the most significant cost appears to be that the undercapitalized banks did *not* provide more credit to good firms. Also, the main difference does not seem to be between the first and the second recapitalizations, as Hoski and Kashyap (2010) without using micro data argue, but rather between banks. To the extent that it was larger, the second recapitalization appears to have involved even larger costs in terms of missed credit.

In what follows, we attempt to quantify how much the supply of credit to good firms would have increased if all banks had been able to meet the capital requirements after the first intervention in 1998. In particular, we compute how much larger the cost of the capital injections should have been to bring all the banks 2% above the official capital requirements, a level that

given the amount of bad loans on banks' balance sheets we evaluate as necessary for banks to meet their capital requirements. On the one hand, we estimate that achieving this would require an additional disbursement of about 1.28 trillion Yen. On another hand, it is plausible to conjecture that if after the 1998 capital injection all banks had been well capitalized, no recapitalization would have been needed in 1999 saving 2 trillion Yen. Thus, increasing the budget for the first round of capital injections and avoiding the second round in 1999 would have been approximately budget neutral for the government. It would have however brought significant benefits, which we estimate as follows.

In 1998, the average capital injection would have increased to 2.67%. Considering that no bank would have remained undercapitalized, the amount of credit supplied to good firms would have been over 418 billion Yen, that is, 2.5 times the amount of credit good firms actually received in 1998. An additional benefit of the faster resolution of banking problems would have been the improvement in the allocation of credit and the decrease to the loans to zombie firms of 19 billion Yen. This confirms that size of the capital injections relative to the banks' initial financial conditions is crucial for the success of bank bailouts and that only capital injections that are sufficient to reestablish bank capital requirements are successful in increasing the supply of credit and spurring investment.

V. Conclusions

To the best of our knowledge, this paper provides the first micro-evidence on the effects of bank bailouts on firm access to credit, valuation, and subsequent investment. We highlight that the size of the capital injections and the banks' ex post ability to meet the capital requirements are crucial determinants of the effects of capital injections. Only if recapitalizations are large and banks are able to meet the capital requirements, firms have easier access to bank loans, experience positive abnormal returns and ultimately are able to invest more. The real effects of bank bailouts are weaker if recapitalizations are smaller and do not materialize at all if the banks remain unable to meet the capital requirements. In fact, injecting capital in banks that remain unable to meet the capital requirements has undesirable effects for the allocation of credit and investment, as larger loans are directed (only) to unviable zombie firms, which as a consequence invest more.

Our results strongly suggest that ill-designed interventions may increase the misallocation of credit and raise concerns because the size of government recapitalizations is often constrained by fiscal and political considerations. For instance, also in the U.S. the balance sheets of many banks continued to be fragile after the TARP injections (Congressional Oversight Panel, 2009). We believe that it is an exciting area for future research to explore whether more decisive interventions to tackle problems of capital shortage may further enhance the positive effects of capital injections uncovered in this paper.

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Table 1
Japanese Banks and Capital Injections

Table 1 reports the Tier 1 capital ratio from Bankscope for the recapitalized banks in the year following the recapitalization and for the unaffected banks and the affected banks in the years that are not preceded by a capital injection. It also reports the size of government and private capital injections relative to the bank's risk-weighted assets also obtained from Bankscope. We then present three alternative conditions aiming to capture whether banks are still undercapitalized after the capital injections. The first condition defines a bank to be still undercapitalized after the capital injection if the tier 1 capital ratio is sufficiently low. The second definition adds the size of the capital injection relative to the bank's risk-weighted assets to the bank's tier 1 capital ratio. A bank is defined to be still undercapitalized if this quantity is below the capital requirements. The third definition classifies a bank to be undercapitalized, if the total capital ratio is below the bank's capital requirements plus 2 percent. Finally, we provide statistics for the proportion of loans that sample firms receive from each bank as a proxy for the strength of the lending relationships.

	N	Mean	Median	Standard Deviation
Banks' Tier 1 Capital Ratio	860	7.40	7.07	5.98
…Government Capital Injections	17	5.94	6.00	1.93
…Private Capital Injections	76	5.74	5.67	1.75
…Unaffected Banks	776	7.59	7.24	6.24
Capital Injection Size				
…Government Capital Injections	17	4.13	2.56	4.26
…Private Capital Injections	76	2.07	1.67	1.53
Banks Still Undercapitalized -Def 1(Tier1 Ratio<Capital Requirement - 2%)				
…Government Capital Injections	17	0.24		
…Private Capital Injections	76	0.50		
Banks Still Undercapitalized -Def 2 (Tier1 Ratio + Capital Injection Size<Capital Requirement)				
…Government Capital Injections	17	0.12		
…Private Capital Injections	76	0.51		
Banks Still Undercapitalized -Def 3 (Total Capital Ratio<Capital Requirement + 2%)				
…Government Capital Injections	17	0.12		
…Private Capital Injections	76	0.71		
Relationships Strength	151,697	0.081	0.035	0.124
…Government Capital Injections	8,458	0.165	0.126	0.127
…Private Capital Injections	14,281	0.098	0.055	0.120
…Unaffected Banks	131,925	0.075	0.030	0.123

Table 2
Descriptive Statistics

This table reports descriptive statistics for the main variables. *ΔLoan* is the percentage change in loans from bank *k* to firm *i* between *t* and *t+1*. *Loan Increase* is a dummy that takes value 1 if the loan from bank *k* to firm *i* increase between *t* and *t+1* and takes value zero otherwise. *%Loans k* is the proportion of loans that firm *i* receives from bank *k* at time *t*. *First recapitalization Bank k*, *Second Recapitalization Bank k*, *Third Recapitalization Bank k*, *Private Recapitalization Bank k*, *Recapitalization Bank k, Bidder Bank k* and *Target Bank k* are dummy variables that take value 1 if in year *t* bank *k* has been affected by any of these interventions and are equal to zero otherwise. *Undercapitalized Bank-Def 1*, *Undercapitalized Bank-Def 2* and *Undercapitalized Bank-Def 3* are dummy variables that take value 1 if at *t* bank *k* is defined as undercapitalized according to each of the three definitions presented in Table 1. *Tier1 Capital Ratio of Bank k* is the tier 1 capital ratio of bank *k* at time *t-1*. *Firm Shareholdings of Bank k* is the fraction of shares that firm *i* holds in bank *k* at time t. *Bank k Shareholdings of the Firm* is the fraction of shares that bank *k* holds in firm *i*. It is winsorised at the 99th percentile. *Same Keiretsu* is a dummy variable that takes value 1 if firm *i* belongs to the same financial keiretsu of bank *k* and value zero otherwise. *Firm abnormal return* is the difference between the actual return of firm *i* on day *t* minus the expected return predicted using the CAPM. The CAPM regression coefficients are computed with daily data using a *(t-280,t-20)* estimation window for each firm-day. We discard observations with less than 100 days to compute expected returns. Δ*FinDebt/TA* is the change in financial debt of firm *i* between year *t* and *t+1* divided by the firm's total assets at time *t*; to improve the readability of the tables we multiply this variable by 100,000. Δ*Cash/TA* is the change in the cash of firm *i* between year *t* and *t+1* divided by the firm's total assets at time *t*. *Investment* is the growth rate of fixed assets of firm *i* between *t* and *t+1*. *Growth of Employment* is the growth rate in the number of employees of firm *i* between year t and t+1; we censored the observations of this variable at the 1st and and the 99th percentiles. *Size* is the logarithm of the firms market capitalization. Mkt to Book is the ratio of firm *i* market capitalization and total assets at year *t*; we removed observations with negative book values as well as observations above 99th percentile. *Interest Rate Coverage* is the interest rate coverage ratio of firm *i* at year *t* defined as earning before interest and taxes divided by interest expenses. *Loans from Banks Affected by Intervention j* is the proportion of loans that firm *i* receives from each of the banks affected by intervention *j* in the year prior to the recapitalization. These variables capture the firms' exposures to the interventions and are allowed to differ from zero only during the year following the interventions. *Injection Exposure* is defined as $\sum_k Loans\ from\ Bank_{ikt} * Injection\ Size_{kt}$. *Undercapitalized Injection Exposure* is defined as $\sum_k Loans\ from\ Bank_{ikt} * Injection\ Size_{kt} * Still\ Undercapitalized\ Bank_{kt}$. *Zombie Firm* is a dummy variable that takes value 1 if during year *t* the actual interest payments of firm *i* are lower than if the firm paid the prime rate on long-term and short-term debt and zero coupon on its bonds; the dummy variable takes value zero otherwise. All variables are reported at yearly frequency with the exception of Firm Abnormal Return, which is reported at daily frequency.

Variable	Obs	Mean	Std.Dev	Median	1st percentile	99th percentile
Firm-Bank-Time Specific Variables						
ΔLoan (%)	151697	5.836	42.486	0.000	-84.720	100.000
Loan Increase	151697	0.324	0.467			
%Loans k	151697	0.081	0.125	0.035	0.000	0.595
First Recapitalization Bank *k* * %Loans k	151697	0.005	0.036	0.000	0.000	0.175
Second Recapitalization Bank *k* * %Loans k	151697	0.004	0.031	0.000	0.000	0.139
Third Recapitalization Bank *k* * %Loans k	151697	0.001	0.013	0.000	0.000	0.000
Private Recapitalization Bank *k* * %Loans k	151697	0.012	0.052	0.000	0.000	0.266
Recapitalization Bank *k* * %Loans k	151697	0.009	0.048	0.000	0.000	0.247
Undercapitalized Bank-Def 1	151697	0.097	0.296			
Undercapitalized Bank-Def 2	151697	0.004	0.063			
Undercapitalized Bank-Def 3	151697	0.130	0.337			
Bidder Bank *k* * %Loans k	151697	0.014	0.057	0.000	0.000	0.293
Target Bank *k* * %Loans k	151697	0.001	0.014	0.000	0.000	0.001
Tier1 Capital Ratio of Bank *k*	151697	7.249	4.849	7.250	2.310	11.270
Tier1 Capital Ratio of Bank *k** %Loans k	151697	0.570	1.011	0.239	0.000	4.628
Firm Shareholdings of Bank k	151697	0.002	0.001	0.000	0.000	0.004
Bank k Shareholdings of the Firm	151697	0.012	0.027	0.000	0.000	0.012
Same Keiretsu	151697	0.009	0.093			
Firm-Time Specific Variables						
Firm Abnormal Return (daily, %)	3722512	0.043	3.398	-0.037	-9.158	11.042
ΔFinDebt/TA	10308	-0.016	1.129	-0.003	-0.896	0.774
ΔCash/TA	10781	0.002	0.051	0.000	-0.118	0.145
Investment	10546	0.012	0.104	0.001	-0.159	0.309
Growth of Employment	9999	-0.000	0.041	-0.004	-0.108	0.144
Size	13580	8.684	4.021	10.218	0.010	12.371
Mkt to Book	13580	1.212	1.433	0.825	0.010	7.689
Interest Rate Coverage	13457	0.524	4.456	0.130	0.000	2.500
Loans from Banks Affected by the First Recapitalization	13580	0.039	0.138	0.000	0.000	0.710
Loans from Banks Affected by the Second Recapitalization	13580	0.028	0.107	0.000	0.000	0.581
Loans from Banks Affected by the Third Recapitalization	13580	0.005	0.040	0.000	0.000	0.182
Loans from Banks Affected by Private Recapitalizations	13580	0.097	0.178	0.000	0.000	0.734
Loans from Undercapitalized Banks Affected by Recapitalizations	13580	0.064	0.208	0.000	0.000	1.000
Injection Exposure	13580	0.285	0.781	0.000	0.000	3.731
Undercapitalized Injection Exposure	13580	0.080	0.515	0.000	0.000	2.052
Loans from Bidder Banks	13580	0.127	0.213	0.000	0.000	0.876
Loans from Target Banks	13580	0.008	0.042	0.000	0.000	0.222
Zombie Firm	13580	0.119	0.324			

Table 3
The Supply of Credit

The dependent variable are either the loan growth of firm *i* from bank *k* between *t* and *t+1* or Loan Increase, a dummy variable that takes value 1 if bank *k* increases the amount of loans it provides to firm i between *t* and *t+1* and takes value zero otherwise. All variables are defined in Tables 1 and 2 and the dependent variable is indicated on each column. Parameters are estimated either by using a within-firm estimator (i.e., we include firm*year fixed effects in all equations and estimate the parameters by ordinary lest squares) or by using a firm fixed effects estimator. The constant is included in all regressions, but the coefficient is omitted. Standard errors presented in parentheses are corrected for heteroskedasticity and clustering at the firm level. ***, **, and * denote statistical significance at the 1, 5, and 10 percent, respectively. All estimates in Panel A and estimates for *%Loans k, Bidder Bank k*%Loans k, Target Bank k*%Loans k, Tier1 Capital Ratio of Bank k, Tier1 Capital Ratio of Bank k*%Loans k* are multiplied by 100.

Panel A. Recapitalization Rounds

	(1)	(2)	(3)	(4)
	ΔLoan	Loan Increase	ΔLoan	Loan increase
First Recapitalization Bank k*%Loans k	49.16***	0.571***	57.27***	0.625***
	(3.37)	(0.046)	(3.55)	(0.046)
Second Recapitalization Bank k *%Loans k	58.19***	0.656***	61.74***	0.665***
	(3.66)	(0.052)	(3.72)	(0.053)
Third Recapitalization Bank k *%Loans k	-2.48	-0.238**	-9.04	-0.351***
	(9.30)	(0.095)	(9.52)	(0.098)
Private Recapitalization Bank k *%Loans k	-12.36***	-0.055*	-12.62***	-0.067**
	(2.45)	(0.030)	(2.54)	(0.032)
%Loans k	-94.58***	-0.417***	-94.48***	-0.370***
	(2.10)	(0.019)	(2.30)	(0.021)
Bidder Bank k *%Loans k	8.19***	0.097***	12.24***	0.092***
	(2.48)	(0.028)	(2.59)	(0.029)
Target Bank k *%Loans k	-1.76	0.039	4.66	0.094
	(6.42)	(0.077)	(6.91)	(0.082)
Fixed effects	Firm, Bank, Year	Firm, Bank, Year	Firm*Year, Bank	Firm*Year, Bank
Observations	151697	151697	151697	151697
R-squared	0.189	0.152	0.300	0.278

Panel B. The Size of the Capital Injections

	(1) ΔLoan	(2) ΔLoan	(3) ΔLoan	(4) ΔLoan	(5) ΔLoan	(6) Loan increase	(7) ΔLoan	(8) ΔLoan
%Loans k *Government Injection Size	2.856***	8.742***						
	(0.591)	(0.989)						
%Loans k * Government Injection Size * Undercapitalized Bank-Def 1		-8.034***						
		(1.168)						
%Loans k* Injection Size			1.979***	3.698***	4.400***	6.603***		5.583***
			(0.433)	(0.615)	(0.611)	(0.782)		(0.596)
%Loans k * Injection Size *Undercapitalized Bank-Def 1				-3.337***	-3.760***	-6.045***		
				(0.849)	(0.862)	(1.097)		
Recapitalization Bank k*%Loans k							0.510***	
							(0.028)	
Recapitalization Bank k*%Loans k * Undercapitalized Bank-Def 2							-0.171*	
							(0.088)	
%Loans k * Injection Size * Undercapitalized Bank-Def 3								-6.445***
								(0.921)
Private recapitalization Bank k* %Loans k	-2.224	-2.687						
	(2.434)	(2.538)						
%Loans k	-97.86***	-97.32***	-97.84***	-97.86***	-97.50***	-0.346***	-105.91***	-97.46***
	(2.894)	(2.886)	(2.479)	(2.478)	(2.851)	(0.030)	(2.96)	(2.848)
Bidder Bank k*%Loans k	4.969**	6.145**	1.918	3.083	6.384***	0.024	14.39***	7.477***
	(2.451)	(2.467)	(2.295)	(2.332)	(2.416)	(0.028)	(2.543)	(2.422)
Target Bank k*%Loans k	-4.365	-3.455	-10.229	-9.433	-3.560	0.005	5.018	-2.907
	(6.819)	(6.829)	(6.394)	(6.404)	(6.816)	(0.081)	(6.913)	(6.814)
Tier1 Capital Ratio of Bank k	-0.196***	-0.193***	-0.159***	-0.156***	-0.190***	-0.001***	-0.211***	-0.188***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.0003)	(0.031)	(0.031)
Tier1 Capital Ratio of Bank k*%Loans k	1.171***	1.065***	1.033***	0.974***	1.052***	0.003	1.407***	1.000***
	(0.295)	(0.294)	(0.235)	(0.236)	(0.295)	(0.003)	(0.302)	(0.294)
Fixed effects	Firm*Year,	Firm*Year,	Firm*Year,	Firm, Year,	Firm*Year,	Firm*Year,	Firm*Year,	Firm*Year,

	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank
Observations	151697	151697	151697	151697	151697	151697	151697	151697
R-squared	0.298	0.299	0.187	0.187	0.298	0.277	0.300	0.299

Panel C. Types of Bank Clients

	(1) ΔLoan	(2) Loan Increase	(3) ΔLoan	(4) ΔLoan	(5) ΔLoan
%Loans k* Injection Size	4.755***	6.993***	4.357***	4.264***	3.234**
	(0.621)	(0.788)	(0.617)	(0.643)	(1.040)
%Loans k * Injection Size *Undercapitalized Bank-Def 1	-4.091***	-6.306***	-3.665***	-3.563***	-3.704**
	(0.943)	(0.108)	(0.867)	(0.896)	(1.628)
Zombie Firm* %Loans k* Injection Size	-11.789***	-11.578***			
	(3.342)	(4.057)			
Zombie Firm* %Loans k * Injection Size *Undercapitalized Bank-Def 1	11.670***	11.323**			
	(3.629)	(4.481)			
Same Keiretsu* %Loans k* Injection Size			0.669		
			(3.485)		
Firm shareholdings of Bank k* %Loans k * Injection Size				4.050	
				(5.913)	
Firm shareholdings of Bank k* %Loans k * Injection Size*Undercapitalized Bank-Def 1				-6.182	
				(11.64)	
Bank k Shareholdings of the Firm*%Loans k * Injection Size					-15.711
					(14.889)
Bank k Shareholdings of the Firm*%Loans k * Injection Size *Undercapitalized Bank-Def 1					22.038
					(21.792)
%Loans k	-97.39***	-0.345***	-98.351***	-99.080***	-132.86***
	(2.851)	(0.030)	(2.861)	(2.858)	(3.640)
Bidder Bank k*%Loans k	6.309***	0.023	5.791**	6.249***	-4.378*
	(2.414)	(0.028)	(2.412)	(2.417)	(2.285)
Target Bank k*%Loans k	-3.625	0.004	-3.156	-4.494	-15.525**
	(6.815)	(0.081)	(6.821)	(6.862)	(6.619)
Tier1 Capital Ratio of Bank k	-0.190***	-0.001***	-0.190***	-0.189***	-0.228***
	(0.031)	(0.0003)	(0.031)	(0.031)	(0.032)
Tier1 Capital Ratio of Bank k*%Loans k	1.045***	0.00343	1.039***	1.017***	1.704***
	(0.295)	(0.00329)	(0.295)	(0.294)	(0.329)
Same Keiretsu			0.102***		
			(0.011)		
Firm Shareholdings of Bank k				0.759***	
				(0.117)	
Bank k Shareholdings of the Firm					8.331***
					(0.341)
Fixed effects	Firm*Year, Bank	Firm*Year, Bank	Firm*Year, Bank	Firm*Year, Bank	Firm*Year, Bank
Observations	151697	151697	151697	151697	151697
R-squared	0.298	0.277	0.299	0.299	0.306

Table 4
Firm Abnormal Returns

We explore the response of firms' daily abnormal returns to the interventions. In columns 1 to 4, the event window is [-3,+1] (i.e., we allow the exposure to intervention *j* captured by Loans from Banks affected by Intervention j to be different from zero 3 days before the event until 1 days afterwards); in column 5 (6) the event window is [-5,+1] ([-10,+1]). The dependent variable is the firm's daily abnormal return. All variables are defined in Tables 1and 2. Parameters are estimated by ordinary least squares. The constant is included in all regressions, but the coefficient is omitted. The coefficients of size, mkt to book and interest rate coverage are multiplied by 100. Estimates are obtained by ordinary least squares. Standard errors presented in parentheses are corrected for heteroskedasticity and clustering at the firm and year level. ***, **, and * denote statistical significance at the 1, 5, and 10 percent, respectively.

	(1) [-3,+1]	(2) [-3,+1]	(3) [-3,+1]	(4) [-3,+1]	(5) [-5,+1]	(6) [-10,+1]
Loans from Banks Affected by the First Recapitalization	0.748***	0.746***				
	(0.125)	(0.124)				
Loans from Banks Affected by the Second Recapitalization	-0.151	-0.151				
	(0.367)	(0.367)				
Loans from Banks Affected by the Third Recapitalization	-0.657***	-0.655***				
	(0.055)	(0.054)				
Injection Exposure			31.52***	32.39***	29.91***	23.88***
			(4.49)	(3.61)	(383)	(4.33)
Undercapitalized Injection Exposure			-28.80***	-28.71***	-23.53***	-18.23***
			(3.288)	(3.07)	(3.11)	(4.63)
Zombie Firm* Injection Exposure				-25.19		
				(17.22)		
Zombie Firm* Undercapitalized Injection Exposure				19.33		
				(19.16)		
Loans from Banks Affected by Private Recapitalizations	0.495	0.493				
	(0.381)	(0.382)				
Loans from Bidder Banks	-0.006	-0.008	-0.014	-0.014	-0.014	-0.015
	(0.057)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
Loans from Target Banks	-0.084	-0.086	-0.086	-0.085	-0.085	-0.087
	(0.096)	(0.097)	(0.097)	(0.098)	(0.097)	(0.096)
Size		-0.170	-0.171	-0.171	-0.170	-0.175
		(0.176)	(0.175)	(0.175)	(0.175)	(0.176)
Mkt to Book		0.132	0.133	0.133	0.133	0.134
		(0.082)	(0.083)	(0.084)	(0.083)	(0.083)
Interest rate coverage		0.085*	0.088**	0.086**	0.088**	0.088**
		(0.046)	(0.044)	(0.044)	(0.044)	(0.044)
Zombie Firm				-0.006		
				(0.018)		
Observations	3722512	3722512	3722512	3722512	3722512	3722512
R-squared	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

Table 5
Corporate Policies

We study the effects of the interventions on the corporate policies indicated in each column (i.e., ΔFinDebt/TA, ΔCash/TA, Growth of Employment and Investment). All variables are defined in Tables 1 and 2. All regressions include the constant, firm and year fixed effects, whose coefficients are not reported. In columns 7 of Panel B we classify firms in 13 industries and also include interactions of industry and year fixed effects. In column 8 of Panel B, we perform a placebo test by fictitiously applying the capital infusions two years after they occurred. Parameters are estimated by ordinary least squares. The coefficients of size, mkt to book and interest rate coverage are multiplied by 100. Standard errors presented in parentheses are corrected for heteroskedasticity and clustering at the firm level. ***, **, and * denote statistical significance at the 1, 5, and 10 percent, respectively.

Panel A. Recapitalization Rounds

	(1) ΔFinDebt/TA	(2) ΔCash/TA	(3) Growth of Employment	(4) Investment
Loans from Banks Affected by the First Recapitalization	0.108**	0.003	-0.004	0.007
	(0.045)	(0.005)	(0.005)	(0.010)
Loans from Banks Affected by the Second Recapitalization	0.028***	0.010	0.001	0.016
	(0.094)	(0.006)	(0.009)	(0.019)
Loans from Banks Affected by the Third Recapitalization	-0116	-0.010	0.009	0.004
	(0.082)	(0.0110)	(0.010)	(0.033)
Loans from Banks Affected by Private Recapitalizations	-0.039	-0.004	-0.006	0.001
	(0.083)	(0.005)	(0.005)	(0.011)
Loans from Bidder Banks	0.065	-0.000	-0.003	-0.017*
	(0.050)	(0.005)	(0.003)	(0.009)
Loans from Target Banks	0.287	0.008	-0.012	0.005
	(0.179)	(0.015)	(0.012)	(0.028)
Size	1.854**	-0.003	-0.030	-92.629
	(0.758)	(0.0245)	(0.018)	(69.581)
Mkt to Book	-2.917	0.003	-0.048	286.890
	(4.043)	(0.136)	(0.061)	(179.444)
Interest rate coverage	0.169	0.011	-0.007	-21.689
	(0.130)	(0.010)	(0.030)	(26.719)
Fixed Effects	Firm, Year	Firm, Year	Firm, Year	Firm, Year
Observations	10308	10781	9999	10546
R-squared	0.304	0.224	0.367	0.297

Panel B. The Size of the Capital Injections

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔFinDebt/TA	ΔCash/TA	Growth of Employment	Growth of Employment	Investment	Investment	Investment	Investment Placebo
Injection Exposure	4.450***	15.68	0.019	0.031	0.780**	0.840***	1.008***	-0.599
	(1.675)	(10.02)	(0.137)	(0.153)	(0.321)	(0.323)	(0.367)	(1.654)
Undercapitalized Injection Exposure	-5.851**	-14.05	-0.013	0.000	-0.691*	-1.671**	-1.434**	0.479
	(2.439)	(12.81)	(0.184)	(0.177)	(0.359)	(0.678)	(0.708)	(1.682)
Zombie Firm* Injection Exposure				-0.168		-0.782**	-0.953**	
				(0.404)		(0.369)	(0.398)	
Zombie Firm* Undercapitalized Injection Exposure				0.023		1.852**	1.562*	
				(0.441)		(0.762)	(0.801)	
Loans from Bidder Banks	0.0638	0.024	-0.0023	-0.0024	-0.0167*	-0.0166*	-0.0169**	0.0115*
	(0.0493)	(0.444)	(0.0028)	(0.0028)	(0.0090)	(0.0090)	(0.0084)	(0.0070)
Loans from Target Banks	0.2658	0.805	-0.0112	-0.0113	0.0040	0.0049	0.0002	0.0302
	(0.1791)	(1.521)	(0.0119)	(0.0120)	(0.0276)	(0.0276)	(0.0272)	(0.0371)
Size	1.851**	-0.004	-0.0299*	-0.0299*	-0.0944	-0.0965	-0.0905	-0.0933
	(0.758)	(0.025)	(0.0181)	(0.0182)	(0.0695)	(0.0696)	(0.0700)	(0.0701)
Mkt to Book	-2.938	0.001	-0.0523	-0.0525	0.2911	0.2970*	0.2712	0.3001*
	(4.060)	(0.136)	(0.0610)	(0.0610)	(0.1782)	(0.1789)	(0.1789)	(0.1792)
Interest rate coverage	0.1741	0.011	-0.0078	-0.0078	0.0092	0.0094	0.0049	0.0079
	(0.1283)	(0.010)	(0.0301)	(0.0302)	(0.0201)	(0.0201)	(0.0183)	(0.0206)
Zombie Firm				0.0020		-0.0061	-0.0049	
				(0.0019)		(0.0042)	(0.0042)	
Fixed Effects	Firm, Year	Firm, Year	Firm, Year	Firm, Year	Firm, Year	Firm, Year	Firm, Industry*Year	Firm, Year
Observations	10308	10781	9999	9999	10546	10546	10546	10546
R-squared	0.304	0.224	0.367	0.367	0.297	0.298	0.307	0.296

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