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Do banks propagate debt market shocks?

Abstract

Recent financial crisis demonstrated that the banking system can be a pathway for shock transmission. In this paper, we analyze how banks transmit shocks that hit the debt market to their borrowers. Our paper shows that when banks experience a shock to the cost of their bond financing, they pass a portion of their extra costs or savings to their corporate borrowers. While banks do not offer special protection from bond market shocks to their relationship borrowers, they also do not treat all of them equally. Relationship borrowers that are not bank-dependent are the least exposed to bond market shocks via their bank loans. In contrast, banks pass the highest portion of the increase in their cost of bond financing to their relationship borrowers that rely exclusively on banks for external funding. These findings show that banks put more weight on the informational advantage they have over their relationship borrowers than on the prospects of future business with these borrowers. They also show a potential side effect of the recent proposals to require banks to use CoCos or other long-term funding.

1 Introduction

Recent financial crisis demonstrated that the banking system can be a pathway for shock transmission. In this paper, we analyze how banks transmit shocks that hit the debt market to their borrowers. Traditionally banks have funded their business with deposits. Since deposits are largely inelastic with respect to the interest rate, this source of funding gave banks an opportunity to shield their corporate borrowers from economy-wide shocks. Berger and Udell (1992), for example, document that bank loan rates move in a smoother fashion than the market interest rate and Berlin and Mester (1999) find that banks with more core deposits smooth loan interest rates in response to adverse economic shocks.

In recent years banks have been increasingly relying on the bond market to finance their business. At the end of 1988, the ratio of bond financing to deposit funding was 3.5% among the top 100 U.S. banks. By the end of 2007, this ratio had gone up to 9%. This change in banks' funding choices is important because it is likely to make it more difficult for banks to shield corporate borrowers from economy-wide shocks. In addition, it is likely to create an additional indirect link between the bond market and the corporate sector, since shocks to the bond market may now get propagated to the corporate sector via banks' loan pricing policies. We test for evidence of this link and identify which corporate borrowers have become more exposed to bond market shocks as a result of banks' growing reliance on bond financing.

We consider two hypotheses. Our first hypothesis links the interest rates banks charge on their corporate loans to banks' costs of issuing in the bond market. Specifically, we hypothesize that shocks to the costs banks pay to issue in the bond market are transmitted to the corporate sector via banks' loan pricing policies. The alternative to this hypothesis is that banks perfectly shield their corporate borrowers from the bond market shocks, absorbing all fluctuations in the cost of bond issuance.

Our second hypothesis is about the borrowers which are more likely to be affected by shocks to banks' cost of bond financing. Following Berlin and Mester (1999), we hypothesize that the prospects of future business with their relationship borrowers leads banks to protect these borrowers from shocks to banks' cost of bond financing, possibly passing these costs onto relationship borrowers over a longer period of time. Under this condition, we expect banks to pass a smaller portion of the shocks to their bond funding costs onto their relationship borrowers than onto their non-relationship borrowers. An alternative hypothesis is following the hold-up theories of Sharpe (1990) and Rajan (1992). It states that banks will pass a larger portion of the shocks to their bond funding costs onto their relationship borrowers than onto their non-relationship borrowers, since banks are more likely to have an informational advantage over their relationship borrowers.[1]

The effects of bond market shocks on loan rates under our second hypothesis or under its alternative are likely to be more pronounced for relationship borrowers that do not have access to the bond market. On the one hand, these borrowers will likely be more dependent on banks for external funding, increasing banks' prospects of future business with them. On the other hand, banks will likely have a bigger informational advantage over these borrowers since these borrowers do not benefit from the information that comes with the issues in the bond market. We use these differences to refine our second hypothesis, by hypothesizing that if banks shield their relationship borrowers from bond market shocks, then relationship borrowers that depend on them for funding stand to be the least affected by shocks to banks' cost of bond funding. In contrast, if banks take advantage of their informational monopoly over their borrowers, then these bank-dependent relationship borrowers stand to be affected the most by such shocks.

To test our hypotheses, we start by investigating whether banks' loan pricing varies with the cost they paid to raise funding in the bond market the last time they issued a bond prior to any given loan. We next test whether this link is stronger or weaker for the borrowers that have a relationship with their bank. Finally, we investigate whether this link is stronger for relationship borrowers that are more dependent on banks because they do not have access to the bond market. To help disentangle our hypotheses we compare how banks' loan pricing policies vary across borrowers when the bank experiences a shock that increases its cost of bond financing versus when it benefits from a shock that lowers its cost of bond financing.

We find, consistent with out first hypothesis, that when banks experience a shock to the cost they pay to issue in the bond market, they respond by passing a portion of the shock onto their corporate borrowers. Importantly, we find that on these occasions banks do not offer special protection to their relationship borrowers: relationship borrowers are less exposed to shocks to the cost of their banks' bond financing than non relationship borrowers, but the difference is not statistically significant. On closer inspection, we find that relationship borrowers that are not dependent on banks are less exposed to shocks to the cost their banks pay to raise bond financing compared to relationships borrowers that are dependent on banks for funding. Moreover, our results show that when banks are able to raise bond financing at very low cost, they pass a small portion of the resulting savings to all of their relationship

[1]Following Boot, Greenbaum, and Thakor (1993), who show that banks with low capital are more likely to exploit borrowers, sacrificing reputational capital in order to preserve financial capital. One could also hypothesize that the increase in the cost of bond funding will lead banks to renege on implicit guarantees they have given their borrowers, including the guarantee not to explore their informational monopoly, and thereby raise the loan rates on them. For evidence in support of the hypothesis that banks price their informational monopoly see Santos and Winton (2008), Hale and Santos (2008) and Schenone (2010).

borrowers. In contrast, when banks experience a shock that substantially increases their cost of bond financing, they pass the bulk of this cost onto their relationship borrowers that are dependent on them, while fully protecting the relationship borrowers that have access to the bond market. In other words, dependent borrowers are more exposed to shocks to banks funding costs than non-dependent borrowers. Further, our evidence shows that dependent borrowers are more exposed to shocks that raise the cost of banks' bond financing than to shocks that lower the cost of this funding source for banks.

These findings do not support the hypothesis that the prospects of future business with relationship borrowers leads banks to smooth over time the interest rates they charge on loans to these borrowers. In contrast, our findings are consistent with the idea that banks take into account the informational advantage they have over their relationship borrowers when they decide on their loan rates. Even though banks do not pass the entirety of the shocks to their cost of bond financing onto their relationship borrowers that do not have access to the bond market, possibly because these borrowers are not fully dependent on them, banks do expose these borrowers the most to these shocks while protecting their relationship borrowers that do have access to the bond market.[2]

Our paper is most closely related to Berlin and Mester (1999) and complements their work in at least three important respects.[3] Berlin and Mester focus on a period when banks funded themselves almost entirely with deposits, the 1970s and 1980s. Their key finding is that banks' use of core deposits makes it possible for them to shield borrowers from economy-wide shocks, possibly because these deposits are interest-inelastic. Our focus is on the two decades that follow their sample period (1988-2007), and while we find evidence similar to theirs in the first half of our sample period, we also find that the effect of core deposit financing weakens in the second half of our sample period. More importantly, we find that after controlling for the role of deposit funding, banks still adjust their loan pricing policies in response to shocks they experience when raising funding in the bond market. Consistent with increasing importance of bond financing for banks, this bond effect is only evident in the second half of our sample period. It appears, therefore, that the absorbing effect of deposit funding weakened over time

[2] Publicly listed borrowers that do not have access to the bond market, for example, are not likely to experience the same level of bank dependency than privately held borrowers that do not have access to the bond market, but the absence of accounting information on the latter borrowers precludes us from including them in our investigation.

[3] Our paper is also related to the bank lending channel literature, including Kashayap, Stein and Wilcox (1993), Peek and Rosengren (1997), Kashyap and Stein (2000), Paravisini (2008) and Khwaja and Mian (2008). This literature focuses on the effects of shocks to bank liquidity on the volume of bank lending. Our focus instead is on the loan pricing effects of shocks to the bond market. In this regard, our paper is related to Santos (2011) who investigate the effect of bank losses during the subprime crisis on their loan pricing policies.

while the bond-funding effect grew in importance.

Our paper also extends Berlin and Mester's analysis by investigating how the propagation of the bond market shocks by banks differs across different sets of borrowers, depending on whether they have a lending relationship with the bank and whether they are dependent on the bank for external funding. In doing so, we also investigate how banks pass the savings or the extra costs they incur when raising funding in the bond market onto these sets of borrowers.

Lastly, like Berlin and Mester we have detailed information about bank lenders and their loans.[4] In contrast to them, however, we also have information on the identity of borrowers, which gives us the opportunity to control for firm-specific factors known to explain loan interest rates and to distinguish whether the borrower is a relationship borrower and whether it is likely to be bank-dependent or not.

Our findings are timely, given the ongoing debates on the proposals to introduce bail-in programs and proposals to require banks to use CoCos or other long-term funding. These debates have focused on the effects these programs would have on banks' risk-taking incentives and their contribution to solve problems of financial distress and have paid little attention to the effects these programs might have on corporate borrowers relying on these banks for funding. Since these proposals will require banks to access the bond market periodically, our findings suggest that they will further expose corporate borrowers, in particular those that are dependent on banks, to the conditions in the bond market.

Our findings are also important because they show that as banks increasingly rely on bond financing they will find it more difficult to promote relationship lending, which remains a distinctive feature of banks.[5] Finally, our findings show a new mechanism that interlinks the financial intermediation done through banks with the intermediation done through the debt market.[6] A common view in the financial architecture literature is that banks and debt markets

[4]Our loan data source is Dealscan. This database has some nonsyndicated loans, but is only comprehensive for loans which banks syndicate. Berlin and Mester rely instead on the Survey of Terms of Bank Lending to Business. This database reports information on every business loan but only for a stratified sample of about 340 banks and for the loans banks made on a particular day (or number of days).

[5]Petersen and Rajan (1995) show that provided banks have some monopoly power in the loan market, they are able to do intertemporal interest rate smoothing to their relationship borrowers. In their setting banks are solely funded with deposits. If they used bond financing in addition, it is easy to see that shocks to their cost of bond financing would hinder their ability to smooth interest rates, notwithstanding their monopoly power in the loan market. See Boot (2000) for a review of the benefits of relationship lending.

[6]Recent papers by Acharya, Afonso, and Kovner (2012) and by Bord and Santos (2013) show that bank's access to liquidity affect the price of the loans and liquidity to corporate borrowers. These results are complementary to ours.

operate independently from each other.[7] Holmstrom and Tirole (1997), Allen and Gale (2000), and Song and Thakor (2009) develop models in which banks and financial markets complement each other, but none of them consider the complementarity that we identify in this paper. In Holmstrom and Tirole (1997), the complementarity arises because access to bank funding allows some borrowers to tap debt markets for additional funding. In Allen and Gale (2000), intermediaries provide individuals with insurance against unforeseen contingencies in some states of nature, thereby eliminating the need for individuals to acquire costly information. Analysis in Song and Thakor (2009) is the closest to the complementarity we identify, but in their setting banks rely on the equity market, not the bond market, to raise the equity capital they need for regulatory reasons.

The remainder of our paper is organized as follows. The next section presents our methodology and data, and characterizes our sample. Section 3 investigates whether the interest rates banks charge their borrowers vary with the cost banks pay to issue in the bond market. Section 4 investigates whether banks pass on the shocks to the bond market equally to all corporate borrowers. This section also investigates whether banks adjust their loan pricing policies differently when they experience shocks that substantially increase their cost of bond financing as opposed to shocks that allow them to raise bond financing at a very low cost. Section 5 concludes the paper.

2 Methodology, data, and sample characterization

2.1 Methodology

Our methodology has two parts corresponding to our two main hypotheses. Part I investigates whether the spreads banks charge on their corporate loans vary with the cost they pay to issue in the bond market. Part II investigates whether banks pass the cost they pay to raise bond financing to a greater or lesser extent to borrowers with whom they have a lending relationship.

2.1.1 Loan spreads and cost of banks' access to the bond market

We start by investigating whether the spreads banks charge on their corporate loans vary with the cost they pay to raise funding in the bond market. To this end, we estimate the following model of loan spreads:

[7] See Allen and Gale (1997, 1999), Bhattacharya and Chiesa (1995), Dewatripont and Maskin (1995) and Boot and Thakor (1997).

$$LLOANSPD_{b,f,l,t} = c + \alpha\ LBK\ BOND\,COST_b + \beta\ LBBBSPD_t + \gamma\ LIBOR_t + \sum_{i=1}^{I} \psi_i B_{i,b,t-1} + \sum_{j=1}^{J} \zeta_j F_{j,f,t-1} + \sum_{k=1}^{K} \nu_k L_{k,l} + \epsilon_{f,t}. \tag{1}$$

where $LLOANSPD_{b,f,l,t}$ is the natural log of the all-in-drawn spread over Libor of loan l extended by bank b to firm f at date t.[8] According to Dealscan, our source of loan data, the all-in-drawn spread is a measure of the overall cost of the loan, expressed as a spread over the benchmark Libor, because it takes into account both one-time and recurring fees associated with the loan.

$LBK\ BOND\,COST_b$ is the natural log of our measure of the cost bank b paid the last time it issued in the bond market. The coefficient on this variable, α, measures the elasticity of loan spreads with respect to the cost banks paid to issue in the bond market, and so we would expect it to be positive. Since bonds are fixed rate securities, we measure this cost at the time of the bank's most recent public bond issue (prior to the loan).

We consider the cost to issue in the bond market only if the bank issued bonds within three years prior to loan. If the bank issued bonds a long time ago the cost it incurred back then is less likely to affect its current loan pricing policy. To isolate the effect of the bank cost of bond financing from the effect of a change in the overall interest rates or in the overall "price" of risk at the time of the loan, we add the following two controls to our model of loan spreads. We control for the cost to issue in the bond market at the time of the loan by including in our model the log of the spread between triple-B and triple-A primary yields on new bonds issued at the time of the loan, $LBBBSPD_t$. Since this spread tends to be correlated with the overall price of risk, we expect $\beta > 0$. In addition, we control for the level of interest rates at the time of the loan, by including $LIBOR_t$ in our model. Since loan spreads are computed over Libor, the two variables tend to move in opposite directions and so we expect $\gamma < 0$.[9]

We complement these controls for the overall interest rates in the economy, with three sets of bank-, firm-, and loan-specific controls, B, F, and L, which we describe next. We first discuss the set of firm-specific variables that we use. A subset of these variables, which includes $LAGE$, the log of the firm's age in years (we compute the firm's age by subtracting the date the firm first appeared in Compustat from the date of each observation in the sample), and

[8] We use the log of the loan spread, as opposed to the spread itself, because the log of the loan spread has distribution which is closer to the normal, and because this allows us to interpret the coefficients on the log of other spreads we use on the left-hand side of our model as elasticities. In any case, using spreads instead of the log of spreads in our models does not affect our key findings.

[9] Including natural logarithm of this variable instead of the level, does not change our results.

$LSALES$, the log of the firm's sales in hundreds of millions of dollars, control for the firm's overall risk. Older firms are typically better established and so less risky. Similarly, larger firms are usually better diversified across customers, suppliers, and regions.

A subset of firm variables controls for the risk of the firm's *debt*. It includes the firm's profit margin, $PROF\ MARGIN$ (net income divided by sales); interest coverage, $INTEREST\ COV$ (EBITDA divided by interest expense); the leverage ratio, $LEVERAGE$ (debt over assets); and its earnings volatility, $EARNINGS\ VOL$ (the standard deviation of the firm's quarterly return on assets over the last three years). More profitable firms as well as firms with higher interest coverage have a greater cushion for servicing debt and so should pay lower spreads on their loans. In contrast, firms with higher leverage and those with higher earnings volatility will likely have a higher probability of default and so should pay higher spreads on their loans.

The next set of firm variables attempts to control for another aspect of credit risk — the losses that debt holders incur in the event of default. To capture this, we consider several variables that measure the size and quality of the asset base that debt holders can draw on in default, including the firm's tangible assets, $TANGIBLES$ (inventories plus plant, property, and equipment over assets), its advertising expenses, $ADVERTISING$ (advertising expense divided by sales), and its expenses with research and development, $R\&D$ (research and development expense divided by sales).[10] Tangible assets lose less of their value in default than do intangible assets, so we expect this variable to have a negative effect on spreads. In contrast, advertising expenses and R&D expenses, which proxy for the firm's brand equity and intellectual capital, respectively, are intangible, and so we also expect them to have a positive effect on spreads. We also control for the value the firm is expected to gain by future growth, $MKTTOBOOK$ (firm's market to book ratio), and the firm's net working capital, NWC (current assets less current liabilities over debt).[11] Although growth opportunities are vulnerable to financial distress, we already control for the portion of the firm's assets that are tangible. Thus, this variable could have a negative effect on spreads if it represents additional value (over and above book value) that debt holders can in part access in the event of default. With regards to the firm's net working capital, since the firm's liquid asset base is less likely to lose value in default, we expect this variable to have a negative effect on spreads.

We complement this set of firm controls with $RELATIONSHIP$, which is a dummy

[10]Firms are required to report expenses with advertising only when they exceed a certain value. For this reason, this variable is sometimes missing in Compustat. The same is true of expenses with research and development. In either case, when the variable is missing we set it equal to zero.

[11]For firms with no debt, this variable is set equal to the difference between current assets and current liabilities.

variable equal to one if the firm borrowed from the same lead arranger in the three years prior to the current loan.[12] In addition, we include dummy variables for single digit SIC industry groups since each industry may face additional risk factors that are not captured by our controls, and include a time trend, $TREND$, to account for a potential secular trend in loan interest rates.

The next set of variables controls for aspects related to the loan that are likely to affect loan spreads. It includes the log of loan amount in dollars, $LAMOUNT$; and the log of the loan maturity in years, $LMATURITY$. Larger loans may represent more credit risk, but they may also allow economies of scale in processing and monitoring the loan. Similarly, loans with longer maturities may face greater credit risk, but they are more likely to be granted to firms that are thought to be more creditworthy. So, the effects of these variables on the spread is ambiguous. This set also includes dummy variables equal to one if the loan has restrictions on paying dividends ($DIVIDEND\ REST$), is senior ($SENIOR$), or is secured ($SECURED$). All else equal, any of these features should make the loan safer, decreasing the spread, but it is well known that lenders are more likely to require these features if they think the firm is riskier (Berger and Udell, 1990), so the relationship may be reversed. Because the purpose of the loan is likely to affect its credit spread, we include dummy variables for loans taken out for corporate purposes ($CORP\ PURPOSES$), to refinance a loan ($REFINANCE$), and for working capital purposes ($WORK\ CAPITAL$). Similarly, we include dummy variables to account for the type of the loan, in particular for lines of credit ($CREDIT\ LINE$) and for term loans ($TERM\ LOAN$). Some of the loan controls are likely to be jointly determined with loan spreads.[13] Since we do not have instruments for the various loan controls, we address the concerns that may arise with this endogeneity by estimating our models both with and without the set of loan controls. Using either approach does not affect our key findings.

Finally, we control for a set of bank-specific variables. These variables aim at controlling for aspects related to banks that are likely to play a role in their loan pricing policies. In addition to potentially having a direct effect on the pricing of the loan, these variables are also meant to proxy for unobserved characteristics of banks, including their management quality, that may affect their loan pricing policies at a given time. $LASSETS$, the log of the bank's total assets in hundreds of millions of dollars, controls for bank size. Larger banks are likely to be better diversified or to have access to funding under better terms giving them the opportunity to charge lower loan spreads. If safer banks are able to access funding under better terms, then we also expect other measures of bank risk, such as the return on assets, ROA,

[12]Using a time horizon of one year to determine if the borrower has a lending relationship with the bank yields similar results.

[13]For evidence on the endogeneity of loan covenants see Demiroglu and James (2010) and Murfin (2011).

the volatility of return on assets, $ROAVOL$, and net loan charge-offs as a fraction of assets, $CHARGEOFFS$, to be correlated with the interest rates banks charge on their corporate loans.[14] For the same reason we expect the bank's capital-to-assets ratio, $CAPITAL$, to be negatively related to loan interest rates. This relationship may also arise because, according to Boot, Greenbaum, and Thakor (1993), banks with low capital are more willing to consume reputational capital to build up financial capital and thus are more likely to renege on implicit guarantees, including the guarantee not to explore their informational monopoly.

We include the bank's holdings of cash and marketable securities as a fraction of total assets, $LIQUIDITY$, because banks with more liquid assets may find it easier to fund loans on the margin, leading to lower loan spreads. We include the fraction of subdebt over assets, $SUBDEBT$, to control for the importance of bond financing for the bank. Again, banks that rely on this funding source are likely to find it easier to fund loans on the margin and so we should expect them to charge lower spreads. This variable is also likely to have a negative effect on loan spreads because bond financing is predominantly used by larger banks. Lastly, we include the fraction of total deposits over assets, $DEPOSITS$, to control for the importance of deposit funding for the bank. Insured deposits are believed to be the least expensive source of funding for banks. Our control for the importance of this funding source, however, also includes uninsured deposits which tend to be more expensive.[15]

2.1.2 Are relationship borrowers less exposed to the cost of banks' bond funding?

We next investigate whether banks pass the shocks to their funding costs that arise with their use of bond financing to all of their borrowers equally. Specifically, we are interested in learning whether borrowers that have a lending relationship with banks are exposed to these shocks to a lesser or greater extent. If banks expect to continue doing business with their relationship borrowers, they may be willing to shield them from bond market shocks, thereby smoothing the interest rates they charge their relationship borrowers over time. On the other hand, the pressure to maintain their financial performance may lead banks to renege on implicit guarantees, including the guarantee not to explore their informational monopoly over their relationship borrowers, and pass onto these firms a larger portion of the cost increase they face in raising funding in the bond market.[16]

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[14] We use the volatility of ROA rather than stock return because a large number of the banks in the sample do not have publicly traded shares.

[15] Our results do not change if instead we control for insured deposits only.

[16] Bharath, Dahiya, Saunders, and Srinivasan (2011) find that the impact of a relationship on spreads is negative; however, Santos and Winton (2008) find that this effect is reversed in recessions, when information monopolies are likely to be stronger and maintaining relationships is likely to be less attractive to lenders.

Thus, we investigate whether banks shield their relationship borrowers from the shocks they face to their bond funding costs or whether they exploit their informational advantage over such borrowers. To that end, we estimate the following model:

$$\begin{aligned}
LLOANSPD_{b,f,l,t} = {} & c + \alpha\ LBK\ BOND\,COST_b + \lambda\ RELATIONSHIP_{f,t-1} \\
& + \eta\ RELATIONSHIP_{f,t-1} \cdot LBK\ BOND\,COST_b \\
& + \beta\ LBBBSPD_t + \gamma\ LIBOR_t \\
& + \sum_{i=1}^{I} \psi_i B_{i,b,t-1} + \sum_{j=1}^{J} \zeta_j F_{j,f,t-1} + \sum_{k=1}^{K} \nu_k L_{k,l} + \epsilon_{f,t}. \qquad (2)
\end{aligned}$$

where all the variables are as defined in part I above. If banks shield their relationship borrowers from the shocks to their bond financing costs, then we would expect $\eta < 0$. If on the other hand banks pass these shocks onto their relationship borrowers to a greater extent than on other borrowers, then we would expect $\eta > 0$.

These effects are likely to vary within the sample of relationship borrowers depending on how dependent the borrower is on the bank for funding. For example, banks will likely find it difficult to pass shocks to their cost of funding onto borrowers that have alternative funding sources, as these borrowers will respond by ending their relationship with the bank. Banks will find it easier to pass these shocks onto borrowers that depend on them for their funding, but the greater prospects of future business with these borrowers may lead banks to shield them form shocks to their funding costs.

To investigate these possibilities, we need to distinguish borrowers that are dependent on banks from those that are not bank-dependent. We assume that borrowers that have access to the bond market are not bank dependent. Besides having access to an alternative source of funding, there will also be more information available on these borrowers coming from the opinions of bond analysts and ratings of rating agencies, and the spreads on their bonds. This additional information will reduce banks ability to hold these borrowers up for higher interest rates à la Sharpe (1990) and Rajan (1992) when their cost of funding goes up.

Our loan pricing model (2) distinguishes between borrowers that have and those that do not have a lending relationship with their bank, and it compares how these borrowers are exposed to changes in the cost of bond financing of their banks. To avoid adding a third level of interaction terms that would distinguish borrowers that have access to the bond market among those that have relationship with their bank, we opted for estimating model (2) separately for borrowers with a lending relationship with their bank and those borrowers without such a relationship. Within these subsamples of loans we distinguish between borrowers with and without access to the bond market. In other words, we replace $RELATIONSHIP_{f,t-1}$, in model (2) with $MACCESS_{f,t-1}$,, our proxy for borrowers' access to the bond market, and estimate the model separately for relationship borrowers and non-relationship borrowers.

We assume that borrowers have access to the bond market if they issued a public bond in the recent past. For the purpose of our tests we define the recent past as the three-year period prior to the loan. We get similar results if we assume that any borrower that has issued at least one bond in the past has access to the bond market.[17] Further, since according to Rajan (1992) the holdup problem is more acute for risky firms than safe firms, among the relationship borrowers with access to the bond market we would expect those that are rated investment grade to be the least exposed to the bond market shocks that affect their bank's cost of funding. For this reason, we also distinguish among the firms that have access to the bond market those that are rated investment grade from those that are rated below investment grade. We use the rating of the borrower's most recent public bond (prior to a given loan) to determine whether it is rated investment grade or below investment grade.

2.2 Data

The data for this project come from several data sources, including the Loan Pricing Corporation's Dealscan database (LPC), the Securities Data Corporation's Domestic New Bond Issuances database (SDC), the Center for Research on Securities Prices's stock prices database (CRSP), the Salomon Brother's bond yields indices, Compustat, and from the Federal Reserve's Call Reports.

We use LPC's Dealscan database of business loans to identify firms that borrowed from banks and to gather information on their loans. This database goes as far back as the beginning of the 1980s, but in the first part of that decade it has a somewhat limited number of entries. It is for this reason that we begin our sample in 1987. Our sample ends in December 2007 to avoid any effects arising from the subprime financial crisis.

We rely on SDC's Domestic New Bond Issuances database to identify which firms in our sample issued bonds prior to borrowing in the syndicated loan market and to gather information on banks' bond issuance activity. We also rely on this database to gather information on the bond issuance activity of banks.

We use Compustat to get information on firms' balance sheets. Even though LPC contains loans from both privately held and publicly listed firms, given that Compustat is

[17] We do not count privately placed bonds as a measure of public bond market access. We believe private placements are very different from public issues, reaching a smaller set of investors and thus not increasing informed competition as much as a public issue does. As a practical matter, there is far less information on private placements because the SEC filing rules on public issues do not apply to private issues. This makes it hard to control for firms' private placements. This is consistent with earlier work that considers private placements to be closer to syndicated bank loans than to public bonds.

dominated by the latter, we have to exclude from our sample the loans borrowed by privately held firms.

We rely on the CRSP database to link companies and subsidiaries that are part of the same firm, and to link companies over time that went through mergers, acquisitions, or name changes.[18] We then use these links to merge the LPC, SDC and Compustat databases in order to find out the financial condition of the firm at the time it borrowed from banks and if by that date the firm had already issued bonds.

We use Salomon Brothers' indices on the yields of new industrial long-term triple-A and triple-B rated bonds to control for the conditions in the bond market at the time firms take out loans from banks.

Finally, we use the Reports of Condition and Income (Call Reports) compiled by the FDIC, the Comptroller of the Currency, and the Federal Reserve System to obtain bank-level data for the lead bank(s) in each loan syndicate.

2.3 Sample characterization

Table 1 characterizes our sample of 19,930 loans. These loans are extended by 381 banks over the years 1987-2007 to 4,222 borrowers. The top panel compares the 150 banks that had access to the bond market at the time of their loans with the 335 banks that relied on deposit funding.[19] We classify a bank as having access to bond financing, if it issued at least once in the bond market in the three years prior to the loan and it still had public debt on its balance sheet at the time of the loan. Otherwise, we assume the bank funds its operations mainly with deposits. The middle panel compares the 16,212 loans in the sample that "bond-financing" banks extended with the 3,718 loans extended by banks that do not use bond financing. Finally, the bottom panel of the table compares the 3,529 borrowers that took out loans from bond-financing banks with the 1,699 borrowers that took out loans from deposit-financing banks.

Looking at the top panel, it is apparent that, compared to banks that rely on deposit funding, banks that use bond financing are larger, hold less liquidity, and operate with a lower deposit-to-asset ratio. Bond financing banks appear to be less profitable since they have a

[18]The process we used to link LPC, SDC, and Compustat can be summarized as follows. The CRSP data was first used to obtain, through name-matching procedure, CUSIPs for the companies in LPC for which this information was missing. With a CUSIP, LPC could then be linked to both SDC and Compustat, which are CUSIP-based data sets. We proceed by using the PERMCO variable from CRSP to group companies across CUSIPs, since that variable tracks the same company across CUSIPs and ticker changes.

[19]The number of banks adds up to more than the total number because some banks switch from using bond financing to deposit financing alone (or vice versa) over the sample period.

lower ROA. Further, these banks may be riskier. Their ROA is less volatile, but they have a lower capital-to-asset ratio ($CAPITAL$).

In the middle panel of the table we see that bond financing banks charge on average 60 basis points less on their loans than deposit financing banks. This difference may arise because bond financing banks extend significantly larger loans or because they extend a larger fraction of their loans borrowers that are not bank dependent. A larger portion of the borrowers of these banks have a credit rating or issued bonds in the public bond market in the three years prior to the loan, confirming that borrowers of these banks are less likely to be bank dependent.

That difference in interest rates may also reflect a difference in the risk of these banks' borrowers. However, in this case the evidence appears to be mixed. As we can see from the bottom panel, compared to borrowers of deposit funding banks, borrowers of bond financing banks are older, larger, have better profit margins and higher net working capital, and they have more growth opportunities. All of these features suggest that bond financing banks tend to extend loans to safer borrowers. There is also evidence that suggests otherwise. For example, borrowers of bond financing banks on average have lower interest coverage and less tangible assets. Further, they have higher leverage ratios and their earnings are more volatile.

Last, that difference in the interest rates that these banks charge on their loans to corporate borrowers may arise because of a difference in these banks' funding costs. Bond financing banks appear to be able to raise deposit funding at lower interest rates. In addition, they can complement this funding source with bond financing.

2.3.1 Banks' bond funding costs and their loan spreads

In Table 2, we take a first look at whether there is a link between banks' loan pricing policies and their bond funding costs. To that end, we compare in the first row of the table the loan spreads that banks charge their borrowers when the cost banks pay to issue in the bond market is low and high, respectively. We proxy for this cost by the spread between triple-B and triple-A primary yields on new bonds issued at time the bank issued its most recent bond prior to the loan, $BBBSPD_b$. We assume the cost to issue in the bond market is low (high) if $BBBSPD_b$ is in the lowest (highest) quartile of the distribution of this variable during the sample period.

When banks pay low bond yields to issue in the bond market, they charge on average 137 bps on their corporate loans. When they pay high yields to issue bonds, they charge their borrowers on average 176 bps. Thus, when the banks' cost to issue in the bond market goes up, they increase the spreads they charge on their loans by 38 bps. Banks appear to shield at least in part their relationship borrowers from these cost hikes. As we can see from the middle panel of Table 2, when the cost banks pay to issue in the bond market goes up they increase the spreads on the loans they extend their non relationship borrowers by 44 basis points. On these occasions, they increase the spreads they charge their relationship borrowers by only 35 basis points.

Finally, as shown in the bottom panel of Table 2, we investigate if it is important for borrowers to have access to the bond market. We classify borrowers that issued in the bond markets at least once in the three years prior to the loan date to have access to the bond market. Borrowers that have never issued in the bond market or those that only issued more than three years ago (from the loan date) are classified as bank dependent. As we can see from that panel, effectively non bank dependent borrowers are less exposed to the cost banks pay to raise funding in the bond market, irrespective of whether they have a relationship with their bank. More importantly, among relationship borrowers those that are not dependent on banks for funding do not appear to be exposed to shocks to the cost their banks pay to issue in the bond market. While relationship borrowers that are bank dependent pay on average an additional 61 basis points when it is more expensive for banks to issue in the bond market (meaning that they issued when $BBBSPD_b$ was in the upper quartile of the distribution of this variable as opposed to the lower quartile of that distribution), relationship borrowers that are not bank dependent pay only an additional 3 basis points, an increase which is not statistically different from zero.

In sum, the results of our sample characterization suggest that banks do adjust their loan pricing policies in response to changes in the cost they pay to raise funding in the bond market. Banks appear to shield their relationship borrowers from changes in the cost of this source of funding, but only if they are not dependent on them for funding. Relationship borrowers that are dependent on banks for external funding seem to be exposed to shocks to the cost of funding of their banks. In the rest of this paper, we look at the exposures of these cohorts of borrowers to the cost their banks pay to issue in the bond market more closely, using multivariate analysis.

3 Do banks pass bond market shocks onto their borrowers?

We investigate in this section whether banks' reliance on the bond market to fund their activities creates a link between the cost they pay to issue bonds and the spreads they charge on their corporate loans. In the next section we investigate whether banks shield their relationship borrowers from shocks to the cost they pay to raise bond financing.

Table 3 reports the results of our tests of whether banks that rely on bond financing adjust their loan spreads in response to changes in the cost they pay to issue in the bond market. We measure this cost at the time of banks' most recent bond issue prior to any given loan. Given that yields are missing for a large number of bonds issued by banks, we proxy for that cost by the log of the spread between triple-B and triple-A primary yields on new bonds issued on the day the bank issued its most recent bond prior to the loan, $LBBBBSPD_b$.[20] Model 1 investigates whether banks adjust their loan pricing policies in response to changes in the cost they pay to access the bond market, controlling for our set of firm-specific characteristics, F. Models 2 expands our controls to account for our set of loan-specific variables, L. As we discussed in the methodology section, we estimate our model with and without loan controls to reduce concerns with the potential endogeneity of some of these controls. Model 3 investigates what happens when we further expand our controls to account for our set of bank-specific variables, B. Models 4 and 5, in turn, investigate the robustness of our findings when we control for the overall level of interest rates at the time of the loan. In model 4, we control for the log of the spread between triple-B and triple-A primary yields on new bonds issued at the time of the loan, $LBBBBSPD_l$, and in model 5 we further control for the level of Libor at the time of the loan, $LIBOR$. These controls are important to assure us that the link we identify between loan spreads and the bank's cost of bond financing is not driven by changes in the overall interest rates or in the price of risk at the time of the loan. Finally, model 6 re-estimates our most comprehensive model (model 5) with bank fixed effects to reduce concerns with sample selection.

Model 1 shows that banks that rely on bond financing take into account the cost they incur to raise funding in the bond market when they decide on their loan spreads. The coefficient on our proxy for the cost the bank pays to issue in the bond market, the triple-B over the triple-A yield spread at the time of the bank's most recent bond issue (prior to the loan), $LBBBSPD_b$, is highly statistically significant and equal to 0.29. A one-percent increase in the cost banks pays to issue in the bond market leads to an increase of 29 basis points in the loans spreads they charge their borrowers.

With regards to the effects of firm controls we use in model 1, they are generally consistent with our discussion in the methodology section. As expected, older and larger firms as well as firms with more interest coverage, and tangibles pay lower spreads on their loans. Firms that have relationship with their banks are also able to borrow at lower interest rates. Firms with higher levels of leverage and more volatile earnings pay higher spreads on their loans. Contrary to expectations, though, firms with more R&D expenses as well as those with more advertising expenses (relative to their sales) are able to borrow at lower interest rates.

Models 2 and 3 show that the link we find in model 1 between loan spreads and the cost the bank pays to issue in the bond market continues to hold when we add our loan controls and bank controls, respectively. Adding these controls does not alter the statistical significance

[20] In the Robustness section below we test whether our results continue to hold when we measure banks' cost of bond financing by the actual ex ante yields they pay on their new bond issues.

and it has only a minor effect on the size of the coefficient on $LBBBSPD_b$. With respect to our loan controls, their effects are generally consistent with our intuition. Larger loans and senior loans pay lower interest rates. In contrast, longer maturity loans carry higher interest rates. Similarly, secured loans and loans that give rise to dividend constraints carry higher spreads. Even though these covenants aim at protecting lenders, they are more often present in loans to riskier borrowers, thereby explaining why these loans carry higher spreads. Term loans and credit lines carry lower spreads. Refinance loans and loans for working capital, on the other hand, pay higher spreads.

With regards to bank controls, our results confirm that banks that incur larger losses charge higher spreads on their loans. Banks with higher capital-to-asset ratios, those with more liquidity as well as banks that rely more heavily on subdebt charge lower spreads. In contrast, banks that depend more heavily on deposit funding, usually smaller banks, tend to charge higher spreads on their loans. Lastly, bank size as measured by assets has a positive sign, which may be contrary to expectations, but the evidence on scale economies in banking is mixed.

The results of models 1-3 suggest that when the cost banks pay to raise funding in the bond market goes up, banks respond by increasing the spreads they charge on their corporate loans. A potential concern with this finding is that the increase in the loan spread is not actually driven by the cost banks pay to issue in the bond market but rather arises as a result of an overall increase in the cost of funding. To alleviate this concern, in model 4 we expand our set of controls to account for the cost to raise funding in the bond market at the time of the loans, $LBBBSPD_l$. In model 5, we expand our controls further to include the Libor also measured at the time of the loan, $LIBOR$. Adding these controls cuts in half the estimated loan spread elasticity with respect to the cost the bank pays to raise funding in the bond market, suggesting that some of the effect in models 1-3 is indeed driven by an overall increase in the cost of funds. However, the positive and statistically significant loan spread effect of the bank's cost to issue in the bond market remains. In other words, we find that, conditional on overall cost of funding at the time of the loan, when banks incur higher costs to issue in the bond market, they tend to charge higher loan spreads on their corporate loans.

Finally, in model 6 we show that this finding continues to hold when we estimate our model of loan spreads with bank fixed effects. Adding bank fixed effects further reduces our loan spread elasticity to 0.11, but does not affect its statistical significance. In the remainder of the paper we refer to model 6 of Table 3 as our benchmark specification.

3.1 Identifying the loan spread effect of banks' bond financing costs

As we pointed out above, one concern with our findings is that they may reflect an overall increase in the cost of credit rather than the cost banks pay to issue in the bond market. Even though the cost of borrowing in the bond market and the loan spreads are measured at different times, there is a high correlation, 0.93, between the bond spread at the time of the bank's bond issue and the bond spread at the time of the loan.

In this section, we attempt to reduce this concern by presenting the results of four tests we developed for this purpose. The first test investigates whether our result changes over time. If our result is driven by changes in the overall cost of credit in the economy, then it should be independent from the sample period we consider. The second test is a falsification test which uses as a control group the banks that do not use bond financing but extended loans at the same time as bond-financing banks. The next two tests use two alternative measures of the cost of bond issue by bank — actual spread on the bank's most recent bond issue, which limits substantially our sample, but has only 0.21 correlation with the bond spread at the time of the loan; and binary variables to indicate whether the last bond prior to each loan was issued at a time of very high or very low spreads in the bond market.

3.1.1 Loan spread effect of banks' bond financing costs over time

As we noted earlier, our first test builds on the idea that if the link unveiled between loan spreads and the bank's cost of bond funding were driven by the overall cost of credit in the economy at the time of the loan, then this effect should hold throughout the sample period. In contrast, if that link is indeed driven by the cost banks pay to raise funding in the bond market, then we should find stronger evidence of it in the most recent portion of the sample period, since the importance of bond financing for banks has grown over the years.

To test this, we estimate our model separately for the first half of our sample period (1988-1997) and for the second half of the sample period (1998-2007). The results of these tests are reported in Table 4. We use in this test, as well as in all the subsequent robustness tests, our most general model, model 6 of Table 3, which includes all the control variables and estimated with bank fixed effects. In the interest of space we do not report the coefficients on the control variables. Models 1 and 2 test for the effect of the cost in the bond market at the time the bank issued its most recent bond prior to the loan, $LBBBSPD_b$. As we can see from these models, we find evidence of an effect of the cost banks pay to raise funding in the bond market on their loan spreads in the second half of the sample period (model 2), but not in the first half of the sample period (model 1).

Models 3 and 4 expand the set of controls in the previous models to account for the overall cost of credit in the economy at the time of the loan as measured by the cost to issue in the bond market at the time of the loan, $LBBBSPD_l$. This variable is only significant in the second half of the sample, and while adding it reduces the size of the coefficient on $LBBBSPD_b$ we continue to have the striking difference between the two parts of our sample period. This difference suggests that the link we find between the cost banks pay to raise funding in the bond market and the spreads they charge on their corporate loans cannot be entirely driven by changes in the overall cost of credit at the time of the loan.

The statistical significance of $LBBBSPD_l$ in the second half of the sample period (models 3 and 4) may appear surprising in light of Berlin and Mester's (1999) finding that banks shield their borrowers from changes in the overall cost of credit. Recall that Berlin and Mester show that banks that use relatively more core deposits offer more protection to their borrowers from shocks to the current cost of credit which they proxy by $LBBBSPD_l$. To get closer to their specification, we modify the previous models and control for the bank's use of insured deposits (scaled by its assets) and the interaction of this variable with $LBBBSPD_l$.[21] The results of this exercise, which are reported in models 5 and 6 of Table 4, show that the effect of $LBBBSPD_l$ is positive and significant in the two parts of our sample period while the effect of $DEPOSITS\ INSURED \times LBBBSPD_l$ is negative, but significant only in the first part. In other words, the finding that Berlin and Mester uncovered over the period 1977-89, that banks with more core deposits offered more protection to their borrowers from shocks to the current cost of credit, persisted in the decade that followed their study (model 5), but weakened afterwards (model 6). In contrast, the effect of our proxy for the cost the bank paid when it issued the last bond prior to the loan, $LBBBSPD_b$, is only significant in the second half of the sample period. Thus, the differential effect we had uncovered for $LBBBSPD_b$ during our sample period continues to hold in these models, adding support to our assertion that the effect of the bank's cost of bond financing is not driven by changes in the overall cost of credit at the time of the loan. The fact that we find evidence of the link only in the most recent part of our sample was to be expected since the importance of bond financing for banks grew over time.

3.1.2 Falsification test

So far we focused our attention on banks that rely on bond financing, meaning that they issued at least once in the bond market in the three years prior to the loan. We also have data on loans extended by banks that do not rely on this source of funding, meaning that they issued bonds only more than three years prior to the loan or have not issued any bonds since 1970 (this is the first year we have information on banks' bond issuance. Recall that our sample of

[21] Berlin and Mester use core deposits while we rely on insured deposits, but the two concepts share the idea that this funding source is less prone to be affected by changes in the overall cost of credit in the economy.

loans starts in 1987).

If our earlier finding is driven by an increase in the overall cost of credit, then we should detect a similar effect on the loan spreads of the latter set of loans. If, on the other hand, our finding is driven by the cost banks pay to issue in the bond market, then the spreads on the latter loans should be unaffected by bond market conditions prior to the loan. Thus, we construct the following matched sample. For each of the loans that had a bond issued by the bank within past three years, we identify loans that were extended on the same day but did not have a bond issued within three years prior. We find such a match for 6,659 of our loans extended by banks that have accessed the bond market (treatment group), with 2,896 loans extended by banks that have not accessed the bond market (control group). For the loans issued by the treatment group banks we continue using $LBBBSPD_b$ as the measure of the cost of bank funding trough bond market, measured on the day the last bond prior to any given loan was issued. For the control group we don't have that measure, by construction, because they did not issue a bond. Thus, for the control group we construct a synthetic measure, which is equal to the average $LBBBSPD_b$ of the treatment loans issued on the same day. We re-estimate our main model for this matched sample, the total of 9,555 loans, including the interaction of the treatment indicator, that the banks accessed bond market, $BK\ ACCESS$, with $LBBBSPD_b$. We expect the main effect (coefficient on $LBBBSPD_b$, which corresponds to the effect on the control group) to be zero, while the coefficient on the interaction term (which, when summed up with the coefficient on $LBBBSPD_b$, corresponds to the effect on the treatment group) to be positive.

The results of this test are reported in Table 5. As in the previous test, we use our most comprehensive model of loan spreads, model 6 of Table 3, and estimate the models with all controls and bank fixed effects. The results of Table 5 vividly demonstrate the importance of controlling for the cost of borrowing at the time of the loans, $LBBBSPD_l$, and $LIBOR$. In the first two columns the first regression does not control for either measure of the borrowing cost and the second does not control for Libor. In these regressions we find that the effect of the cost of the access to the bond market is positive and statistically significant for the control group, which is indicative of the spurious correlation — through correlation of the cost of borrowing over time. As the third regressions shows, once we properly control for the cost of borrowing at the time of the loan, past cost of borrowing no longer has an effect on the pricing of the loans by banks that did not access the bond market. In all three regressions we find solid evidence of the effect of the bond market conditions at the time of the banks' bond issue on loan spreads they charge their corporate borrowers — the coefficient on the interaction term is positive and statistically significant. The sum of the main effect and the coefficient on the interaction term is equal to 0.18 and is highly statistically significant (F-statistic is 17.6), indicating that for the treatment group of loans we continue to observe the effect of cost of borrowing on the bond market.

There remains a possibility that borrowers that are more risky in a way that we cannot observe or control for push banks to issue debt during the times when the costs of borrowing are high. If this is the case, we will observe more expensive loans made by these banks not because they are passing on the costs of their bond issues but because this subset of borrowers is riskier. While we cannot test the differences in unobserved characteristics,[22] we can, nevertheless, see that loans extended by banks whose last public bond was issued during the period of high borrowing costs are extended to borrowers that have similar share of tangible assets, interest coverage ratio, market to book ratio, and net working capital ratio compared to borrowers of the banks that either did not issue at all (from our matched sample) or issued in the period of low borrowing costs. Moreover, borrowers of the banks that issued their previous public bond during high borrowing costs period, have higher profit margin than other borrowers.[23]

3.1.3 Using actual cost of bond financing

The results we reported thus far assume that the cost of bond financing for banks is correlated with the spread between Moody's indexes of ex ante yields of triple-B and triple-A rated bonds on the date of the most recent bond the bank issued prior to the loan. As we explained above, we chose to rely on these yield indexes because primary yields are missing for many of the bonds issued by banks in our sample. The spread between these indexes is likely a good proxy for the cost of bond financing for our banks because they are all rated investment grade. Nonetheless, ideally one would like to control for a measure of the cost of bond financing which is specific to each bond issue in order to account for idiosyncracies across banks and over time. For this reason, we re-estimated our model of loan spreads, but this time using the log of the yield on the most recent bond the bank issued prior to the loan over the one-year Treasury on that date, $LBK\ BOND\ YIELDSPD$, to measure the cost of bond financing for the bank. When we use this measure, our sample of loans drops from 16067 to 3595.

The results of this test are reported in Table 6. Model 1 tests whether the bank's cost of bond financing, as determined by the yield it paid on its most recent bond issue prior to the loan, affects the spreads on its corporate loans. Model 2 accounts for the cost to access the bond market at the time of the loan. As before, we measure this cost by the log of the spread between Moody's indexes of ex ante yields of triple-B and triple-A rated bonds at the time of

[22]We control for time-invariant unobserved borrower characteristics by including borrower fixed effects, as discussed below.

[23]In the interest of space we do not report these numbers, but they are available from the authors upon request.

the loan, $LBBBSPD_l$. Model 3 further controls for the level of Libor at the time of the loan, $LIBOR$. As with the previous test, we use our most comprehensive model of loan spreads, model 6 of Table 3, which accounts for our sets of bank-, firm-, and loan-specific controls, B, F, and L, respectively, as well as bank fixed effects. In the interest of space, however, we do not report the coefficients on these control variables.

A quick look at Table 6 reveals that this test confirms our earlier finding that when a bank pays a higher cost to issue in the bond market, it increases the spreads on its corporate loans. According to the estimates of model 1, when the ex ante yield spread on a bank's bond doubles, the bank increases its spreads on the loans it extend subsequently by 7 percent (which, given the mean of loan spread of these banks of 158 basis points, corresponds to an increase of about 11 basis points).

The results of this test should lay to rest any concerns that may exist with our use of the ex ante yield spread between Moody's indexes of triple-B and triple-A rated bonds to measure the cost of banks' bond financing. These results are important for yet another potential concern with our use of this measure of the bank's cost of bond financing: the correlation between the yield spread measured at the time of the bank's most recent bond prior to the loan, $LBBBSPD_b$, and this same spread at the time of the loan, $LBBBSPD_l$. In our base model, we account for this correlation by controlling for the triple-B spread at the time of loan, $LBBBSPD_l$. Since the correlation between $BK\ BOND\ YIELD$ and $LBBBSPD_l$ is much lower than the correlation between $LBBBSPD_b$ and $LBBBSPD_l$, the result of this robustness test further confirms that the effect of $LBBBSPD_b$ on loan spreads is attributable to an increase in the cost of the bank's bond financing and is not the result of an increase in the overall interest rates around the time of the loan.

3.1.4 Loan spread effect when banks issue during good periods and crises periods

Another way to isolate the effect of the triple-B ex ante yield spread at the time of the bank's most recent bond issue prior to the loan, while controlling for the value of this spread at the time of the loan, is to focus on periods when there was a crisis a bond market and/or periods when the cost to issue in the bond was extraordinary low. We can then test whether banks that issued bonds during these periods charged different spreads on the loans they extended afterwards when compared to the other banks that also rely on bond financing but did not issue during these periods or to these same banks on the loans not immediately following these periods.

To test this hypothesis, we identify the "crises" in the bond market during our sample period, defined as extended periods of time when the ex ante triple-B over triple-A yield spread was above one. This criteria left us with five bond market crises during the sample period (1987–2007).[24] We excluded from our sample all loans taken prior to the first crisis. Next, we identified loans for which the most recent public bond was issued by the lender during the crisis as opposed to other loans for which the most recent public bond was issued by lender during periods between crises.[25] This allows us to test whether loans that followed banks' bond issues during crisis times carried higher spreads when compared to the loans extended after bank's bond issues occurred during non-crisis times.

The results of this test are reported in the top panel of Table 7. Models in this panel are similar to those in Table 6, but now the key variable is $BOND\ CRISIS$, a dummy variable that is equal to one if the bank issued the last bond prior to each loan during the period of high triple-B spread. As in previous tables we do not report coefficients on all the control variables to save on space. Model 1 investigates whether banks that issued bonds in the period where the spreads in the bond market were elevated charged higher rates on the loans they extended following these bond issues, controlling for our sets of firm-, loan-, and bank-specific controls as well as bank fixed effects. Model 2 expands this set of controls to account for the cost to access the bond market at the time of the loan as determined by the spread between Moody's indexes of ex ante yields of triple-B and triple-A rated bonds at the time of the loan, $LBBBSPD_l$. Model 3 further expands our set of controls to account for the level of Libor at the time of the loan, $LIBOR$.

The results of this test also confirm our earlier findings. In all the models, loans that followed banks' bond issues placed during the periods of tight bond market conditions carried higher spreads than loans that followed bonds issued during a tranquil period. As before, controlling for the conditions in the bond market at the time of the loan (model 2) and additionally for the level of Libor at the time of the loan (model 3) reduces the loan-spread elasticity vis-à-vis our measure of the bank's cost of funding.

Next, we expand the previous test to investigate whether banks pass onto their borrowers any savings they enjoy when they issue bonds in periods of unusually low cost to issue in the bond market. We define these periods as periods during which the ex ante triple-B over triple-A yield spread was in the lowest 25 percent of its distribution.[26] We follow the approach

[24] The dates of these "crises" are as follows: Aug. 15, 1990 through Mar. 4, 1992; Sept. 30, 98 through Dec. 9, 1999; Apr. 11, 2000 through Nov. 24, 2003; May 2, 2005 through May 30, 2005 and Nov 7, 2007 through end of sample period Dec. 31, 2007).

[25] According to this definition, about 38 percent of loans in our sample were issued following a bond placed during crisis times.

[26] More specifically, we define the beginning of the episode when the spread falls below 0.62 and only include episodes during which the spread dipped below 0.6 for at least one period. We identify "good times" as follows: July 30, 1993 through Oct. 1, 1993; Jan. 26, 1994 through Feb. 17, 1994; Feb. 8, 1995 through July 30, 1998; Jan. 27, 2006 through May 30, 2006; and Jan. 18, 2007 through June 20, 2007.

used in the previous test and define a dummy variable *BOND GOODTIMES* to isolate the loans that followed banks' issues of bonds during these "good times."[27] We add this variable to the preceding regressions.

The results of this test, which are reported in the bottom panel of Table 7, show that there is a symmetry in the bond market effect on loan spreads. When banks fund themselves in the bond market at a high cost, they pass a portion of this cost onto their borrowers; when they are able to fund themselves in the bond market at a very low cost, they pass a portion of their "savings" onto their borrowers as well. The coefficient on *BOND CRISIS* is slightly higher than the coefficient on *BOND GOODTIMES* in models 1 and 2, and the opposite in model 3, but the difference between these coefficients in all models is not statistically significant. Once again, these results show that the effects of the cost banks pay to raise funding in the bond market continue to hold when we control for the conditions in the bond market at the time of the loan (model 2) and additionally for the level of Libor at the time of the loan (model 3), further confirming that they are driven by the cost banks pay to fund themselves in the bond market.

3.2 Other robustness tests

We undertake some additional robustness tests to make sure our results are not driven by omitted variables. As in the previous section, we use model 6 of table 3, which is our comprehensive model estimated with bank fixed effects, to do these tests. We do not report them in the interest of space, but they are available upon request. All of them confirm that our results continue to hold when we include additional controls.

Despite the large set of factors we account for with our controls, a concern with our findings is that we do not account for a potentially important determinant of a bank's cost of funds — the cost it incurs to raise deposit funding. We do not consider this cost because there is no bank level information on the interest rates banks pay on deposits. We tried to alleviate these concerns by controlling for the 3-month Libor at the time of the loan, which is the most commonly used proxy for banks' cost of funding. However, if this cost is strongly correlated with our proxy for the banks' cost to issue in the bond market, this could explain our findings. To investigate this possibility, we expand our set of bank controls to account for the cost a bank incurs to raise deposit funding by interacting the ratio of deposits to assets with the 3-month Libor. This control variable does not enter the regression significantly and does not affect our results.

A more accurate proxy for the cost of deposit funding is the interest expenses on

[27] According to this definition, about 40 percent of loans in our sample were issued following a bond placed during good times.

deposits reported by each bank, but this variable is missing in the Call Reports for 35% of the observations in our sample. Nonetheless, we used this variable to create two alternative proxies for the cost of deposit funding. In one case we complemented the interest expenses on deposits reported by banks with the above proxy; in the other case, we complemented that variable with total interest expense reported by banks in the Call Reports.[28] In both cases, our results remain unchanged.

The absence of controls for loan securitization and loan sales could also be a source of concerns since banks could use these activities to manage their funding sources. Controlling properly for loan sales and securitization activity by banks is not an easy task because there is no bank-level information on these activities for most of the sample period.[29] We tried to account for the effect of loan sales and securitization by controlling for the bank's outstanding balance of C&I loans sold and securities (scaled by the bank's assets). This variable is never statistically significant, probably because it is available for less than half of the observations in our sample, since Call Reports began including information on banks' securitization activity only in 2001:Q3. Controlling for this variable does not affect our finding on the effect the bank's cost of bond financing has on loan spreads. We also tried to account for these activities by using the Call Report variable "loans held for sale". This variable goes back to 1991, but it does not contain separate information on C&I loans, and it reports information on the loans the bank intends to sell, not on the loans it effectively sells. Again, controlling for this variable (scaled by the bank's assets) does not affect our key finding. Lastly, since securitization activities are relatively more important for the large banks, we test whether these banks drive our key finding. Dropping the largest 3 banks from the sample does not affect our key finding, even though these banks account for about 23 percent of loans in our sample.

We have attributed the change in banks' loan pricing policies when the spreads in the bond market at the time of banks' bond issuance go up to changes in the cost of banks' bond financing. Could that change in banks' loan pricing policies instead be driven by an overall increase in the "price" of risk? The results of our falsification test suggest this is not the case. In addition, our models control for the 3-month Libor rate and the triple-B bond spread at the time of the loan, which tend to vary with the overall economic conditions. To further reduce concerns with this hypothesis, we add the GDP growth rate and the slope of the Treasury

[28]To assure smooth pasting of our proxy into missing observations, we first regressed interest expenses on deposits for the observations we had on other proxies and then we constructed out-of-sample linear predictions based on these regressions.

[29]Call Reports have information on loan sales and securitization, but it goes back only to 2001, covers only sale and securitization activities that the bank retains some servicing, credit enhancements or there is recourse, and is about the stock not the flow of activity in each quarter.

yield curve, one at a time, as additional proxies for the state of the economy and for potential changes in the overall risk premium. Again, we find that these additional controls do not enter significantly and do not affect our results.

Standard errors in our models are clustered by bank. Since many firms took multiple loans throughout the sample period, the error term in our regression could be correlated across loans not just for a given bank, but also for a given firm. To address this issue, we follow Petersen (2009) and rerun our core regressions with clustering by firm as well as by bank.[30] The results of this test show only a negligible increase (less than one percent) in the standard errors, suggesting that clustering by bank only is, in fact, appropriate.

Yet another concern with our findings is whether they could be driven by unobserved heterogeneity across borrowers that is correlated with their lenders' access to the bond market. Leady (2009), for instance, document that when there is a shock to the supply of bank loans, bank borrowers with access to the bond market increase their use of bond financing. Similarly, when there are shocks to the bond market, borrowers with access to this source of funding could increase their use of bank funding, possibly crowding out lending that banks would otherwise extend to bank dependent borrowers. To reduce concerns that heterogeneity across borrowers drives our key findings, we re-estimate our loan pricing model with firm fixed effects as well as with bank-firm pair fixed effects. Our key findings remain unchanged.

3.3 How large are the costs to borrowers?

Now that we established that there is a statistically significant effect of the cost banks pay to issue on the bond market on the interest rates they charge on their corporate loans, we want to assess the economic significance of this effect.

Using the results of our benchmark model, model 6 in Table 3, we can see that the elasticity of loan spreads with respect to the bond spread at a time of the bank's last bond issue is 0.11. According to the estimates of this model, when the triple-B spread in the bond market doubles, banks that issue bonds at that time increase spreads on the loans they extend subsequently by 11 percent.[31] This change, given the average loan spread of these banks of 158 basis points, corresponds to an increase of about 18 basis points.

To get a better intuition for the magnitude of this effect, consider a median-size loan among those extended by banks that use bond financing, a facility of 175 million dollars. According to the estimates of model 6 in Table 3, a firm that borrows from a bank that issued a bond during a crisis in the bond market, if that firm takes out a loan in the three years that

[30] We omit bank fixed effects to conduct this test.

[31] Historically, during crises in the U.S. bond market the triple-B yield spread has more than doubled (see footnote (24) for further details).

follow the bank's last bond issue, it will pay on average over 300 thousand dollars more per year than a firm that borrows from a bank that also uses bond financing but did not issue a bond during the crisis. These effects indicate that the link we identified between the cost banks pay to issue in the bond market and the interest rates they charge corporate borrowers is not only statistically significant but also economically meaningful. While the magnitude of this effect is not very large, one has to keep in mind that all borrowers in our sample are publicly traded. There are many reasons to believe, including our findings in the subsequent section of this paper, that these effects would be larger for smaller private firms.

In sum, the findings we reported thus far show that banks pass on to their corporate borrowers a portion of the cost they incur to issue in the bond market. Consequently, shocks to the cost of banks' access to the bond market transmit to the cost of bank lending. According to our estimates, the effect of these shocks on loan spreads is economically significant.

In the next section, we investigate whether all borrowers are equally exposed to these shocks. We are particularly interested in finding out whether banks shield their relationship borrowers from these shocks or whether they instead build on their informational advantage over these borrowers to pass on to them the bulk of the cost increase they face to raise funding in the bond market.

4 Do banks pass bond market shocks to all of their borrowers?

The tests we reported in the previous section show that banks adjust their loan prices in response to changes in the cost they pay to issue in the bond market. Those tests, however, do not distinguish between different categories of borrowers. In particular, they do not distinguish borrowers that have a lending relationship with their bank from those that do not have such a relationship. As we explained in the introduction, this is important because banks' expectation of future business with their relationship borrowers may lead them to shield these borrowers from the shocks to their funding costs that arise with their use of the bond market. Alternatively, since banks are likely to have an information advantage over relationship borrowers, it will be easier for them to pass any shocks to their funding costs onto relationships borrowers.

To test which of these two effects dominates, we estimate our model (2) of loan spreads, which extends model (1) to include the interaction of our relationship variable with our proxy for the cost of banks' bond financing, $RELATIONSHIP \times LBBBSPD_b$. The results of these tests are reported in Table 8. Model 1 controls for firm-, loan-, and bank-specific variables, as well as bank fixed effects. We do not report coefficients on these controls to save space. Model 2 expands this set of controls to account for the cost to access the bond market at the time of the loan, $LBBBSPD_l$, and model 3 accounts for the level of Libor at the time of the loan,

$LIBOR$.

We continue to find that banks adjust their loan pricing policies in response to changes in the cost they incur to issue in the bond market. In all three models the coefficient on $LBBBSPD_b$, our measure of the bank's cost to issue in the bond market, is positive and highly statistically significant, indicating that banks increase the loan spreads on their borrowers that do not have a relationship with them when the banks' cost to issue in the bond market goes up. The coefficient on $RELATIONSHIP \times LBBBSPD_b$ is always negative, suggesting that banks may shield their relationship borrowers from shocks to their funding costs. This coefficient, however, is never statistically different from zero. In other words, our results show that banks may shield their relationship borrowers (when compared to nonpartisanship borrowers) from shocks to their funding costs, but by an amount that is not statistically different from zero.

4.1 Relationship lending and bank dependency

The evidence we just presented indicates that we cannot reject the hypothesis that banks do not give "special" treatment to their relationship borrowers vis-à-vis their nonpartisanship borrowers when they need to raise loan spreads in order to make up for the additional cost they incur when it becomes more expensive to raise bond financing. Our results, however, also show that banks do not pass the entirety of the shocks to their cost of bond financing onto their borrowers. This combination of results poses an interesting question: since banks do not offer special treatment to their relationship borrowers, why don't they use the informational advantage they are likely to have over these borrowers to pass onto to them the bulk of the shock to their cost of bond financing?

This apparent puzzle could arise because among the relationship borrowers some are dependent on banks for funding while others are not. Banks' may have more incentives to shield relationship borrowers that are dependent on them for external funding more than relationship borrowers that have access to other sources of funding, such as the bond market. This is because banks are more likely to recover the "subsidy" from future business with the former borrowers. On the other hand, banks will find it easier to pass on the additional cost to they face in the bond market onto the bank-dependent relationship borrowers because relationship borrowers that do not depend on their bank for funding may respond to any attempt of an increase in their loan rates by looking for funding elsewhere.

To test which of these predictions is borne out in the data, we estimate our loan pricing model separately for relationship borrowers and borrowers with no lending relationship with their bank. Further, we modify this model to distinguish whether the borrower is bank dependent or not, and interact this dummy variable with our proxy for the cost the bank incurred the last time it issue in the bond market prior to the loan. We identify borrowers as bank dependent if they never issued in the public bond market or issued a bond more than three years prior to the loan.[32] In addition, since according to Rajan (1992) the holdup problem is more pronounced for risky firms than for safe firms, we also consider a specification in which we distinguish among the firms that have access to the bond market those that are rated investment grade from those that are rated below investment grade.

The results of these tests for the loans of relationship borrowers are reported in Table 9. Model 1 investigates the effect of $LBBBSPD_b$ on loan spreads controlling for our sets of firm-, loan- and bank-specific factors as well as bank fixed effects. Model 2 adds to this model the cost to access the bond market at the time of the loan, $LBBBSSPD_l$, while model 3 further adds to our controls the $LIBOR$ at the time of the loan. Models 4 through 6, in turn, investigate whether relationship borrowers that have access to the bond market are less exposed to their banks' cost of bond financing. As with the previous set of models, model 4 investigates this hypothesis controlling for our sets of firm-, loan- and bank-specific factors; model 5 adds to these controls the cost to access the bond market at the time of the loan, and model 6 further adds the Libor at the time of the loan. Finally, models 7 through 9 follow the same pattern, but distinguish among relationship borrowers that have access to the bond market those that are rated investment grade from those that are rated below grade. For completeness, Table 10 reports the results of these same tests but for borrowers that do not have a lending relationship with their bank. In the interest of space we report in these two tables only coefficients on variables that are key to our hypotheses, leaving out the coefficients on our sets of firm, loan and bank controls.

Focusing on Table 9, we see that models 1 through 3 confirm the findings we reported in Table 8 — when the bank's cost to issue in the bond market goes up, the bank passes a portion of this cost hike onto the borrowers it has a lending relationship with. Models 4 through 6 show that not all relationship borrowers are exposed to the cost of the bank's bond financing. Among loans of relationship borrowers, model 4 shows the loan-spread elasticity to the cost of the bank's bond financing is 0.30 for loans of bank-dependent borrowers and only 0.21 for loans of borrowers with access to the bond market. These elasticities decline as we expand our controls to account for the cost to access the bond market at the time of the loan (model 5) and to account for the level of Libor at the time of the loan (model 6). According to model 6, the aforementioned elasticities are 0.14 and 0.04, respectively. Importantly, the former elasticity is statistically different from zero, but we cannot reject the hypothesis that the latter elasticity is equal to zero, according to the F-test (P-value is 0.47). In other words, when banks' cost of bond financing goes up, they passes a portion of this cost increase onto

[32] Limiting the definition of bank dependency to borrowers that never issued in the bond market yields similar results.

their relationship borrowers that do not have access to the bond market. On these occasions, they also raise the spreads on their loans to those relationship borrowers that have access to the bond market, but by an amount that is smaller and is not statistically different from zero.

In models 7 though 9 we further split relationship borrowers with access to the bond market into those that are rated investment grade and those that are rated below grade (according to the rating of their most recent bond issue prior to the loan). Consistent with the insights of Rajan (1992) we find that risky borrowers that have access to the bond market are more exposed to the cost of banks' bond financing than safe borrowers that have access to the bond market. Among relationship borrowers, those that have access to the bond market but are risky pay a premium on their loans which is similar to that paid by borrowers that do not have access to the bond market in response to a shock to their bank's cost of bond financing. This could be because on these occasions risky borrowers loose their access to the bond market and in essence become dependent on banks for external funds. In contrast, relationship borrowers that have access to the bond market and are safe pay a lower premium than relationship borrowers that are dependent on banks for funding. In fact, in the case of models 8 and 9, we cannot reject the hypothesis that safe borrowers do not pay any premium.

Turning our attention to table 10, which reports the same tests but for the sample of borrowers that do not have a lending relationship with their bank, we see one important difference with respect to the results we just discussed for relationship borrowers. Among the non-relationship borrowers, we do not find any evidence that banks charge different premiums associated with their cost of bond financing to those borrowers that do not have access to the bond market and those that have access to the bond market, regardless of the rating of their bond. This is reassuring as it shows that it is not critical for non-relationship borrowers to have access to the bond market, possibly because banks do not have an informational advantage over them.

Though not as apparent, because of the way we organize our results, there is one other piece of evidence which suggests that access to the bond market is more important for relationship borrowers than non-relationship borrowers. If one compares the coefficient on $LBBBSPD_b$ for benchmark, bank-dependent, category of relationship borrowers (line 1 column (9) of Table 9) and of non-relationship borrowers (line 1 column (9) of Table 10), we can see that the former are more sensitive than the latter borrowers. True, this difference is not very large and is not statistically significant, but it points in the direction that among relationship borrowers, those that do not have access to the bond market are more exposed to shocks to banks' cost of bond funding than non-relationships borrowers that also do not have access to the bond market.

The results of Tables 9 and 10 suggest that banks pass the largest portion of shocks to their cost of bond financing onto their relationships borrowers that do not have access to the bond market, and they "protect" the most their relationship borrowers that have access to the bond market, particularly those that are safe. These findings are important in that they do not support the hypothesis that banks take into account the prospects of future business with their relationship borrowers and smooth the interest rates they charge them over time, as in this case we would expect relationship borrowers that are bank dependent to receive the largest level of protection. In contrast, our findings suggest that the market power resulting from the informational advantage that banks have over their borrowers drives their loan pricing policies.

The next two tests aim at further confirming these findings. The first test furthers our investigation of how banks pass the shocks to their cost of bond financing onto different categories of borrowers. We report the results of this test in Table 11. The left-hand columns compare the portion of the shocks to the cost of bond financing that banks pass onto their relationship borrowers that have access to the bond market and are safe vis-à-vis the portion of the shocks that they pass onto their remaining borrowers. The right-hand columns, in turn, compare the portion of these shocks that banks pass onto their relationship borrowers that are dependent on them for external funding vis-à-vis the portion of the shocks that they pass onto their remaining borrowers. Consistent with our earlier findings, the differences in elasticity of loan spreads with respect to the cost banks pay to issue in the bond market (that is, the coefficients on the interaction terms) are negative and significant in left-hand side models, but positive and significant in right-hand side models. In other words, banks do not pass the shocks to their cost of bond financing to their relationship borrowers that have access to the bond market, but they do it to their relationship borrowers that depend on them for funding.

According to our results, banks do not pass the entirety of the shock to their cost of funding onto their relationship borrowers that do not have access to the bond market. This could be because these borrowers are not fully dependent on banks. Since these borrowers are publicly listed, they are likely to be less dependent on banks than privately held borrowers that do not have access to the bond market because there will be even less information available on the latter borrowers. We do not include privately held borrowers in our sample because Compustat, our source of firm-level data, does not include information for these borrowers.

Our final test takes this analysis another step further by comparing the costs and the savings banks pass onto dependent and non-dependent relationship borrowers when they issue in periods of crisis and in periods of low spreads in the bond market, respectively. To that end, we replace our proxy for the cost the bank paid when it issued its last bond prior to the loan, $LBBBSPD_b$, with the two dummy variables we defined in section 3.1.4 to identify the loans banks extended after issuing bonds in periods of crisis in the bond market, $BOND\,CRISIS$, and those they extended after issuing bonds in periods of low spreads in the bond market,

$BOND\ GOOD\ TIMES$, respectively. Models 1 though 3 compare how banks pass the costs and the savings from their bond issues on these two occasions onto their relationship borrowers that have access to the bond market and are safe vis-à-vis the remaining borrowers. Models 4 though 6 repeat this analysis, but in this case we isolate borrowers that have a lending relationship with the bank and do not have access to the bond market.

The difference in the treatment that banks offer to these two sets of borrowers is striking. Both sets of borrowers enjoy the same savings as everyone else when banks lower loan rates following their bond issues at low cost.[33] In contrast, when banks raise bond financing at a high cost, they do not raise loan rates on their relationship borrowers that are not dependent on them, but do raise loan rates on their relationship borrowers that are dependent on them for external funding, by an amount that is statistically different from zero.[34] In other words, dependent borrowers are more exposed to shocks to banks funding costs than nondependence borrowers. Further, our evidence shows that the former borrowers are more exposed to shocks that raise the cost of banks' bond financing than to shocks that lower the cost of this funding source for banks. According to Model 6 of Table 12, when banks raise loan spreads on their dependent relationship borrowers following a bond issue during crisis times, they raise these rates on average by 10 percent. When banks lower loan spreads following a bond issue during good times, they lower these rates on average by 5.3 for relationship dependent.[35] These findings confirm that banks' loan pricing policies are driven by informational advantage more than by the prospects of future business with borrowers.

In sum, the results we unveiled in this section confirm that banks adjust their loan rates in response to shocks to the cost they pay on their bond issues. The results also show that establishing a relationship lending with a bank does not guarantee a special treatment of the borrower. When banks are able to issue bonds at very low rates, they pass some of their cost savings to their relationship borrowers regardless of whether their are dependent on them. However, when banks raise bond financing at high rates, they do not pass any of these costs to the relationship borrowers that are not dependent on them, but they do so to their relationship borrowers that depend on them for funding. These results, therefore, show that

[33]Note that the coefficient on $BOND\ GOOD\ TIMES$ is negative and significant in all models, but neither $RL\ PBOND\ IG{\times}BD\ GOOD\ TIMES$ nor $RL\ NOACCESS{\times}BD\ GOOD\ TIMES$ have effects that are statistically different from zero.

[34]Note that the coefficient on $BOND CRISIS$ is positive and significant in all models, and while the effect of $RLPBONDIG{\times}BONDCRISIS$ is negative and significant and the sum of the two coefficients is not different from zero, the effect of $RL\ NOACCESS{\times}BOND\ CRISIS$ is positive and significant.

[35]In terms of basis points, given that spreads on loans on average during times of no crisis and no good times are 165 basis points (170 basis points on average overall), these would correspond to 16.5 basis points increase following crises and 8 basis points decline following good times.

the market power resulting from the informational advantage that banks have over borrowers more than the prospects of future business drives their loan pricing policies.

4.1.1 Robustness tests

We undertook a set of robustness tests similar to those we report in the previous section to investigate the robustness of our findings on the differential response of banks vis-à-vis their relationship borrowers and their non-relationship borrowers. In the interest of space we do not report these results, but describe them briefly.

First, we consider two subsamples as before, the first half of our sample time period, from 1988 to 1997, and the second half, from 1998 to 2007. For the full set of borrowers, when we allow the effect of the cost of bond funding by banks on their loan pricing to vary for relationship and non-relationship borrowers (as in Table 8), we find that in the early half of the sample, relationship borrowers paid on average higher interest on their loans, and their loans were more sensitive to the interest rate the banks paid on their bonds, but the overall effect of bank bond issuance cost on the loan pricing is not statistically different for these two sets of borrowers.[36] The results for the late half of our sample are almost identical to those in Table 8, indicating that it is the second half of the sample that drives our main results. When we limit the sample to relationship borrowers, as in Table 9, we lose the precision of our estimates in both subsamples, but qualitatively the story remains unchanged. The results for non-relationship borrowers (Table 10) are the sample for the full, early, and late sample periods.

Next, we re-estimates the regressions reported in Tables 8-10 with the actual spread on the last bond issued by the bank prior to any given loan, as we did in Table 6. Even though using these spreads leaves out a lot of observations, we continue to find the results of Table 8 unchanged with this modification. Once we split the sample, however, as we do in Tables 9 and 10, we do not find statistically significant difference in the response of loan prices to the change in bank's bond spreads depending on whether the borrower has access to the bond market and the rating of their most recent bond. This is not surprising, given that the number of observations falls from 10212 to 2336 and from 5855 to 1293 in Tables 9 and 10, respectively, with only a small portion of these observations accounted for by borrowers that had issued an investment grade bond in the three years prior to the loan (676 loans of relationship borrowers and 241 loans of non-relationship borrowers).

[36]The main effect of bond spreads is negative and not statistically significant. The main effect of relationship borrower indicator is positive and highly statistically significant. The effect of the interaction of these two coefficients is positive and statistically significant, but the total effect of bond spreads for relationship borrowers is very close to and not statistically different from zero.

Next, we repeat the analysis with various controls for the amount of the bond issue, cost of deposits, and the general economic conditions. In this case, all of our results in Tables 8-10 remain almost identical to the ones in the regressions we reported. The only exception is, when we control for bank's outstanding balance of C&I loans sold and securities, which dramatically limits our sample, we lose statistical significance of the effect of the interaction term of borrower issuing ING bond in the regression for relationship borrowers (as in Table 9). We recover all of our results, however, when instead we control for loans sold, which allows us to retain a larger sample. Neither of these controls enters significantly in Table 9 regressions, while loan sales enter significantly (with a positive sign) in the regression of Table 10, which limits the sample to non-relationship borrowers. In this case, however, including either of the two controls does not affect the coefficients of interest.

Finally, we attempt different specifications — with clustering standard errors both on bank and firm as well as with firm fixed effect. All of our results are robust to these modifications. A minor difference is that the main effect in Table 10 becomes statistically significant at 10 percent level (but the same in magnitude) when we cluster standard errors on both bank and firm.

5 Final remarks

Our findings show that banks' use of bond financing creates a link between the conditions in the bond market and their loan pricing policy. The evidence we uncovered on this link further shows that banks do not offer special protection to their relationship borrowers. To the contrary, banks expose their relationships borrowers that depend on them for funding the most to the shocks to their cost of bond financing. Banks protect from the bond market shocks only their relationship borrowers that have access to the bond market and are safe, possibly because they cannot hold them up for higher interest rates. The fact that banks pass some savings onto the latter borrowers but not to the former borrowers when they raise funding in the bond market at extraordinarily low cost adds further support to our conclusion that market power drives banks loan pricing policies more than relationship aspects of lending.

These findings are novel and have important implications. Since the number of banks that rely on bond financing continues to grow, our findings indicate that financial intermediation through banks will become increasingly interlinked with the intermediation performed through financial markets. In addition, corporate borrowers, in particular those that are dependent on banks for external funding, will become increasingly exposed to adverse shocks to the bond market. Moreover, a policy push towards longer-term bank financing is likely to further increase banks' reliance on the bond market, leading to unintended consequences of increasing the exposure of bank-dependent borrowers to the bond market shocks.

These finding suggest some potential ideas for future research. For instance, a common view in the financial architecture literature is that banks and debt markets operate independently from each other.[37] Holmstrom and Tirole (1997), Allen and Gale (2000), and Song and Thakor (2009) develop models in which banks and financial markets complement each other, but none of them consider the complementarity that we identify in this paper. Since banks rely increasingly on market funding, including bond financing, commercial paper funding and repo funding, it would be interesting to investigate the effect of these changes in the funding structure of financial intermediaries on the roles they perform.

[37]See Allen and Gale (1997, 1999), Bhattacharya and Chiesa (1995), Dewatripont and Maskin (1995) and Boot and Thakor (1997).

References

Acharya, Viral V., Gara Afonso and Anna Kovner, 2012, How Do Global Banks Scramble for Liquidity? Evidence from the Asset-Backed Commercial Paper Freeze of 2007, mimeo, available on SSRN.

Allen, Franklin and Douglas Gale, 1997, Financial Markets, Intermediaries, and Intertemporal Smoothing, *Journal of Political Economy*, 105, 523-546.

Allen, Franklin and Douglas Gale, 1999, Diversity of Opinion and Financing of New Technologies, *Journal of Financial Intermediation* 8, 68-89.

Allen, Franklin and Douglas Gale, 2000, Comparing Financial Systems, The MIT Press.

Berger, Allen N. and Gregory F. Udell, 1992, Some Evidence on Empirical Significance of Credit Rationing, *Journal of Political Economy* 100, 1047–1077.

Berger, Allen N. and Gregory F. Udell, 1990, Collateral, loan quality, and bank risk, *Journal of Monetary Economics* 25(1), 21-42.

Berlin, Mitchell and Loretta Mester, 1999, Deposits and relationship lending, *Review of Financial Studies* 12, 579-607.

Bhattacharya, Sudipto and Gabriella Chiesa, 1995, Proprietary Information, Financial Intermediation, and Research Incentives, *Journal of Financial Intermediation* 4(4), 328-357.

Bharath, Sreedhar, Sandeep Dahiya, Anthony Saunders, and Anand Srinivasan, 2011, Lending Relationships and Loan Contract Terms, *Review of Financial Studies* 24(4), 1141-1203.

Boot, Arnoud W.A., 2000, "Relationship banking: What do we know?" *Journal of Financial Intermediation* 9, 725.

Boot, Arnoud, W.A. and Anjan V. Thakor, 1997, "Financial System Architecture," *Review of Financial Studies* 10, 693-733.

Boot, Arnoud, W.A., Stewart I. Greenbaum and Anjan V. Thakor, 1993, Reputation and Discretion in Financial Contracting, *American Economic Review* 83, 1165-1183.

Bord, Vitaly M. and João A.C. Santos, 2013, Banks liquidity and the cost of liquidity to corporations, *Journal of Money Credit and Banking*, forthcoming.

Demiroglu, Cen and Christopher M. James, 2010, The Information Content of Bank Loan Covenants, *Review of Financial Studies* 23(10), 3700-3737.

Dewatripont, Mathias and Eric Maskin, 1995, Credit Efficiency in Centralized and Decentralized Economies, *Review of Economic Studies* 62, 541-555.

Hale, Galina B. and João A.C. Santos, 2009, Do banks price their informational monopoly? *Journal of Financial Economics* 93, 185-206.

Holmstrom, Bengt and Jean Tirole, 1997, Financial Intermediation, Loanable Funds, and the Real Sector, *Quarterly Journal of Economics*, 112(3), 663-691.

Kashyap, Anil K. and Jeremy C. Stein, 2000, What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?, *American Economic Review* 90(3), 407-428.

Kashyap, Anil K., Jeremy C. Stein and David W. Wilcox, 1993, Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance, *American Economic Review* 83(1), 78-98.

Khwaja, Asim and Atif Mian, 2008, Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market, *American Economic Review* 98(4), 141342.

Murfin, J., 2011, The Supply-Side Determinants of Loan Contract Strictness. Working paper.

Paravisini, Daniel, 2008, "Local Bank Financial Constraints and Firm Access to External Finance," *Journal of Finance* 63(5), 2161-2193.

Peek, Joe and Eric S. Rosengreen, 1997, The International Transmission of Financial Shocks: The Case of Japan, *American Economic Review*, 87(4), 495-505.

Petersen, Mitchell A., 2009, "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches," *Review of Financial Studies* 22, 435-480.

Petersen, Mitchell A. and Raghuram G. Rajan, 1995, "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics*, 110(2), 407-443.

Rajan, Raghuram G., 1992, Insiders and outsiders: The choice between informed and arm's length debt, *Journal of Finance* 47(4), 1367-1400.

Santos, João A.C., 2011, Bank Corporate Loan Pricing Policy Following the Subprime Crisis, *Review of Financial Studies*, 24(6), 1916-1943.

Santos, João A.C. and Andrew Winton, 2008, Bank Loans, Bonds, and Informational Monopolies across the Business Cycle, *Journal of Finance* 63, 1315-1359.

Schenone, Carol, 2010, Lending Relationships and Information Rents: Do Banks Exploit Their Information Advantages? *Review of Financial Studies*, 23(3), 1149-1199.

Sharpe, Steven A., 1990, Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships, *Journal of Finance* 45(4), 1069-1087.

Song, Fenghua and Anjan V. Thakor, 2009, Financial System Architecture and the Co-Evolution of Banks and Capital Markets, Mimeo Olin School of Business, Washington University in St. Louis.

Table 1. Sample characterization[a]

Variables	Bond financing banks	Deposit financing banks	Difference	p-value
		Differences among banks		
ASSETS	467.990	85.985	382.006	0.000
ROA	0.126	0.138	-0.012	0.000
ROAVOL	0.001	0.002	-0.001	0.000
CHARGEOFFS	0.107	0.110	-0.003	0.244
LIQUIDITY	19.795	26.386	-6.591	0.000
DEPOSITS	30.602	48.749	-18.147	0.000
CAPITAL	7.386	8.151	-0.765	0.000
		Differences in the loan policies		
LOANSPD	157.969	218.325	-60.356	0.000
AMOUNT	431.923	136.613	295.309	0.000
MATURITY	4.050	3.572	0.478	0.029
SECURED	0.416	0.624	-0.208	0.000
SENIOR	0.964	0.930	0.034	0.000
DIVIDENDREST	0.457	0.426	0.031	0.000
CORPORATEPURP	0.304	0.263	0.041	0.000
REFINANCE	0.623	0.444	0.179	0.000
WORKINGCAPITAL	0.179	0.214	-0.035	0.000
TERMLOAN	0.391	0.352	0.039	0.000
CREDITLINE	0.578	0.593	-0.015	0.101
RELATIONSHIP	0.635	0.509	0.126	0.000
		Differences among borrowers		
AGE	23.455	15.126	8.329	0.000
SALES	6854.742	1707.320	5147.422	0.000
PROMARGIN	-0.009	-0.052	0.044	0.026
INTERESTCOV	26.890	24.171	2.719	0.641
EARNINGSVOL	45.652	19.041	26.612	0.000
LEVERAGE	0.319	0.302	0.017	0.000
TANGIBLES	0.730	0.740	-0.010	0.167
ADVERTISING	0.011	0.009	0.002	0.000
RD	0.028	0.042	-0.014	0.138
NWC	8.001	5.771	2.230	0.271
MKTTOBOOK	1.784	1.744	0.040	0.136
PBOND	0.596	0.329	0.267	0.000
PBONDIG	0.272	0.067	0.204	0.000
PBONDBG	0.196	0.143	0.053	0.000

[a] *ASSETS* Bank assets in 100 million dollars. *ROA* returns on assets (net income divided by assets); *ROAVOL* Standard deviation of the quarterly ROA computed over the last three years. *CHARGEOFFS* net charge offs over assets; *LIQUIDITY* Cash plus securities over assets. *DEPOSITS* deposits over assets; *DEPOSIT COST* product between the ratio of deposits over assets and the three month LIBOR; *INT EXPENSE* interest expenses on deposits alone (over deposits). Numbers reported are for only 13009 of the 19930 observations in the sample because it is missing for the remaining banks; *CAPITAL* equity capital over assets; *LOANSPD* all-in-drawn loan spread over LIBOR at origination; *AMOUNT* Loan amount; *MATURITY* Loan maturity in years; *SECURED* Dummy variable equal to 1 if the loan is secured; *SENIOR* Dummy variable equal to 1 if the loan is senior; *DIVIDEND REST* Dummy variable equal to 1 if the borrower faces dividend restrictions in connection with the loan; *CORP PURPOSES* Dummy variable equal to 1 if the

loan is corporate purposes; $REFINANCE$ Dummy variable equal to 1 if the loan is to refinance existing debt; $WORK\ CAPITAL$ Dummy variable equal to 1 if the loans is for working capital; $TERM\ LOAN$ Dummy variable equal to 1 if it is a term loan; $CREDIT\ LINE$ Dummy variable equal to 1 if it is a credit lien; AGE Age of the borrower in years; $SALES$ Sales in millions of dollars; $PROF\ MARGIN$ Net income over sales; $INT\ COV$ the interest coverage (EBITDA divided by interest expense). $EARNINGS\ VOL$ earnings volatility (the standard deviation of the firm's quarterly return on assets over the last three years); $LEVERAGE$ leverage ratio (debt over total assets); $TANGIBLES$ tangible assets (inventories plus plant, property, and equipment over total assets); $ADVERTISING$ expenses with advertising scaled by the firm's sales; $R\&D$ expenses with R&D scaled by the firm's sales; NWC Net working capital. $MKTOBOOK$ market to book value. $PBOND$ Dummy variable equal to 1 if the borrower issued a public bond in the last three years prior to the loan; $PBONDIG$ Dummy variable equal to 1 if the borrower issued a public bond which was rated investment grade in the last three years prior to the loan; $PBONDBG$ Dummy variable equal to 1 if the borrower issued a public bond which was rated below investment grade in the last three years prior to the loan;

Table 2. Loan spreads and banks' cost of bond financing: Univariate analysis[a]

		Low BK BOND COST	High BK BOND COST	Difference	p-value
Loan spreads: Differences as bank cost to issue in the bond market changes					
		137.2	175.6	38.4	0.000
Differences depending on whether the borrower has a lending relationnship with the bank					
Relationship		125.6	161.0	35.4	0.000
No relationship		156.1	200.3	44.1	0.000
Differences depending on whether the borrower has access to the bond market					
Relationship	Access	114.1	117.2	3.14	0.540
	No access	132.4	192.9	60.5	0.000
No relationship	Access	136.4	151.8	15.4	0.060
	No Access	162.8	219.4	56.6	0.000

[a] Computations limited to banks that rely on bond financing at the time of the loan. This means the bank issued at least once in the bond market in the three years prior to the loan and it has public debt in its balance sheet at the time of the loan. The loan spread is the all-in-drawn loan spread over LIBOR at origination. High (low) *BK BOND COST* is the top (bottom) quartile of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the most recent bond the bank issued prior to the loan. Borrowers have a lending relationship with the bank if they borrowed from it at least once in the last three years prior to the loan. Borrowers have access to the bond market if they issued at least once in the bond market in the three years prior to the loan.

Table 3. Shocks to bond markets and bank loan pricing policies.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$LBBBSPD_b$	0.293***	0.311***	0.285***	0.169***	0.137***	0.112***
	(0.0122)	(0.0115)	(0.0133)	(0.0294)	(0.0295)	(0.0416)
$LBBBSPD_l$				0.123***	0.126***	0.145***
				(0.0281)	(0.0281)	(0.0415)
LIBOR					-0.0172***	-0.0200***
					(0.00317)	(0.00565)
LAGE	-0.145***	-0.105***	-0.103***	-0.103***	-0.104***	-0.105***
	(0.00736)	(0.00653)	(0.00650)	(0.00651)	(0.00649)	(0.0178)
LSALES	-0.235***	-0.101***	-0.102***	-0.103***	-0.104***	-0.104***
	(0.00361)	(0.00554)	(0.00564)	(0.00565)	(0.00563)	(0.00950)
LEVERAGE	0.395***	0.321***	0.321***	0.322***	0.322***	0.316***
	(0.0425)	(0.0336)	(0.0335)	(0.0333)	(0.0330)	(0.0517)
TANGIBLES	-0.0746***	-0.0272*	-0.0253	-0.0251	-0.0276*	-0.0162
	(0.0183)	(0.0157)	(0.0156)	(0.0156)	(0.0156)	(0.0196)
ROAVOL	0.0998***	0.0935***	0.0857***	0.0866***	0.0833***	0.0818***
	(0.0241)	(0.0208)	(0.0206)	(0.0206)	(0.0204)	(0.0233)
RD	-0.201***	-0.137***	-0.134***	-0.133***	-0.131***	-0.126**
	(0.0574)	(0.0414)	(0.0416)	(0.0416)	(0.0413)	(0.0561)
ADVERTISING	-0.654***	-0.635***	-0.656***	-0.655***	-0.663***	-0.734***
	(0.242)	(0.191)	(0.194)	(0.194)	(0.195)	(0.237)
LINTCOV	-0.205***	-0.164***	-0.164***	-0.163***	-0.163***	-0.162***
	(0.0119)	(0.00933)	(0.00933)	(0.00936)	(0.00931)	(0.0204)
MKTBOOK	-0.205***	-0.164***	-0.164***	-0.163***	-0.163***	-0.162***
	(0.0119)	(0.00933)	(0.00933)	(0.00936)	(0.00931)	(0.0204)
PROF MARGIN	-0.0309	-0.0309*	-0.0301*	-0.0298*	-0.0288*	-0.0293
	(0.0223)	(0.0160)	(0.0162)	(0.0161)	(0.0160)	(0.0205)
NWC	0.0722	0.0661	0.0644	0.0623	0.0657	0.0657
	(0.0563)	(0.0571)	(0.0567)	(0.0575)	(0.0584)	(0.0519)
RELATIONSHIP	-0.0643***	-0.0267***	-0.0253**	-0.0239**	-0.0239**	-0.0232
	(0.0112)	(0.00987)	(0.00992)	(0.00991)	(0.00990)	(0.0214)
TREND	0.0259***	0.0213***	0.0257***	0.0256***	0.0226***	0.0309***
	(0.00130)	(0.00149)	(0.00200)	(0.00199)	(0.00208)	(0.00756)
LAMOUNT		-0.108***	-0.108***	-0.108***	-0.106***	-0.107***
		(0.00576)	(0.00576)	(0.00577)	(0.00575)	(0.00671)
LMATURITY		0.0953***	0.0921***	0.0944***	0.0955***	0.0964***
		(0.00786)	(0.00786)	(0.00786)	(0.00789)	(0.0171)
SECURED		0.560***	0.554***	0.554***	0.553***	0.541***
		(0.0128)	(0.0127)	(0.0127)	(0.0127)	(0.0376)
CORP PURPOSES		-0.0123	-0.0193*	-0.0174	-0.0230*	-0.0239
		(0.0117)	(0.0117)	(0.0117)	(0.0117)	(0.0206)
REFINANCE		-0.0740***	-0.0771***	-0.0774***	-0.0815***	-0.0796***
		(0.0116)	(0.0116)	(0.0116)	(0.0115)	(0.0151)
WORK CAPITAL		-0.0636***	-0.0726***	-0.0710***	-0.0802***	-0.0804***
		(0.0130)	(0.0131)	(0.0131)	(0.0132)	(0.0218)
TERM LOAN		-0.401***	-0.394***	-0.396***	-0.403***	-0.415***
		(0.0371)	(0.0369)	(0.0368)	(0.0369)	(0.0599)

Continues on the next page.

Table 3 (Continued).[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)
CREDIT LINE		-0.481***	-0.473***	-0.474***	-0.480***	-0.494***
		(0.0374)	(0.0372)	(0.0371)	(0.0372)	(0.0730)
DIVIDEND REST		0.121***	0.134***	0.134***	0.131***	0.160***
		(0.0111)	(0.0113)	(0.0113)	(0.0113)	(0.0344)
SENIOR		-0.102***	-0.117***	-0.126***	-0.107***	-0.0993**
		(0.0249)	(0.0249)	(0.0250)	(0.0253)	(0.0406)
LASSETS			0.0127**	0.0140**	0.0167***	-0.0717
			(0.00568)	(0.00566)	(0.00572)	(0.0543)
ROA			4.726	5.137	4.373	7.242
			(6.290)	(6.294)	(6.279)	(11.50)
CHARGEOFFS			20.45***	20.55***	17.91***	-1.298
			(6.144)	(6.129)	(6.142)	(10.22)
ROA VOL			-1.288	-3.704	-0.583	4.881
			(4.697)	(4.736)	(4.748)	(11.69)
LIQUIDITY			-0.213***	-0.180**	-0.215***	-0.273
			(0.0800)	(0.0802)	(0.0801)	(0.235)
CAPITAL			-0.0300***	-0.0283***	-0.0273***	-0.0139
			(0.00405)	(0.00406)	(0.00405)	(0.0118)
DEPOSITS			0.247***	0.244***	0.255***	0.667**
			(0.0464)	(0.0464)	(0.0463)	(0.266)
SUBDEBT			-3.045***	-3.184***	-3.413***	-3.383*
			(0.711)	(0.711)	(0.710)	(1.843)
CONSTANT	6.595***	6.364***	6.292***	6.263***	6.312***	7.696***
	(0.0826)	(0.0865)	(0.142)	(0.142)	(0.141)	(0.850)
Bk fixef effects	NO	NO	NO	NO	NO	YES
Observations	16067	16067	16067	16067	16067	16067
R^2Adjusted	0.483	0.597	0.600	0.600	0.601	0.560

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. See definitions of remaining controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Bank cost of bond financing and loan spreads over time.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Sample period					
	1988-97	1998-07	1988-97	1998-07	1988-97	1998-07
$LBBBSPD_b$	0.0141	0.221***	-0.0213	0.0814**	-0.0464	0.0752**
	(0.0554)	(0.0370)	(0.0697)	(0.0364)	(0.0644)	(0.0336)
$LBBBSPD_l$			0.0542	0.167***	0.203**	0.175**
			(0.0611)	(0.0424)	(0.0800)	(0.0848)
$DEPOSITS\,INSURED \times LBBBSPD_b$					-0.462**	-0.0366
					(0.182)	(0.277)
$DEPOSITS\,INSURED$					0.326	0.578
					(0.359)	(0.385)
$DEPOSITS$	0.276	0.639*	0.249	0.639*		
	(0.351)	(0.352)	(0.355)	(0.345)		
LIBOR	-0.0337***	-0.0247***	-0.0342***	-0.0235***	-0.0319***	-0.0253***
	(0.0107)	(0.00679)	(0.0107)	(0.00668)	(0.0113)	(0.00651)
Bk fixef effects	YES	YES	YES	YES	YES	YES
Observations	4546	11521	4546	11521	4524	11521
R^2Adjusted	0.574	0.570	0.574	0.571	0.576	0.571

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $DEPOSITS\,INSURED$ Bank's insured deposits over assets. $DEPOSITS$ Bank's total deposits over assets. All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Falsification test.[a]

Variables	(1)	(2)	(3)
$LBBBSPD_b$	0.237***	0.146**	0.103
	(0.0384)	(0.0598)	(0.0640)
$BK\ ACCESS$	0.0686*	0.0699*	0.0534
	(0.0382)	(0.0388)	(0.0389)
$BK\ ACCESS$ x $LBBBSPD_b$	0.0844*	0.0885*	0.0776*
	(0.0462)	(0.0463)	(0.0457)
$LBBBSPD_l$		0.0922**	0.115***
		(0.0393)	(0.0413)
LIBOR			-0.0211***
			(0.00775)
Bk fixef effects	YES	YES	YES
Observations	9555	9555	9555
R^2Adjusted	0.499	0.499	0.501

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $BK\ ACCESS$ Dummy variable equal to one for the banks in the sample that issued bonds. Sample limited to the set of banks that issued bonds during the sample period and those banks that did not issue, but match the former banks on observable characteristics. All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Controlling for the yields on bank bonds.[a]

Variables	(1)	(2)	(3)
$LBK\ BOND\,YIELD$	0.0680***	0.0569***	0.0480***
	(0.00944)	(0.00882)	(0.0120)
$LBBBSPD_l$		0.177***	0.168***
		(0.0497)	(0.0513)
LIBOR			-0.0127
			(0.0100)
Bk fixef effects	YES	YES	YES
Observations	3629	3629	3629
R^2Adjusted	0.569	0.574	0.575

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBK\ BOND\ YIELDSPD$, Natural log of the yield on the most recent bond the bank issued prior to the loan over the one-year Treasury on that date; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Controlling for bonds banks issue in good and crises times in the bond market.[a]

Variables	(1)	(2)	(3)
Bonds banks issue during crises times in the bond market			
BOND CRISIS	0.188***	0.0413*	0.0587**
	(0.0321)	(0.0234)	(0.0244)
$LBBBSPD_l$		0.228***	0.169***
		(0.0397)	(0.0345)
LIBOR			-0.0293***
			(0.00651)
Bk fixef effects	YES	YES	YES
Observations	15200	15200	15200
R^2Adjusted	0.562	0.566	0.568
Bonds banks issue during good and crises times in the bond market			
BD CRISIS	0.137***	0.0446**	0.0603**
	(0.0296)	(0.0222)	(0.0238)
BD GOOD TIMES	-0.128***	-0.0771***	-0.0623***
	(0.0168)	(0.0210)	(0.0213)
$LBBBSPD_l$		0.175***	0.130***
		(0.0442)	(0.0387)
LIBOR			-0.0276***
			(0.00708)
Bk fixef effects	YES	YES	YES
Observations	15200	15200	15200
R^2Adjusted	0.565	0.567	0.568

[a] Dependent variable is *LLOANSPD* is the natural log of the all-in-drawn loan spread over LIBOR at origination; *BOND CRISIS* Dummy variable equal to one if the bank issued its most recent bond during a crisis period in the bond market. See footnote (24) for the crises in the bond market during the sample period; *BD GOOD TIMES* Dummy variable equal to one if the bank issued its most recent bond during a period of extraordinarily low rates in the bond market. See footnote (26) for the good time periods in the bond market during the sample period. $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; *LIBOR* Three month-level Libor at the time of the loan. All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8. Relationship borrowers and bank bond costs.[a]

Variables	(1)	(2)	(3)
$LBBBSPD_b$	0.317***	0.186***	0.144***
	(0.0315)	(0.0425)	(0.0459)
$RELATIONSHIP$	-0.0300	-0.0289	-0.0302
	(0.0258)	(0.0258)	(0.0257)
$RELATIONSHIP$ x $LBBBSPD_b$	-0.0526	-0.0556	-0.0520
	(0.0440)	(0.0431)	(0.0433)
$LBBBSPD_l$		0.142***	0.146***
		(0.0423)	(0.0411)
LIBOR			-0.0198***
			(0.00572)
Bk fixef effects	YES	YES	YES
Observations	16067	16067	16067
R^2Adjusted	0.559	0.560	0.561

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $RELATIONSHIP$ refers to 3 year horizon in columns (1)-(3) and 1 year horizon in columns (4)-(6). All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9. Bank cost of bond financing and loan spreads the bank charges relationship borrowers.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$LBBBSPD_b$	0.264***	0.149**	0.108*	0.303***	0.183***	0.140**	0.296***	0.170**	0.131**
	(0.0509)	(0.0632)	(0.0630)	(0.0490)	(0.0631)	(0.0639)	(0.0501)	(0.0650)	(0.0659)
$PBOND$				-0.0885***	-0.0893***	-0.0940***			
				(0.0162)	(0.0162)	(0.0166)			
$PBOND$ x $LBBBSPD_b$				-0.0909***	-0.0924***	-0.0975***			
				(0.0251)	(0.0252)	(0.0246)			
$PBOND\ IG$							-0.218***	-0.219***	-0.222***
							(0.0218)	(0.0218)	(0.0213)
$PBOND\ BG$							0.201***	0.201***	0.194***
							(0.0277)	(0.0278)	(0.0273)
$PBOND\ IG$ x $LBBBSOD_b$							-0.0845***	-0.0879***	-0.0925***
							(0.0232)	(0.0232)	(0.0226)
$PBOND\ BG$ x $LBBBSOD_b$							0.0331	0.0369	0.0306
							(0.0667)	(0.0677)	(0.0667)
$LBBBSPD_l$		0.121**	0.123**		0.126**	0.129***		0.133***	0.136***
		(0.0522)	(0.0486)		(0.0507)	(0.0466)		(0.0500)	(0.0465)
LIBOR			-0.0226***			-0.0244***			-0.0221***
			(0.00552)			(0.00535)			(0.00536)
Bk fixef effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	10212	10212	10212	10212	10212	10212	10212	10212	10212
R^2 Adjusted	0.578	0.578	0.580	0.580	0.580	0.582	0.594	0.595	0.596

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $PBOND$ Dummy variable equal to 1 if the borrower issued a public bond in the last three years prior to the loan; $PBOND\ IG$ Dummy variable equal to 1 if the borrower issued a public bond which was rated investment grade in the last three years prior to the loan; $PBOND\ BG$ Dummy variable equal to 1 if the borrower issued a public bond which was rated below investment grade in the last three years prior to the loan; $RELATIONSHIP$ Dummy variable equal to 1 if the borrower took out at least one loan from the lender of the current loan in the previous three years; Sample limited to borrowers with a lending relationship with their bank ($RELATIONSHIP = 1.$); All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10. Bank cost of bond financing and loan spreads the bank charges non-relationship borrowers.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$LBBBSPD_b$	0.314***	0.160**	0.120*	0.312***	0.160**	0.119	0.313***	0.141**	0.103
	(0.0349)	(0.0679)	(0.0734)	(0.0427)	(0.0668)	(0.0722)	(0.0429)	(0.0622)	(0.0672)
$PBOND$				-0.0618**	-0.0617**	-0.0668**			
				(0.0269)	(0.0270)	(0.0279)			
$PBOND$ x $LBBBSPD_b$				0.0118	0.00970	0.00117			
				(0.0489)	(0.0498)	(0.0503)			
$PBOND\ IG$							-0.189***	-0.190***	-0.194***
							(0.0309)	(0.0309)	(0.0317)
$PBOND\ BG$							0.199***	0.203***	0.197***
							(0.0313)	(0.0322)	(0.0328)
$PBOND\ IG$ x $LBBBSOD_b$							0.0259	0.0233	0.0150
							(0.0585)	(0.0598)	(0.0609)
$PBOND\ BG$ x $LBBBSOD_b$							0.0942	0.0937	0.0858
							(0.0743)	(0.0751)	(0.0749)
$LBBBSPD_l$		0.167**	0.174**		0.166**	0.174**		0.186***	0.194***
		(0.0718)	(0.0729)		(0.0721)	(0.0734)		(0.0669)	(0.0680)
LIBOR			-0.0173***			-0.0186***			-0.0173***
			(0.00500)			(0.00506)			(0.00501)
Bk fixef effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	5855	5855	5855	5855	5855	5855	5855	5855	5855
R^2 Adjusted	0.534	0.535	0.536	0.535	0.536	0.536	0.547	0.548	0.549

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $PBOND$ Dummy variable equal to 1 if the borrower issued a public bond in the last three years prior to the loan; $PBOND\ IG$ Dummy variable equal to 1 if the borrower issued a public bond which was rated investment grade in the last three years prior to the loan; $PBOND\ BG$ Dummy variable equal to 1 if the borrower issued a public bond which was rated below investment grade in the last three years prior to the loan; $RELATIONSHIP$ Dummy variable equal to 1 if the borrower took out at least one loan from the lender of the current loan in the previous three years; Sample limited to borrowers with no lending relationship with their bank ($RELATIONSHIP = 0$.); All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 11. Bank cost of bond financing and loan spreads of relationship borrowers.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$LBBBSPD_b$	0.307***	0.171***	0.127***	0.266***	0.130***	0.0863**
	(0.0356)	(0.0369)	(0.0418)	(0.0349)	(0.0346)	(0.0378)
$RL\ PBOND\ IG$	-0.268***	-0.268***	-0.271***			
	(0.0231)	(0.0229)	(0.0232)			
$RL\ PBOND\ IG$ x $LBBBSPD_b$	-0.0991***	-0.104***	-0.105***			
	(0.0283)	(0.0276)	(0.0274)			
$RL\ NOACCESS$				0.0550***	0.0561***	0.0578***
				(0.00973)	(0.00960)	(0.00915)
$RL\ NOACCESS$ x $LBBBSPD_b$				0.0466*	0.0458*	0.0507**
				(0.0254)	(0.0249)	(0.0250)
$LBBBSPD_l$		0.146***	0.152***		0.145***	0.150***
		(0.0409)	(0.0395)		(0.0406)	(0.0397)
LIBOR			-0.0214***			-0.0203***
			(0.00524)			(0.00573)
Bk fixef effects	YES	YES	YES	YES	YES	YES
Observations	16067	16067	16067	16067	16067	16067
R^2Adjusted	0.570	0.570	0.572	0.559	0.560	0.561

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $RL\ PBOND\ IG$ Dummy variable equal to 1 if the borrower has a lending relationship with the lender (the borrower took out at least one loan from the lender of the current loan in the previous three years) and it issued a public bond which was rated investment grade in the last three years prior to the loan; $RL\ NOACCESS$ Dummy variable equal to 1 if the borrower has a lending relationship with the lender (the borrower took out at least one loan from the lender of the current loan in the previous three years) and it has never issued a public bond or did it only more than three years ago. All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 12. Bank cost of bond financing and loan spreads of relationship borrowers: Further analysis.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)
$BOND\,CRISIS$	0.154***	0.0629***	0.0784***	0.116***	0.0223	0.0363
	(0.0251)	(0.0194)	(0.0197)	(0.0264)	(0.0254)	(0.0254)
$BOND\,GOOD\,TIMES$	-0.133***	-0.0829***	-0.0676***	-0.131***	-0.0790***	-0.0640***
	(0.0160)	(0.0213)	(0.0219)	(0.0203)	(0.0237)	(0.0237)
$RL\,PBOND\,IG$	-0.235***	-0.233***	-0.236***			
	(0.0265)	(0.0261)	(0.0277)			
$RL\,PBOND\,IG{\times}CRISIS$	-0.0575**	-0.0611**	-0.0584**			
	(0.0250)	(0.0255)	(0.0241)			
$RL\,PBOND\,IG{\times}GOOD\,TIMES$	0.00943	0.0110	0.00959			
	(0.0426)	(0.0428)	(0.0422)			
$RL\,NOACCESS$				0.0184	0.0192	0.0178
				(0.0218)	(0.0211)	(0.0223)
$RL\,NOACCESS{\times}CRISIS$				0.0593*	0.0591*	0.0635*
				(0.0336)	(0.0325)	(0.0336)
$RL\,NOACCESS{\times}GOOD\,TIMES$				0.0129	0.0111	0.0110
				(0.0223)	(0.0219)	(0.0229)
$LBBBB_l$		0.173***	0.126***		0.177***	0.132***
		(0.0431)	(0.0376)		(0.0431)	(0.0370)
LIBOR			-0.0281***			-0.0276***
			(0.00678)			(0.00716)
Bk fixef effects	YES	YES	YES	YES	YES	YES
Observations	15200	15200	15200	15200	15200	15200
R^2Adjusted	0.576	0.577	0.579	0.566	0.567	0.569

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $BOND\,CRISIS$ and $BOND\,GOOD\,TIMES$ are defined as in Table 7. $LBBBSPD_b$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the bank's most recent bond issue prior to the loan; $LBBBSPD_l$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds at the time of the loan; $LIBOR$ Three month-level Libor at the time of the loan. $RL\,PBOND\,IG$ Dummy variable equal to 1 if the borrower has a lending relationship with the lender (the borrower took out at least one loan from the lender of the current loan in the previous three years) and it issued a public bond which was rated investment grade in the last three years prior to the loan; $RL\,NOACCESS$ Dummy variable equal to 1 if the borrower has a lending relationship with the lender (the borrower took out at least one loan from the lender of the current loan in the previous three years) and it has never issued a public bond or did it only more than three years ago. All models include the controls used in model 6 of Table 3. See definitions of controls in Table 1. Robust standard errors clustered by bank in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.