Corporate stress and bank nonperforming loans: Evidence from Pakistan

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Abstract

Using detailed administrative Pakistani credit registry data, we show that banks with low leverage ratios are both significantly slower and less likely to recognize a loan as nonperforming than other banks that lend to the same firm. Moreover, we find suggestive evidence that this lack of recognition impedes loan curing, with banks with low leverage ratios reporting significantly higher final default rates than other banks for the same borrower (even after controlling for differences in loan terms). Our empirical findings are consistent with the theoretical prediction that classifying a nonperforming loan is more expensive for banks with less capital.

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1 Introduction

Banks play a crucial role in the efficient allocation of credit through screening and monitoring firms as well as enforcing credit contracts. However, a bank's incentives are not necessarily aligned with either their investors or the social planner. In this paper, we present evidence that highlights one potential friction—banks with low leverage ratios inefficiently forbearing loans to potentially insolvent firms. Our evidence is consistent with a bank's incentive to ration scarce regulatory capital causing worse credit outcomes.

We show that banks with low leverage ratios are both significantly slower and less likely to recognize a loan as overdue than other banks. Specifically, using an empirical strategy similar to Khwaja and Mian [2008], we isolate characteristics of bank lending by analyzing firms that receive multiple loans from different banks. Moreover, we find suggestive evidence that this lack of recognition impedes loan curing, with banks with low leverage ratios reporting significantly higher final default rates than other banks for the same borrower (even after controlling for differences in loan terms). Our empirical findings are consistent with the theoretical prediction that classifying a nonperforming loan is more expensive for banks with less capital. By masking the status of a loan, banks reduce the required loan loss provisions, consequently artificially maintaining higher regulatory capital and leverage ratios (Bushman and Williams [2015]). In turn, this potentially allows the bank to avoid raising new, costly external financing and possibly attracting additional regulatory scrutiny.

Moreover, we follow the time-path of firm borrowing and bank lending. We first show that following an overdue loan, the number of bank lenders and the total amount of bank loans dramatically fall. Second, we show that banks with low leverage ratios did not increase their share of lending to distressed firms relative to other banks, but rather, reduced total lending to these firms.

Finally, we examine whether there are other possible theoretical explanations for slower nonperforming loan recognition by banks with low leverage ratios. We examine three possibilities. First, do firms prefer to repay banks with lower leverage ratios more than other banks? Second, do banks with low leverage ratios monitor their loans less and, consequently, have higher loan defaults (Holmstrom and Tirole [1997], Allen et al. [2011], Mehran and Thakor [2011])? Third, do banks with low leverage ratios utilize superior information and efficiently forbear their loans to firms (Rajan [1992])? We do not find strong evidence to support any of these alternative explana-

tions.

What are the welfare implications of delaying the recognition of nonperforming loans? Theoretically, the implications are ambiguous. On the one hand, if a borrower faces temporary liquidity shocks but is financially solvent, a lender providing additional funds and forbearing the initial loan can be both productive and welfare-improving (Tracey [2019] and Brunnermeier and Krishnamurthy [2020a]). For instance, Fukuda and Nakamura [2011] argue that Japanese banks were successful in reviving "zombie firms" and avoiding bankruptcy. Moreover, in response to the large financial shock stemming from the COVID-19 pandemic, many international regulators have promoted loan and regulatory forbearance (Financial Stability Board [2020]) with some arguing that banks should do *more* evergreening (Schivardi et al. [2020] and Brunnermeier and Krishnamurthy [2020b]).

On the other hand, there is substantial theoretical and empirical literature describing the negative effects of zombie lending. Increased bank lending to insolvent firms reduces bank profitability and increases financial stability risks (Blattner et al. [2019]). Moreover, the effects of zombie lending extend far beyond the direct banks and firms involved. Caballero et al. [2008], Kwon et al. [2015] structurally model how zombie lending in Japan caused a severe misallocation of capital by simultaneously propping up inefficient and unproductive firms while starving new, potentially more productive firms of venture capital, thereby distorting the allocative role of prices and subsequent decisions on employment and investment.

Incomplete information on the true nature of banks' asset quality has financial stability implications. Indeed, banks that disguise nonperforming loans may have insufficient loan loss reserves to cover losses on their loan portfolio, and in extreme cases, insufficient capital. Moreover, a loss of confidence in banks' asset quality and a mere reduction in the credibility in banks' reported asset quality, can substantially undermine trust in already underdeveloped financial system, as depositors, investors, and bond holders withdraw funding to banks.

Our paper contributes to the large literature on such "zombie lending," also known as "evergreening." Zombie lending has been defined variously as lending to firms with negative profits (McGowan et al. [2017], Banerjee and Hofmann [2018]), subsidizing credit (Caballero et al. [2008], Fukuda and Nakamura [2011], Kwon et al. [2015], Acharya et al. [2019]), or lending to firms with low expected future growth rates (Banerjee and Hofmann [2018]). We identify suggestive zombie lending by showing systemic delayed loan recognition by banks with low leverage ratios relative

to other banks.

We present evidence that banks are motivated to zombie lend due to incentives to ration scarce bank capital (similar to Peek and Rosengren [2005], Storz et al. [2017], Caballero et al. [2008], Acharya et al. [2019], Bonfim et al. [2020]). However, there a number of additional theoretical motivations for zombie lending. Rajan [1994] theoretically and Hertzberg et al. [2010] and Tantri [2021] empirically demonstrate how principal-agent problems, specifically career concerns, can facilitate zombie lending. Bruche and Llobet [2014] show that zombie lending can be an outcome of insolvent banks "gambling for resurrection". Hu and Varas [2020] theoretically show how banks may continue to lend to unprofitable firms due to the prospect of future market financing.

Zombie lending has been found to be pervasive with evidence cited in many different economies, in both advanced and emerging markets—for example, the "savings and loan crisis" in the United States (Kane [1989]); the Japanese banking crisis in the 1990s (Peek and Rosengren [2005], Caballero et al. [2008] and Giannetti and Simonov [2013]); European banks (Acharya et al. [2019]) and Italian banks (Schivardi et al. [2017]) following the Great Financial Crisis; Indian rural lenders (Tantri [2021]); and in Argentina (Hertzberg et al. [2010]). Two recent papers have also documented the growth in the fraction of zombie firms, suggesting that zombie lending may be rising. McGowan et al. [2017] document increases in the share of zombie firms in nine advanced economies since the mid-2000s and Banerjee and Hofmann [2018] show an increase in zombie firms in fourteen advanced economies since the early 1980s.

By analyzing the time-path of nonperforming loans (from performing, to overdue, to eventual potential default), we contribute to a nascent literature that is starting to examine in more detail the dynamics of nonperforming loan formation and resolution (Laeven and Valencia [2013, 2018], Ari et al. [2019]). To some extent, we are analyzing the dynamics of bank lending to zombie firms, in the way that Banerjee et al. [2020] analyze the path of zombie firms.

The rest of the paper is organized as follows: Section (2) outlines the Pakistani credit registry data and the data used in our paper. Section (3) presents evidence that banks with low leverage ratios delayed the recognition of bad loans consistent with the theoretical prediction that classifying a nonperforming loan is more expensive for banks with less capital. Section (4) provides robustness tests for alternative possible theoretical explanations. Finally, Section (5) concludes.

2 Data

We use administrative data on the universe of all Pakistani corporate loans from Pakistan's central bank, the State Bank of Pakistan. Pakistan's credit registry contains the universe of all corporate loans from all officially designated financial institutions in Pakistan, including loans from public banks, private banks, Islamic banks, and non-bank financial institutions such as trust lenders and leasing companies.[1] The data includes key information on firm loans, including information on the lender, the loan size, whether the loan is secured, and the performance status of the loan. The credit registry also contains information on interest rates and the maturity dates of loans, but data on these variables is sometimes missing for some firms. This dataset has been used in numerous papers including Khwaja and Mian [2005], Khwaja and Mian [2008], Choudhary and Limodio [2017], and Choudhary and Jain [2020].

Our credit registry dataset stretches, which from 2007:Q1 to 2012:Q4, contains 58,206 firms and 94,483 different bank-firm relationships. Moreover, of the 107 financial institutions in the dataset, only 29 institutions report capital and leverage metrics to the central bank—these institutions are the focus of our study. Similar to Khwaja and Mian [2008] and Choudhary and Jain [2020], since firms may have multiple loans at the same bank, for each firm we aggregate all of its loans at a specific bank to create measures of that firm's total debt at that bank. Because part of our paper's aim is to analyze how a firm transitions from having a loan overdue more than 90 days to potentially loan default, and how banks subsequently respond to these different events, we exclude all firms that had a nonperforming loan at the start of our dataset, since we cannot track when their first loan went overdue.

Our paper focuses on analyzing nonperforming loans, so we exploit the three different definitions in the credit registry. First, the least severe, the loan is overdue more than 90 days but less than 365 days. Second, the loan is overdue more than 365 days but has not defaulted. Finally, loan default, where we code a loan as defaulted if any of the following three events are reported to the credit registry: a loan is written off, the loan is restructured, or the bank initiates litigation to recover the loan.

For the majority of our regressions, we use a Khwaja and Mian [2008] strategy to analyze how two different banks that lend to the same borrower respond differently to specific events. Therefore, in

[1] For ease of exposition, we refer to all financial institutions as "banks" unless otherwise stated.

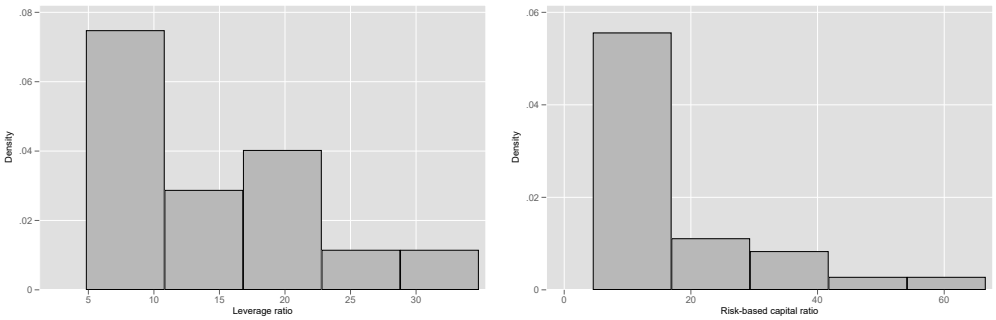
table (1), we report summary statistics for bank loans to firms with at least two active bank lending relationships in 2012:Q4. Since we concentrate on analyzing how banks with lower capital ratios respond differently to more capitalized institutions, the left (right) panel in figure (1) shows the leverage ratio (risk-based capital ratio) for banks in our sample in 2007 that demonstrates there is a definite skew of banks with low leverage and capital ratios.

Table 1: Summary statistics for bank loans for firms that had two or more loans in 2012:Q4

	Obs.	Median	Mean	Std. Dev.
Loan size (Mil. USD)	16,117	0.24	2.55	12.80
(Weighted) Months to maturity	9,550	4.37	6.48	6.29
(Weighted) Interest rate	7,752	13.61	13.75	4.73
Unsecured loan	16,117	0.00	0.14	1.50
Public bank	16,117	0.00	0.08	0.27
Non-bank financial institution	16,117	0.00	0.23	0.42
Domestic private bank	16,117	1.00	0.65	0.48
Foreign private bank	16,117	0.00	0.05	0.22
Observations	16117			

This table presents summary lending statistics for firms with two or more lending relationships in 2012:Q4 (the final quarter of our dataset). Since firms may have multiple loans at the same bank, we aggregate all the firm's loans at a specific bank to create measures of that firm's total debt at that bank. Additionally, we calculate a lending relationship's weighted months to maturity and weighted interest rate by weighting these variables by the size of a firm's loan at that bank. The number of observations for maturity length and interest rate are fewer than the other observations because for some loans these data are missing.

Figure 1: The leverage and capital ratio for banks in 2007



The left (right) panel shows the distribution for leverage ratio (risk-based capital ratio) for banks in 2007. There is a large skew of banks with low leverage and capital ratios.

3 Results

3.1 Recognition of nonperforming loans by banks with low leverage ratios

The key result from this section is that some banks—specifically, banks with lower leverage ratios—were more likely to delay the recognition of nonperforming loans. To identify this result we utilize a Khwaja and Mian [2008] strategy. Specifically, we compare loan outcomes for a firm that borrowed from multiple banks. Our empirical findings are consistent with the theoretical prediction that classifying a nonperforming loan is more expensive for banks with less capital. By masking the status of a loan, banks reduce the required loan loss provisions, consequently artificially maintaining higher regulatory capital and leverage ratios (Bushman and Williams [2015]). In turn, this potentially allows the bank to avoid raising new, costly external financing and attracting additional regulatory scrutiny.

We start by examining if there are systemic differences across banks in the designation of nonperforming loans. Specifically, for those firms that had a nonperforming loan during our dataset, we examine if banks with less capital (lower capital ratios or lower leverage ratios) were less likely to be the first bank to designate this loan as nonperforming. Since banks with lower capital ratios may lend to different firms (that have differing rates of having nonperforming loans), in this test, we restrict our attention to those firms that borrow from multiple banks—that is, we rely on within-firm variation.

We run the following cross-sectional regression:

$$\text{First overdue bank (NPL)}_{b,f} = \beta_1 \times \text{Measure of bank capital}_b + \beta_2 \times \text{Controls}_{b,f} + \epsilon_{b,f} \quad (1)$$

where "First overdue bank (NPL)$_{b,f}$" is a dummy variable equal to 1 if bank b was the first bank to designate a loan from firm f as nonperforming in the period 2007:Q2 to 2012:Q4 (the length of our dataset).[2] "Measure of bank capital$_b$" is a measure of bank capital; for our preferred regressions it is a dummy variable for whether bank b's leverage ratio is in the bottom quartile in 2007. In alternative specifications, in the online appendix, we use a dummy variable for whether bank b's capital ratio is in the bottom quartile in 2007 [table (14)] and a continuous variable for bank b's

[2] As described earlier, we omit all firms that had an overdue loan in the first period of our dataset (2007:Q1) because we are unable to determine when the loan first became overdue.

leverage ratio in 2007 [table (15)]. Additionally, we investigate differences in loan outcomes using different nonperforming loan definitions: overdue more than 90 days, overdue more than 365 days, and loan default.

The key result from table (2) is that for those firms that borrowed from multiple banks, banks with low leverage ratios were relatively slower to designate a loan as overdue than other banks. In column 1, for firms that borrowed from multiple banks, we see that banks with low leverage ratios were over 5 percentage points less likely to be the first bank to designate a loan as overdue more than 90 days than other banks. In column 2, we see a similar pattern, with banks with low leverage ratios more than 6 percentage points less likely to be the first bank to designate a loan as overdue more than 365 days. Interestingly, when it comes to designating a loan as defaulted, banks with low leverage ratios were equally, or more, likely to be the first lender to designate a loan as defaulted—a finding we expound in the next set of tables.

Table 2: Differences in the first lender to designate a loan as nonperforming: Banks with low leverage ratios

	(1) First overdue bank (90+)	(2) First overdue bank (365+)	(3) First default bank
Low leverage bank	-0.056***	-0.077***	0.014
	(0.020)	(0.025)	(0.027)
Observations	5602	3161	2382
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	2161	1114	728
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.27	0.28	0.27

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether banks with low leverage ratios were slower to designate a loan as overdue relative to other banks for the same firm. "First overdue bank $(\text{NPL})_{b,f}$" is a dummy variable equal to 1 if bank b was the first bank to designate a loan from firm f as nonperforming in the period 2007:Q2 to 2012:Q4 (the length of our dataset), where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). We restrict attention to firms with multiple bank loans and have at least one overdue loan during our sample. Standard errors are clustered at the firm level.

In table (3), we examine whether banks with low leverage ratios are less likely to designate a loan as nonperforming relative to other banks that also lend to the same firm. To do so, we restrict attention to firms with active lending relationships from multiple banks and use the following

regression:

$$\text{Nonperforming loan}_{b,f} = \beta_1 \times \text{Low leverage bank}_b + \alpha_f + \epsilon_{b,f} \tag{2}$$

where "Nonperforming loan$_{b,f}$" is a dummy variable for whether the loan from bank b to firm f becomes nonperforming during the length of our dataset (2007:Q2 to 2012:Q4) and α_f is a firm fixed effect.

The results in table (3) show that banks with lower capital ratios were relatively less likely to declare a loan as overdue more than 90 days (column 1) or declare a loan as overdue more than 365 days (column 2) than other banks. However, banks with low leverage ratios were significantly *more* likely to declare a defaulted loan than other banks (column 3). Loans by low leverage banks were 130 basis points more likely to default than loans from other banks to the same firm—a default rate that is more than 20 percent higher than other banks (the mean rate of loan defaults on loans to borrowers with multiple banks was around 6 percent).

The results in table (3) are consistent with the explanation that banks with low leverage ratios are delaying the recognition of overdue loans (negative and statistically significant results in columns 1 and 2) and, in turn, leading to worse loan outcomes (higher rates of loan defaults in column 3); in other words, banks are willing to choose short-term gain for potentially larger long-term pain. For instance, banks with higher leverage ratios may have taken more immediate corrective actions to recover overdue loans than banks with low leverage ratios, causing relatively higher loan defaults for banks with lower leverage ratios. Additionally, since banks with low leverage ratios may be delaying the recognition of loan defaults (as well as overdue loans), we may be underestimating the extent of evergreening by banks with low leverage ratios; consequently, the result in column 3 would be biased downwards.

Table 3: Differences in nonperforming loan rates across banks for the same firm

	(1) Loan overdue (90+)	(2) Loan overdue (365+)	(3) Loan defaulted
Low leverage bank	-0.038***	-0.012*	0.013**
	(0.0082)	(0.0065)	(0.0059)
Observations	8215	8215	8215
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	2726	2726	2726
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.17	0.10	0.060

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether nonperforming loan rates for the same firm that borrowed from multiple banks varied across banks. "Loan overdue $(90+)_{b,f}$" is a dummy variable for whether the loan from bank b to firm f becomes overdue more than 90 days during the length of our dataset (2007:Q2 to 2012:Q4). Similarly, "Loan overdue $(365+)_{b,f}$" and "Loan default$_{b,f}$" are defined for a loan overdue more than 365 days and a loan default, respectively. "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). We restrict attention to firms with multiple bank loans. Standard errors are clustered at the firm level.

Taking the results in tables (2) and (3) together, we show that banks with low leverage ratios are both slower and less likely to designate a loan as overdue than other banks that lend to the same firm. These results suggest that banks with low leverage ratios are evergreening some of their loans. However, there are other plausible theoretical explanations that are consistent with these results, and in section (4) we explore three alternative explanations. First, do firms prefer to repay banks with lower leverage ratios more than other banks? Second, do banks with low leverage ratios monitor their loans less and consequently cause higher loan defaults? Third, do banks with low leverage ratios efficiently forbear their loans to firms?

3.2 Relative exposure of low leverage banks to firms with overdue loans

In section (3.1), we found suggestive evidence that banks with low leverage ratios mask nonperforming loans. One additional prediction from the bank evergreening literature is that banks roll over a firm's existing debt into new larger performing loans. We investigate this possibility in three ways. First, are banks with low leverage ratios more likely to keep lending to firms with an overdue loan at a different bank? Second, do banks with low leverage ratios increase their relative share of total lending to a firm with an overdue loan at a different bank? Finally, are banks with

low leverage ratios more likely to start a new bank-firm relationship with a firm that recently had an overdue loan at a different bank? Overall, we find that banks with low leverage ratios did not materially increase their exposure to firms that recently had a nonperforming loan at a different bank. This bodes well for the allocation for credit, as banks (on average) tend to reduce their credit exposure to financially vulnerable firms.

To start, we examine whether banks with low leverage ratios were more likely to keep lending to a firm that has a nonperforming loan at a different bank. To do so, we examine the set of banks that still lend to a firm four quarters after the firm's first nonperforming loan at a different bank. Specifically, we conduct the following regression:

$$\text{Active loan}_{b,f,t+4} = \beta_1 \times \text{Low leverage bank}_b + \alpha_f + \alpha_{t+4} + \epsilon_{b,f,t+4} \tag{3}$$

where "Active Loan $_{b,f,t+4}$" is a dummy variable equal to one if bank b has an active loan to firm f four quarters following the firm's first nonperforming loan at a different bank. As before, we include a firm fixed effect, α_f, to ensure we're only estimating the effect from firms with multiple lender and we also include a time fixed effect (α_{t+4}) to account for any aggregate changes in lending patterns over time.

Banks with low leverage ratios were generally as likely as other banks to keep lending to firms with a nonperforming loan, as shown in table (4). Across all the different definitions of nonperforming loan, four quarters following the firm's first nonperforming loan, low leverage banks were roughly equally likely to stop lending (on average, between 10 and 13 percent of banks stopped lending to firms following a nonperforming loan). The only regression that is different at a statistically significant level (and only at the 10 percent level) is that banks with low leverage ratios seem slightly less likely to keep lending to firms one year after an overdue loan at a different bank.

Table 4: Changes in firm's lending relationships following a nonperforming loan at a different bank

	(1) Active Loan	(2) Active Loan	(3) Active Loan
Low leverage bank	-0.013	-0.031*	0.025
	(0.014)	(0.017)	(0.020)
Observations	2717	1501	1184
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	738	368	280
Event type	Overdue 90+	Overdue 365+	Default
Firm FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Dep. variable mean	0.87	0.88	0.90

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether a firm was relatively more likely to continue a lending relationship at a bank with a low leverage ratio relative to other banks within four quarters of a nonperforming loan at a different bank. "Active loan$_{b,f,t+4}$" is a dummy variable equal to one if bank b has an active loan to firm f four quarters following the firm's first nonperforming loan at a different bank. "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). This regression restricts attention to only firms with multiple bank loans and only observations four quarters after the firm's first nonperforming loan at a different bank, where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). To ensure we can observe changes four quarters after the first nonperforming loan, we restrict our observations to those firms that had their first nonperforming loan between 2007:Q2 and 2011:Q4. Standard errors are clustered at the firm level.

Second, we examine whether the relative share of lending by low capital banks increased to firms with a nonperforming loan. To examine this question we create a new variable, "Change in Debt share$_{b,f,t}$", which is defined as the following:

$$\text{Change in debt share}_{b,f,t} = \text{Debt share}_{b,f,t} - \text{Debt share}_{b,f,t-4} \tag{4}$$

where "Debt share$_{b,f,t}$" is defined as[3]:

[3]Note that the summation of a "debt share" across all banks for a particular firm will not necessarily add to one because some firms may have zero total debt at time t, in that case, we have defined the bank's "debt share" to that firm to be zero.

$$\text{Debt share}_{b,f,t} = \begin{cases} \dfrac{\text{Debt of firm } f \text{ to bank } b \text{ at time } t}{\text{Total debt of firm } f \text{ at time } t} & \text{if Total debt of firm } f \text{ at time } t > 0 \\ 0 & \text{if Total debt of firm } f \text{ at time } t = 0 \end{cases} \tag{5}$$

Therefore, "Change in debt share$_{b,f,t}$", measures the change in bank b's share of lending to firm f at time t relative to the bank's share of lending four quarters previously. In our regression, we restrict attention to the set of banks that were lending at the time of the firm's first nonperforming loan and examine whether banks with low leverage ratios relatively increased their share of lending four quarters later. The specific regression we run is (note that since we are a regressing a change in a firm's debt from a specific bank over time, the inclusion of a time fixed effect is not needed for this regression):

$$\text{Change in debt share}_{b,f,t} = \beta_1 \times \text{Low leverage bank}_b + \alpha_f + \epsilon_{b,f,t} \tag{6}$$

Table (5) shows that banks with low leverage ratios did not increase their share of lending following a firm's first nonperforming loan, suggesting that banks with low leverage ratios did not roll over the firm's debts into new loans relatively more than other banks.

Table 5: Changes in the bank's share of a firm's total credit following a nonperforming loan at a different bank

	(1) Change in debt share	(2) Change in debt share	(3) Change in debt share
Low leverage bank	-0.0026	-0.0022	-0.0029
	(0.0064)	(0.0070)	(0.0057)
Observations	2717	1501	1184
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	738	368	280
Event type	Overdue 90+	Overdue 365+	Default
Firm FEs	Yes	Yes	Yes
Dep. variable mean	-0.011	-0.012	-0.0039

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether the relative share of lending by low capital banks increased to firms with a nonperforming loan at a different bank. "Change in debt share$_{b,f,t}$" measures the change in bank b's share of lending to firm f at time t relative to the bank's share of lending four quarters previously and is formally defined in equations (4) and (5). "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). This regression restricts attention to only firms with multiple bank loans and only observations four quarters after the firm's first nonperforming loan at a different bank, where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). To ensure we can observe changes four quarters after the first nonperforming loan, we restrict our observations to those firms that had their first nonperforming loan between 2007:Q2 and 2011:Q4. Standard errors are clustered at the firm level.

Finally, we examine whether banks with low leverage ratios were relatively more likely to start new lending relationships with firms with an overdue loan at a different bank. Firms that are overdue on their loans may try to repay their loans by taking new loans at different banks. To test this possibility, we examine whether banks with low leverage ratios start relatively more new lending relationships with a firm with a nonperforming loan.[4]

We run the following regression:

$$\text{New loan}_{b,f,t+4} = \beta_1 \times \text{Low leverage bank}_b + \alpha_f + \alpha_t + \epsilon_{b,f,t+4} \tag{7}$$

where "New Loan$_{b,f,t+4}$" is a dummy variable equal to one if bank b started a new banking rela-

[4]For this regression we create a dummy variable ("new loan") for all new possible bank-firm relationships; hence, the number of observations in table (6) are significantly larger than for all other regressions. Moreover, to increase the power of our tests and because we are comparing whether low leverage banks and other banks were more likely to start new lending relationships to the same firm, we include both firms with only one lender and firms with multiple lenders (whereas in tables (2) to (5), we restricted attention to only those firms with multiple lenders).

tionship with firm f within four quarters of the firm's first nonperforming loan event at a different bank, and α_f and α_t are firm and date fixed effects respectively.

The results in table (6) show weak evidence that banks with low leverage ratios were more likely to start new lending relationships with firms that recently had a nonperforming loan. Banks with low leverage ratios were 13 basis points more likely to start a new banking relationship with a firm that had an overdue loan more than 90 days than other banks (column 1), but there was no sizable or statistically significant effect for loans overdue more than 365 days or loan defaults (columns 2 and 3). Moreover, even though banks with low leverage ratios were more likely to start a new relationship with a firm with an overdue loan at another bank, the effect is economically very small. For instance, we found that 12 *percent* of banks, one year after the firm's first overdue loan, stopped lending to that firm (the mean of "active loan" in table (4) column 2).

Table 6: Likelihood of forming a new bank lending relationship following an overdue loan at a different bank

	(1) New Loan	(2) New Loan	(3) New Loan
Low leverage bank	0.0013***	0.00038	0.00029
	(0.00025)	(0.00026)	(0.00045)
Constant	0.0031***	0.0026***	0.0033***
	(0.00011)	(0.00012)	(0.00020)
Observations	248535	167404	75746
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	8966	6040	2765
Event type	Overdue 90+	Overdue 365+	Default
Firm FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Dep. variable mean	0.0037	0.0027	0.0034

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether banks with low leverage ratios were relatively more likely to start new lending relationships with firms with an overdue loan at a different bank."New Loan$_{b,f,t+4}$" is a dummy variable equal to one if bank b started a new banking relationship with firm f within four quarters of the firm's first nonperforming loan event at a different bank, where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). For this regression we create a dummy variable ("new loan") for all new possible bank-firm relationships and include both firms with only one lender and firms with multiple lenders; hence the number of observations in this table are significantly larger than for all other regressions. To ensure we can observe changes four quarters after the first nonperforming loan, we restrict our observations to those firms that had their first nonperforming loan between 2007:Q2 and 2011:Q4. Standard errors are clustered at the firm level.

3.3 Dynamic effects on firm-bank relationships following a nonperforming loan

In sections (3.1) and (3.2), we established that banks with low leverage ratios were more likely to delay the recognition of nonperforming loans but did not increase their overall exposure to firms with nonperforming loans. In this section, we examine the time-path of firm credit characteristics (total loan size outstanding and the number of lenders) before and after a firm's first loan is classified as nonperforming at any bank. To increase the power of our results, and since we are interested in how firms respond, we include all firms in the credit registry with a nonperforming loan during our sample period (that is, in contrast to tables (2) to (5), we also include firms that borrow from only a single lender). This section's main result is that a firm's total debt and a firm's

number of lenders dramatically falls following the firm's first nonperforming loan at any bank.

To examine how a firm's total debt changes over time, we define a new normalized variable, "Indexed Debt$_{f,t}$", which measures firm f's total debt in quarter t relative to the firm's total debt in the quarter in which the firm's first loan becomes nonperforming.[5] Specifically,

$$\text{Indexed Debt}_{f,t} = \frac{\text{Firm } f\text{'s total firm debt at time } t}{\text{Firm } f\text{'s total firm debt at occurrence of first nonperforming loan}} \tag{8}$$

Furthermore, since we define a nonperforming loan in three ways (overdue more than 90 days, overdue more than 365 days, or loan default), we analyze how indexed debt changes in response to each of these three different events.

The specific regression we run is[6]:

$$\begin{aligned}\text{Indexed Debt}_{f,t} = {} & \beta_B \times \text{Quarters until first loan nonperforming}_{f,t} \\ & + \beta_A \times \text{Quarters since first loan nonperforming}_{f,t} + \alpha_f + \epsilon_{f,t}\end{aligned} \tag{9}$$

where α_f is a firm fixed effect. In this regression, we estimate how the firm's path of total debt changes in the eight quarters before (β_B) and eight quarters after (β_A) the firm's first loan becomes nonperforming.[7] The results are presented in table (7). Column 1 assesses how the debt changes with the first occurrence of a loan being overdue more than 90 days; similarly, columns 2 and 3, assess how the debt changes but for the first occurrence of a loan being overdue more than 365 days and a loan defaulting, respectively.

Table (7) shows two main results. First, a firm's total debt was relatively steady before the first occurrence of a loan being overdue more than 90 days (statistically and economically insignifi-

[5] We use the variable indexed debt because we want to both measure relative changes in credit (therefore, not using absolute values) and be able to account for the firms' total debt being zero (thereby, excluding the use of taking logs of firm debt). Since the firm must have some debt at the point at which the loan becomes overdue, using that loan amount seems an appropriate denominator for the index.

[6] "Quarters until first loan nonperforming" is the number of quarters before the firm's first loan becomes overdue and is zero for the quarters after the first occurrence of a nonperforming loan. Symmetrically, "Quarters since first loan nonperforming" is the number of quarters after the firm's first loan becomes overdue and is zero for the quarters before the first occurrence of a nonperforming loan.

[7] To ensure we have a balanced panel we include only those firms for which their first nonperforming loan occurred between 2009:Q1 and 2010:Q4. This restriction ensures that we have both observations for the firms' total debt for the eight quarters before and after the first loan becomes nonperforming.

cant coefficient on the variable "quarters until first overdue loan more than 90 days"). Second, following a loan going overdue more than 90 days, the firms' total debt started to dramatically *fall* (negative coefficient on the variable "quarters since first overdue loan more than 90 days"). For the firms that subsequently have either a loan overdue more than 365 days or a loan default, this reduction in credit continues with a firm's total debt falling both before a loan goes overdue more than 365 days and before the first loan default (as observed by the large and statistically significant coefficients on "quarters until first overdue loan more than 365" and "quarters until first loan default").

The key inference from the results in table (7) is that banks do seem to take prudent actions following a firm's loans going overdue with banks subsequently significantly reducing lending to the firm—by just over 5 percent per quarter. A key financial stability concern would be if banks systemically continued to increase lending to firms that were in financial stress, which is not the case here.

Table 7: Changes in a firm's debt before and after the firm's first nonperforming loan

	(1) Indexed Debt	(2) Indexed Debt	(3) Indexed Debt
Qtrs. until first overdue loan (90+)	0.0055		
	(0.0041)		
Qtrs. since first overdue loan (90+)	-0.051***		
	(0.0029)		
Qtrs. until first overdue loan (365+)		0.038***	
		(0.0046)	
Qtrs. since first overdue loan (365+)		-0.031***	
		(0.0027)	
Qtrs. until first loan default			0.012**
			(0.0049)
Qtrs. since first loan default			-0.021***
			(0.0031)
Observations	45334	33146	15138
Observation level	Firm-bank	Firm-bank	Firm-quarter
Number of firms	3267	2385	1085
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.89	0.95	0.96

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

"Quarters until first loan nonperforming" is the number of quarters before the firm's first loan becomes overdue and zero for the quarters after the first occurrence of a nonperforming loan. Symmetrically, "Quarters since first loan nonperforming" the number of quarters after the firm's first loan becomes overdue and is zero for the quarters before the first occurrence of a nonperforming loan. To ensure we have a balanced panel we include only those firms for which their first nonperforming loan occurred between 2009 and 2011. This restriction ensures that we have both observations for the firms' total debt for the eight quarters before and after the first loan becomes nonperforming. A negative coefficient for "Quarters *until*..." implies that total debt was *rising* before the first loan was denoted as overdue. A negative coefficient for "Quarters *since* ..." implies that the total debt *fell* following the first loan was denoted as overdue. Standard errors are clustered at the firm level.

In addition to examining how total debt responded to changes in a firm's nonperforming loans, we can observe how the number of bank relationships changes before and after a loan becomes nonperforming. To do so, we run regressions that are similar to those in equation (9), specifically:

$$\begin{aligned}\text{Number of bank relationships}_{f,t} = \beta_B \times \text{Quarters until first loan nonperforming}_{f,t} \\ + \beta_A \times \text{Quarters since first loan nonperforming}_{f,t} \\ + \alpha_f + \epsilon_{f,t}\end{aligned} \tag{10}$$

where "Number of bank relationships$_{f,t}$" is the number of active lending relationships for firm f at time t, and α_f are firm fixed effects.[8] "Quarters until first loan nonperforming" and "Quarters since first loan nonperforming" are defined as in equation (9).

In this regression, we estimate how the number of lenders to a firm changes in the eight quarters before and eight quarters after the firm's first loan becomes nonperforming.[9] The results are presented in table (8).

Table (8) shows two main results. First, the number of lenders was increasing before the first occurrence of a loan being overdue more than 90 days, by over 0.05 lenders per quarter. Second, following a loan going overdue more than 90 days, the number of lenders started to dramatically *fall*, by about 0.04 lenders per quarter.

The results presented in tables (7) and (8) together show that banks, on aggregate, significantly reduced exposure to firms following their first nonperforming loan. Moreover, the designation of a nonperforming loan seems to have large real effects on the firm's capacity to borrow, with a sharp change in the firms' credit growth and number of lending partners following the designation.

[8] The use of a firm fixed effect ensures that we control for the average number of bank relationships a firm has over the period.

[9] Similar to table (7), we include only those firms for which their first nonperforming loan occurred between 2009 and 2011.

Table 8: Changes in a firm's total number of bank relationships before and after the firm's first nonperforming loan

	(1) Number of bank rel.	(2) Number of bank rel.	(3) Number of bank rel.
Qtrs. until first overdue loan (90+)	-0.053***		
	(0.0028)		
Qtrs. since first overdue loan (90+)	-0.043***		
	(0.0023)		
Qtrs. until first overdue loan (365+)		-0.017***	
		(0.0028)	
Qtrs. since first overdue loan (365+)		-0.038***	
		(0.0026)	
Qtrs. until first loan default			-0.0070
			(0.0064)
Qtrs. since first loan default			-0.039***
			(0.0045)
Observations	46564	34244	15778
Observation level	Firm-quarter	Firm-quarter	Firm-quarter
Number of firms	3326	2446	1127
Firm FEs	Yes	Yes	Yes
Dep. variable mean	1.37	1.50	2.31

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

"Quarters until first loan nonperforming" is the number of quarters before the firm's first loan becomes overdue and is zero for the quarters after the first occurrence of a nonperforming loan. Symmetrically, "Quarters since first loan nonperforming" is the number of quarters after the firm's first loan becomes overdue and is zero for the quarters before the first occurrence of a nonperforming loan. To ensure we have a balanced panel we include only those firms for which their first nonperforming loan occurred between 2009 and 2011. This restriction ensures that we have both observations for the firm's total debt for the eight quarters before and after the first loan becomes nonperforming. A negative coefficient for "Quarters *until*..." implies that the number of bank-firm relationships was *rising* before the first loan was denoted as overdue. A negative coefficient for "Quarters *since* ..." implies that the number of bank-firm relationships *fell* following the first loan was denoted as overdue. Standard errors are clustered at the firm level.

4 Alternative potential explanations

This section examines three other possible theories that would be consistent with the results. First, do firms prefer to repay banks with lower leverage ratios more than other banks? Second, do banks with low leverage ratios monitor their loans less and consequently have higher loan de-

faults? Third, do banks with low leverage ratios efficiently forbear their loans to firms? We do not find strong evidence to support any of these alternative explanations.

A key possibility is that firms may value their relationships with banks with low leverage ratios more or receive more favorable loan terms from these banks. In turn, this may cause firms to strategically repay other banks first. We explore this possibility in two ways. First, we examine whether the results in section (3.1) are robust to the inclusion of loan-level controls. Second, we examine whether banks with low leverage ratios offer more favorable loan terms.

Table (9) shows that firms are more likely to go overdue first on larger and unsecured loans. Similarly, table (10) shows that firms are more likely to be overdue on larger and unsecured loans. However, the results in both tables show that banks with low leverage ratios—even after controlling for loan level terms—are slower to designate a loan as overdue and less likely to designate the loan as overdue. These results suggest that differences in loan terms are not the principal cause for relatively lower overdue rates for banks with low leverage ratios.

Table 9: Differences in the first lender to designate as a loan as nonperforming, including loan-level controls

	(1)	(2)	(3)
	First overdue bank (90+)	First overdue bank (365+)	First default bank
Low leverage bank	-0.066***	-0.082***	0.015
	(0.021)	(0.027)	(0.028)
Ln. bank loan	0.027***	0.036***	0.048***
	(0.0049)	(0.0071)	(0.0078)
Unsecured loan	0.0080	0.0071	0.019*
	(0.012)	(0.024)	(0.010)
Observations	5377	3041	2286
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	2132	1107	721
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.28	0.29	0.27

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

"First overdue bank $(\text{NPL})_{b,f}$" is a dummy variable equal to 1 if bank b was the first bank to designate a loan from firm f as nonperforming in the period 2007:Q2 to 2012:Q4 (the length of our dataset), where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). Loan-level controls are defined using loan values and secured status as of 2007:Q1. We restrict attention to firms that have multiple bank loans and at least one overdue loan during our sample. Standard errors are clustered at the firm level.

Table 10: Differences in overdue rates for the same firm across different banks, including loan-level controls

	(1) Loan overdue (90+)	(2) Loan overdue (365+)	(3) Loan defaulted
Low leverage bank	-0.050***	-0.018***	0.011*
	(0.0086)	(0.0067)	(0.0062)
Ln. bank loan	0.025***	0.018***	0.012***
	(0.0021)	(0.0017)	(0.0013)
Unsecured loan	0.0050	0.0077	0.00029
	(0.0063)	(0.0057)	(0.0054)
Observations	7552	7552	7552
Number of firms	2516	2516	2516
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.18	0.11	0.062

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

"Loan overdue (90+)$_{b,f}$" is a dummy variable for whether the loan from bank b to firm f becomes overdue more than 90 days during the length of our dataset (2007:Q2 to 2012:Q4). Similarly, "Loan overdue (365+)$_{b,f}$" and "Loan default$_{b,f}$" are defined for a loan overdue more than 365 days and a loan default, respectively. "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). Loan-level controls are defined using loan values and secured status as of 2007:Q1. We restrict attention to firms that have multiple bank loans. Standard errors are clustered at the firm level.

In table (11), we explore differences in initial loan terms for firms with multiple loans between banks with low leverage ratios and other banks. Specifically, we run the following regression for firms with multiple loans in the final quarter of our dataset (2012:Q4):[10]

$$\text{Outcome of interest}_{b,f} = \beta_1 \times \text{Low leverage bank}_b + \alpha_f + \epsilon_{b,f} \tag{11}$$

where the Outcome of interest$_{b,f}$ are the firm's loan size with bank b, the length of the firm's relationship with bank b, the interest rate of the firm's loans with bank b (weighted over all the firm's loans with bank b), and the months to maturity for the firm's loans with bank b (weighted over all the firm's loans with bank b).[11]

[10] We use the final quarter of our dataset so that we can examine the length of the firm's lending relationship with that bank.

[11] Data for loan maturity and loan interest rates are missing for some firms; therefore, there are fewer observations in columns 3 and 4 than columns 1 and 2.

The evidence is mixed as to whether banks with low leverage ratios offer more favorable ratios, which is presented in table (11). One key measure, interest rates (column 3), shows that banks with low leverage ratios charged higher rates. Also, two key measures of the lending relationship are relatively similar across the banks—namely, loan size (column 1) and months to maturity (column 4). These three results suggest that loan terms from banks with low leverage ratios were not more favorable than other banks. However, in the opposite direction, we also find that firms had significantly longer lending relationships to banks with lower leverage ratios (column 2). Given the long empirical and theoretical literature on the importance of relationship lending (such as Rajan [1992], Petersen and Rajan [1994], Boot and Thakor [2000], Boot [2000]), this result suggests that firms may receive greater benefits from their long-term relationships with the banks with low leverage ratios. Overall, we can neither rule out that firms received greater benefits, nor conclusively say that firms received less benefits from the lending relationships from banks with low leverage ratios.[12]

Table 11: Comparing loan terms for the same firm across different banks

	(1) Ln. bank loan	(2) Length of Relation. (Qtrs.)	(3) Interest Rate	(4) Months to maturity
Low leverage bank	0.055	2.17***	0.46**	0.28
	(0.054)	(0.17)	(0.20)	(0.21)
Observations	13087	14228	6344	8256
Observation level	Firm-bank	Firm-bank	Firm-bank	Firm-bank
Number of firms	4943	5012	3400	3928
Firm FEs	Yes	Yes	Yes	Yes
Dep. variable mean	17.1	15.9	12.8	5.36

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table explores differences in loan terms for firms with multiple loans between banks with low leverage ratios and other banks. "Ln. bank loan$_{b,f}$" is the natural logarithm of firm f's total loans at bank b. "Length of Relationships (Qtrs.)$_{b,f}$ is the number of quarters that firm f had an active loan with bank b prior to 2012:Q4. "Interest rate$_{b,f}$ is weighted interest rate of firm f's existing loans with bank b (weighted by the total size of each loan). "Months to maturity$_{b,f}$ is the weighted months to maturity of firm f's existing loans with bank b (weighted by the total size of each loan). We restrict attention to only active loans in the final quarter of our dataset (2012:Q4) so that we can examine the length of the firm's lending relationship with that bank. Data for loan maturity and loan interest rates are missing for some firms; therefore, there are fewer observations in columns 3 and 4 than columns 1 and 2. Standard errors are clustered at the firm level.

[12]There is the additional possibility that the finding that banks with low leverage ratios have a longer lending relationship is an outcome of evergreening. Specifically, if banks with low leverage ratios forbear their loans more than other banks, then this relationship will be mechanically longer.

A further theoretical possibility is that banks with low leverage ratios monitored their loans less than other banks, causing both a relatively slower designation of overdue loans, and greater defaults for these banks (Holmstrom and Tirole [1997], Allen et al. [2011], Mehran and Thakor [2011]). If low leverage banks monitored their loans less, we would expect larger effects for unsecured loans because these are the loans where monitoring is the most relevant since the bank has larger expected loss given default and the borrower has less incentive to repay. We find no evidence to support this potential explanation.

We test whether banks with low leverage ratios were relatively more likely to have greater default rates on unsecured loans relative to other banks (similar to the test in table (3) but concentrating on differences between secured and unsecured loans for banks with low leverage ratios).

In table (12) we present the results of the following regression on the set of firms with multiple lending relationships:

$$\begin{aligned}\text{Nonperforming Loan}_{b,f} = \beta_1 \times \text{Low leverage bank}_b \times \text{Unsecured Loan}_{b,f} \\ + \beta_2 \times \text{Unsecured Loan}_{b,f} + \beta_3 \times \text{Low leverage bank}_b + \alpha_f + \epsilon_{b,f}\end{aligned} \tag{12}$$

where "Unsecured $\text{Loan}_{b,f}$" is a dummy variable equal to one if firm f has an unsecured loan with bank b, and all other variables are defined as previously.[13]

Starting with the results in the third column of table (12), we find that the coefficient on our variable of interest "Low leverage $\text{bank}_b \times$ Unsecured $\text{Loan}_{b,f}$" is both negative and statistically significant, which is inconsistent with the prediction that banks with low leverage ratios were monitoring loans less. Specifically, if banks with low leverage ratios were monitoring loans less, we would expect this coefficient to be positive—that is, banks with lower leverage ratios would have relatively higher default rates for unsecured loans—because loans that are unsecured require the most monitoring. We include firm fixed effects and restrict attention to only those borrowers that borrow from multiple banks; therefore, this result is robust to banks with low leverage ratios lending to a different set of firms as other banks.

Turning to the results in the first column of table (12), we find that the coefficient on our variable

[13]This regression is the analogue of the regressions in table (3) but includes both a dummy variable for an unsecured loan and the interaction of our measure for low bank leverage with the dummy variable for whether the loan is unsecured.

of interest "Low leverage bank$_b$ $\times$ Unsecured Loan$_{b,f}$" is both positive and weakly statistically significant. The interpretation of this coefficient with respect to the theory of lower monitoring by less capitalized banks is difficult. For instance, if banks with less capital were monitoring loans less, we could expect this coefficient to be negative, because banks may be slow to recognize the loan as overdue due to their lack of monitoring capacity. Alternatively, we may expect higher rates of overdue loans for these banks due to the lack of monitoring of borrower behavior causing more loans to become overdue.

Table 12: Differences in nonperforming loan rates for different loan types across banks with different leverage ratios

	(1)	(2)	(3)
	Loan overdue (90+)	Loan overdue (365+)	Loan defaulted
Low leverage bank x Unsecured	0.024*	0.0073	-0.029**
	(0.013)	(0.011)	(0.012)
Low leverage bank	-0.041***	-0.012*	0.017***
	(0.0084)	(0.0066)	(0.0062)
Unsecured loan	-0.00017	0.0085	0.020**
	(0.0099)	(0.0087)	(0.0088)
Observations	8215	8215	8215
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	2726	2726	2726
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.17	0.10	0.060

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether banks with low leverage monitored loans less by examining whether unsecured loans were more likely to default for banks with low leverage ratios. "Loan overdue (90+)$_{b,f}$" is a dummy variable for whether the loan from bank b to firm f becomes overdue more than 90 days during the length of our dataset (2007:Q2 to 2012:Q4). Similarly, "Loan overdue (365+)$_{b,f}$" and "Loan default$_{b,f}$" are defined for a loan overdue more than 365 days and a loan default, respectively. 'Unsecured Loan$_{b,f}$' is a dummy variable equal to one if firm f has an unsecured loan with bank b. "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). Standard errors are clustered at the firm level.

As a final possible explanation, we analyze if banks with low leverage ratios efficiently forbear their loans. That is, do these banks provide necessary liquidity to firms that are solvent but facing either cash-flow difficulties or overcoming a temporary demand shock (Fukuda and Nakamura [2011])? In effect, rather than banks delaying the recognition of problem loans to protect their balance sheet, were banks with low leverage ratios using their discretion to improve loan outcomes?

We present two pieces of evidence that do not support this view.

First, in table (3) in section (3.1), we found that banks with low leverage ratios had *higher* default rates than loans by other banks to the same firm (column 3). Therefore, this result strongly refutes the suggestion that banks with low leverage ratios were inducing better loan outcomes.

Second, if banks with low leverage ratios were effectively forbearing strictly productive loans, one would anticipate that at an overdue loan at a bank with a low leverage ratio would be a strong predictor for a future loan default. This relationship follows because the bank with low leverage ratios would classify a firm's loans as nonperforming only if the bank believed that firm was insolvent, which in turn, would cause higher final default rates. To explore this idea, we examine directly whether overdue loans by banks with low leverage ratios are more predictive of future loan defaults than loans issued by other banks that lend to the same firm. Specifically, we examine the conditional probability of a loan default between 2007:Q3 and 2012:Q4 on the likelihood of the loan being designated as overdue more than 90 days in 2007:Q2. We run regressions similar to:

$$\begin{aligned}\text{Loan default}_{b,f,\text{2007:Q3}-\text{2012:Q4}} = \beta_B \times \text{Overdue loan (90+)}_{b,f,\text{2007:Q2}} \times \text{Low leverage bank}_{b,f} \\ + \beta_B \times \text{Overdue loan (90+)}_{b,f,\text{2007:Q2}} + \alpha_f + \epsilon_{b,f,\text{2007:Q3}-\text{2012:Q4}}\end{aligned} \tag{13}$$

where "Loan default$_{b,f}$" is a dummy variable for whether the loan from bank b to firm f defaults between 2007:Q3 to 2012:Q4 and α_f is a firm fixed effect. This regression tests whether overdue loans from banks with low leverage ratios were a better predictor of a future loan default than overdue loans from other banks.

The results in table (13) show that overdue loans by banks with low levels of capital (as measured by capital or leverage ratios) were less predictive of a future default by economically significant magnitudes (11 percent for banks with low capital banks and 3.5 percent for banks with low leverage ratios) *for the same firm*. These results strongly refute the interpretation that banks with low leverage ratios may have been efficiently forbearing productive loans.

Table 13: Predictive power of an overdue loan on a future loan default across banks with relatively less capital

	(1) Loan defaulted	(2) Loan defaulted	(3) Loan defaulted
Overdue loan (90+)	0.15***	0.22***	0.20***
	(0.018)	(0.034)	(0.035)
Low cap. bank x Overdue loan (90+)		-0.11***	
		(0.038)	
Low capital bank		-0.0049	
		(0.0058)	
Low lev. bank x Overdue loan (90+)			-0.035
			(0.039)
Low leverage bank			0.015**
			(0.0062)
Observations	19332	9965	9965
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	5799	3326	3326
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.11	0.12	0.12

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether banks with relatively less capital were efficiently forbearing productive loans by examining the predictive power of a loan overdue more than 90 days on a future loan default. "Loan default$_{b,f}$" is a dummy variable for whether the loan from bank b to firm f defaulted in the period 2007:Q3 to 2012:Q4. "Overdue (90+)$_{b,f}$" is a dummy variable for whether the loan from bank b to firm f was overdue more than 90 days in 2007:Q2. "Low leverage bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 7 percent). "Low capital bank" is a dummy variable equal to 1 if bank b's capital ratio was in the bottom quartile of our dataset in 2007 (equal to just below 10 percent). This table restricts attention to only firms with multiple bank loans in 2007:Q2. Standard errors are clustered at the firm level.

Taken together, we do not find strong evidence that the alternative explanations can explain our results. This supports our main explanation that banks with low leverage ratios were delaying the recognition of their nonperforming loans to mitigate the hit on their capital.

5 Conclusion

We study how banks that vary in their capital structure respond to firm distress. We provide evidence that banks with low leverage ratios intentionally delay classifying their loans as nonper-

forming thereby postponing the regulatory hit to their capital ratios. By masking the status of a loan, banks reduce the required loan loss provisions, consequently artificially maintaining higher regulatory capital and leverage ratios. Moreover, we find suggestive evidence that this delay in recognizing bad loans, although improving the banks' capital position in the short-term, causes worse final loan outcomes, with evidence that the banks with a greater delay in recognizing bad loans also had greater resultant loan defaults.

Somewhat surprisingly, we find that banks with low leverage ratios do not materially increase their exposure to firms that recently had a nonperforming loan at a different bank. This bodes well for the allocation for credit, as banks (on average) tend to reduce their credit risk to financially vulnerable firms.

Overall, our results contribute to the large literature on zombie lending and highlight the importance of improving the prompt and accurate disclosure of banks' nonperforming loans, especially by banks that may be under capitalized.

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6 Online appendix

In section (3.1) we found that banks with low leverage ratios were slower to designate a loan as overdue. In table (14), we show this result is robust to including a continuous measure of bank leverage and, in table (15), we show this result is robust to using a measure of risk-based capital instead of leverage.

Table 14: Differences in the first lender to designate a loan as nonperforming: Banks with low leverage ratios

	(1) First overdue bank (90+)	(2) First overdue bank (365+)	(3) First default bank
Leverage ratio	0.0044***	0.0064***	0.00067
	(0.0012)	(0.0015)	(0.0015)
Observations	4944	3358	2958
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	1503	997	834
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.26	0.26	0.26

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether banks with low leverage ratios were slower to designate a loan as overdue relative to other banks for the same firm. "First overdue bank $(\text{NPL})_{b,f}$" is a dummy variable equal to 1 if bank b was the first bank to designate a loan from firm f as nonperforming in the period 2007:Q2 to 2012:Q4 (the length of our dataset), where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). Leverage ratio_b is continuous variable for bank b's leverage ratio in 2007 (equal to just below 7 percent). We restrict attention to firms with multiple bank loans and have at least one overdue loan during our sample. Standard errors are clustered at the firm level.

Table 15: Differences in the first lender to designate a loan as nonperforming: Banks with low risk-based capital ratios

	(1) First overdue bank (90+)	(2) First overdue bank (365+)	(3) First default bank
Low capital bank	-0.0099	-0.076***	0.0071
	(0.020)	(0.022)	(0.024)
Observations	5602	3706	3151
Observation level	Firm-bank	Firm-bank	Firm-bank
Number of firms	2161	1345	1027
Firm FEs	Yes	Yes	Yes
Dep. variable mean	0.27	0.28	0.28

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table examines whether banks with low risk-based capital ratios were slower to designate a loan as overdue relative to other banks for the same firm. "First overdue bank $(\text{NPL})_{b,f}$" is a dummy variable equal to 1 if bank b was the first bank to designate a loan from firm f as nonperforming in the period 2007:Q2 to 2012:Q4 (the length of our dataset), where a nonperforming loan is defined in three ways (overdue more than 90 days in column 1, overdue more than 365 days in column 2, and loan default in column 3). "Low capital bank" is a dummy variable equal to 1 if bank b's leverage ratio was in the bottom quartile of our dataset in 2007 (equal to just below 10 percent). We restrict attention to firms with multiple bank loans and have at least one overdue loan during our sample. Standard errors are clustered at the firm level.