Do banks propagate debt market shocks?

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Abstract

Over the years, U.S. banks have increasingly relied on the bond market to finance their business. This created the potential for a link between the bond market and the corporate sector whereby borrowers, including those that do not rely on bond funding, became exposed to the conditions in the bond market. We investigate the importance of this link. Our results show that when the cost to access the bond market goes up, banks that rely on bond financing charge higher interest rates on their loans. Banks that rely exclusively on deposit funding follow bond financing banks and increase the interest rates on their loans, though by smaller amounts. Further, banks pass the bond market shocks predominantly to their risky borrowers that have access to the bond market and to their borrowers that do not have access to the bond market. These results show that banks propagate shocks to the bond market by passing them through their loan policies to their borrowers, including those that do not use bond financing.

1 Introduction

Traditionally banks have funded their business with deposits. This made it easier for them to shield corporate borrowers from shocks to the debt markets. Increasingly, however, banks are relying on the bond market to finance their business. This has the potential of making bank borrowers, including those that do not rely on bond funding, exposed to the conditions in the bond market. In this paper, we seek evidence of this role of banks as propagators of bond market shocks onto the corporate sector.

In a Modigliani and Miller world with complete markets and no information frictions, the two sides of a firm's balance sheet, including those of a bank, are independent. Absent these conditions, such separation no longer holds and the capital structure of banks will likely affect their loan policy. Consistent with this thesis, Berlin and Mester (1999) report that banks with more core deposits smooth loan interest rates in response to adverse economic shocks, a finding which the authors argue is feasible because core deposits are largely interest rate inelastic.[1] Mester, Nakamura and Renault (1998) document that checking accounts provide information about borrowing firms' transactions, which in turn provide information about the firms' financial condition thereby influencing banks' lending policies. More recently, Kuttner, and Palia (2002), Steffen and Wahrenburg (2008) and Santos and Winton (2009) show that bank capital plays a role in banks' lending policy. These studies report that banks with low capital charge higher rates, particularly to borrowers that are bank dependent, a finding consistent with Boot, Greenbaum, and Thakor's (1993) theory of bank capital.[2] Santos and Winton (2009), in addition, find that banks with low level of capital charge higher spreads for borrowers with low cash flow but offer bigger discounts to borrowers with high cash flow, a result which supports Diamond and Rajan's (2000) theory of bank capital.[3] In this paper, we add to this literature by investigating the potential effect on banks' loan pricing policies of another component of banks' capital structure, bond financing.

Banks rely increasingly on the bond market to fund their business. At the end of 1988,

[1] Berger and Udell (1992) document that bank loan rates move in a smoother fashion than the market interest rate, but they interpret this finding as evidence of implicit risk sharing agreements.

[2] According to Boot, Greenbaum, and Thakor's (1993) theory of bank capital, banks with low capital are likely to sacrifice reputational capital by reneging on implicit guarantees to improve their financial capital position. Since one of banks' implicit guarantees is the commitment not to exploit their monopoly power over borrowers, those banks are likely to charge higher rates on their dependent borrowers.

[3] According to Diamond and Rajan's (2000) theory of bank capital, banks with low capital are very focused on obtaining cash flow quickly to improve their capital stance. As a result, banks with low capital will charge more to borrowers with low cash flow and give big discounts to borrowers with high cash flow in order to raise their capital standards.

the first year of our sample, the share of bond financing relative to deposit funding was 3.5% among the top 100 U.S. banks. By the end of 2007, the last year of our sample, that share had gone up to 9%. Banks' use of bond financing can have implications that go far beyond the disciplining role that bondholders may exercise on banks.[4] In particular, it may create a 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. This link is important because it exposes corporate borrowers, including those that do not rely on bond financing, to the conditions in the bond market. We attempt to detect evidence of that link in this paper and to identify which corporate borrowers have become more exposed to shocks to the bond market as a result of it.

We hypothesize that banks that rely on bond financing adjust their loan pricing policies in response to changes in the cost to issue in the bond market. Specifically, we hypothesize that when the cost to issue in the bond market goes up, banks that use bond financing increase the interest rates on their corporate loans. Building on the theories of Sharpe (1990) and Rajan (1992) on bank information monopoly, we further hypothesize that on these occasions banks will increase interest rates for bank-dependent borrowers that do not have access to the bond market. Since there is less information available about these borrowers, if they seek to switch to a new funding source they will be pegged as lemons regardless of their true financial condition. As a result, banks that rely on bond financing will try to pass on to these borrowers the cost increase arising from their exposure to the bond market.[5] Regarding borrowers that have access to the bond market, since there is more information available about them, banks will likely find it more difficult to hold them up and pass on to them part of that additional cost of funding. On the other hand, since on these occasions the alternative funding source that these borrowers have access to — bond financing — is also more expensive, banks may take advantage of this to increase interest rates on loans to these borrowers as well.[6] In that case, among the borrowers that do not depend on bank financing exclusively, those that are risky are more likely to see the interest rates on their bank loans go up because the cost they

[4]Research on banks' use of bond funding has focused almost exclusively on the potential disciplining role it may have on banks by investigating whether the credit spreads on bank bonds vary with their risk. Avery, Belton and Goldberg (1988) and Gorton and Santomero (1990), find that credit spreads on bank subordinated debentures were virtually unrelated to traditional accounting measures of bank risk, but subsequent studies, including Flannery and Sorescu (1996) and Sironi (2003), find a relationship between the credit spreads on bank subordinated debentures and risk.

[5]For evidence in support of the hypothesis that banks price their informational monopoly see Santos and Winton (2008), Hale and Santos (2008) and Schenone (2009).

[6]For evidence on the impact of the state of the economy on ex ante bond credit spreads, see Santos (2006), Bernanke (1993), and Fama and French (1989).

pay to access the bond market tends to increase by more in periods when there are shocks to the bond market.

Banks that rely exclusively on deposit funding are not exposed to the conditions in the bond market. As a result, they do not have the pressure to adjust their loan pricing policy in response to an increase in the cost of bond financing. In fact, these banks could take advantage of these occasions and attempt to attract some borrowers from the former banks, in particular those borrowers for which more information is available and thus which have lower switching costs, by offering them loans under better terms than their incumbent banks. On the other hand, because those banks that rely exclusively on deposit funding are overwhelmingly smaller institutions, they may find it difficult to compete with larger banks and may instead choose to follow bond financing banks and increase the interest rates on their corporate loans when it becomes more expensive to raise funding in the bond market. In this case, however, we would expect them to increase the interest rates on their loans by less or at most by the same amount as the bond funding banks.

To test these hypotheses, we start by investigating whether banks' loan pricing policies vary with the cost of access to the bond market as determined by the primary yield on triple-B rated bonds over the primary yield on triple-A rated bonds.[7] We proceed by investigating whether banks propagate shocks to the cost of access to the bond market to all of their corporate borrowers. We are particularly interested in finding out whether borrowers that do not rely on bond financing are nonetheless exposed to the conditions in the bond market via their banks.

Our results show that, other things being equal, banks that use bond financing on average charge about 25 basis points less on their loans than banks that rely exclusively on deposit financing. Our results also show that when the cost to access the bond market goes up, banks that rely on bond financing increase interest rates on their loans. When that happens, these banks increase interest rates on their loans to borrowers that themselves use bond financing, in particular those that are riskier. They also increase interest rates on their loans to borrowers that do not use bond financing and are therefore likely dependent on banks for funding.

We further find that when the cost to access the bond market goes up, smaller banks that rely exclusively on deposit funding follow banks that are directly exposed to bond market conditions and increase the interest rates on their loans, though by smaller amounts. We

[7]We proxy the cost of access to the bond market by the primary yield spread of triple-B rated bonds over triple-A bonds because all banks are rated investment grade. Further, the indexes on the yields of below investment grade bonds go back only to February 1990 while those on investment grade rated bonds are available for our entire sample period.

do not find significant differences in the interest rate increases between bank-dependent and non-bank-dependent borrowers of deposit funding banks.

Our analysis relies on some assumptions. One assumption is that the triple-B primary yield spread captures the additional cost that banks with bond financing incur when there are shocks to the bond market. While this spread is correlated with the cost to issue in the bond market, a potential concern is that this spread may also reflect changes in the overall risk premium in the economy, in which case the effect of the triple-B spread on banks' loan pricing could reflect instead an increase in banks' overall cost of funds. To separate these effects, we control in our models for the cost of deposit funding as proxied by the product between the share of deposit funding used by the bank and the 3-month LIBOR rate.[8] In addition, we investigate the robustness of our findings when we control for other variables that tend to respond to changes in the risk premium demanded by investors, including the Treasury yield spread, the level of LIBOR and the growth rate of the GDP. Under these conditions, we feel confident that our triple-B yield spread proxies for the additional cost of bond financing.

Another assumption is that when spreads in the bond market go up this increases the cost of funds for banks that have bond financing on their balance sheets. Since bonds are fixed rate securities, this implicitly assumes that these banks issue frequently in the bond market and that it is costly for them to delay new issues in order to avoid periods of high bond spreads. To reduce concerns with this assumption, we investigate the loan pricing policies of banks that *did* issue in the bond market during periods of high bond spreads. The results of this investigation confirm that banks that rely on bond financing do propagate shocks to the corporate sector via their loan pricing policies.

Yet another assumption of our analysis is that banks as well as firms access to public bond markets is exogenous. In reality, such access is likely to be endogenous, depending on bank- and firm-specific variables, respectively. To reduce concerns with this endogeneity on the firm side, we reestimate our core models with firm fixed effects. In addition, we follow Faulkender and Petersen (2006) and reestimate our models using a two-step procedure. First, we regress bond market access on a number of exogenous variables including several instrumental variables that proxy for how well known the firm is. We repeat similar procedure for the bank access to the bond market. We then substitute the predicted value of market access into our loan spread regression. Our results hold without substantial change.

Our paper is close to Berlin and Mester (1999) and in our view it complements their

[8]We cannot use banks' interest expenses to proxy for the cost of deposit funding since these expenses also include the interest banks pay on their bond financing. While some banks report interest expenses on deposits directly, only a small subsample of banks do so, making it infeasible to use this variable in our analysis.

work in many important respects.[9] Berlin and Mester focus on a period, the 1970s and the 1980s, where banks funded themselves almost entirely with deposits. We focus on the subsequent decades, when banks started to use bond financing to complement their deposit funding. Berlin and Mester's key finding is that banks' use of deposit funding makes it possible for them to shield borrowers from economywide shocks because deposits are largely interest inelastic. Our investigation shows that banks' use of bond financing makes their borrowers, including those that rely exclusively on bank funding, exposed to shocks to the bond market. Since banks are increasingly relying on bond financing, our finding suggests that it will be increasingly more difficult for banks to shield their borrowers from economywide shocks. Lastly, like Berlin and Mester we have detailed information about bank lenders and their loans.[10] In contrast to them, we 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 likely to be bank dependent or not.

Our findings are important not only because banks are increasingly relying on bond financing, but also because they show that as a result banks will find it increasingly difficult to shield their borrowers from shocks to debt markets and by extension to promote relationship lending, which remains a distinctive feature of banks.[11] Our findings are also important because they show that policies which aim at promoting market discipline have effects that will go far beyond the monitoring of banks by investors. Lastly, our findings show a new mechanism that interlinks the financial intermediation done through banks with the intermediation done through the debt market. A common view in the financial architecture literature is that banks and debt markets operate independently from each other.[12] Holmstrom and Tirole (1997),

[9]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), Paravisni (2006) and Khwaja and Mian (2008). This literature focuses on the lending effects of shocks to bank liquidity. Our focus instead is on the lending effects of shocks to the bond market. Further, we attempt to identify these effects by investigating banks' loan pricing policies rather than through the volume of loans they extend as is common in that literature.

[10]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).

[11]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.

[12]See Allen and Gale (1997, 1999), Bhattacharya and Chiesa (1995), Dewatripont and Maskin (1995) and Boot and Thakor (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 banks' use of bond financing and with cost to access the bond market. Section 4 investigates whether banks pass on the shocks to the bond market to all corporate borrowers. Section 5 reports the results of our robustness tests. Section 6 concludes the paper.

2 Methodology, data, and sample characterization

2.1 Methodology

Our methodology has two parts. Part I investigates whether the interest rates banks charge on their corporate loans vary with banks' use of bond financing and with the conditions in the bond market at the time of the loan. Part II investigates whether banks pass the shocks to the cost they incur to raise bond financing to all of their corporate borrowers, including those that do not have access to the bond market.

2.1.1 Loan interest rates and banks' access to debt markets

We start by investigating whether the interest rates banks charge on their corporate loans vary across banks, depending on whether they rely on bond financing, and with the conditions in the bond market at the time of the loan. We are particularly interested in finding out whether banks, including those that do not rely on bond financing, account for the conditions in the bond market when they extend loans to corporate borrowers. To this end, we estimate the following model of loan spreads:

$$LLOANSPD_{b,f,l,t} = c + \alpha\ SUBDEBT_{b,t-1} + \beta\ LBBBSPD_t + \gamma\ SUBDEBT_{b,t-1} \cdot LBBBSPD_t + \sum_{i=1}^{I} \psi_i B_{i,b,t-1} + \sum_{j=1}^{J} \zeta_j F_{j,f,t-1} + \sum_{k=1}^{K} \nu_k L_{k,l,t} + \epsilon_{f,t}. \quad (1)$$

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. 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.

$SUBDEBT_{b,t-1}$ is a dummy variable indicating whether bank b has subdebt in its balance sheet at time $t-1$. This is our proxy for a bank's reliance on bond funding. Since $SUBDEBT$ does not take into account when banks issued their bonds, in Section 5, we investigate what happens to our findings when we account for the timing of banks' bond issuance activity. Besides being an indicator of bank access to public debt markets, $SUBDEBT$ may also capture an effect related to bank capital since subdebt may act (within certain limits) as a substitute for bank equity capital. Bond financing is likely more expensive that deposit funding because it does not benefit from deposit insurance. On the other hand, subdebt is likely less expensive than bank capital. Thus the effect of subdebt on loan spreads, measured by α, could be either positive or negative.

$LBBBSPD_t$ is the natural log of the spread between triple-B and triple-A primary yields on new bonds issued at time t. This is our proxy for the cost to access the bond market at time t. This spread tends to increase in times when it is harder to access the bond market. The coefficient on this variable, β, measures the elasticity of loan spreads with respect to the cost of access the bond market.

We hypothesize that when the cost to access the bond market increases, banks that rely on the bond market to fund their business will pass on to their borrowers *part* of the additional funding cost they incur. As a result, we expect $0 < \gamma + \beta \leq < 1$ with $\gamma > 0$. On these occasions, banks that rely exclusively on deposit funding may choose not to alter their loan pricing policies in an attempt to attract some borrowers of the former banks. Alternatively, since these banks are usually smaller, they may choose to follow bond financing banks and also increase the interest rates on their loans. In other words, we expect $\beta \geq 0$. We estimate these effects controlling for a set of bank-, firm-, and loan-specific variables, $B_{i,b,t-1}$, $F_{j,f,t-1}$, and $L_{k,l,t}$, 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 $LSALES$, 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.

The next subset 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.

Our next set of 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).[13] 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).[14] 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 NWC, 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

[13]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.

[14]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. A relationship may give the firm the benefit of a lower spread, but it may also indicate greater information monopoly, leading to higher spreads.[15] 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 ($TERM\ LOAN$). Since loan controls can be jointly determined with loan spreads, we estimate our models both with and without the set of loan controls.

Our final set of variables controls for aspects related to banks that are also likely to play a role in their loan pricing policies. $LASSETS$, 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, 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.[16] For the same reason we expect

[15] Bharath, Dahiya, Saunders, and Srinivasan (2008) 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.

[16] 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.

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. In addition, 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, again leading to lower loan spreads. Lastly, to reduce concerns that the proxy we use to capture the cost to raise funding in the bond market, $BBBSPD$, may also pick up changes in the cost of bank deposits, we control for the cost of deposit funding, $DEPOSIT\ COST$, as proxied by the product of the bank's deposit-to-asset ratio with LIBOR.[17]

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

In the second part of our methodology, we investigate whether banks pass the bond market shocks to all of their borrowers. We are particularly interested in learning whether bank-dependent borrowers, that is borrowers that do not have access to the bond market, are exposed to these shocks. We are also interested in finding out whether borrowers with access to the bond market are exposed to those shocks. These borrowers tend not to be bank dependent in good times, but they may become dependent on banks for funding when the conditions in the bond market deteriorate, in which case they may also become exposed to shocks to the bank's bond funding costs.

To investigate these issues, we distinguish bank-dependent borrowers from borrowers that have access to the bond market. Our loan pricing model already distinguishes between banks that use bond financing and those that rely exclusively on deposit funding, and it attempts to compare how each of these banks react to changes in the cost of bond financing. Thus, to avoid adding a third level of interaction terms in order to account for different types of borrowers, we opted for estimating the following modified version of our loan pricing model separately for the two types of banks in our sample: those with subordinated debt and those without.

[17] Call report data contain information on banks' total interest expenses. They also contain separate information on interest expenses related to deposit financing and interest expenses related to subdebt, but the information on these costs is missing for a significant number of observations in our sample. In Section 5 we discuss what happens to our key findings when we control for the cost of deposit funding by the interest expenses banks incur with their deposits.

$$LLOANSPD_{b,f,l,t} = c + \eta\, MACCESS_{f,t-1} + \beta\, LBBBSPD_t + \gamma\, MACCESS_{f,t-1} \cdot LBBBSPD_t + \sum_{i=1}^{I} \psi_i B_{i,b,t-1} + \sum_{j=1}^{J} \zeta_j F_{j,f,t-1} + \sum_{k=1}^{K} \nu_k L_{k,l,t} + \epsilon_{f,t}, \quad (2)$$

where $LLOANSPD_{b,f,l,t}$ and $BBBSPD_t$ are as defined in part I above.

$MACCESS_{f,t-1}$ is our proxy for borrowers' access to the bond market. Firms with access to the public bond market are less likely to be bank-dependent. These firms can tap a large number of reasonably well informed investors. In addition, there is more information available on them. There is information on these firms which arises from their filings to register bonds, information that their underwriters disclose in their effort to place bonds with investors, information from bond spreads and bond analysts, and from the credit ratings assigned by rating agencies. This reduces the extent to which lenders can hold-up these firms for higher interest rates á la Sharpe (1990) and Rajan (1992). Thus, we expect to have $\eta < 0$ and $\beta > 0$ with $\beta + \gamma \geq 0$ for borrowers that take out loans from bond financing banks. For borrowers that take out loans from banks that rely exclusively on deposit funding we also expect to have $\eta < 0$ for the same reasons. However, in this case, we expect to find a smaller effect or even no effect of the cost to access the bond market, $LBBBSPD$, on the spreads these borrowers pay on their loans. In other words, $\beta > 0$ and γ are less likely to be significant in the sample of loans extended by deposit funding banks.

We consider two alternative approaches to determine whether a borrower has access to the bond market. Under the first approach, we assume that if a borrower has a credit rating at the time of the loan then it has access to the bond market. This assumption follows the evidence that firms usually need to have a credit rating to issue in the public bond market. A potential problem with this definition of non-bank-dependent firms, however, is that some of the firms with a credit rating may have never issued in the public bond market or did it only a long time ago. Since these firms are more likely to be dependent on banks than rated firms that issued in that market recently under our second approach, we distinguish bank-dependent borrowers from nondependent borrowers by whether they have issued in the public bond market in the recent past (for the purpose of our tests we define the recent past as the five-year period prior to the loan).[18]

[18]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

Since according to Rajan (1992) the holdup problem is more acute for risky firms than safe firms, we further 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. When we classify firms as bank dependent or not according to whether they have a credit rating, we use the rating of the firm to determine if they are rated investment grade or below investment grade at the time of the loan. When we classify firms as bank dependent or not according to whether they have issued at least once in the public bond market in the five years prior to the loan, we use the rating of the firm's most recent public bond (prior to the loan) to determine whether it is rated investment grade or below investment grade.

As in part I, we estimate whether banks pass the shocks to the bond market differently to bank-dependent and non-bank-dependent borrowers, controlling for the set of bank-, firm-, and loan-specific characteristics, $B_{i,b,t-1}$, $F_{j,f,t-1}$, and $L_{k,l,t}$. Further, since loan controls can be jointly determined with loan spreads, as in part I, we estimate our models both with and without the set of loan controls.

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 the firms that borrowed from banks and when they did so. Most but not all of the loans in this database are syndicated. It goes as far back as the beginning of the 1980s. In the first part of that decade the database has a somewhat limited number of entries but its comprehensiveness has increased steadily over time, which is why we begin our sample in 1987. Our sample ends in December 2007. We also use the Dealscan database to obtain the following information: individual loan characteristics, including the loan's spread over LIBOR, maturity, seniority status, purpose and type; borrower characteristics, including its sector of activity and its legal status (private or public firm); and finally, the identity and role of the banks in the syndicate.

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. This database contains information on the bonds issued in the United States by American corporations since 1970. We also rely on this database

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.

to identify some features of the bonds issued by the firms in our sample, including issuance date, credit rating, and whether they were publicly placed.

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 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.[19] 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 the Salomon Brothers yield indices on new industrial long-term bonds to control for the conditions in the bond market at the time firms take out loans from banks. We consider the indices on yields of triple-A and triple-B rated bonds because these go further back in time than the indices on the investment grade and below investment grade bonds.

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, including the bank's capital-to-asset ratio, its size, profitability, risk, and information on whether it uses bond financing.

2.3 Sample characterization

Table 1 characterizes our sample of 19930 loans. These loans are extended by 381 banks over the years 1987-2007 to 4222 borrowers. The top panel compares the 205 banks that had bond financing at the time of their loans with the 251 banks that had only deposit financing at the time of their loans.[20] The middle panel compares the 18033 loans in the sample that the former banks extended with the 1897 loans extended by banks that rely exclusively on deposit funding. Finally, the bottom panel of the table compares the borrowers of these two sets of loans.

Looking at the top panel, it is apparent that, compared to banks that rely exclusively

[19]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.

[20]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.

on deposit funding, banks that use bond financing are larger, hold less liquidity, operate with a lower deposit-to-asset ratio, and spend less on deposit funding according to the two proxies we consider for the cost of this funding source, $DEPOSITCOST$ and $INTEXPENSE$.[21] Despite these differences, bond financing banks appear to be less profitable since they have a lower ROA. Further, these banks may not be safer. Their ROA is less volatile, but they have a lower capital-to-asset ratio ($CAPITAL$), and higher charge-offs ($CHARGEOFFSS$), though in the latter case the difference with deposit funding banks is not statistically significant.

In the middle panel of the table we see that bond financing banks charge on average 72 basis points less on their loans than banks that rely exclusively on deposit financing. This difference may be because former banks extend significantly larger loans or because they are more likely to extend loans to relationship borrowers. It may also arise because bond financing banks extend more loans to borrowers that are not bank dependent. As we can see from the bottom panel of the table, a larger portion of the borrowers of those banks have a credit rating and therefore are likely to have access to the bond market themselves. A larger portion of the borrowers of bond financing banks has also 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. Although in this case, as we can see from the bottom panel, the evidence appears to be mixed. Compared to borrowers of deposit funding banks, borrowers of bond financing banks are on average older, larger, have better profit margins and higher net working capital, and have more growth opportunities. All of these features suggest that bond financing banks tend to extend loans to safer borrowers. However, 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, the difference in the interest rates that these banks charge on their loans to corporate borrowers may reflect differences in their costs of funding, including their use of bond financing. As we noted above, 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.

In Table 2, we look more closely at the questions we pose in this paper. To ascertain

[21] As we noted above, since the information on interest expenses banks incur on their deposits, $INTEXPENSE$, is missing for 6921 of the 19930 observations in our sample, we also proxy for banks' expenses with their deposits by $DEPOSITCOST$, which we compute as the product between the ratio of deposits over assets and the three-month LIBOR.

whether there is a link between banks' loan pricing policies and their bond funding costs, we compare in the top panel of the table the loan interest rates that deposit funding and bond funding banks charge when the cost to access the bond market is low and high; meaning that $BBBSPD$ is in the lowest and highest quartiles of the distribution of this variable. Consistent with our priors, the results show that when the conditions in the bond market deteriorate, banks that rely on bond financing increase the interest rates they charge on their loans by 38 bps. On those occasions banks that rely exclusively on deposit funding also increase their loan interest rates by 53 bps. Contrary to our expectations, deposit funding banks appear to react more to the increase in the cost of raising funds in the bond market than bond financing banks, though the difference between the increase in spreads by the two groups of banks is not statistically significant.

The bottom panel of Table 2 reports whether all borrowers are exposed to the shocks in banks' funding costs. To that end, we classify each borrower that does not have a credit rating at the time of the loan to be bank dependent while those that have a credit rating are classified as non-bank dependent. In line with our expectations, bank-dependent borrowers appear to be more exposed to those shocks. Note though that borrowers that are not bank dependent also suffer from an increase in interest rates, possibly because the alternative funding source they have access to—bond financing—also becomes more expensive on those occasions. Bank dependent borrowers that take out loans from banks that rely on bond financing on average pay an additional 51 bps on their loans when the cost to access the bond market goes up. On these occasions, non-bank dependent borrowers that take out loans from these banks pay only an additional 44 bps on their loans. For banks that rely exclusively on deposit funding, we find a similar pattern: bank-dependent borrowers are forced to pay an additional 55 bps while non-bank-dependent borrowers pay only an additional 42 bps. It is worth noting though that on either occasion the difference in the increase in the loan interest rates of these groups of borrowers is not statistically significant.

In sum, the results of our sample characterization suggest that banks, including those that rely exclusively on deposit funding, adjust their loan pricing policies in response to changes in the cost to raise funding in the bond market. Our results also suggest that all borrowers are exposed to these changes in bank policies. As a consequence, borrowers that do not rely on the bond market become exposed to the conditions in the bond market. In other words, it appears that banks by using the bond market to fund their business, expose *all* corporate borrowers to the conditions in the bond market. In the rest of this paper, we look at this link that banks create between the bond market and their corporate borrowers more closely, using multivariate analysis.

3 Do banks pass bond market shocks on to borrowers?

We investigate in this section whether banks' access to the bond market creates a link between the cost to issue in that market and the interest rates banks charge on their corporate loans. In the next section we investigate whether this link has a bigger effect on borrowers that are dependent on banks for external funding. We then proceed with a series of robustness tests to our key results.

Table 3 reports the results of our tests of whether banks, including those that do not rely on bond financing, adjust their loan interest rates in response to changes in the cost to access the bond market. Model 1 compares the loan pricing policies of banks that use bond financing with the policies of banks that fund their business solely with deposits, controlling for our set of borrower-specific characteristics, F. Model 2 expands model 1 to investigate whether these two sets of banks adjust their loan pricing policies differently in response to changes in the cost to access the bond market as determined by the log of the yield spread of triple-B over triple-A rated bonds, $BBBBSPD$. Models 3 and 4 investigate if the insights of model 2 continue to hold when further control for our sets of loan-specific, L, and bank-specific controls B. Finally, model 5 further expands model 4 to account for the cost of deposit funding.

Looking at model 1, it is apparent that banks that rely on bond financing extend loans at lower interest rates. The coefficient on the dummy variable we use to control whether the bank uses bond financing, $SUBDEBT$, is equal to -0.14 indicating that, on average, spreads on loans extended by bond financing banks are about 14 percent, or 24 basis points when evaluated at sample mean, lower than on loans extended by banks that rely exclusively on deposit funding. Model 2 shows that these savings go down when the cost to raise funding in the bond market goes up. Since the coefficient on $SUBDEBT$ x $LBBBSPD$ is positive and statistically significant, this indicates that bond financing banks increase the spreads on their loans when the cost to access the bond market goes up. Importantly, this model also shows that when this happens, deposit financing banks follow the former banks and increase the interest rates on their loans, though by a smaller amount, as represented by a positive and statistically significant coefficient on $LBBBSPD$. According to the estimates of model 2, when the triple-B yield spread in the bond market doubles,[22] deposit funding banks increase their loan spreads by 10.2 percent (which, given the mean of loan spread of these banks of 234 basis points, corresponds to an increase of about 23.9 basis points), while it leads bond funding banks to increase their loan spreads by 27.5 percent (which, given the mean loan spreads for this group of banks of 162 basis points, corresponds to an increase of about 44.6 basis points).

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

The firm controls we use in models 1 and 2 are generally consistent with our discussion in the methodology section. Older and larger firms and firms with more interest coverage, tangibles and growth opportunities pay lower spreads on their loans. Firms that borrow from relationship banks are also able to borrow at lower interest rates. In contrast, 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 3 and 4 show that the above findings continue to hold when we account for loan controls and bank controls, respectively. Bond financing banks increase the interest rates on their corporate loans when the cost they incur to raise bond financing goes up. When that happens, deposit funding banks follow suit and increase interest rates on their loans, though by a statistically significantly smaller amount. Loan controls are consistent with our expectations as discussed in the methodology section. 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 loans with these covenants carry higher spreads. Finally, term loans and credit lines carry lower spreads. Refinance loans and loans for working capital pay higher spreads. With respect to bank controls, our results confirm that banks that incur larger losses charge higher spreads on their loans while those with higher capital-to-asset ratios charge lower spreads. None of the remaining bank controls are statistically significant, but their signs are generally consistent with expectations.[23]

Despite the large set of factors we account for with our controls, a potential concern with our result that deposit funding banks follow bond financing banks and adjust the interest rates on their loans when the cost to access the bond market goes up is the possibility of a third factor explaining this link. In particular, the set of bank controls we use in model 4 does not account for a potentially important determinant of a bank's cost of funds — the cost it incurs to raise deposit funding. If this cost is strongly correlated with our proxy for the cost to access the bond market, this could explain some of our findings.[24] To investigate this possibility, we expand our set of bank controls to account for the cost a bank incurs to raise deposit

[23]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.

[24]It is unlikely to explain the entirety of our results because deposit funding banks rely more heavily on this source of funding than bond financing banks and yet they adjust their loan interest rates by less when the cost of bond financing goes up. Moreover, for the subsample of banks for which we have interest expenses on deposits, the correlation between these expenses as a share of assets and triple-B spread is only 3.8 percent.

funding. The results of this test, which are reported in model 5, show that the cost of deposit funding increase loan interest rates though by an amount that is not statistically different from zero. More importantly, the results of model 5 confirm our earlier findings: When it becomes more expensive to raise bond financing, banks that rely on this source of funding pass on part of these additional costs to their corporate borrowers. On those occasions, deposit funding banks, which are smaller and thus likely to follow the former banks, also choose to increase the interest rates they charge their corporate borrowers, though by a smaller amount than the former banks.

In sum, the findings we reported in this section show that banks propagate shocks to the bond market to the corporate sector. According to our estimates the effect of these shocks on loans spreads is economically significant. In times of crises in the bond market, it will lead banks that rely on bond financing to increase spreads on their loans in excess of 45 basis points. Further, our findings indicate that deposit funding banks 'follow" bond financing banks and increase interest rates on their loans on these occasions, though by a smaller amount (24 basis points).

It is not clear though from the results we reported thus far whether banks expose all borrowers to those shocks. It is possible that when the conditions in the bond market deteriorate, banks increase interest rates on their loans only to borrowers that also happen to use this funding source while shielding the remaining borrowers from these shocks. It is also possible that banks pass that cost increase mostly on to the latter borrowers since they are more dependent on banks for external funding. This difference is important because it highlights the extent of banks' propagation of the conditions in the bond market to their corporate borrowers. We investigate this issue in the next section.

4 Do banks pass bond market shocks to all borrowers?

The tests we reported in the previous section distinguish between banks that do and those that do not use bond financing, but do not distinguish between bank borrowers that do and those that do not rely on this funding source. Identifying these borrowers will help us understand how bond financing banks transfer the additional cost they incur when there are shocks to the bond market. A reason is that borrowers that do not rely on bond financing are more likely to be bank dependent. As such, they are more vulnerable to banks' needs to make up for the additional cost they incur when it becomes more expensive to raise bond financing. Borrowers that have access to the bond market are less likely to be bank dependent and as a result are less exposed to those pressures on banks. On the other hand, since these pressures arise from an increase in the cost of bond financing this will also increase the cost of the alternative source

of funding available to these borrowers, thereby giving banks an opportunity to increase the interest rates on their loans to them.

To investigate these possibilities, we estimate our loan pricing model separately for banks that use bond financing and those that rely exclusively on deposit funding. Further, we expand this model to distinguish whether each borrower is bank dependent or not. As we noted in the methodology section, we consider two alternative ways to identify bank-dependent borrowers. Under the first approach, we assume a borrower that does not have a credit rating to be bank dependent. Since not all rated firms have access to the public bond market, either because they never issued in this market or only did it a long time ago, under our second approach we classify as bank dependent all borrowers that did not issue in the public bond market recently (over the five years prior to the loan). Further, since according to Rajan (1992) the holdup problem is more pronounced to risky firms than safe firms, we further 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 are reported in Table 4. In the interest of space, we report only the coefficients relevant for each test and the coefficients that show banks' loan pricing response to shocks to the bond market. All models, however, include our sets of firm-, loan-, and bank-specific controls as well as our control for the cost of deposit funding as used in model 5 of Table 3.

Models 1 and 2 investigate how deposit funding and bond funding banks, respectively, adjust their loan pricing policies in response to shocks to the bond market, without differentiating between groups of borrowers. Consistent with our earlier findings, these models show that both banks increase interest rates on their loans when the cost to access the bond market goes up. Also consistent with our earlier findings, these models show that bond financing banks adjust their loan pricing policy by more than deposit funding banks in response to changes in the cost to access the bond market. The elasticity of loan spreads to the triple-B yield spread for loans extended by banks that rely exclusively on deposit funding is 0.11 (model 1 of Table 4). Among loans of bond financing banks, this elasticity is 0.27 (model 2 of Table 4). It is worth noting that these elasticities are very similar to the elasticities we reported in Table 3, even though now we allow for the coefficients on control variables to vary between the two groups of banks.

Models 3 and 4 expand the previous models to distinguish between borrowers that have a credit rating and those that do not. As with models 1 and 2, we continue to find that banks increase interest rates on their loans when the cost to access the bond market goes up and that this effect is larger for banks that use bond financing. However, our results indicate that while deposit funding banks apply a smaller interest rate increase to their non-bank-dependent borrowers and to their dependent borrowers (though the difference is not significant), bond

financing banks apply a larger interest rate increase to their non-dependent borrowers than to their dependent borrowers, and in the difference is statistically significant. Among loans of bond financing banks, the loan-spread elasticity to the triple-B yield spread is 0.30 for loans of borrowers with a credit rating and only 0.23 for loans of unrated borrowers.

Bond financing banks may impose a larger interest rate premium on borrowers with a credit rating than on unrated borrowers when the cost to access the bond market goes up because on these occasions the former borrowers also become dependent on banks for funding. An alternative explanation for this finding is that our proxy for non bank dependent borrowers is too broad and includes also borrowers that are bank dependent. For instance, some borrowers may have a credit rating but they may have not been to the bond market for quite some time. These borrowers are more likely to be bank-dependent than say borrowers that have issued recently in that market. To investigate this possibility, in models 5 and 6, we consider a narrower definition of firms' access to the bond market. We assume that a firm has access to the bond market if it issued a public bond at least once in the five year period before the loan. As in our earlier tests, we continue to find that banks that rely exclusively on deposit funding apply a smaller interest premium to their non-dependent than to their bank-dependent borrowers, though the difference continues to be statistically insignificant. In contrast with our previous findings, however, the new tests show that banks that rely on bond financing increase interest rates on their loans to bank-dependent borrowers by more than they do on their loans to borrowers with access to the bond market. The loan spread elasticity to the triple-B bond yield spread is 0.29 for bank-dependent borrowers and 0.23 for non-dependent borrowers. The difference between these elasticities is statistically significant as indicated by the significance of the interaction term in model 6.

These insights continue to hold when we further split borrowers with access to the bond market into two groups: those that are safe (their most recent public bond issue prior to the loan was rated investment grade) and those that are risky (their most recent public bond issue was rated below investment grade). As we can see from these tests, which are reported in models 7 and 8 of Table 4, there is one important difference vis-á-vis the previous set of models — when the conditions in the bond market deteriorate, banks that rely on bond financing apply their largest increase on loan spreads to their risky borrowers that have access to the bond market. Next in line come the borrowers that are bank-dependent, followed by safe borrowers that have access to the bond market, though the difference between the last two sets of borrowers is not statistically different from zero.

According to models 7 and 8, in periods of crisis in the bond market (the triple-B yield spread more than doubles (see footnote (31) for further details), banks that rely exclusively on deposit funding increase the loan spreads to their bank-dependent borrowers as well as

on their non-bank-dependent borrowers by about 10.8 percent (assuming that during crises triple-B yield spreads double). This increase corresponds to 25 basis points when computed at the mean loan spread charged by these banks. As for banks that rely on bond financing, they increase the loan spreads to their bank-dependent borrowers and those borrowers that issued investment grade bond by 27.5 percent (which corresponds to an increase of 45 basis points when computed at the mean loan spread charged by these banks), while borrowers that issued a bond rated below investment grade see their loans spreads go up by about 36.8 percent (which corresponds to an increase of 60 basis points when computed at the mean loan spread charged by these banks).

In sum, the results we unveiled in this section confirm our earlier findings that both banks that rely on bond financing and those that use exclusively deposit funding increase their loan spreads when the cost to access the bond market goes up, though the former banks impose a larger interest rate premium possibly because their cost of funding goes up by more on these occasions. The results of this section further show that banks do not pass this increase in their cost of funding equally to all of their borrowers. On these occasions, banks that rely on bond financing, for instance, impose the largest interest premium on their risky borrowers that have access to the bond market, possibly because these firms are often shut out of the bond market when the conditions in the bond market deteriorate, making them effectively dependent on banks. Borrowers that do not have access to the bond market face the next largest interest rate premium. Borrowers that have access to the bond market and are rated investment grade are the least exposed to this interest rate premium. We do not find the same differences among borrowers of banks that rely exclusively on deposit funding. This could be because the vast majority of these banks' borrowers are bank dependent. It could also be because these banks are not subject to the same increase in their cost of funding when spreads in the bond market go up. On these occasions, they increase their loan spreads by less than bond financing banks and do it likely only to take advantage of the spread increase promoted by the latter banks, which are probably the leaders of the banking industry.

These findings, if proven to be robust, are quite important. For instance, they show a novel channel — the funding choices of banks — that connects bank funding and market funding. Before we discuss some of the implications of these results, in the next section we present the results of our robustness tests.

5 Robustness tests

We report in this section the results of our robustness tests. We begin with the robustness tests to our findings on banks' response to shocks to the bond market. This is followed by

the robustness tests to our findings on how banks pass the shocks to the bond market to their dependent borrowers and to their borrowers that have access to the bond market. We conclude this section with an investigation of the loan policies of those banks that did issue during crises periods in the bond market.

5.1 Do banks pass bond market shocks on to borrowers? Robustness tests

Our investigation into banks' response to shocks to the bond market shows two important findings: First, when it becomes more expensive to raise funding in the bond market, banks that rely on this source of funding increase the interest rates on their corporate loans. Second, on those occasions, banks that fund themselves exclusively with deposits also increased the interest rates on their corporate loans though by a smaller amount than the former banks.

We report in Table 5 the robustness of these findings when we control for (a) an alternative proxy for the cost of deposit funding, (b) the overall conditions in the economy at the time of the loan, (c) the extent to which banks use bond financing, (d) the potential endogeneity of banks' access to the bond market, and when we (e) cluster the standard errors simultaneously by firm and by bank and (f) account for firm fixed effects. All tests use as a benchmark model 5 of Table 3, which is our most comprehensive model of loan pricing. In the interest of space, we report in that table only the coefficients relevant for each test as well as the coefficients that show banks' loan pricing response to shocks to the bond market.

5.1.1 Controlling for the cost of deposit funding

An important determinant of the cost banks pay to raise funding, and possibly of their loan pricing policy, is the cost of deposit funding. As we saw above, when we control for the cost of deposit, $DEPOSIT\ COST$, as proxied by the product of the bank's deposit-to-asset ratio with LIBOR, our results remain unchanged. As we also noted back then, contrary to expectations the coefficient on this variable while positive is not statistically significant. This may arise because our proxy for the cost of deposit funding does not reflect the cost banks incur to raise deposit funding since it does not capture differences in the interest rates that each bank pays on its deposits. A more accurate proxy for that cost is the interest expenses on deposits reported by each bank, but as we noted earlier 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 our proxy for the cost of deposits, $DEPOSIT\ COST$. In the other case, we complemented that variable with total interest expense reported by banks in the Call

Reports.[25] The results of these two tests are reported in models 2 and 3 of Table 5. Model 1 of that table repeats our original results to facilitate the comparison with the robustness tests we report in this section. As we can see from models 2 and 3, neither of the new proxies for the cost of deposit funding enters the regression with a statistically significant coefficient. More importantly, our key findings remain unchanged when we control for these alternative proxies for the cost of deposit funding.

5.1.2 Controlling for overall economic conditions

Thus far we have attributed the change in banks' loan pricing policies when the spreads in the bond market go up to changes in the cost to banks' accessing the bond market. Could that change in banks' loan pricing policies instead be driven by another factor that we do not account for in our loan pricing model, such as an overall increase in the "price" of risk?

In the previous robustness test we already ruled out a key alternative driver for our findings – the cost of deposit funding. Another set of possible drivers are overall conditions in the economy. Since in good times bond spreads tend to be lower and bank borrowers tend to be in better financial condition, the overall state of the economy could potentially explain our finding that banks increase spreads on their corporate loans when the yield spread in the bond market goes up and reduce their loan spreads when bond spreads goes down. According to this alternative hypothesis, it is not clear though why banks that rely exclusively on deposit funding would adjust their loan pricing policies by less than banks that rely on bond financing. Nonetheless, we undertake three robustness tests to further reduce concerns with this potential explanation to our findings. In the first test we control for the GDP growth rate to account for the overall state of the economy. In the second test we control for the slope of the Treasury yield curve for potential changes in the overall risk premium. Finally, in the third test we control for the level of the base interest rate used in loan spreads — LIBOR. To be more specific, since we are using the log of loan spreads, in the last test we control for the log of the LIBOR.[26]

The results of these tests are reported in models 4, 5 and 6, respectively. All of new controls come out with expected signs and are statistically significant with the exception of

[25] 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.

[26] We obtain similar results when we use control for the level of LIBOR, instead. We do not use the log of the Treasury yield curve because the yield spread is negative (the yield curve is inverted) for some of the observations in our sample. When we exclude these observations and use the log of the yield spread we obtain similar results.

the growth rate of GDP. Adding these controls does not affect our key findings. In other words, even when we control for the state of the economy we continue to find that banks increase spreads on their loans to corporations when the cost to access the bond market goes up. Further, and importantly, we continue to find that on those occasions, banks that rely on bond financing increase the interest rates on their corporate loans by more than banks that rely exclusively on deposit funding.

5.1.3 Controlling for banks' use of bond financing

Our investigation into the way banks adjust their loan pricing policies in response to shocks to the bond market distinguishes banks that rely exclusively on deposit funding from banks that use bond financing in addition to deposit funding, but it does not account for the relative use of bond financing by the latter banks. Our finding that bond financing banks increase their loan spreads by more than deposit funding banks when spreads in the bond market go up suggests that the more banks rely on bond financing, the larger the premium they will apply to their borrowers when the cost of bond financing goes up.

To investigate this possibility we replaced in our model of loan spreads the dummy variable $SUBDEBT$, which identifies those banks that have bond financing, with the variable $SUBASSETS$, which measures the portion of the bank's assets that is funded with bonds. In addition, we replaced the interaction $SUBDEBT$ x $LBBBSPD$ with $SUBASSETS$ x $LBBBSPD$. The results of these tests, which are reported in model 7, continue to show that the coefficient on $LBBBSPD$ is positive and significant. They also show that the coefficient on $SUBASSETS$ is negative and significant, indicating that the more bond financing banks use, the lower the interest rates they charge their borrowers. Consistent with our priors the new results also show that the coefficient on $SUBASSETS$ x $LBBBSPD$ is positive, indicating when the spreads in the bond market go up, the more bond financing the bank uses the higher the interest premium it imposes on its borrowers as a result. However, the effect of this interaction term is not statistically significant.

Since we found in the previous section that safe borrowers that have access to the bond market are the least exposed to the interest rate premium banks impose on their borrowers when bond spreads go up and since bond financing banks lend to a higher proportion of these borrowers, this could explain why that interaction term does not enter the regression significantly. To investigate this possibility, we reestimated the loan spread model 7 after we dropped all borrowers rated investment grade. The new results, which are reported in model 8, support our expectations: when the cost to access the bond market goes up, bond financing banks increase their loan spreads by more than do deposit funding banks and the difference in the interest premium imposed by these banks increases with the amount of bond financing

used by the former banks.

5.1.4 Controlling for endogeneity of banks' access to debt markets

Until now, we have been taking a bank's use of bond financing as exogenous. In reality, such access will likely depend on bank characteristics, making it endogenous.[27] To correct for this, we follow the two-step procedure of Faulkender and Petersen (2006): first, we conduct a probit analysis of the determinants of banks' bond market access, including several instruments that are *not* part of our bank controls, then we use the predicted value of bond market access in a second-stage regression that is analogous to our benchmark model.

The instruments we use are indicators for the bank's visibility. The idea being that the more visible the bank is to potential investors the more likely it is it will used bond financing in addition to deposit funding. One of the variables indicates whether the bank's stock is listed in the stock market. Banks that are listed are likely to have a bigger visibility in the financial community, making it less costly to issue bonds to the investing public. For similar reasons, we include a dummy variable that equals one if the bank's bond issues exceed the minimum amount required to be in Lehman Brothers Corporate Bond Index ($LEHMAN$). Bond investors and analysts are more likely to follow these bonds. As a result, they will have more information about the issuers of these bonds. Although both of these variables tend to correlate with size, note that size itself is included as a separate regressor. Our goal is to try to pick up effects that are incremental to bank size, that is, for a given size, does stock listing favor bond market access?

We estimated in the first stage a Tobit regression of the ratio of subordinated debt to assets and used predicted values to construct a new dummy variable indicating whether predicted subordinated debt is positive. Our instruments are jointly significant with the P-value of 0.04. We report the second-stage results of this procedure in model 9. Again, our two key findings on deposit funding and bond financing banks' responses to shocks to the cost of accessing the bond market remain unchanged.

5.1.5 Clustering simultaneously by firm and by bank

Throughout the paper standard errors are clustered by firm. Since banks extend multiple loans each year this could lead the error term in our regression to be correlated across loans not just for a given firm, but also for a given bank. To address this issue, we follow Petersen (2006) and rerun our core regressions with clustering by bank as well as by firm. The results of this

[27] Faulkender and Petersen (2006), for example, document that nonfinancial firms' access to the bond market is endogenous.

test, which are reported in model 10 of Table 5, show only a negligible increase in the standard errors, suggesting that clustering by firm only is, in fact, appropriate.

5.1.6 Controlling for firm fixed effects

Another potential concern with the results we presented thus far is whether they could be driven by sample selection. To the extent that there are differences between the cohorts of borrowers that take out loans from the two groups of banks and these are observable, we likely account for them through our set of firm controls. That said, there is always a possibility of some unobservable differences. This could explain, for instance, why bond funding banks charge lower spreads on their loans than banks that rely exclusively on deposit funding. It is unlikely to explain why banks increase their loan interest rates when the cost to raise funding in the bond market goes up. It is even less likely to explain why on those occasions deposit funding banks increase their loan interest rates by less than bond funding banks. Nonetheless, to further reduce concerns that sample selection drives our key findings, we re-estimate our loan pricing model with firm fixed effects. The results of this test are reported in model 11 of Table 5. Since our key findings remain unchanged when identified solely by within-firm variation in loan spreads, it is unlikely that sample selection drives our results.

5.2 Do banks pass bond market shocks to all borrowers? Robustness tests

We undertook a set of robustness tests similar to those we report in the previous subsection to investigate the robustness of our findings on the differential response of banks vis-à-vis their bank-dependent borrowers and non-bank-dependent borrowers. All tests build on models 7 and 8 of Table 4, which differentiate between borrowers that do and that do not have access to the bond market, depending on whether they have issued in that market recently, and further distinguish among borrowers that are rated investment grade and those that are rated below investment grade. To facilitate the comparisons we report these models again in the first two columns of Table 6. As with our previous tests, in the interest of space, we report only the coefficients relevant for each test as well as the coefficients that show how banks adjusted their loan pricing policies to their bank-dependent and non-bank-dependent borrowers.

Models 3 though 6 investigate the robustness of our findings when we consider our two alternative measures of banks' cost of deposit funding $DEPOSITCOST1$ and $DEPOSITCOST2$, respectively. Models 7 though 12, in turn, attempt to account for macroeconomic conditions by controlling for the GDP growth rate, the slope of the Treasury yield curve, and the log of LIBOR.[28] Models 13 and 14 show the results of the second-stage approach we consider to

[28] As with the robustness tests we reported in the previous subsection, we get similar results when we use the

investigate the effects of the potential endogeneity of firms' access to the bond market. As before, we follow the two-step procedure of Faulkender and Petersen (2006): first, we conduct a probit analysis of the determinants of firms' bond market access, including several instruments that are not part of our firm controls, then we use the predicted value of bond market access in a second-stage regression that is analogous to model we use in the other robustness tests. The dependent variable of the first stage is our dummy variable which indicates if the firm issued in the public bond market at least once in the last five years. Our instruments are intended to identify firms that are more visible to bond investors. The instruments we use are whether a firm is included in the S&P 500, whether a firm's shares trade on the NYSE, and whether a firm's outstanding bond issues are large enough to merit inclusion in Lehmann's Corporate Bond Index. As discussed in Faulkender and Petersen (2006) and Santos and Winton (2008), these variables correlate with public debt market access but have an impact over and above that induced by our other firm controls.[29] Finally, models 15 and 16 investigate the robustness of our findings when we cluster simultaneously by firm and by bank, and models 17 and 18 investigate what happens to our findings when we estimate our loan pricing models for the deposit and bond financing banks with firm fixed effects.

Since we discussed in detail each of these tests in the previous subsection, in the interest of space here we only discuss the robustness of our findings regarding the extent to which banks pass bond market shocks to their dependent and non-dependent borrowers. The results of the robustness tests confirm the three findings we reported in Section 4. First, both deposit and bond funding banks increase their loan spreads when the cost to access the bond market goes up, but this increase is less pronounced among banks that rely exclusively on deposit funding.

Second, deposit funding banks appear to apply the same interest premium to all of their borrowers, regardless of whether they have access to the bond market. Our results show that these banks apply different premiums to their borrowers in only two instances. When we investigate the effect of the potential endogeneity of firm access to the bond market, we find evidence that deposit funding banks apply a smaller premium to their safe borrowers that have access to the bond market (model 13). However, when we consider firm fixed effects we find that these banks apply a larger premium to these same borrowers.[30]

Third, bond funding banks apply the largest interest premium to risky borrowers that have access to the bond market. Bank dependent borrowers come next and safe borrowers

level of the Treasury yield curve and the level of LIBOR or the log of these variables.

[29] Our instruments are jointly significant at less than 1% level.

[30] It must be noted that only 350 loans in our sample were given by deposit funding banks to borrowers with the access to the bond market and only 157 of those to safe borrowers. Thus, these particular results could be driven by influential observations.

with access to the bond market are the least penalized, though, the difference in their interest premium and that of bank dependent borrowers is sometimes not statistically significant. Again, in only one test we find a slight difference to these results. When we account for the potential endogeneity of firma access to the bond market, we find that even safe firms with access to the bond market pay a higher interest premium than banks dependent borrowers, but not as high as risky borrower with access to the bond market (model 14).

In sum, our robustness tests by and large confirm our earlier findings that banks, particularly those that rely on bond financing, pass bond market shocks predominantly to their risky borrowers that have access to the bond market, possibly because these borrowers are shut out of this market, becoming bank dependent on those occasions, and to their borrowers that do not have access to the bond market and therefore are likely to depend on banks for external funding. Safe borrowers that have access to the bond market are also exposed to these shocks via banks, though, they tend to pay the lower interest rate premium as a result.

5.3 Do banks issue bonds during crises periods?

The results we reported thus far presume that when the spreads on the bond market go up this increases the cost of funding for banks that have bond funding in their capital structure. Since bonds are usually priced as fixed-rate securities, that link implicitly assumes that these banks issue in the bond market regularly or at least with a frequency that makes them likely to issue even in periods when the spreads in the bond market have gone up. Indeed many banks, in particular the larger ones, have bond issuance programs whereby they issue bonds regularly not only because of their funding needs but also to maintain a constant presence in the market and benefit from the bank's visibility in the bond investor community. For example, over the period 2000–2007, five of the largest banks in the country, Citigroup, Bank of America, JP Morgan, Wells Fargo and Vachovia, issued on average 13, 44, 32, 11 and 7 bonds each year, respectively.

Of course if banks, including those that have such bond issuance programs, are able to time their funding needs and avoid issuing bonds when the conditions in the bond market are not favorable, this will weaken the link that we find between spreads in the bond market and banks' cost of funding. Thus, such programs will bias us against finding our results. Nonetheless, to further reduce concerns with this issue we investigated if banks still issue in the bond market when spreads in this market are elevated and if these banks adjusted their loan pricing policies as a result.

To that end, we started by identifying the "crises" in the bond market during the sample period. We defined these crises as extended periods of time where 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).[31] Next, we identified which of the banks issued bonds during these crises. After that, we isolated those borrowers that took out loans during these crises or in the time period immediately after the crisis. We considered two alternative definitions to identify these periods of time: one year and three years. Lastly, we investigated whether the loans that were taken out during these periods of time from banks that issued bonds during the corresponding crisis carried higher spreads.

The results of this test are reported in Table 7, where control variables are omitted in the interest of space. Our variables of interest are $BKBONDCRISIS$, 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, $LOANCRISIS$, a dummy variable that is equal to one if the loan itself was extended during the period of tight bond market conditions, and the interaction of these two variables.

Table 7 follows a structure similar to Table 3 with an additional model to consider firm fixed effects. Panels A and B report separate sets of regressions for one-year and three-year windows, respectively. 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 during and after that time, controlling for our set of firm controls. Models 2 and 3 add our sets of loan and bond controls, respectively. Model 4 further expands our controls to account for the cost of deposit funding of banks. Finally, model 5 includes firm fixed effects in addition to the set of controls in model 4, to make sure that our results are not driven by differences across bank borrowers.

The results of this test confirm our earlier findings. In all the models, regardless of the time period included, banks that issued during the periods of tight bond market conditions charged higher interest rates on their subsequent loans compared to banks that issued their last bond before the loan during a tranquil period, which could be the same bank during a different period of time.[32] Not surprisingly, we also find that loans extended during tight bond market conditions carry higher interest rates, even when we control for the cost of deposits in models 4 and 5. The coefficients on the interaction terms are not statistically significant, indicating that banks that issued bonds during the crisis periods continued charging higher interest rates on loans extended within one or three years after the crisis was over. This is consistent with banks passing the cost of their funding onto borrowers, considering that bonds

[31] The dates of these "crises" are as follows: Aug. 15, 90 through Mar. 4, 92; Sept. 30, 98 through Dec. 9, 99; Apr. 11, 00 through Nov. 24, 03; May 2, 05 through May 30, 05 and Nov 7, 07 through end of sample period Dec. 31, 07).

[32] To keep this comparison clean, we excluded from these regressions all loans issued by banks that did not access bond market prior to loans.

tend to be fixed-rate and have an average maturity of five years.

In this section, therefore, we provide direct evidence of the mechanism that we believe is behind our main findings — by separately estimating the effects of bond market conditions during the time when the loan is extended and during the time when the bond funding bank issued a corresponding bond, we are able to conclude that bond funding banks, indeed, pass the cost of their bond financing onto borrowers.

6 Final remarks

Our result that banks' use of bond financing creates a link between their loan pricing policy and the conditions in the bond market is novel. This result also has some important implications. For instance, it shows that as banks increasingly rely on bond financing, financial intermediation that is performed through banks will become increasingly interlinked with the intermediation performed through financial markets. As a consequence, corporate borrowers, including those that rely exclusively on banks for external funding, will become increasingly exposed to the conditions in the bond market. In addition, banks will find it more difficult to smooth interest rates on their loans over the business cycle.

That result suggests several potential ideas for fruitful research. Researchers, for instance, have pointed out that an important advantage of bank funding is banks' ability to "smooth" interest rates on their loans to relationship borrowers over the business cycle.[33] It would be interesting to ascertain whether banks are still capable of smoothing the interest rates to their relationship borrowers when they themselves rely on bond financing. Similarly, a common view in the financial architecture literature is that banks and debt markets operate independently from each other.[34] 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 and commercial paper funding, it would be interesting to investigate the effects of the roles of financial intermediaries and markets when the former also rely on financial markets to raise funding.

[33] See Berlin, and Mester (1999) for a theory of bank interest rate smoothing and some supporting evidence.

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

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Table 1. Sample characterization[a]

Variables	Banks with bond financing	Banks without bond financing	Difference	p-value
Differences among banks				
ASSETS	437.6	8.43	429.1	0.000
ROA	0.128	0.137	-0.009	0.001
ROAVOL	0.002	0.003	-0.001	0.000
CHARGEOFFS	0.108	0.106	0.001	0.724
LIQUIDITY	20.130	29.525	-9.395	0.000
DEPOSIT	31.631	56.390	-24.759	0.000
DEPOSIT COST	1.409	3.059	-1.650	0.000
INT EXPENSE	0.117	0.297	-0.180	0.000
CAPITAL	7.45	8.26	-0.81	0.000
Differences in the loan policies				
LOANSPD	162.4	234.0	-71.5	0.000
AMOUNT	407.5	85.1	322.4	0.000
MATURITY	4.007	3.523	0.484	0.016
SECURED	0.433	0.658	-0.225	0.000
SENIOR	0.963	0.902	0.061	0.000
DIVIDEND REST	0.460	0.373	0.087	0.000
CORP PURPOSES	0.297	0.292	0.005	0.640
REFINANCE	0.613	0.370	0.242	0.000
WORK CAPITAL	0.183	0.205	-0.021	0.029
TERM LOAN	0.387	0.357	0.030	0.010
CREDIT LINE	0.580	0.585	-0.005	0.672
RELATIONSHIP	0.622	0.514	0.108	0.000
Differences among borrowers				
AGE	22.8	13.5	9.26	0.000
SALES	6376.9	1375.0	5001.9	0.000
PROF MARGIN	-0.011	-0.076	0.065	0.032
INT COV	26.013	29.903	-3.890	0.698
EARNINGS VOL	44.260	6.732	37.528	0.000
LEVERAGE	0.317	0.305	0.012	0.033
TANGIBLES	0.730	0.751	-0.021	0.049
ADVERTISING	0.011	0.009	0.002	0.003
RD	0.027	0.064	-0.037	0.039
NWC	8.019	3.457	4.562	0.000
MKTOBOOK	1.785	1.701	0.084	0.009
RATING	0.538	0.229	0.309	0.000
RATINGIG	0.325	0.056	0.269	0.000
RATINGBG	0.213	0.173	0.040	0.000
PBOND	0.575	0.277	0.298	0.000
PBONDIG	0.254	0.035	0.220	0.000
PBONDBG	0.190	0.148	0.042	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. $DEPOSIT$ 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. $RATING$ Dummy variable equal to 1 if the borrower has a credit rating; $RATINGIG$ Dummy variable equal to 1 if the borrower has an investment grade rating; $RATINGBG$ Dummy variable equal to 1 if the borrower has a below investment grade rating; $PBOND$ Dummy variable equal to 1 if the borrower issued a public bond in the last five 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 five 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 five years prior to the loan;

Table 2. Differences between loan spreads of banks with and without bond financing[a]

Differences as the conditions in the bond market change					
Bond market condtions		Banks with bond financing	Banks without bond financing	Difference	p-value
High BBB spd		180.5	267.7	-87.2	0.000
Low BBB spd		142.7	214.6	-71.8	0.000
Difference		37.8	53.1		
p-value		0.000	0.000		
Differences for bank dependent and non bank dependent borrowers as the conditions in the bond market change					
Borrower	Bond mkt conditions	Banks with bond financing	Banks without bond financing	Difference	p-value
Not bk dep	High BBB spd	146.5	232.2	-85.7	0.000
	Low BBB spd	102.5	189.8	-87.3	0.000
	Difference	44.0	42.4		
	p-value	0.000	0.050		
Bk dep	High BBB spd	228.1	276.8	-48.7	0.00
	Low BBB spd	177.0	222.4	-45.4	0.00
	Difference	51.1	54.5		
	p-value	0.000	0.000		

[a] The loan spread is the all-in-drawn loan spread over LIBOR at origination. Banks have bond financing if they have subdebt in their balance sheet at the time of the loan. Borrowers are defined to be bank dependent if they do not have a credit rating at the time of the loan. High (low) BBB 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.

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

Variables	(1)	(2)	(3)	(4)	(5)
SUBDEBT	-0.138***	-0.104***	-0.0421	-0.0650	-0.0652
	(0.0345)	(0.0400)	(0.0281)	(0.0444)	(0.0450)
LBBBSPD		0.102***	0.158***	0.133***	0.133***
		(0.0331)	(0.0289)	(0.0305)	(0.0307)
SUBDEBT x LBBBSPD		0.173***	0.132***	0.133***	0.133***
		(0.0425)	(0.0365)	(0.0370)	(0.0371)
LAGE	-0.111***	-0.119***	-0.0876***	-0.0881***	-0.0881***
	(0.0164)	(0.0162)	(0.0153)	(0.0149)	(0.0150)
LSALES	-0.234***	-0.235***	-0.106***	-0.107***	-0.107***
	(0.00696)	(0.00690)	(0.00860)	(0.00913)	(0.00911)
LEVERAGE	0.435***	0.433***	0.354***	0.353***	0.353***
	(0.0501)	(0.0491)	(0.0460)	(0.0457)	(0.0457)
TANGIBLES	-0.0670***	-0.0678***	-0.0326	-0.0314	-0.0314
	(0.0214)	(0.0213)	(0.0202)	(0.0204)	(0.0205)
ROAVOL	0.119***	0.111***	0.0992***	0.0965***	0.0965***
	(0.0390)	(0.0387)	(0.0306)	(0.0296)	(0.0295)
RD	-0.148***	-0.147***	-0.104***	-0.105***	-0.105***
	(0.0428)	(0.0406)	(0.0317)	(0.0316)	(0.0316)
ADVERTISING	-0.650**	-0.650**	-0.591**	-0.608**	-0.608**
	(0.273)	(0.264)	(0.240)	(0.244)	(0.243)
LINTCOV	-0.183***	-0.176***	-0.140***	-0.139***	-0.139***
	(0.0213)	(0.0213)	(0.0178)	(0.0177)	(0.0179)
MKTBOOK	-0.0421*	-0.0428*	-0.0351*	-0.0352*	-0.0352*
	(0.0236)	(0.0232)	(0.0188)	(0.0189)	(0.0189)
PROF MARGIN	-0.0151	-0.0144	-0.0208	-0.0210	-0.0210
	(0.0215)	(0.0204)	(0.0142)	(0.0142)	(0.0143)
NWC	0.0325	0.0267	0.0232	0.0225	0.0225
	(0.0464)	(0.0439)	(0.0443)	(0.0443)	(0.0443)
RELATIONSHIP	-0.0610**	-0.0571**	-0.0210	-0.0197	-0.0198
	(0.0303)	(0.0285)	(0.0256)	(0.0245)	(0.0243)
TREND	0.0293***	0.0253***	0.0204***	0.0248***	0.0248***
	(0.00341)	(0.00346)	(0.00483)	(0.00414)	(0.00417)
LAMOUNT			-0.104***	-0.106***	-0.106***
			(0.00556)	(0.00536)	(0.00532)
LMATURITY			0.0757***	0.0741***	0.0741***
			(0.0197)	(0.0195)	(0.0194)
SECURED			0.536***	0.534***	0.534***
			(0.0355)	(0.0346)	(0.0346)
CORP PURPOSES			-0.0242	-0.0266	-0.0266
			(0.0204)	(0.0204)	(0.0204)
REFINANCE			-0.0707***	-0.0714***	-0.0714***
			(0.0137)	(0.0137)	(0.0138)
WORK CAPITAL			-0.0521***	-0.0533**	-0.0533**
			(0.0193)	(0.0207)	(0.0207)
TERM LOAN			-0.341***	-0.338***	-0.338***
			(0.0616)	(0.0616)	(0.0606)

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Table 3 (Continued).[a]

Variables	(1)	(2)	(3)	(4)	(5)
CREDIT LINE			-0.409***	-0.405***	-0.405***
			(0.0708)	(0.0709)	(0.0700)
DIVIDEND REST			0.119***	0.125***	0.125***
			(0.0293)	(0.0283)	(0.0287)
SENIOR			-0.115***	-0.122***	-0.122***
			(0.0302)	(0.0302)	(0.0314)
LASSETS				0.00113	0.00108
				(0.0104)	(0.0103)
ROA				-4.833	-4.838
				(10.62)	(10.61)
CHARGEOFFS				18.37***	18.36***
				(6.853)	(6.821)
ROA VOL				6.148	6.130
				(8.404)	(8.439)
LIQUIDITY				0.00758	0.00750
				(0.122)	(0.121)
CAPITAL				-0.0123*	-0.0123*
				(0.00706)	(0.00710)
DEPOSIT COST					-0.000332
					(0.0113)
Observations	19930	19930	19930	19930	19930
R^2Adjusted	0.462	0.480	0.586	0.587	0.587

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $SUBDEBT$ Dummy variable that takes the value 1 for loans extended by banks with subdebt in their balance sheet at the time of the loan; $LBBBSPD$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds; See definitions of remaining controls in Table 1. Robust standard errors clustered on company in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Bank borrowers' exposures to bond market shocks.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1
LBBBSPD	0.108***	0.266***	0.113***	0.230***	0.126***	0.287***	0.108***	0.275***
	(0.0378)	(0.0338)	(0.0391)	(0.0299)	(0.0476)	(0.0351)	(0.0382)	(0.0356)
RATING			0.0935**	-0.0778***				
			(0.0468)	(0.0254)				
RATING x LBBBSPD			-0.0275	0.0694**				
			(0.0673)	(0.0330)				
BOND					-0.0677	-0.0744***		
					(0.0436)	(0.0121)		
BOND x LBBBSPD					-0.155	-0.0599**		
					(0.119)	(0.0247)		
BONDIG							-0.0904	-0.213***
							(0.0559)	(0.0165)
BONDBG							0.0357	0.224***
							(0.0538)	(0.0223)
BONDIG x LBBBSPD							0.0599	-0.0361
							(0.0834)	(0.0251)
BONDBG X LBBBSPD							-0.0324	0.0925**
							(0.0732)	(0.0457)
Observations	1887	17979	1887	17979	1887	17979	1887	17979
R^2Adjusted	0.474	0.588	0.475	0.589	0.474	0.589	0.475	0.606

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $SUBDEBT$ Dummy variable that takes the value 1 for loans extended by banks with subdebt in their balance sheet at the time of the loan; $LBBBSPD$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds; Included, but not reported, are the same controls as in model 5 of Table 3. Robust standard errors clustered on company in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Shocks to bond markets and bank loan pricing policies: Robustness tests.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
SUBSDEBT	-0.0652	-0.0675	-0.0646	-0.0652	-0.0738	-0.0718*				-0.0652	-0.0485
	(0.0450)	(0.0448)	(0.0424)	(0.0450)	(0.0448)	(0.0418)				(0.0458)	(0.0313)
LBBBSPD	0.133***	0.134***	0.150***	0.132***	0.119***	0.115***	0.194***	0.150***	0.135***	0.133***	0.189***
	(0.0307)	(0.0314)	(0.0347)	(0.0314)	(0.0323)	(0.0319)	(0.0362)	(0.0291)	(0.0329)	(0.0312)	(0.0398)
SUBDEBT x LBBBSPD	0.133***	0.134***	0.118***	0.133***	0.112***	0.104***				0.133***	0.114***
	(0.0371)	(0.0379)	(0.0387)	(0.0369)	(0.0365)	(0.0359)				(0.0377)	(0.0415)
DEPOSIT COST	-0.000332			-0.000442	0.0248*	0.0352**	-0.000146	-0.0152*	-0.000848	-0.000332	-0.0343***
	(0.0113)			(0.0115)	(0.0144)	(0.0169)	(0.0107)	(0.00786)	(0.0115)	(0.0119)	(0.00727)
DEPOSIT COST1		-0.0994									
		(0.147)									
DEPOSIT COST2			-0.251								
			(0.172)								
GDP				-0.00124							
				(0.0104)							
TREASURY					0.0534***						
					(0.0135)						
LLIBOR						-0.124***					
						(0.0245)					
SUBASSETS							-3.946***	-3.584***			
							(1.446)	(1.256)			
SUBASSETS x LBBBBSPD							3.067	4.135***			
							(1.922)	(1.442)			
$\widehat{SUBDEBT}$									-0.106**		
									(0.0464)		
$\widehat{SUB}$ x LBBBSPD									0.125***		
									(0.0422)		
Firm fixed effects	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Observations	19930	19930	19930	19930	19354	19930	19930	13965	19930	19930	19930
R^2Adjusted	0.587	0.587	0.587	0.587	0.588	0.588	0.587	0.425	0.587	0.587	0.283

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $SUBDEBT$ Dummy variable that takes the value 1 for loans extended by banks with subdebt in their balance sheet at the time of the loan; $LBBBSPD$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds; $DEPOSIT\ COST1$ Is equal to the interest expenses on deposits reported by banks when available. When this variable is missing, we use our proxy for the cost of deposits $DEPOSIT\ COST$, as defined in Table 1. $DEPOSIT\ COST2$ Is equal to the interest expenses on deposits reported by banks when available. When this variable is missing we use interest expense reported by banks. In order 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. GDP Annual growth rate of real GDP. $TREASURY$ Slope of the yield curve computed as the difference between 5-year and 1-year Treasury bond yields. $LLIBOR$ Natural log of the 3-month LIBOR at the time of the loan origination. $SUBASSETS$ Ratio of subdebt to bank assets. $\widehat{X}$ is the fitted variable X computed using the same set of controls as in model 5 of Table 3 plus the set of instruments described in the Robustness section. Included, but not reported, are the same controls as in model 5 of Table 3. Robust standard errors clustered on company in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Bank borrowers' exposures to bond market shocks: Robustness tests.[a]

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1	SUBDEBT=0	SUBDEBT=1
BONDIG	-0.0904	-0.213***	-0.0902	-0.213***	-0.0891	-0.215***	-0.0881	-0.213***	-0.110**	-0.210***
	(0.0559)	(0.0165)	(0.0563)	(0.0166)	(0.0558)	(0.0168)	(0.0575)	(0.0164)	(0.0545)	(0.0169)
BONDBG	0.0357	0.224***	0.0362	0.223***	0.0355	0.221***	0.0307	0.224***	0.0262	0.216***
	(0.0538)	(0.0223)	(0.0538)	(0.0224)	(0.0541)	(0.0227)	(0.0532)	(0.0224)	(0.0569)	(0.0204)
LBBBSPD	0.108***	0.275***	0.113***	0.278***	0.108***	0.279***	0.129***	0.273***	0.129***	0.243***
	(0.0399)	(0.0321)	(0.0405)	(0.0339)	(0.0386)	(0.0369)	(0.0662)	(0.0214)		
BONDIG x LBBBSPD	0.0599	-0.0361	0.0600	-0.0369	0.0584	-0.0430*	0.0628	-0.0363	0.0635	-0.0503**
	(0.0834)	(0.0251)	(0.0833)	(0.0252)	(0.0834)	(0.0241)	(0.0839)	(0.0251)	(0.0853)	(0.0235)
BONDBG x LBBBSPD	-0.0324	0.0925**	-0.0320	0.0920**	-0.0384	0.0884*	-0.0392	0.0927**	-0.0484	0.0798*
	(0.0732)	(0.0457)	(0.0723)	(0.0456)	(0.0701)	(0.0460)	(0.0724)	(0.0459)	(0.0717)	(0.0431)
DEPOSIT COST	-0.0138	-0.00185					-0.0119	-0.00235	-0.0194	0.0290*
	(0.0122)	(0.0125)					(0.0124)	(0.0127)	(0.0170)	(0.0167)
DEPOSIT COST1			-0.114	-0.127						
			(0.144)	(0.153)						
DEPOSIT COST2					0.0381	-0.273				
					(0.225)	(0.173)				
GDP							0.0436*	-0.00502		
							(0.0227)	(0.0109)		
TREASURY									-0.0301	0.0596***
									(0.0336)	(0.0137)
	(0.228)	(0.232)	(0.226)	(0.229)	(0.203)	(0.233)	(0.227)	(0.230)	(0.256)	(0.252)
Firm fixed effects	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Observations	1887	17979	1887	17979	1887	17979	1887	17979	1823	17469
R^2Adjusted	0.475	0.606	0.475	0.606	0.474	0.606	0.476	0.606	0.466	0.607

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Table 6. (Continued).[a]

Variables	(11) SUBDEBT=0	(12) SUBDEBT=1	(13) SUBDEBT=0	(14) SUBDEBT=1	(15) SUBDEBT=0	(16) SUBDEBT=1	(17) SUBDEBT=0	(18) SUBDEBT=1
BONDIG	-0.0907	-0.215***			-0.0904	-0.213***	0.0299	-0.0704***
	(0.0554)	(0.0170)			(0.0561)	(0.0243)	(0.0899)	(0.0256)
BONDBG	0.0309	0.217***			0.0357	0.224***	0.182	0.0549*
	(0.0547)	(0.0212)			(0.0549)	(0.0281)	(0.126)	(0.0295)
LBBBSPD	0.118***	0.232***	0.116***	0.261***	0.108***	0.275***	0.103	0.312***
	(0.0416)	(0.0316)	(0.0402)	(0.0400)	(0.0386)	(0.0369)	(0.0662)	(0.0214)
BONDIG x LBBBSPD	0.0590	-0.0476*			0.0599	-0.0361	0.412***	-0.0266
	(0.0834)	(0.0246)			(0.0846)	(0.0321)	(0.139)	(0.0337)
BONDBG x LBBBSPD	-0.0417	0.0763*			-0.0324	0.0925*	0.0275	0.0618
	(0.0729)	(0.0448)			(0.0747)	(0.0481)	(0.198)	(0.0431)
DEPOSIT COST	-0.0210	0.0496***	-0.00327	0.00664	-0.0138	-0.00185	-0.0121	-0.0447***
	(0.0159)	(0.0174)	(0.0157)	(0.0135)	(0.0123)	(0.0131)	(0.0200)	(0.00845)
LLIBOR	0.0445	-0.136***						
	(0.0530)	(0.0257)						
$\widehat{BONDIG}$			-0.230	-0.369***				
			(0.170)	(0.0348)				
$\widehat{BONDBG}$			0.0448	0.370***				
			(0.0964)	(0.0388)				
$\widehat{BONDIG}$ x LBBBSPD			0.269	0.0321				
			(0.234)	(0.0339)				
$\widehat{BONDBG}$ x LBBBSPD			0.207	0.204**				
			(0.146)	(0.0865)				
Firm fixed effects	NO	NO	NO	NO	NO	NO	YES	YES
Observations	1887	17979	1347	16381	1887	17979	1887	17979
R^2Adjusted	0.475	0.608	0.490	0.613	0.475	0.606	0.174	0.293

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $SUBDEBT$ Dummy variable that takes the value 1 for loans extended by banks with subdebt in their balance sheet at the time of the loan; $LBBBSPD$ Natural log of the difference between the Moody's indexes on the ex ante yields of triple-B and triple-A rated bonds; $DEPOSIT\ COST1$ Is equal to the interest expenses on deposits reported by banks when available. When this variable is missing, we use our proxy for the cost of deposits $DEPOSIT\ COST$, as defined in Table 1. $DEPOSIT\ COST2$ Is equal to the interest expenses on deposits reported by banks when available. When this variable is missing we use interest expense reported by banks. In order 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. GDP Annual growth rate of real GDP. $TREASURY$ Slope of the yield curve computed as the difference between 5-year and 1-year Treasury bond yields. $LLIBOR$ Natural log of the 3-month LIBOR at the time of the loan origination. $SUBASSETS$ Ratio of subdebt to bank assets. $\widehat{X}$ is the fitted variable X computed using the same set of controls as in model 5 of Table 3 plus the set of instruments described in the Robustness section. Included, but not reported, are the same controls as in model 5 of Table 3. Robust standard errors clustered on company in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Loan policies of banks that issue during bond market crises.[a]

Variables	(1)	(2)	(3)	(4)	(5)
Panel A: Loans taken out during a crisis in bond market or one year after the crisis					
BK BOND CRISIS	0.0761*	0.0789**	0.0889***	0.0695**	0.0700**
	(0.0413)	(0.0310)	(0.0323)	(0.0338)	(0.0307)
LOAN CRISIS	0.0920	0.102**	0.119***	0.130***	0.127***
	(0.0593)	(0.0428)	(0.0390)	(0.0379)	(0.0413)
BK BOND CRISIS x LOAN CRISIS	-0.0740	-0.0559	-0.0871	-0.0840	-0.0643
	(0.0753)	(0.0583)	(0.0568)	(0.0572)	(0.0488)
Firm fixed effects	NO	NO	NO	NO	YES
Observations	10468	10468	10468	10468	10468
R^2Adjusted	0.492	0.599	0.601	0.603	0.233
Panel B: Loans taken out during a crisis in bond market or three years after the crisis					
BK BOND CRISIS	0.101***	0.0782**	0.0803**	0.0655*	0.0778***
	(0.0361)	(0.0337)	(0.0337)	(0.0343)	(0.0262)
LOAN CRISIS	0.137**	0.113***	0.122***	0.134***	0.140***
	(0.0568)	(0.0401)	(0.0361)	(0.0339)	(0.0366)
BK BOND CRISIS x LOAN CRISIS	-0.0965	-0.0495	-0.0773	-0.0747	-0.0693
	(0.0692)	(0.0561)	(0.0552)	(0.0545)	(0.0433)
Firm fixed effects	NO	NO	NO	NO	YES
Observations	14029	14029	14029	14029	14029
R^2Adjusted	0.478	0.586	0.588	0.590	0.246

[a] Dependent variable is $LLOANSPD$ is the natural log of the all-in-drawn loan spread over LIBOR at origination; $BK\ BOND\ CRISIS$ Dummy variable equal to one if the bank issued a bond during the crisis in the bond market. $LOAN\ CRISIS$ Dummy variable equal to one if the loan was taken out during the crisis in the bond market. Crises in the bond market correspond to periods of time when $BBBSPD$ was above or close to 1 for an extended period of time. These periods are Aug. 15, 1990 through Mar. 4, 1992; Sept. 30, 1998 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. Included, but not reported, are the same controls as in corresponding columns of Table 3. Robust standard errors clustered on company in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.