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Abstract

We study how debt market frictions constraining the ability to replace bank with bond financing during a tightening in bank credit supply affect corporate yield spreads. We document that more inflexible firms suffer bigger increases in bond yield spreads as bank credit supply tightens. Debt inflexibility also amplifies the impact of firm-specific tightening in bank credit availability induced by the violation of loan covenants. More inflexible firms display a stronger link between yield spreads and cash flow volatility, a stronger link between yield spreads and stock volatility and a closer correlation between changes in yield spreads and stock returns.

JEL Classification: G12, G21 and G23
Keywords: bank credit tightening, bond yield spreads, debt and equity correlation, debt inflexibility and lending standards

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Introduction

The literature has long argued that one necessary condition for a reduction in loan supply to have real effects is that bank loans and non-bank financing are imperfect substitutes. An important driver of the inability to buffer a shortage in the bank credit supply is the lack of *flexibility* in replacing bank loans with public debt financing. Firms that either are not able to replace bank debt with bonds or find it expensive to do it, will be more exposed to a tightening in bank credit availability (Kashyap, Stein and Wilcox, 1993, Kashyap and Stein, 1995, 2000).

The recent 2008-2009 subprime crisis has shown that the ability to substitute bank loans with public debt is crucial. For example, from 2008 to 2009, the total net credit lending by US commercial banks and by foreign banking offices in the US has dropped from 631.8 billion to -397.8 billion, while the total net credit lending by insurance companies, private pension funds and mutual funds increased from 159.6 billion to 665.4 billion.[1] A similar pattern has also been there over the period 2000-2001 – a period in which bank credit was tightened.[2]

However, this aggregate level of substitution clouds substantial cross-sectional heterogeneity across firms due to the strong segmentation of the debt markets (Kashyap et al., 1993, Faulkender and Petersen, 2005, Leary, 2009, Lemmon and Roberts, 2010, Lin and Paravisini, 2011). This suggests that, while there is an overall substitution from bank debt to public debt in the event of bank credit tightening, market segmentation will still drive cross-sectional variations in the ability of the firms to do so due to frictions in the access to the public debt market.

One obvious friction is the inability to properly access the debt market: small and financially constrained firms are more affected by a shortage in bank credit supply (Lin and Paravisini, 2011). Traditionally financing frictions have been associated with the inability to issue bonds or have a credit rating (e.g., Faulkender and Petersen, 2005). However, recent evidence suggests that such

[1] These figures are obtained from the US Federal Reserve Flow of Funds data.
[2] Over the period of 2000-2001, net lending by commercial banks dropped by 164.4 billion dollars, and net lending by funding corporations decreased by 126.2 billion dollars. Over the same period, net lending by life insurance companies increased by 69.7 billion dollars and net lending by mutual funds increased by 100.3 billion dollars.

frictions also exist for firms with access to the bond market (e.g., Massa, Yasuda and Zhang, 2013, Massa and Zhang, 2013). Moreover, while it may appear that firms with bonds outstanding rely very little on bank debt, an examination of their debt structure clearly shows that this is not the case. Based on the data from Capital IQ from 2001 to 2008, among the firms with long-term S&P credit rating in the Compustat database, the average fraction of bank debt over total debt is 42%. This suggests that a tightening in bank credit supply would have a significant impact on the financing of these firms in the case of scarce substitutability between bank and bond financing.

Given that the firms with bond outstanding represent the overwhelming majority of the market capitalization – e.g., 80% of the US stock market capitalization in 2008 – these frictions will significantly affect the transmission of bank credit tightening.

In this paper, we study this issue by investigating whether and how cross-sectional variations in the firms' flexibility to replace bank debt with bonds affect the transmission of bank credit tightening to the bond market.

We focus on firms that have already accessed the bond market and on one particular source of friction: the geographical segmentation in the ability to replace bank financing with bond financing due to the limited regional availability of debt. Previous findings show that *geography-specific* constraints in debt financing do affect firm conditions (Massa, Yasuda and Zhang, 2013, Massa and Zhang, 2013). In the presence of local bias and market segmentation in the debt market,[3] a scarce availability of local institutional investors able to absorb bond issuances relative to local bank credit supply will constrain the ability of the firm – the one with access to the bond market – to substitute bank financing with bond financing ("debt inflexibility"). In the spirit of Kashyap et al., (1993), we quantify debt inflexibility as the relative availability of local bank and

[3] There is ample evidence suggesting that corporate financing tend to be locally driven. In the case of banks, it has been argued that proximity lending is related to a better ability to screen and monitor the lender (Degryse and Ongena, 2005, Aggarwal and Hauswald, 2010), whereas in the case of market-based financing – bonds and equity – the local bias of institutional investors has been justified in terms of better information (Coval and Moskowitz, 2001, Baik, Kang and Kim, 2010, Butler, 2008, Massa, Yasuda and Zhang, 2013) or familiarity (Huberman, 2001).

bond financing. A regional market with more debt inflexibility will make it harder or more costly for firms to replace bank debt with bond financing.[4]

We argue that, by constraining the ability of the firm to substitute bank debt with bonds, debt inflexibility increases the sensitivity of the firm's bond yield spreads to a tightening in the availability of bank credit: more inflexible firms should display a bigger increase in yield spreads in the presence of bank credit tightening. The impact of debt inflexibility should concentrate among the relatively weaker firms – smaller firms, lower rated firms, and especially firms relying more on bank debt in their leverage structure.

Moreover, given that debt inflexibility constrains the ability of the firm to face tight credit conditions, it should raise the probability that cash flow swings affect the firm creditworthiness. We therefore expect to observe a higher sensitivity of yield spreads to firms' cash flow volatility. The fact that for more inflexible firms, cash flow volatility will affect not only equity volatility but also bond yield spreads will raise the comovement between bond and equity. More specifically, we expect debt inflexibility to increase the link between stock volatility and yield spreads. Indeed, it is documented that there is a strong relation between equity volatility and corporate yield spreads and that stock volatility can explain cross-sectional variations in yield spreads to a large extent (Campbell and Taksler, 2003). However, what drives this correlation is less known. We expect that debt inflexibility amplifies such a link, and this amplification effect is stronger during periods of tightened bank credit conditions.

These considerations suggest a new channel through which bank credit tightening and local debt market conditions affect the yield spreads of firms *with access to the bond market*. We test these intuitions on a comprehensive sample of US corporate bonds for the period 1998-2008

[4] On the corporate side, Massa and Zhang (2013) show that debt inflexibility tilts the firm's financial structure towards equity and reduces investment. Overall, this acts as a source of financial constraints – e.g., it increases the sensitivity of cash holdings to cash flows, reduces the likelihood of dividend payment and makes the firm more likely to pay equity in mergers and acquisitions.

using a unique dataset with detailed information on corporate bond holdings by bond institutional investors.

We start by providing some evidence on the "locality of lending". First, we show that bond investors tilt their investment towards the bonds of geographically close firms even more than what equity investors do (Coval and Moskowitz, 1999, 2001). They hold 13% more of their portfolio in the bonds of nearby firms than what a widely diversified benchmark (Bank of America Merrill Lynch bond index portfolio) would require. This figure increases to 24% in the case of smaller bonds and 16% in the case of below-investment grade bonds. Second, consistent with the argument that local banks have better ability to screen and monitor the borrowers, we also show that borrowers tend to resort 59% more to local banks than to distant ones.

Armed with these findings on geography-based segmentation in the debt market, we rely on the idea of Kashyap et al. (1993) and Kashyap and Stein (1995, 2000) that the inability to replace bank debt with public debt financing creates a sort of financial constraint for the firm that affects its ability to finance and grow. We build a measure of locally-driven debt inflexibility which proxies for the inability of the firm to replace bank financing with bond financing and test how this affects the reaction of the firm to bank credit tightening.

We consider both "market-wide" bank credit tightening related to the tightening of bank lending standards, and "firm-specific" tightening related to loan covenants violations. Our main proxy for market-wide bank credit conditions exploits the information contained in the Senior Loan Officer Opinion Survey on Bank Lending Practices (Schreft and Owens, 1991, Lown and Morgan, 2002, 2006, Bassett, Chosak, Driscoll and Zakrajsek, 2013, Axelson, Jenkinson, Strömberg and Weisbach, 2013). We use the net percentage of loan officers in the US banks reporting tightening in lending standards for commercial and industrial loans to medium and large firms. This measure captures non-price aspects of bank credit supply conditions such as debt covenants and quantity constraints (Schreft and Owens, 1991, Axelson et al., 2013). We test

whether a tightening in lending standards affects bond yield spreads differently depending on the degree of debt inflexibility of the bond issuers.

We find that a tightening in lending standards has a strong and significant effect on corporate yield spreads. One standard deviation higher tightening increases bond yield spreads by 10 bps (per quarter). This suggests that even for firms with public bonds outstanding, bank credit tightening still has a sizable impact on the credit worthiness of the firm. More importantly, we find that debt inflexibility strongly amplifies the effect of bank credit tightening. The sensitivity of changes in bond yield spreads to a tightening in bank lending standards is more than two times higher for more inflexible firms than for less inflexible firms.

The amplification effect of debt inflexibility is related to firm characteristics - e.g., firm size, credit ratings and leverage. Debt inflexibility increases the sensitivity of changes in yield spreads to the tightening in lending standards more strongly for the firms that are likely to be constrained in the debt policy, such as smaller firms, below investment grade firms, firms with higher leverage, and especially firms replying more on bank debt in their leverage structure.

We find consistent results using alternative proxies for the tightening in bank credit at the macro level, such as the component of the tightening in lending standards orthogonal to loan demand, the under-performance of banking stocks (the difference between market return and the value-weighted stock returns of listed commercial banks), and the increase in non-performing loans of banks (the ratio of non-performing loans to total assets).

Also, given that the tightening in lending standards can be driven by a tightening in monetary policy, we explicitly control for monetary policy shocks. This allows us to see whether debt inflexibility directly amplifies the way monetary policy shocks affect the firm, in a way that is distinct from the tightening in lending standards. We focus on two proxies for monetary policy shocks used in the macroeconomics literature (Romer and Romer, 2004, Barakchian and Crowe, 2010). We find that debt inflexibility raises the sensitivity of changes in yield spreads to both tightening in lending standards and monetary policy shocks.

Next, we focus on a more firm-specific event: the violation of loan covenants. A direct effect of covenant violation is that bank credit availability becomes more costly or more restrictive (Roberts and Sufi, 2009, Nini, Smith, and Sufi, 2009, 2012). If debt inflexibility makes it difficult for the firm to replace bank financing with bonds, we should expect the violation of loan covenants to increase the bond yield spreads more, the higher the degree of firm inflexibility.

We document that debt inflexibility strongly amplifies the effect of covenant violation on the changes in bond yield spreads. The sensitivity of changes in yield spreads to covenant violation for more inflexible firms is more than three times higher than that for less inflexible firms. On average, the violation of loan covenants increases bond yield spreads by 26 bps for more inflexible firms and only 8 bps for less inflexible firms. Overall, these results show that debt inflexibility amplifies the effects of bank credit tightening on corporate yield spreads.

Next, we focus on the link between yield and cash flow volatility. By reducing the firm's ability to adjust its debt structure to fare through tightened credit conditions, debt inflexibility should also constrain the firm's ability to buffer the impact of cash flow fluctuations on the default risk of the firm. We find that this is indeed the case. We document that the yield spreads of more debt inflexible firms display significantly higher sensitivity to cash flow volatility, and this effect is more pronounced during periods of tightened lending standards. For example, when lending standards get tightened, one standard deviation increase in cash flow volatility raises yield spreads by 28 bps for more inflexible firms, compared to just 13 bps for less inflexible firms. In contrast, in periods of loosened lending standards, one standard deviation increase in cash flow volatility increases yield spreads by 18 (9) bps for more (less) inflexible firms.

Armed with these results, we explore how the effect of inflexibility carries over to the equity side. We examine whether debt inflexibility affects the relation between equity volatility and yield spreads (Campbell and Taksler, 2003). First, we document that the sensitivity of yield spreads to stock volatility is 24% higher in more inflexible firms than that in less inflexible ones. One standard deviation higher equity volatility is related to a 50 bps higher yield spreads for more

inflexible firms, compared to that of 39 bps for less inflexible firms. Second, we follow Campbell and Taksler (2003) and assess how the explanatory power of equity volatility on bond yield spreads varies with different degrees of inflexibility. We find that by itself, equity volatility explains 29% of the variations in yield spreads for more inflexible firms, compared to only 14% for the less inflexible ones. The difference in R-squared persists even after we control for bond maturity, size, coupon rate and industry effects. Also, consistent with the previous findings, these effects are more pronounced during periods of tightened lending standards.

Finally, we directly look at the correlation between equity and bonds. We find that debt inflexibility increases the correlation between stock returns and changes in yield spreads. One standard deviation higher inflexibility is related to a 31% more negative correlation between stock returns and changes in bond yield spreads, relative to the unconditional mean of -7%. One standard deviation higher inflexibility is related to a 20% more negative correlation between stock returns and changes in CDS spreads, relative to the unconditional mean of -11%. Consistently, the effect is particularly evident during periods of tightened lending standards.

These results provide strong evidence that debt inflexibility magnifies the link between the bond and the equity side of the firm. It is worth mentioning that the friction we identify is related to the ability of the firm to replace bank debt with bond financing as opposed to generic market frictions or inefficiencies. There is no obvious reason why traditional market frictions would increase the correlation between debt and equity. In fact, traditional market frictions such as short selling constraints, by reducing the ability of the market to do capital structure arbitrage, will in fact reduce the correction between bond and equity.

All our results are robust to a series of robustness checks. First, they hold after we control for firm-specific measures of financial constraints such as the size and age (SA) index as in Hadlock and Pierce (2010). Importantly, although the effects of debt inflexibility and the SA financial constraint in general point to the same direction, the former remains *both quantitatively and qualitatively unchanged* after controlling for the latter. This suggests that debt inflexibility acts as

a form of "supply-driven" financing friction, distinct from financial constraints driven by firm-specific characteristics. Second, all our results remain unchanged after we control for the absolute amount of local debt financing as well as the local economic conditions. Third, our results are robust to the inclusion of industry fixed effects, credit rating fixed effects and a series of firm level and macro-economic controls.

Overall, our results provide a novel way of showing how asset prices react to a tightening in bank credit supply. It has been documented that stock returns react to changes in credit supply conditions and *firm-specific* financial constraints affect such a reaction (Lin and Paravisini, 2011). However, what is less known is whether *supply-driven* financing constraints on the ability of the firms to substitute private debt with public debt affect the transmission of bank credit tightening to the bond market as well as its relation to the equity market. Our results go against the "folk theorem" that such frictions should have no sizable impact for firms which already enjoy access to the bond market. This issue is all the more important as these firms represent the biggest part of the total market capitalization.

Our results contribute to the literature relating the transmission of credit tightening to the ability of the firms to substitute among different types of debts (Kashyap et al., 1993, Kashyap and Stein, 1995, 2000). We provide firm level evidence on the asset pricing implications, showing the conditions under which yield spreads are affected by a tightening in bank credit supply and their relation to the equity side.

Furthermore, we contribute to the literature on the connection between bond and equity (Campbell and Taksler, 2003). Understanding the link between the equity market and the bond market as well as its determinants is essential to many capital structure arbitrage strategies. The friction we identify is related to the inability of the firm to replace bank debt with bond financing as opposed to generic market inefficiencies. As we argued, traditional market frictions would not increase the correlation between debt and equity and may in fact reduce it by, for example, limiting the ability to do capital structure arbitrage.

Finally, our results are related to the literature on proximity investment (e.g., Coval and Moskowitz, 1999, 2001) and especially its asset pricing implications. This literature has mostly focused on the equity side, showing that investors (households and institutional investors) tend to hold the stocks of firms located nearby and showing that this has implications in terms of the value of the stocks as well as comovements in stock returns (e.g., Pirinsky and Wang, 2006). We focus on the debt side and show that this has important implications in terms of how corporate yield spreads respond to bank credit tightening.[5]

The remainder of the paper is articulated as follows. Section 2 describes the sample and the variables we use. Sections 3 and 4 look at how debt inflexibility affects the sensitivity of yield spreads to tightening in bank credit supply, including both tightening in lending standards and the event of loan covenant violations. Section 5 looks at how inflexibility affects the overall relation between yield spreads and cash flow volatility and equity volatility, as well as the correlation between changes in yield spreads and stock returns. A brief conclusion follows.

2. Data, Preliminary Evidence and Main Variables

In this section, we describe the data and provide evidence on proximity borrowing in the debt market. Then, we describe our proxy for debt inflexibility and the other variables we use.

2.1 Data

Our data come from multiple sources. The data on institutional holdings of corporate bonds are from Lipper's eMAXX fixed income database. It contains details of fixed income holdings for nearly 20,000 US and European insurance companies, US, Canadian and European mutual funds, and leading US public and private pension funds. It provides information on quarterly ownership of more than 40,000 fixed-income issuers with $5.4 trillion in total fixed income par amount from the first quarter of 1998 to the second quarter of 2008.

[5] In the case of the equity side, the identification between institutional investors and local investors is in general a first type approximation, as there is no information about where the individual investors invest. In the case of bonds, instead, the results are potentially more telling, as corporate bonds are mostly held by institutional investors.

The data on monthly bond yield spreads and bond level credit ratings (average rating of Moody's, S&P, and Fitch) are from the Bank of America Merrill Lynch US Corporate and High Yield Master Bond Index data from 1997 to 2008. This data combine bonds that are included either in the Merrill Lynch Corporate Master Index or in the Merrill Lynch Corporate High Yield Master Index. These bonds are highly representative of the universe of US bond market: they include most of the rated, publicly issued US corporate bonds, for a total of over 5,000 individual bonds per month (Schaefer and Strebulaev, 2008). The index tracks the performance of US dollar denominated investment grade-rated and high yield-rated corporate bonds publically issued in the US domestic market. It is rebalanced on the last calendar day of each month.

The data on the characteristics of new bond issuances such as issue amount outstanding, coupon rate, callability, putability and convertibility are from Mergent FISD.[6] The data on stock returns and firm accounting information are from Compustat and CRSP.

The data on the geographical locations (zip codes) of bond institutional investors are from Lipper's eMAXX. The data on the geographical location (zip codes) and deposits of commercial banks are from FDIC's Summary of Deposits (SOD) database. It contains deposit data for more than 89,000 branches of FDIC-insured institutions.[7] We obtain the geographical coordinates (longitudes and latitudes) of bond investors and bank headquarters by merging their zip codes with Gazetteer Files of Census 2000. Location data on firm headquarters are from Compustat.[8]

2.2 Locality in the Debt Market

We now present evidence on the "local" borrowing behavior in the debt market. We start with evidence on the degree of proximity investment by bond institutional investors. We include all the asset managers in the Lipper's eMAXX database with holdings in corporate bonds. These are:

[6] We match the data from Lipper's eMAXX, BofA Merrill Lynch and Mergent FISD by the 8-digit issue CUSIP of individual bonds. We exclude putable bonds, private placements and convertible bonds. We do, however, keep callable bonds in the sample, given their non-trivial representation in the bond market.
[7] The Federal Deposit Insurance Corporation (FDIC) collects deposit balances for commercial and savings banks as of June 30 of each year starting from 1994. The data are collected annually.
[8] We cross-check the historical records of firms' location information from Compact Disclosure and firm 10-K filings.

mutual fund families, property insurance companies, life insurance companies, reinsurance companies, bank trusts, public and private pension funds. Given that we identify investor location by the headquarters of the asset management companies, we perform this analysis at the management company level. The frequency is quarterly.

We test the tilt of bond investors towards local bonds by comparing the investment in bonds in the local area to the investment that should have taken place if the investors were behaving like index-tracking investors.[9] Following Massa and Zhang (2013), we define the local region as a 300-mile radius circle centered at the location of the bond investor.[10] We follow Coval and Moskowitz (1999, 2001) and compare the fraction of local bonds in the investor's bond portfolio ("Real-local frac.") to the allocation in local bonds that the fund would have made if it allocated its portfolio on the basis of the index weight ("Pseudo-local frac."). We perform a two-sided T-test to compare the differences.

We report the results in Table II, Panel A. We present the results based on investors' overall portfolio as well as the sub-portfolios according to specific bond characteristics. "Small bond portfolio" only includes bonds with index weights below the sample median. "Large bond portfolio" only includes bonds with index weights above the sample median. "Investment grade bond portfolio" consists of investment grade bonds (an average of Moody's, S&P, and Fitch credit rating above or equal to BBB3). "Below-investment grade bond portfolio" refers to the portfolio made of high yield bonds (an average of Moody's, S&P, and Fitch credit rating below BBB3). We also repeat the analysis on the subsample of investors with non-zero local bond holdings in their portfolios.[11]

The results show a clear tendency of bond investors to invest in the bonds of the firms located nearby. They hold 13% more of their portfolio in the bonds of local firms if compared with the

[9] The proxy for the market is the Bank of America Merrill Lynch US Corporate and High Yield Master Bond Index.
[10] In unreported analysis, we use alternative identifications of the local region such as the 100-mile radius circle and the 200-mile radius circle centered at the location of the bond investor. The results are consistent with the reported ones.
[11] Different investors may have their own specific investment styles/mandates in terms of the types of bonds they are restricted to hold. The focus on the subsample of investor-quarters with non-zero local bond holdings helps to make sure that at least one of the local bonds satisfies such investor-specific styles/mandates.

BofA Merrill Lynch bond index portfolio.[12] This figure increases to 22% if we focus on the subsample of investor portfolios with non-zero local holdings. Moreover, consistent with Coval and Moskowitz (1999), the local bias is much stronger among bonds with higher degree of information barriers such as smaller bonds and high yield bonds. The economic significance based on the overall investor portfolios increases to 24% in the case of smaller bonds and to 16% in the case of high yield bonds.

Next, we investigate whether it is also the case that banks have a preference to lend to closely located borrowers. The tendency of the borrowers to resort to local banks can be interpreted as evidence that local banks have better ability to screen and monitor the borrowers. And indeed, there is evidence that the further away the bank is from the borrower, the higher is the cost of borrowing (Petersen and Rajan, 2002, Degryse and Ongena, 2005, Agarwal and Hauswald, 2010).

In Table II, Panel B, we investigate whether firms tend to borrow from local banks. The analysis is done at the borrower-year level. We focus on the universe of Compustat firms from 1998 to 2008. The data on bank loans are from LPC Dealscan, and the information on bank deposits comes from the Summary of Deposit (SOD) database. We define "Real-local frac." as the fraction of loans a firm borrows from the local banks (bank headquarters) in each year, and "Pseudo-local frac." as the fraction of loans a firm would borrow from local banks if it borrowed proportionally from all the banks according to the size of bank deposits. As before, we define the local region as a 300-mile radius circle centered by the headquarters of the borrower. We also report the results separately by distinguishing borrowers by firm size (book assets below median vs. above median), and by credit rating (S&P long term rating above BBB, below BBB or non-rated). We also consider the subsample of borrowers with non-zero borrowing from local banks.

[12] We report this economic significance in percentage terms, by comparing the actual fraction of local bonds in the investor's bond portfolio to the pseudo local allocation. Specifically, it is calculated as (22.2%-19.3%)/22.2%=13%. This figure is comparable to the well-documented local bias of equity investors (11% documented in Coval and Moskowitz (1999)). The other economic significances are reported likewise.

We find a strong tendency of borrowers to resort to local banks (59% more if we compare the actual fraction of borrowing from local banks to the pseudo fraction). This holds across different firm size and rating categories. As expected, the effect is stronger for smaller borrowers, high yield borrowers and especially for non-rated borrowers.

2.3 Debt Inflexibility

Given the previous findings on the geography-based segmentation in the debt market, we can now define the measure of debt inflexibility. It is based on the location of the firm and the regional availability of bond and bank financing. It exploits the information contained in the deposits of local banks and the bond holdings of local institutional investors, and is close in spirit to the proxy for frictions in the credit market developed by Kashyap et al. (1993).[13] Higher debt inflexibility arises when the local bond market is less able to replace bank financing with bonds.

For example, consider a firm whose source of debt financing is located in a specific financial habitat – defined in terms of the local bond holders and bank lenders – in which it is possible to borrow from banks, but the ability to replace them with bonds is limited – i.e., debt inflexibility between bank debt and bonds is high. In the face of bank credit tightening – i.e., when banks are less willing to lend – the firm will be hard-pressed in substituting bank loans with bond financing. The firm may alternatively try to borrow outside of its local market. However, higher information barriers and steeper transaction costs would then make it expensive – i.e., segmentation makes it more difficult for the firms located in these regions to substitute bank debt with bonds.

Following the intuition of Kashyap et al. (1993), we construct the variable as follows. We first define a local area $L(i)$ for each firm i given its geographical location. It is a 300-mile radius circle centered at the headquarter of the firm. We then consider the amount of deposits D_k

[13] Kashyap et al. (1993) focus on the limited substitutability between the overall bank loans and commercial papers in the market, and use the ratio of bank loans divided by the sum of commercial paper outstanding and bank loans as proxy for the constraint.

of the banks headquartered in the local area as well as the amount of bond holdings V_j of the investors headquartered in the local area. Then, we define debt inflexibility as:

$$Debt\ Inflexibility_{\mathrm{it}} = \frac{\sum_{k \in L(i)} D_{kt}}{\sum_{k \in L(i)} D_{kt} + \sum_{j \in L(i)} V_{jt}}.$$

This variable increases when the availability of local bond financing decreases relative to the amount of bank financing – i.e., it is more difficult to replace bank debt with bond financing. We provide descriptive statistics on debt inflexibility in Table I. It has a mean value of 0.78,[14] a standard deviation of 0.10, a 1st percentile value of 0.56 and a 99th percentile value of 0.98. The standard deviation provides evidence of sizable cross-sectional variations across firms. To investigate it further, in Table III, Panel A, we report *year by year* the mean, the 1st percentile, the 99th percentile and the standard deviation of debt inflexibility, while in Panel B, we report these statistics *area by area*.[15]

We see that debt inflexibility is relatively stable over time. It ranges between a high average value of 0.86 in 1997 and a low average value of 0.74 in 2006. The majority of the variation comes from the cross-section. Inflexibility has an average value of 0.68 in the *New England* area, 0.73 in the *Mid-Atlantic* area, 0.86 in the *Mountain* Area, and 0.79 in the *Pacific* area. Moreover, there is also considerable variation across firms within each area. These cross-sectional/time-series variations allow us to examine the impact of tightening in bank credit for firms with different levels of debt inflexibility.

2.4 Other Variables

[14] This suggests that the local bank supply is generally larger than the supply of non-bank type of local bond financing.
[15] We use nine Census Bureau-designated areas: *New England* (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut), *Mid-Atlantic* (New York, Pennsylvania, New Jersey), *East North Central* (Wisconsin, Michigan, Illinois, Indiana, Ohio), *West North Central* (Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa), *South Atlantic* (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida), *East South Central* (Kentucky, Tennessee, Mississippi, Alabama), *West South Central* (Oklahoma, Texas, Arkansas, Louisiana), *Mountain* (Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico), and *Pacific* (Washington, Oregon, California).

We now describe the other variables we use in the analysis. The main dependent variable is the bond yield spreads at the quarterly end.[16] We obtain the measure of yield spreads directly from the BofA Merrill Lynch Bond Index database. It is the option-adjusted spread defined as the number of percentage points that the fair value of the treasury spot curve is shifted to match the present value of the discounted cash flows to the bond price.[17]

We consider a series of control variables. The first set of variables proxy for local geographical characteristics. *Local bank supply* proxies for the amount of average bank financing available in the local area. For each firm i, we define a local area $L(i)$ as the 300-mile radius circle centered at the headquarter of the firm. We select all the banks headquartered in the local area, for which we denote the amount of deposits as D_k. We also select all the firms in Compustat headquartered at the local area, for which we denote the book assets as A_f. Then, local bank supply is defined as the ratio of $\sum_{k \in L(i)} D_{kt} / \sum_{f \in L(i)} A_{ft}$. Analogously, we define *Local bond supply*. We select all the bond investors in the local area, for which we denote the amount of total bond holdings as V_j. Then, local bond supply is defined as the ratio of $\sum_{j \in L(i)} V_{jt} / \sum_{f \in L(i)} A_{ft}$. In addition, we follow Loughran and Schultz (2005) and define an *urban dummy* equal to 1 if the firm headquarters within 50 miles from one of the ten largest metropolitan cities[18] in the US, and 0 otherwise. We also control for the *State household income* defined as the log value of median household income in each state.

The second set of variables proxy for firm-specific characteristics. The proxy for firm-specific financial constraints is the *SA financial constraint index* as defined in Hadlock and Pierce

[16] We use the quarterly frequency because other variables such as the tightening in lending standards and the violation of loan covenants are at the quarterly frequency.

[17] For bonds with embedded options, such as callability, a log normal short interest rate model is used to evaluate the present value of the bonds' potential cash flows. In this case, the option-adjusted spread is equal to the number of percentage points that the short interest rate tree must be shifted to match the discounted cash flows to the bond's price (BofA Merrill Lynch Bond Indices, 2012).

[18] According to the 2000 US Census, these cities are: New York, Los Angeles, Chicago, Houston, Philadelphia, Phoenix, San Antonio, San Diego, Dallas, and Detroit. The 50-mile range includes the firms located in the city suburbs.

(2011). The index is calculated as (−0.737*Size) + (0.043*Size^2) − (0.040*Age), where Size equals the log value of inflation-adjusted book assets, and Age is the number of years since the firm is listed with a non-missing stock price on Compustat.[19] We also consider *Cash flow volatility, Equity volatility, Firm size, Market-to-Book ratio, Book leverage* and *ROA.* We consider industry fixed effects at the two-digit SIC level. We refer to the Appendix for a more detailed description of them.

The third set of variables considers bond-specific characteristics. These variables include *Index weight, Coupon rate, Time-to-maturity and Callability.*[20] We control for the credit riskiness of the bonds using 20 rating dummies each corresponding to the average Moody's, S&P and Fitch rating from AAA to CCC3.

The fourth set of variables captures market-level conditions that have been shown to affect the change in bond yield spreads (Chen, Collin-Dufresne, Goldstein and Martin, 2001). These variables include *Change in 10-year treasury yield, Change in VIX, Change in term spread, and Change in liquidity spread.*[21] These data are from the FRED database at Federal Reserve Bank at San Louis. We also control for the equity market factors: the market factor, SMB, HML, and the momentum factor.

We present descriptive statistics of the variables in Table I. For each of them, we report the number of observations, the mean, the 1st-percentile, the 99th-percentile and the standard deviation. In total, our sample period includes 48 quarters from 1997 to 2008. Our combined bond sample contains 76,169 bond-quarter observations, with an average bond yield spreads of

[19] Following Hadlock and Pierce (2011), Size and Age are winsorized at the sample ninety-fifth percentiles.

[20] Index weight is the weight of the bond in the Bank of America Merrill Lynch US Corporate and High Yield Master Bond Index. Coupon rate is the current applicable annual interest that the bond's issuer is obligated to pay the bond holders. Time-to-maturity is the time to maturity in years, and callability indicates whether the bond is callable.

[21] *Change in 10-year treasury yield* is the quarterly change in the ten-year constant maturity treasury yields. *Change in VIX is* the quarterly change in the Chicago Board Options Exchange (CBOE) Volatility Index. *Change in term spread* is the quarterly change in term spread – where the term spread is defined as the yield difference between the ten-year constant maturity treasury bonds and the two-year constant maturity treasury bonds. *Change in liquidity spread* is the quarterly change in liquidity spread. The liquidity spread is defined as the difference between the 3-month commercial paper rate and the three-month Treasury bill rate. We refer to the Appendix for a more detailed description.

2.1% and an average time-to-maturity of 11 years, out of which 64% are callable bonds and 73% are investment grade bonds.

3. Debt Inflexibility and the Reaction of Changes in Yield Spreads to Tightening in Lending Standards

We now move on to assess the role played by our measure of debt inflexibility in amplifying the impact of tightening in bank credit supply on bond yield spreads. Since debt inflexibility makes it difficult for the firm to replace bank financing with bonds, we expect that bank credit tightening should increase the yield spreads more, the more inflexible the firm is. Moreover, we expect the amplifying effect of debt inflexibility to be stronger among smaller firms, lower rated firms, more levered firms and in particular, firms relying more on bank debt in their leverage structure.

We start by considering the tightening in bank lending standards at the market level. Following the literature (e.g., Lown and Morgan, 2002, Bassett et al., 2013, Axelson et al., 2013), we directly identify a tightening in bank lending standards from the Federal Reserve's Senior Loan Officer Opinion Survey of Bank Lending Practices. We use the net fraction of US domestic banks tightening lending standards (over the previous quarter) for commercial and industrial (C&I) loans to large and middle-market firms reported by the survey.

The Senior Loan Officer Opinion Survey has queried banks about changes in their lending standards for major categories of loans to households and businesses since 1990:Q2 and about changes in demand for those loan categories since 1991:Q4.[22] Specifically, banks are asked to report whether they have changed their lending standards, as well as whether the loan demand has changed during the survey period (over the previous three months). The questions about changes in standards follow the general pattern of "Over the past three months, how have your bank's

[22] These data are available at http://www.federalreserve.gov/datadownload/Choose.aspx?rel=SLOOS. The major loan categories include commercial & industrial loans, commercial real estate, residential mortgages to purchase homes, home equity lines of credit, credit cards, auto, and consumer loans other than credit cards or auto loans. The survey is usually conducted four times per year by the Federal Reserve Board, and up to 60 US commercial banks participate in each survey. For our purpose we focus on commercial and industrial loans to medium and large size firms.

credit standards for approving loans of type X changed?" On the demand side, the typical question is, "Over the past three months, how has the demand for loans of type X at your bank changed?" The survey data report the net fraction of domestic banks reporting tightened standards for C&I loans to large and middle-market firms, as well as the net fraction of domestic banks reporting stronger demand for C&I loans from large and middle-market firms.

The use of bank survey responses lets us define a direct measure of tightening in the availability of bank loans to potential borrowers. The tightening in lending standards may be due, for example, to banks' internal reassessments of the inherent riskiness of their business lines, changes in banking regulations, changes in monetary policy or changes in industry strategies (Bassett and Zakrajesek, 2003).

We provide a graphical view of the time variation in the tightening in lending standards in Figure I. We plot the historical survey data on tightening in lending standards and changes in loan demand over the period 1997:Q1 to 2008:Q4.[23] The solid line depicts the tightening in lending standards, and the dashed line depicts the change in loan demand. Positive values indicate a net tightening (increase) in lending standards (loan demand), while negative values indicate a net easing (decrease) in lending standards (loan demand). We observe a strong variation over the sample period. The tightening of lending standards is higher during periods of market crisis – i.e., the 1998 Russian financial crisis, the 2001 Internet bubble burst and the 2007-2008 subprime crisis – and it seems to lead the loan demand as opposed to reacting to it.[24]

3.1 Main Analysis

We now relate the changes in bond yield spreads to the tightening in bank lending standards. We study whether a tightening in lending standards affects bond yield spreads differently depending on the degree of debt inflexibility of the bond issuer. We regress the change in bond yield spreads

[23] We plot the net fraction of banks (in percentage) reporting that they have tightened their standards, and the net fraction of banks (in percentage) reporting that the loan demand has increased during the previous quarter.
[24] In the robustness checks in later sections, we will address the potential concern that the tightening in lending standard may be spuriously correlated with the change in loan demand.

on the tightening in lending standard and the interaction between it and debt inflexibility as well as a set of control variables.[25]

We report the results in Table IV. The dependent variable is the quarterly change in yield spreads as defined before. The variable of interest is the interaction term between the tightening in lending standards and debt inflexibility. We consider alternative specifications for the interaction term. In columns (2)-(4), we use the level of debt inflexibility, while in columns (5)-(6), we use a dummy variable equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. The use of inflexibility dummy makes it easier to interpret the regression coefficients. In columns (7)-(8), we redefine the inflexibility dummy *year by year* to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. This allows us to focus on cross-sectional variations across firms, instead of time-series variations due to any potential time trend of the inflexibility variable. In columns (3), (4), (6) and (8), we further interact the tightening in lending standards with the SA financial constraint index (with level or dummy variables used consistently with debt inflexibility). In columns (4)-(8), we control for credit rating fixed effects and industry fixed effects.

The results show that a tightening in lending standards has a strong and positive effect on the changes in bond yield spreads. One standard deviation higher tightening in lending standards increases yield spreads by 10 bps (per quarter). This suggests that even for firms with public bonds outstanding, bank credit tightening still has a sizable impact on the credit worthiness of the firm. More importantly, debt inflexibility strongly amplifies such impact. This can be witnessed from the interaction terms between the tightening in lending standards and either the level of inflexibility or the inflexibility dummies. The sensitivity of changes in bond yield spreads to tightening in bank lending standards for more inflexible firms is more than two times higher than

[25] We follow Chen et al. (2001) and control for the change in treasury yields and its squared term, the change in term spread, the change in liquidity spread and the change in VIX, Fama-French four factors, as well as past stock returns and the quarterly change in firm leverage. To facilitate the comparison of the economic significance, we standardize all these control variables and the tightening in lending standard to have a mean of 0 and a standard deviation of 1.

that of less inflexible firms.[26] The effect is present both when the inflexibility dummy is constructed over the entire sample period and in the case when it is constructed year-by-year.[27]

This effect not only is robust across different specifications, but it also survives after controlling for the firm-specific financial constraint and its interaction with tightening in lending standard. The two interaction terms – i.e., the interaction of tightening in lending standards with debt inflexibility and the interaction of tightening in lending standard with the SA financial constraint – always point to the same direction and are both statistically significant. More reassuringly, the former remains both quantitatively and qualitatively similar after controlling for the latter term. This suggests that debt inflexibility acts as a form of supply-driven financing friction, distinct from financial constraint driven by firm-specific characteristics. These results still hold after controlling for changes in other macro conditions such as the treasury yield, term spread, VIX and liquidity spread, as well as changes in firm-specific conditions such as stock returns and leverage.[28]

Next, we consider alternative specifications as robustness checks. First, as we see from Figure I, the tightening in lending standards and the change in loan demand from the survey data are negatively correlated, raising the concern that the previous results may be driven by some unobserved factors related to loan demand. To deal with this issue, we use an identification that zooms in on the component of the tightening in lending standards orthogonal to the change in loan demand. In particular, we regress the tightening in lending standards on the change in loan demand, and take the residual as the new proxy for the tightening in lending standards. We report the results in Panel B, Table IV. The panel layout is the same as Panel A. For brevity we only

[26] From column (5) in Panel A, Table IV, one standard deviation increase in the tightening in lending standards increases bond yield spreads by 15 bps for bonds of more inflexible firms, while the economic significance is only 6 bps for less inflexible firms.

[27] The effect is slightly stronger in the former specification, suggesting that the results are driven not only by the cross-sectional variations of inflexibility, but also by its time series variations.

[28] The role played by these control variables is largely consistent with the literature (Duffee, 1998, Chen et al., 2001). One standard deviation increase in the change in treasury yield is related to 9 bps drop in yield spreads. One standard deviation increase in the change in VIX (liquidity spread) is related to 21 (7) bps increase in yield spreads. One standard deviation increase in firm stock returns is related to 26 bps decrease in yield spreads.

report the variables of interest. We find consistent results with the previous ones. One standard deviation increase in the orthogonalized tightening in lending standards raises yield spreads by 15 bps. The effect is stronger for more inflexible firms (19 bps) than for less inflexible firms (11 bps).

Second, as we previously argued, a tightening in lending standards can be driven by a tightening in monetary policy or by commercial banks' own decisions not related to monetary policy. For example, during the 2007-2008 subprime crisis, the monetary policy got loosened, while banks still tightened their lending standards and became less willing to lend. We therefore expand our variable set by considering measures of monetary policy shocks. This allows us to see whether debt inflexibility directly amplifies the way monetary policy shocks affect yield spreads, in a way that is distinct from the tightening in lending standards.

We focus on two proxies for monetary policy shocks used in the macroeconomics literature (Romer and Romer, 2004, Barakchian and Crowe, 2010),[29] and we interact them with debt inflexibility.[30] We report the results in Panel C, Table IV. In columns (1)-(4), we consider the Romer and Romer (2004)'s measure. In columns (5)-(8), we use the Barakchian and Crowe (2010)'s measure. We find that debt inflexibility raises the sensitivity of changes in yield spreads to both the tightening in lending standards and the monetary policy shocks. The results for the two measures are consistent. For example, one standard deviation increase in the Barakchian and Crowe (2010) measure of monetary policy shocks increases the changes in yield spreads by 5 bps, and this effect is significantly stronger for the more inflexible firms (6 bps) than for the less

[29] We obtain the data on the Romer and Romer (2004) monetary policy shock and the Barakchian and Crowe (2010) monetary policy shock at http://www.imf.org/external/pubs/cat/longres.cfm?sk=24277.0 (data appendix used in Barakchian and Crowe, 2010). Here we only briefly discuss the construction of the two measures. The details can be referred to Romer and Romer (2004) and Barakchian and Crowe (2010). Romer and Romer (2004) first derive a series on feneral funds rate changes around meetings of the Federal Open Market Committee (FOMC). Then, they regress the change in the federal funds rate on the Federal Reserve's internal forecasts of inflation and real activities, and take the residual from this regression as their measure of monetary policy shocks. In contrast, Barakchian and Crowe (2010) first estimate movements in the Fed Funds Futures contract prices on the day of monetary policy announcements following FOMC meetings, then regress the changes in the Fed Funds Futures price on the Fed's forecasts of near-term economic developments, and then take the regression residuals as measure of monetary policy shocks. For both measures, an increase in value implies a further tightening in monetary policy. As before, we standardize the two measures of monetary policy shocks to have a mean of 0 and a standard deviation of 1.

[30] Specifically, we interact the two measures of monetary policy shocks with the debt inflexibility dummy (also the SA financial constraint dummy) defined over the entire sample period as in column (6) of Panel A, Table IV.

inflexible ones (3 bps). The results on the tightening in lending standards and its interaction with debt inflexibility remain similar to the ones in Panel A. Also, they do not change if we control for the interaction between monetary policy shocks and the SA financial constraint.[31]

Next, we consider two alternative and "indirect" measures of tightening in lending standards. We expect banks to tighten their lending standards when banking stocks underperform the market, or when there is an increase in non-performing loans on the banks' balance sheets. We report the results in Panel D, Table IV. In columns (1)-(4), we use the difference between market return and the value-weighted stock returns of listed commercial banks as the measure of tightening in lending standards. In columns (5)-(8), we use the change in banks' non-performing loan ratio as a proxy for the tightening in lending standard.[32] We interact the two measures with the debt inflexibility dummy (SA financial constraint dummy) defined as in column (6) of Panel A. The results are consistent with the previous ones. For example, in the case of using underperformance of banks as the measure, one standard deviation increase in the tightening in lending standards increases bond yield spreads by 17 bps for more inflexible firms, compared to that of 11 bps for less inflexible firms.

Finally, in Panel E, Table IV, we explicitly control for the impact of local supply of debt financing as well as the impact of local economic conditions. Specifically, we consider the local bank supply, the local bond supply, an urban dummy and the average state household income, as defined in the previous section. We not only add these variables as controls, but directly interact them with the tightening in lending standards.[33] The results make intuitive sense, showing that firms located in regions with higher absolute level of availability of debt financing (bank debt or

[31] Reassuringly, the SA financial constraint also amplifies the effect of monetary policy shocks on the changes in bond yield spreads.

[32] We use the quarterly change in the ratio of nonperforming loans (past due 90+ days plus nonaccrual) over total loans for all US commercial banks. The data come from the FRED database at the Federal Reserve Bank of Saint Louis.

[33] To facilitate the interpretation of the coefficients, we always use dummy variables defined as 1 if the value of the variable is above its yearly median and 0 otherwise. Defining these variables year by year helps to eliminate concerns that they may have strong time-series trend. For consistency, we define the inflexibility dummy and the SA constraint dummy year by year as in column (8) of Panel A. Specifically, In columns (1)-(4), Panel E, we interact the tightening in lending standard with the local bank supply dummy, the local bond supply dummy, the urban dummy and the State household income dummy, respectively. Columns (5)-(8) follow the same specifications as in columns (1)-(4), except that we further control for the interaction of the tightening in lending standard and the SA financial constraint dummy.

bonds), firms located in an urban area, or firms located in states with higher average household income are less subject to a tightening in lending standards. More importantly, the coefficient on our variable of interest, the interaction of the tightening in lending standards with debt inflexibility, remains unchanged if compared to the ones reported in Panel A. This suggests that our results on the amplification effect of debt inflexibility are not spuriously driven by the absolute level of availability of debt financing or by local economic conditions.

3.2 Subsample Analysis

The previous results show that debt inflexibility strongly magnifies the impact of a tightening in lending standards on the changes in bond yield spreads. We now investigate whether the amplification effect of inflexibility depends on firm characteristics - e.g., firm size, credit ratings, leverage – as well as capital constraints faced by local banks and local bond investors.

First, we expect the impact of inflexibility to be stronger in the case of smaller and lower rated firms, which are the ones with lower ability to borrow far away from the local region. Second, we expect the impact of inflexibility to be stronger for firms that have a higher leverage and, more specifically, for firms that have a higher representation of bank debt in their leverage structure.[34] These firms are the ones with higher exposure to bank credit tightening, thus have stronger need to replace bank debt with bonds when lending standards get tightened. Third, we expect the impact of inflexibility to be stronger in areas in which local banks are more constrained and local institutional investors are less constrained. These are the cases in which there is higher possibility that local banks do indeed cut credit supply, and local bond investors can step in to replace bank financing. Since insurance companies are the largest class of corporate bond investors and they are subject to the risk-based capital requirements, we will focus on them. A lower risk-based capital ratio signals that the insurance company is more capital constrained.[35]

[34] We obtain the amount of bank debt from Capital IQ from 2001 to 2008.
[35] We obtain the information on the non-performing loan ratio of individual banks from the Bank Regulatory database. Information on the risk-based capital ratio of property and life insurance companies is from the NAIC Insurance data.

We verify these predictions by performing subsample analyses in Table V. In Panel A, we split the sample by firm size (book value of assets, above median vs. below median) and by bond credit rating (above BBB3 vs. below BBB3). In Panel B, we split the sample by firm leverage (total debt/asset, above median vs. below median) and by the bank debt part of leverage (bank debt/total asset, above median vs. below median). In Panel C, we split the sample by local bank solvency (average non-performing loan ratio of local banks, above median vs. below median), and by local insurance company solvency (average risk-based capital ratio of local insurance companies, above median vs. below median).[36] We always use the same specification as in column (5) in Table IV, Panel A. For brevity, we only report the variables of interest. We perform CHOW tests to evaluate the subsample differences in coefficients on the interaction of tightening in lending standards and the inflexibility dummy and report the Chi-squared statistics.

The results support our expectations. The amplifying effect of debt inflexibility is much higher for smaller firms and lower rated firms (Panel A), for firms with higher leverage and firms with higher "bank-specific" leverage (Panel B), as well as for firms located close to banks with higher non-performing loan ratios and firms located close to insurance companies with higher risk-based capital ratios (Panel C). The Chi-squared statistics indicate that the differences between subsamples are highly significant. In particular, the amplification impact of debt inflexibility with regards to one standard deviation increase in the tightening in lending standards on the changes in yield spreads, is 10 bps (6 bps) among smaller (larger) firms, 11 bps (7 bps) among high yield (investment grade) firms, 12 bps (6 bps) among firms with higher (lower) leverage, 15 bps (7 bps) among firms with higher (lower) leverage due to bank debt, 13 bps (5 bps) among firms in areas with worse (better) local bank solvency, and 11 bps (6 bps) among firms in areas with better (worse) local insurance company solvency.

[36] As before, we identify the local region by the 300-mile radius circle centered at the bond issuer's headquarter.

4. Debt Inflexibility and the Reaction of Changes in Yield Spreads to Loan Covenants Violation

Up to now, we have focused on the tightening in lending standards at the market level, we now turn to a more firm-specific scenario of bank credit tightening: the violation of loan covenants. Financial covenants in private loan agreements are typically maintenance-based, meaning that the borrower must be in compliance with the covenant on a regular basis, typically every fiscal quarter.[37] The violation of a loan covenant gives the creditor the right to demand immediate repayment or accelerate the entire loan. In practice, creditors commonly use the right of repayment to initiate a renegotiation of the credit agreement. A direct effect is that bank credit availability becomes more costly or more restrictive after the violation (Roberts and Sufi, 2008, Nini et al., 2009, 2012).[38] If debt inflexibility makes it difficult for the firm to replace bank financing with bonds, we should expect the violation of loan covenants to increase the yield spreads more, the higher the degree of debt inflexibility is.

We therefore investigate whether the event of a loan covenant violation affects the change in bond yield spreads differently depending on the inflexibility of the issuer. We define a "*Covenants violation dummy*" that takes the value of 1 if there is an occurrence of loan covenants violation in the quarter and 0 otherwise. We regress the change in yield spreads on the covenant violation dummy and its interaction with debt inflexibility as well as a set of control variables.

We report the results of the main analysis in Table VI, Panel A. We perform the analysis at the bond-quarter level. The dependent variable is the quarterly change in yield spreads as defined

[37] On the contrary, financial covenants in bond indentures are usually incurrence-based, meaning that the borrower need only be in compliance at the time of a specific event, such as issuing new debt. Therefore, the inability to avoid maintenance-based covenants makes private loan contracts much more restrictive.

[38] Nini et al. (2012) provide an example of loan covenant violation by Digital Generation Systems Inc. The following was reported on the company's 10-Q filings on November 9, 2005: "As of September 30, 2005, the Company was not in compliance with the covenant related to its leverage ratio. On November 9, 2005, the Company received a waiver from its lenders as of September 30, 2005. In connection with securing this waiver, certain other changes were made to the credit facility which, among other things, reduced the amount that can be borrowed under the Company's revolving line of credit from $15.0 million to $4.5 million."

before. We include time fixed effects at year-quarter level in each specification.[39] Our variable of interest is the interaction between covenant violation and debt inflexibility. As before, to make the coefficients easier to interpret, we consider alternative specifications for the interaction term.[40]

The results are consistent with our expectations. First, the event of loan covenant violation corresponds to an average increase of 19 bps in bond yield spreads in the violation quarter. More importantly, debt inflexibility strongly amplifies the effect of covenant violation on the changes in yield spread. The violation of loan covenants increases yield spreads by 26 bps for the bonds of more inflexible firms and only 8 bps for less inflexible firms. The effect is present both in the case in which the inflexibility dummy is constructed over the entire sample and in the case in which it is constructed year-by-year. This effect not only is robust across different specifications, but also survives after controlling for the firm-specific SA financial constraint and its interaction with the covenant violation dummy.[41]

Next, in Panel B, Table VI, we explicitly control for the impact of local supply of debt financing as well as the impact of local economic conditions. We consider the local bank supply, the local bond supply, an urban dummy and the average state household income, as defined in the previous section. We not only add these variables as controls, but directly interact them with the covenants violation dummy.[42] For brevity, we only report the variables of interest. In all these

[39] With the use of time fixed effects at year-quarter level, those market-level controls as used in the previous section are not included. We thus only control for stock return and the change in firm leverage in the previous quarter.

[40] In columns (2)-(4), we use the level of debt inflexibility, while in columns (5)-(6) we use an inflexibility dummy equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. In column (7)-(8), we redefine the inflexibility dummy *year by year* to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. In columns (3), (4), (6) and (8), we interact covenant violation dummy with the SA constraint index (with level or dummy variables defined consistently with the ones for debt inflexibility). In columns (4)-(8), we control for credit rating fixed effects and industry fixed effects at the two-digit SIC level.

[41] Consistent with the previous findings on tightening in lending standards, the two interaction terms, i.e., the interaction of covenant violation with debt inflexibility and the interaction of covenant violation with the SA financial constraint, point to the same direction and are both statistically significant, and the former remains quantitatively and qualitatively similar after controlling for the latter term.

[42] To facilitate the interpretation of the coefficients, we always use dummy variables (1 if above yearly median and 0 otherwise, defined year by year) to interact with the covenant violation dummy. In columns (1)-(4), Panel B, Table V, we interact covenants violation dummy with the local bank supply dummy, the local bond supply dummy, the urban dummy and the State household income dummy, respectively. Columns (5)-(8) use the same specifications of columns (1)-(4), but also control for the interactions of the covenant violation dummy and the SA financial constraint dummy.

alternative specifications, the previous results in Panel A remain unchanged – i.e., debt inflexibility amplifies the impact of loan covenant violation on the changes in yield spreads.[43]

It may be argued that the increase in bond yield spread in the event of loan covenant violation is not driven by a tightening in bank credit supply, but rather by the loss of financial value that triggers the covenant violation. To deal with this concern, we directly control for the effect of a drop in financial value prior to the violation quarter. We define a "Drop dummy in net worth & current ratio" dummy equal to 1 if there is both a drop in net worth (total assets minus total liabilities) and a drop in the current ratio (the ratio of current assets to current liabilities) in the previous quarter. Our variable of interest is the triple interaction among the covenants violation dummy, the drop dummy and debt inflexibility, while controlling for the interaction terms of these variables between each other. This approach is in the same spirit as the discontinuity analysis used in Chava and Roberts (2008) – i.e., we want to capture the effect of debt inflexibility on the link between covenant violation and changes in yield spread, beyond any (amplification) effect related to the drop in financial value.

The results are reported in Panel C, Table VI. The panel layout is similar to Panel A.[44] The results show that debt inflexibility is particularly binding when the firm has experienced a drop in financial value and violated the loan covenants at the same time. In this case, a violation of covenants triggers a 34 bps increase in yield spreads in the violation quarter. This effect is not driven by a mere loss of financial value or any amplification effect associated with it, but rather due to the interaction between loan covenants violation and the consequence of tightening in banking credit supply. As in the previous cases, the effect of inflexibility is not only robust across

[43] It is interesting to note that, different from the case of tightening in lending standards, firms located in regions with higher absolute level of availability of local bank financing experience higher increase in yield spreads in the event of loan covenant violation. This suggests that the violation of loan covenants may represent a significant loss of firm reputation to all potential lenders. Conversely, the result on the interaction with the urban dummy is consistent with before: firms located in urban areas experience less increase in yield spreads in the event of covenant violation.

[44] In columns (2)-(4), we use the level of debt inflexibility variable to calculate the interaction terms, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median and 0 otherwise. In column (7)-(8), we redefine the debt inflexibility year by year to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. We also control for the interaction terms with the SA financial constraints (level or dummy variable). In columns (5)-(8), we add credit rating fixed effects and industry fixed effects at the two-digit SIC level.

different specifications, but also survives after controlling for the SA financial constraint and its interactions with the drop dummy and the covenant violation dummy.

Overall, these results suggest that debt inflexibility amplifies the effect of bank credit tightening on corporate yield spreads, both in the case of market-wide tightening in lending standards and firm-specific violations of loan covenants. This supports our claim that debt inflexibility serves as a form of "supply-driven" financing constraints, reducing the firm's ability to manage its debt structure to fare through tight credit conditions. This also suggests that, for more inflexible firms cash flows fluctuations should have a more direct impact on the credit worthiness of the firm, and we should expect to see a stronger link between equity and bonds. We investigate this issue in the next section.

5. Debt Inflexibility and the Link between Debt and Equity Markets

We now explore how debt inflexibility affects the link between the debt and the equity market. As we argued, debt inflexibility should constrain the firm's ability to buffer the effect of cash flow swings on the default risk of the firm. We first examine the relation between yield spreads and cash flow volatility, and the relationship between yield spreads and equity volatility (Campbell and Taksler, 2003), then we directly link debt inflexibility to the correlation of stock returns and changes in bond yield spreads.

5.1 Yield Spreads and Cash Flow Volatility

We first examine whether debt inflexibility increases the link between yield spreads and cash flow volatility. We perform the analyses in Table VII. The analysis is done at the bond-quarter level. We follow Minton and Schrand (1999) to define cash flow volatility. For each firm-quarter, we calculate cash flow volatility as the standard deviation of operating cash flows – i.e., cash

flow from operations from the statement of cash flows (COMPUSTAT quarterly data108) – in the past 24 quarters[45] divided by the absolute value of the mean during the calculation period.

Panel A presents the results based on the full sample. The panel layout is the same as in previous cases.[46] In Panel B, Table VII, we sort the tightening in lending standards, as used in Table IV, to separate the sample into periods of tightened and loosened lending standards (above versus below median) and we perform subsample analyses.[47] The results display a strong and positive effect of debt inflexibility on the relation between bond yield spreads and cash flow volatility. This effect is more evident during periods of tightened bank lending standards. Then, one standard deviation increase in cash flow volatility raises yield spreads by 28 bps for more inflexible firms and just by 13 bps for less inflexible firms. Conversely, during periods of loosened lending standards, one standard deviation increase in cash flow volatility increases yield spreads by 18 (9) bps for more (less) inflexible firms.

In Panel C, Table VII, we explicitly control for the impact of local supply of debt financing as well as the impact of local economic conditions. We consider the local bank supply, the local bond supply, an urban dummy and the average state household income, as defined in the previous section.[48] For brevity, we only report the variables of interest. In all these alternative specifications, the previous results remain unchanged – i.e., debt inflexibility strongly strengthens the relation between yield spreads and cash flow volatility.

[45] We require a minimum of 15 quarters of non-missing observations.

[46] Specifically, in columns (2)-(4), we use the level of debt inflexibility variable to interact with cash flow volatility, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. In column (7)-(8), we redefine the debt inflexibility *year by year* to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. In columns (3), (4), (6) and (8), we further interact cash flow volatility with the SA financial constraint (with level or dummy variable defined consistently with debt inflexibility). In columns (4)-(8), we control for rating fixed effects and industry fixed effects at the two-digit SIC level.

[47] In Panel B, Table VII, we define the debt inflexibility dummy year by year to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise.

[48] To facilitate the interpretation of the coefficients, we always use dummy variables (1 if above yearly median and 0 otherwise, defined year by year) to interact with the covenant violation dummy. In columns (1)-(4), Panel B, Table VII, we interact covenants violation dummy with the local bank supply dummy, the local bond supply dummy, the urban dummy and the state household income dummy, respectively. Columns (5)-(8) follow the same specifications as in columns (1)-(4), except that we further control for the interactions of the covenant violation dummy and the SA financial constraint dummy.

5.2 Yield Spreads and Equity Volatility

We now examine the link between yield spreads and equity volatility. We follow Campbell and Taksler (2003) and regress bond yield spreads on equity volatility, and interact it with debt inflexibility. For each firm-quarter, we calculate equity volatility as the standard deviation of daily stock returns in the quarter.

We report the results in Table VIII, Panel A. The analysis is done at the bond-quarter level. The panel layout is the same as in the case of cash flow volatility (Table VII, Panel A). The results display a strong and positive effect of debt inflexibility on the relationship between yield spreads and equity volatility. The sensitivity of yield spreads to stock volatility is 24% higher in more inflexible firms than in less inflexible ones. In particular, one standard deviation higher equity volatility is related to a 50 bps higher yield spread for more inflexible firms and a 39 bps higher yield spread for less inflexible firms. The effect of inflexibility is not only robust across different specifications, but also survives after controlling for the SA constraint and its interactions with equity volatility.

In Panel B, Table VIII, we explicitly control for the impact of local supply of debt financing as well as the impact of local economic conditions. We consider the local bank supply, the local bond supply, an urban dummy and the average state household income, and we interact them with equity volatility. We find that, for firms located in regions with higher absolute level of availability of debt financing (bank or bonds), firms in urban areas, or firms located in states with higher average household income, the link between yield spreads and equity volatility is weakened. More importantly, in all these alternative specifications, the previous results remain unchanged – i.e., debt inflexibility strongly strengthens the relationship between yield spreads and equity volatility.

Campbell and Taksler (2003) also focus on the explanatory power of equity volatility on yield spreads, showing that equity volatility can explain as much cross-sectional variations in

yield spreads as credit ratings. We follow the same approach and compare the explanatory power of equity volatility on yield spreads between subsamples defined in terms of debt inflexibility.[49] We define the high and low debt inflexibility subsamples year by year on the basis of the sample median. As before, we consider the overall sample period as well as subsamples defined in terms of the tightening in lending standards.

We report the results in Panel C, Table VIII. In columns (1)-(4), we split the sample by high/low inflexibility, while in columns (5)-(8), we split the sample by both high/low inflexibility and tightened/loosened lending standards. From columns (3) to (8), we include time fixed effects at the year-quarter level. The results are consistent with the ones reported in Panel A, and show that the sensitivity of yield spreads to equity volatility is significantly higher for more inflexible firms than for less inflexible ones. If we focus on the regression R-squares, we see that equity volatility itself explains 29% of the variations in yield spreads for more inflexible firms, compared to only 14% for less inflexible ones. The difference in R-squares persists even if we control for bond maturity, index weight, coupon rate and industry effects. In addition, consistent with the previous findings on cash flow volatility, both the regression coefficient and the explanatory power of equity volatility on yield spreads are stronger for more inflexible firms particularly during periods of tightened lending standards.

5.3 The Correlation between Stock Returns and Changes in Bond Yield Spreads

Next, we directly relate debt inflexibility to the correlation between equity returns and changes in bond yield spreads. Since many capital structure arbitrage strategies involve the trading of stocks and credit default swaps (CDSs), we also consider the correlation between stock returns and changes in CDS spreads. We proceed as follows. First, we obtain the weekly stock returns from CRSP, the weekly issue outstanding-weighted changes in bond yield spreads from BofA Merrill

[49] To be consistent with Campbell and Taksler (2003), we only include non-callable bonds for this analysis, and we only control for bond maturity, index weight, coupon rate and industry effects.

Lynch bond index database, and the weekly CDS spread changes from Markit.[50] Then, for each firm-year, using the weekly data, we calculate the correlation between equity returns and changes in yield spreads, and the correlation between equity returns and changes in CDS spreads. Next, we regress such correlations on debt inflexibility and a set of control variables.

We report the results in Table IX. In columns (1)-(4), we relate debt inflexibility to the correlation between equity returns and changes in bond yield spreads. In columns (2)-(4), we control for credit rating fixed effects (SP long-term credit rating from AAA to CCC) and industry fixed effects at the two-digit SIC level. Columns (1)-(2) are based on the full sample, while in column (3) and (4) we split the sample into subsamples of tightened and loosened lending standards as previously defined. Columns (5)-(8) follow the same specifications as columns (1)-(4) but focus on the correlation between equity returns and changes in CDS spreads.

We find that debt inflexibility significantly increases the correlation between stock returns and changes in yield spreads. In particular, one standard deviation higher inflexibility is related to a 31% more negative correlation between stock returns and changes in bond yield spreads, relative to the unconditional mean of -7%. In addition, one standard deviation higher inflexibility is related to a 20% more negative correlation between stock returns and changes in CDS spreads, relative to the unconditional mean of -11%.[51] Consistently with the previous results, these effects are particularly pronounced during periods of tightened lending standards. These findings are robust across the different specifications and provide strong evidence of a direct impact of debt inflexibility on the connection between the debt and equity market.

[50] The Markit CDS data start from 2001. We focus on the most commonly observed CDS contracts in the market, – i.e., CDS contracts with 5-year maturity and modified restructuring clause (Zhang, Zhou, and Zhu, 2008, Elkamhi, Pungaliya and Vijh, 2010).

[51] The lower economic significance of the correlation of stock returns and CDS spreads is due to the fact that most of the firms with CDS contracts outstanding are usually large firms and investment grade firms (Qiu and Yu, 2012).

Conclusion

We argue that the lack of flexibility of the firm in replacing bank financing with bond financing increases the inability to buffer a tightening in bank credit supply. In locally segmented debt markets in which bond and bank debt are not close substitutes, a regional market with a higher inflexibility amplifies the impact of bank credit tightening on the default risk of the firm. This constrains the firm's ability to go through tightened credit conditions, and increases the link between debt and equity.

We test this hypothesis on US corporations over the period 1997-2008. We first show that bond investors tilt their investment towards local bonds, and that firms are more likely to borrow from local banks. We then build a measure of locally driven debt inflexibility that proxies for the inability of the firm to replace bank financing with bond financing and test how it affects the reaction of bond yield spreads to bank credit tightening. We consider market-wide tightening in bank lending standards. We document that more inflexible firms suffer a bigger increase in yield spreads as bank credit supply tightens. The impact is stronger among smaller firms, lower rated firms, and firms replying more on bank debt. Debt inflexibility also amplifies the impact of firm-specific tightening in bank credit induced by the violation of loan covenants. Then, we investigate whether the effect of inflexibility increases the link between bond and equity. We find that more inflexible firms display a stronger link between yield spreads and cash flow volatility, a stronger link between yield spreads and stock volatility (Campbell and Taksler, 2003), as well as a higher correlation between changes in yield spreads and stock returns.

These results provide a new insight on how supply-driven financing constraints on the ability of the firms to substitute among different sources of financing – e.g., private and public debt – affect the transmission of bank credit tightening to the bond market and its relation to the equity market.

References

Aggarwal, S. and R. Hauswald, 2010, Distance and Private Information in Lending, Review of Financial Studies 23, 2757-2788.

Axelson, U., Jenkinson, T., Strömberg, P. and Weisbach, M. S. , 2013, Borrow Cheap, Buy High? The Determinants of Leverage and Pricing in Buyouts, Journal of Finance 68, 2223–2267.

Baik, B., Kang, J. and Kim, J., 2010, Local Institutional Investors, Information Asymmetries and Equity Returns, Journal of Financial Economics 97, 191-217.

Barakchian, Seyed M., and Christopher Crowe, 2010, Monetary policy matters: New evidence based on a new shock measure, I.M.F. Working Paper 10/230.

Bassett, W. F. and E. Zakrajesek, 2003, Recent Developments in Business Lending by Commercial Banks, Federal Reserve Bulletin, December, 477–492.

Bassett, W., Chosak, M. B., Driscoll, J. C. and Zakrajsek, E., 2013. Changes in bank lending standards and the macroeconomy, Journal of Monetary Economics, Forthcoming.

Butler, A., 2008, Distance Still Matters: Evidence from Municipal Bond Underwriting, Review of Financial Studies 21, 763-784.

Campbell, J. and G.B. Taksler, 2003, Equity Volatility and Corporate Bond Yields, Journal of Finance, 58, 2321-2350.

Chava, Sundheer and Michael Roberts, 2008. How Does Financing Impact Investment? The Role of Debt Covenants, Journal of Finance 63, 2085-2121.

Chen, L., P. Collin-Dufresne, R.S. Goldstein, and J.S. Martin, 2001, The Determinants of Credit Spread Changes, Journal of Finance, 56, 2177-2207.

Coval, J.D. and T. Moskowitz, 1999, Home Bias at Home: Local Equity Preference in Domestic Portfolios, Journal of Finance 54, 2045-2073.

Coval, J.D. and T. Moskowitz, 2001, The Geography of Investment: Informed Trading and Asset Prices, Journal of Political Economy 109, 811-841.

Degryse,H., S.Ongena,2005, Distance Lending Relationships and Competition, Journal of Finance,231-266

Duffee, G.R., 1998, The Relation Between Treasury Yields and Corporate Bond Yield Spreads, The Journal of Finance 6, 2225-2241.

Elkamhi, R., R. S. Pungaliya, and A. M. Vijh, 2010, Do Firms Have a Target Leverage? Evidence from Credit Markets, Working Paper.

Faulkender, Michael, and Mitchell Petersen, 2005, Does the Source of Capital Affect Capital Structure? Review of Financial Studies 19, pp. 45-79.

Hadlock, C., and J. Pierce. 2010. New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. Review of Financial Studies 23, 1909–40.

Huberman, G., 2001. Familiarity Breeds Investment, Review of Financial Studies 14. 659-680.

Kashyap, A., J.C. Stein, and D. Wilcox, 1993, Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance, American Economic Review 83, 78-98.

Kashyap, A., and J.C. Stein, 1995, The Impact of Monetary Policy on Bank Balance Sheets, Carnegie-Rochester Conference Series on Public Policy, 42, 151-95.

Kashyap, A., and J.C. Stein, 2000, What Do a Million Observations on Banks Say About the Transmission of Monetary Policy, American Economic Review 90, 407-28.

Leary, M., 2009. Bank Loan Supply, Lender Choice and Corporate Capital Structure. Journal of Finance 64, 1143-1185.

Lemmon, M., Roberts. M., 2010. The Response of Corporate Financing and Investment to Changes in the Supply of Credit. Journal of Financial and Quantitative Analysis. 45, 555-587.

Lin, H., and D. Paravisini, 2011, The Effect of Financing Constraints on Risk, Review of Finance, 229–59.

Loughran, T. and P. Schultz, 2005, Liquidity: Urban versus Rural Firms, Journal of Financial Economics 78, 341-374.

Lown, C. S. and D. P. Morgan, 2002, Credit Effects in the Monetary Mechanism, Economic Policy Review, Federal Reserve Bank of New York, 8, 217–235.

Lown, C. S. and D. P. Morgan, 2006, The Credit Cycle and the Business Cycle: New Findings from the Loan Officer Opinion Survey," Journal of Money, Credit, and Banking, 38, 1575–1597.

Lown, C. S., D. P. Morgan, and S. Rohatgi, 2000, Listening to Loan Officers: The Impact of Commercial Credit Standards on Lending and Output, Economic Policy Review, Federal Bank of New York, 6, 1–16.

Massa, M., and L. Zhang, 2013, Monetary Policy and Regional Availability of Debt Financing, Journal of Monetary Economics 60, 439-458.

Massa, M., A. Yasuda and L. Zhang, 2013, The Effects of Bond Supply Uncertainty on the Financing Policy of the Firm, Journalf of Financial Economics 110, 185-214.

Massa, M., A. Yasuda, and L. Zhang, 2013, Local Bias in Corporate Bond Holdings, Working Paper.

Minton, B., and Schrand, C., 1999, The Impact of Cash Flow Volatility on Discretionary Investment and the Costs of Debt and Equity Financing, Journal of Financial Economics 54, 423-460.

Nini, Greg, David C. Smith, and Amir Sufi, 2009. Creditor Control Rights and Firm Investment Policy, Journal of Financial Economics 92, 400-420.

Nini, Greg, David C. Smith, and Amir Sufi, 2012. Creditor Control Rights, Corporate Governance, and Firm Value, Review of Financial Studies 25, 1713-1761.

Petersen, M., Rajan, R.G., 2002. Does Distance Still Matter? The Information Revolution in Small Business Lending. Journal of Finance 57, 2533-2570

Pirinsky, C. and Q. Wang, 2006, Does Corporate Headquarters Location Matter for Stock Returns?, Journal of Finance 61, 1991-2015.

Qiu, J., and F. Yu, 2012, Endogenous Liquidity in Credit Derivatives, Journal of Financial Economics 103, 611-631.

Rajan, R. G., 1992. Insiders and Outsiders: the Choice between Informed and Arm's-length Debt. Journal of Finance 47, 1367–1399.

Roberts M. and A. Sufi, 2009, Renegotiation of Financial Contracts: Evidence from Private Credit Agreements, Journal of Financial Economics 93(2), 159-184.

Romer, C.D. and D.H. Romer, 2004, A New Measure of Monetary Shocks: Derivation and Implications, American Economic Review 94, 1055–84.

Schaefer, S., and I. Strebulaev, 2008, Structural Models of Credit Risk are Useful: Evidence from Hedge Ratios on Corporate Bonds, Journal of Financial Economics 90, 1-19.

Schreft, S. L. and R. E. Owens, 1991, Survey Evidence of Tighter Credit Conditions: What Does it Mean?, Federal Reserve Bank of Richmond Economic Review 77, 29–34.

Zhang, B. Y., H. Zhou, and H. Zhu, 2008, Explaining Credit Default Swap Spreads with Equity Volatility and Jump Risks of Individual Firms, Review of Financial Studies 22, 5099-5131.

Appendix: Variable Definitions

Firm-level variables

Debt inflexibility: We first define debt inflexibility. The data on the geographical locations (zip codes) and bond holdings of bond institutional investors are obtained from Lipper's eMAXX fixed income database. It contains details of fixed income holdings for nearly 20,000 US and European insurance companies, US, Canadian and European mutual funds, and leading US public pension funds. It provides information on quarterly ownership of more than 40,000 fixed income issuers with $5.4 trillion in par amount from the first quarter of 1998 to the second quarter of 2008.

Our data on the geographical location (zip codes) and deposits of bank headquarters are from FDIC's Summary of Deposits (SOD) database. It contains deposits data for more than 89,000 branches/offices of FDIC-insured institutions. The Federal Deposit Insurance Corporation (FDIC) collects deposit balances for commercial and savings banks as of June 30 of each year starting from 1994. The data are collected annually. We obtain bond investor and bank headquarters coordinates (longitudes and latitudes) by merging zip codes with Gazetteer Files of Census 2000. The location data on firm headquarters come from Compustat. One potential problem with the Compustat data is that Compustat only reports the current state and county of firms' headquarters. To deal with this problem, we cross-check the historic records of firms' location information from Compact Disclosure and firm 10K filings.

We set up a local area $L(i)$ for each firm i given its geographical locations. It is a 300-mile radius circle centered at the headquarter of the firm. We then consider the amount of deposits D_k of the banks headquartered in the local area as well as the amount of bond holdings V_j of the bond investors in the local area. Then, we define debt inflexibility as:

$$Debt\ Inflexibility_{\text{it}} = \frac{\sum_{k \in L(i)} D_{kt}}{\sum_{k \in L(i)} D_{kt} + \sum_{j \in L(i)} V_{jt}}.$$

Local bank supply: As before, we set up a local area $L(i)$ for each firm i given its geographical locations. It is a 300-mile radius circle centered at the headquarter of the firm. We select all the banks headquartered in the local area, for which we denote the amount of deposits as D_k. We also select all the firms in Compustat headquartered in the local area, for which we denote the book assets as A_f. Then the local bank supply is defined as: $\sum_{k \in L(i)} D_{kt} / \sum_{f \in L(i)} A_{ft}$.

Local bond supply: We apply the same methodology to define local bond supply. We set up a local area $L(i)$ for each firm i given its geographical locations. It is a 300-mile radius circle centered at the headquarter of the firm. We select all the bond investors headquartered in the local area, for which we denote the amount of total bond holdings as V_j. Then local bond supply is defined as: $\sum_{j \in L(i)} V_{jt} / \sum_{f \in L(i)} A_{ft}$.

SA financial constraint: We follow Hadlock and Pierce (2011) to define a measure of firm-level financial constraint. It is calculated as (−0.737* Size) + (0.043* Size^2) − (0.040* Age), where Size equals the log of inflation-adjusted book assets, and Age is the number of years since the firm is listed with a non-missing stock price on Compustat. In calculating the measure, Size and Age are both winsorized at the sample 95th-percentiles.

Equity volatility: For each firm-quarter (i,t), it is the standard deviation of daily stock returns in the quarter.

Cash flow volatility: For each firm-quarter, we calculate cash flow volatility as the standard deviation of operating cash flows – i.e., cash flow from operations from the statement of cash flows (COMPUSTAT quarterly data108) – in the past 24 quarters divided by the absolute value of the mean during the calculation period. We require a minimum of 15 quarters of non-missing observations.

Change in leverage: It is the change in book leverage relative to the previous quarter.

Market Value of Assets: stock price (data199) * shares outstanding (data25) + short term debt (data34) + long term debt (data9) + preferred stock liquidation value (data10) – deferred taxes (data35).

Market-to-Book Ratio: market value of assets/book assets (data6)

Book Leverage: total debt (data9+data34)/book assets (data6)

Firm Size: log(book assets) (data6)

ROA: income before extraordinary items (data20)/book assets (data6)

Corr(Equity return, Δ Yield spread): For each firm-year, we calculate the correlation between weekly equity returns and weekly changes in value-weighted (by bond issue outstanding) average bond yield spreads. We require a minimum of 120 days with available data.

Corr(Equity return, Δ CDS spread): For each firm-year, we calculate the correlation between weekly equity returns and weekly changes in CDS spreads. We require a minimum of 120 days with available data.

Urban dummy: It is equal to 1 if the firm headquarters within 50 miles from one of the ten largest metropolitan cities in the US, and 0 otherwise. According to the 2000 US Census, these cities are: New York, Los Angeles, Chicago, Houston, Philadelphia, Phoenix, San Antonio, San Diego, Dallas, and Detroit. The 50-mile range helps to includes the firms located in the city suburbs.

State household income: It is the log value of median household income in each state.

Bond-level variables

Yield spread: bond yield spread is obtained as the option-adjusted yield spread reported in the Bank of America Merrill Lynch Bond Index database. It measures the amount by which a risk-free spot curve must be raised or lowered so that the resulting discounted cash flows equal the market price of the bond. It simultaneously considers credit risk and contingent cash flow risk, such that bonds with different cash flow characteristics can be compared on a more equal basis.

Index weight: the weight of the bond in the Bank of America Merrill Lynch US Corporate and High Yield Master Bond index, based on market value of the bond.

Coupon rate: the current applicable annual interest that the bond's issuer is obligated to pay the bondholders.

Time-to-maturity: (maturity date-current date)/360

Callability: dummy variable equal to 1 if the bond issue is callable and 0 otherwise.

Rating fixed effects: 20 rating dummies each corresponding to quarterly end bond credit ratings (an average of Moody's, S&P and Fitch) from AAA to CCC3.

Market-level variables

Tightening in lending standards: the net percentage of loan officers in the US banks reporting tightening in lending standards for commercial and industrial loans to medium and large firms. The data come from the Senior Loan Officer Opinion Survey on Bank Lending Practices.

Change in 10-year treasury yield: the change in the ten year constant maturity treasury yields.

Change in VIX: the change in the Chicago Board Options Exchange (CBOE) Volatility Index. VIX measures market expectation of near term volatility conveyed by stock index option prices.

Change in term spread: the change in term spread. Term spread is defined as the yield difference between the ten-year constant maturity treasury bonds and the two-year constant maturity treasury bonds.

Change in liquidity spread: the change in liquidity spread. Liquidity spread is defined as the difference between the 3-month commercial paper rate and the three-month Treasury bill rate.

Equity market factors: the excess return of market portfolio over the risk-free rate (market factor), the return difference between small and large capitalization stocks (SMB), the return difference between high and low book-to-market stocks (HML), the return difference between stocks with high and low past returns (momentum).

Table I: Summary Statistics of Main Variables

This table presents summary statistics of the main variables used in the subsequent analysis. We report the number of observations, the mean, the 1-percentile, the 99-percentile and the standard deviation. Our data come from multiple sources. The data on institutional holdings of corporate bonds are from Lipper's eMAXX fixed income database. The data on bond yield spreads, bond maturity, coupon rate and bond level credit ratings are from Bank of America Merrill Lynch U.S. Corporate and High Yield Master bond index data from 1997 to 2008. The data on credit default swap (CDS) spreads are obtained from Markit between 2001 and 2008. The data on characteristics of bond issuances such as bond callability, putability and convertibility are from Mergent FISD. The data on tightening in lending standards are from the Senior Loan Officer Survey data from the Federal Reserve Board. Macro-economic variables including 10-year treasury yield, term spread, liquidity spread and VIX are from the FRED database at Federal Reserve Bank at San Louis. The data on risk-free rate, market returns, SMB, HML and momentum are obtained from Kenneth French's website. The data on firm characteristics are from Compustat and CRSP. The definition of each variable can be found in the appendix.

	Freq.	Level	Mean	1st-per.	99th-per.	Stan. dev.	N
Bond yield spread	Quarter	Bond	2.102	0.337	10.027	1.917	76319
Bond maturity	Quarter	Bond	11.102	1.119	89.553	12.217	76319
Bond index weight	Quarter	Bond	0.019	0.005	0.088	0.017	76319
Bond coupon rate	Quarter	Bond	7.212	3.700	11.250	1.535	76319
Bond callability dummy	Quarter	Bond	0.640	0.000	1.000	0.480	76319
Investment grade dummy	Quarter	Bond	0.735	0.000	1.000	0.441	76319
Change in bond yield spread	Quarter	Bond	0.116	-2.000	3.660	0.854	76319
Stock return	Quarter	Firm	0.022	-0.544	0.586	0.205	25162
Change in bond leverage	Quarter	Firm	0.001	-0.095	0.129	0.042	25162
Equity volatility	Quarter	Firm	0.023	0.007	0.074	0.013	25162
Cash flow volatility	Quarter	Firm	0.863	0.473	1.434	0.261	19897
Loan covenants violation	Quarter	Firm	0.026	0	1	0.160	23466
Corr(Equity return, Δ Yield spread)	Year	Firm	-0.070	-0.496	0.343	0.179	5189
Corr(Equity return, Δ CDS spread)	Year	Firm	-0.115	-0.521	0.303	0.180	3060
Debt inflexibility	Year	Firm	0.777	0.556	0.982	0.100	6878
SA constraint	Year	Firm	-4.166	-4.878	-3.058	0.621	6878
Local bank supply	Year	Firm	12.516	10.102	14.011	1.066	6878
Local bond supply	Year	Firm	11.126	7.000	13.130	1.400	6878
Urban dummy	Year	Firm	0.436	0.000	1.000	0.496	6878
State household income	Year	Firm	10.601	10.273	11.081	0.173	6878
Firm size	Year	Firm	8.361	5.519	12.265	1.450	6878
Book leverage	Year	Firm	0.356	0.028	0.887	0.183	6878
Market-to-book	Year	Firm	1.292	0.192	5.327	0.971	6878
ROA	Year	Firm	0.033	-0.215	0.194	0.076	6878
Tightening in lending standard	Quarter	Market	0.118	-0.241	0.836	0.260	48
Change in 10-year treasury yield	Quarter	Market	-0.082	-1.160	0.900	0.452	48
Change in VIX	Quarter	Market	0.669	-12.158	20.349	6.316	48
Change in term spread	Quarter	Market	0.020	-0.533	0.902	0.295	48
Change in liquidity spread	Quarter	Market	0.014	-0.698	0.626	0.224	48
Market return	Quarter	Market	0.003	-0.231	0.182	0.092	48
SMB	Quarter	Market	0.008	-0.102	0.117	0.055	48
HML	Quarter	Market	0.012	-0.197	0.227	0.070	48
Momentum	Quarter	Market	0.027	-0.202	0.235	0.084	48

Table II: Locality in Debt Markets

This table presents the results on the proximity borrowing in the debt markets. In Panel A, we examine corporate bonds. The analysis is done at the investor (i.e., asset management company) level. "Real-local frac." is the fraction of local bonds in the investor's bond portfolio. "Pseudo-local frac." is the fraction of local bonds the investor would have in his portfolio if he allocates his portfolio proportionally to the index weight based on the Bank of America Merrill Lynch U.S. Corporate and High Yield Master bond index. We perform a two-sided T-test to compare the differences. We define the local region as a 300-mile radius circle centered at the location of the bond investor. "Small bond portfolio" only includes bonds with index weights below the sample median. "Large bond portfolio" only includes bonds with index weights above the sample median. "Investment grade bond portfolio" consists of investment grade bonds (bond credit rating above or equal to BBB3). "Below-investment grade bond portfolio" refers to the portfolio made of below investment grade bonds (bond credit rating below BBB3). We further perform the same analysis on the subsample of investors with non-zero local bond holdings in their portfolios. ***, ** and * represent significance levels at 1%, 5% and 10% respectively.

Panel A: Corporate Bonds

	Full Sample			Subsample: Real-local>0		
	Real-local	Pseudo-local	Difference	Real-local	Pseudo-local	Difference
Entire portfolio	22.2%	19.3%	2.9%***	28.9%	22.5%	6.4%***
	(42299)	(42299)	(34.75)	(32408)	(32408)	(67.97)
Small bond portfolio	21.1%	16.1%	5.0%***	31.3%	18.5%	12.8%***
	(34478)	(34478)	(39.93)	(23222)	(23222)	(80.51)
Large bond portfolio	22.7%	21.1%	1.6%***	31.6%	26.0%	5.6%***
	(41135)	(41135)	(19.39)	(29587)	(29587)	(55.36)
Investment-grade bond portfolio	22.8%	20.3%	2.5%***	30.4%	24.3%	6.1%***
	(40817)	(40817)	(30.33)	(30597)	(30597)	(64.65)
Below-investment grade bond portfolio	18.5%	15.5%	3.0%***	30.7%	18.1%	12.6%***
	(22517)	(22517)	(18.35)	(13538)	(13538)	(55.54)

Panel B: Bank Loans

Panel B presents the proximity borrowing behavior of bank loan borrowers. The analysis is done at the borrower level. "Real-local frac." is the fraction of loans a firm borrows from local banks (bank headquarters) in each year. "Pseudo-local frac." is the fraction of loans a firm would borrow from local banks if it borrowed proportionally from all the banks according to the size of their bank deposits. We consider the universe of Compustat firms in this analysis. The data on bank loans are from LPC Dealscan, and the information on bank deposits comes from Summary of Deposit (SOD) database from 1997 to 2008. We perform a two-sided T-test to compare the differences. We also report the results separately by distinguishing borrowers by size (book value of assets, below median /above median), and by credit rating (S&P long term rating, above BBB-/below BBB-/non-rated). We define local region as a 300-mile radius circle centered at the headquarters of the borrower. We further perform the same analysis on the subsample of borrowers with non-zero borrowing from local banks. ***, ** and * represent significance levels at 1%, 5% and 10% respectively.

	Full Sample			Subsample: Real-local>0		
	Real-local	Pseudo-local	Difference	Real-local	Pseudo-local	Difference
All borrowers	32.8%	13.3%	19.5%***	57.5%	17.1%	40.4%***
	(6357)	(6357)	(46.48)	(3624)	(3624)	(81.39)
Small borrowers	38.9%	12.8%	26.1%***	68.2%	15.7%	52.5%***
	(3179)	(3179)	(38.23)	(1810)	(1810)	(74.25)
Large borrowers	26.7%	13.7%	13.0%***	46.7%	18.4%	28.3%***
	(3178)	(3178)	(28.09)	(1814)	(1814)	(49.73)
Investment grade borrowers	28.3%	14.5%	13.7%***	46.3%	19.2%	27.1%***
	(2080)	(2080)	(24.73)	(1269)	(1269)	(40.53)
Below-investment grade borrowers	25.9%	12.2%	13.7%***	50.3%	16.2%	34.1%***
	(1222)	(1222)	(16.54)	(630)	(630)	(32.43)
Non-rated Borrowers	38.6%	12.9%	25.7%***	68.3%	15.8%	52.4%***
	(3055)	(3055)	(36.96)	(1725)	(1725)	(72.10)

Table III: Summary Statistics of Debt Inflexibility

This table provides detailed summary statistics on the debt inflexibility variable. In panel A, we report year by year the mean, the 1-percentile, the 99-percentile and the standard deviation of debt inflexibility.

Panel A: Debt Inflexibility by Year

Year	Mean	1st-per.	99th-per.	Stan. dev.	N
1997	0.859	0.784	0.983	0.056	525
1998	0.793	0.637	0.969	0.079	599
1999	0.755	0.606	0.951	0.087	604
2000	0.770	0.587	0.951	0.084	560
2001	0.757	0.605	0.960	0.090	554
2002	0.743	0.496	0.970	0.101	606
2003	0.770	0.480	0.979	0.096	656
2004	0.769	0.600	0.981	0.085	660
2005	0.786	0.617	0.988	0.102	574
2006	0.737	0.395	0.988	0.122	545
2007	0.799	0.592	0.988	0.115	501
2008	0.808	0.588	0.992	0.109	494

Panel B: Debt Inflexibility by Region

In panel B, we report area by area the mean, the 1-percentile, the 99-percentile and the standard deviation of debt inflexibility. We broadly use the following Census Bureau-designated areas:

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut;
Mid-Atlantic: New York, Pennsylvania, New Jersey;
East North Central: Wisconsin, Michigan, Illinois, Indiana, Ohio;
West North Central: Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa;
South Atlantic: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida;
East South Central: Kentucky, Tennessee, Mississippi, Alabama;
West South Central: Oklahoma, Texas, Arkansas, Louisiana;
Mountain: Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico;
Pacific: Washington, Oregon, California.

Region	Mean	1st-per.	99th-per.	Stan. dev.	N
New England	0.679	0.567	0.821	0.060	485
Mid-Atlantic	0.730	0.626	0.914	0.066	1272
East North Central	0.793	0.560	0.944	0.099	1217
West North Central	0.699	0.395	0.989	0.113	395
South Atlantic	0.841	0.641	0.988	0.077	1011
East South Central	0.859	0.702	0.958	0.048	250
West South Central	0.778	0.650	0.971	0.080	1212
Mountain	0.860	0.663	0.996	0.094	358
Pacific	0.787	0.529	0.974	0.109	686

Table IV: Debt Inflexibility and the Amplification Effect of Tightening in Lending Standards

This table explores the effect of tightening in bank lending standards on the changes in bond yield spreads, depending on the degree of debt inflexibility. The analysis is done at the bond-quarter level. The dependent variable is the quarterly change in yield spreads. In each quarter, we use as a direct proxy for the tightening in lending standards the net percentage of domestic banks that reported having tightened standards on commercial and industrial loans to large and middle-sized firms over the past three months, published in the Senior Loan Officer Opinion Survey. We control for the changes in treasury yield, term spread, liquidity spread and VIX, and Fama-French four factors, as well as past stock returns and the changes in firm leverage. To facilitate the comparison of economic significances, we standardize all these variables to have a mean of 0 and a standard deviation of 1. Our variable of interest is the interaction between the tightening in lending standards and debt inflexibility. We consider alternative specifications for the interaction term. In columns (2)-(4), we use the level of debt inflexibility to interact with the tightening in lending standards, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. In columns (7)-(8), we redefine the inflexibility dummy *year by year* to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. In columns (3), (4), (6) and (8), we further interact the tightening in lending standards with the Size and Age (SA) financial constraint index (with level or dummy variables defined consistently with debt inflexibility). In columns (4)-(8), we control for credit rating fixed effects (20 rating dummies from AAA to CCC3) and industry fixed effects at the two-digit SIC level. We cluster the errors at the bond level in all specifications. ***, ** and * represent significance levels at 1%, 5% and 10% respectively, with heteroscedasticity-robust standard errors. t-statistics are in parenthesis.

Panel A: Main Results

	Inflexibility Level				Inflexibility Dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tightening in lending standards	0.100***	-0.294***	-0.047	-0.045	0.056***	0.028***	0.069***	0.037***
	(22.86)	(-9.99)	(-1.11)	(-1.07)	(10.87)	(4.81)	(13.71)	(6.51)
Tightening in lending standards * Debt inflexibility (level or dummy)		0.508***	0.510***	0.508***	0.094***	0.095***	0.070***	0.070***
		(13.27)	(13.56)	(13.75)	(13.75)	(14.03)	(10.17)	(10.27)
Debt inflexibility (level or dummy)		0.252***	0.248***	0.197***	0.034***	0.034***	0.021***	0.021***
		(9.08)	(9.12)	(7.16)	(6.33)	(6.32)	(3.97)	(3.84)
Tightening in lending standards * SA constraint (level or dummy)			0.057***	0.057***		0.055***		0.065***
			(9.02)	(9.04)		(8.10)		(9.57)
SA constraint (level or dummy)			0.061***	0.017***		0.010		0.011*
			(12.41)	(2.91)		(1.58)		(1.74)
Change in 10-year treasury yield	-0.089***	-0.089***	-0.089***	-0.090***	-0.090***	-0.090***	-0.090***	-0.090***
	(-25.37)	(-25.48)	(-25.75)	(-26.17)	(-25.98)	(-26.09)	(-25.87)	(-26.07)
Change in 10-year treasury yield^2	0.102***	0.101***	0.102***	0.104***	0.103***	0.104***	0.104***	0.105***
	(20.15)	(20.10)	(20.46)	(20.94)	(20.72)	(20.89)	(20.86)	(21.11)
Change in VIX	0.213***	0.208***	0.208***	0.210***	0.211***	0.210***	0.214***	0.214***
	(32.98)	(32.39)	(32.62)	(32.85)	(32.82)	(32.84)	(33.50)	(33.53)
Change in term spread	-0.005	-0.001	-0.001	-0.000	0.001	0.001	-0.003	-0.002
	(-1.32)	(-0.32)	(-0.32)	(-0.08)	(0.24)	(0.20)	(-0.73)	(-0.69)
Change in liquidity spread	0.075***	0.075***	0.075***	0.075***	0.075***	0.075***	0.074***	0.074***
	(24.82)	(25.08)	(24.95)	(25.10)	(25.07)	(25.01)	(24.73)	(24.67)
Market return	0.059***	0.058***	0.058***	0.062***	0.066***	0.065***	0.063***	0.063***
	(10.22)	(9.99)	(10.05)	(10.71)	(11.17)	(11.09)	(10.90)	(10.89)
SMB	-0.018***	-0.016***	-0.016***	-0.018***	-0.019***	-0.019***	-0.019***	-0.019***
	(-6.26)	(-5.81)	(-5.76)	(-6.37)	(-6.83)	(-6.76)	(-6.78)	(-6.73)
HML	-0.003	-0.001	-0.001	0.000	0.002	0.002	-0.002	-0.002
	(-0.76)	(-0.13)	(-0.16)	(0.02)	(0.42)	(0.42)	(-0.54)	(-0.54)
Momentum	-0.003	-0.000	-0.000	0.002	0.002	0.002	-0.002	-0.002
	(-0.83)	(-0.01)	(-0.01)	(0.45)	(0.42)	(0.40)	(-0.41)	(-0.39)
Stock return	-0.265***	-0.264***	-0.263***	-0.262***	-0.263***	-0.262***	-0.263***	-0.262***
	(-42.31)	(-42.24)	(-42.39)	(-42.66)	(-42.57)	(-42.55)	(-42.66)	(-42.63)
Change in leverage	0.022***	0.021***	0.021***	0.021***	0.021***	0.022***	0.021***	0.022***
	(4.82)	(4.78)	(4.80)	(4.78)	(4.61)	(4.81)	(4.61)	(4.85)
Credit rating FE, industry FE	-	-	-	Y	Y	Y	Y	Y
R-squared	76,319	76,319	76,319	76,319	76,319	76,319	76,319	76,319
Number of Obs.	0.325	0.329	0.332	0.338	0.336	0.337	0.335	0.336

Table IV (Cont'd)

Panel B: Tightening in Lending Standards Orthogonalized from Loan Demand

In Panel B, we orthogonalize the survey measure on the tightening in lending standards from the change in loan demand also obtained from the Senior Loan Officer Survey. Specifically, we regress the tightening in lending standards on the change in loan demand and take the residual as the new proxy for the tightening in lending standards. The panel layout is the same as Panel A. For brevity we only report the variables of interest.

	Inflexibility Level				Inflexibility Dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tightening in lending standards	0.149***	-0.209***	0.002	0.012	0.111***	0.084***	0.119***	0.088***
	(39.84)	(-7.15)	(0.05)	(0.29)	(22.47)	(14.89)	(25.03)	(16.16)
Tightening in lending standards * Debt inflexibility (level or dummy)		0.457***	0.458***	0.445***	0.075***	0.075***	0.068***	0.067***
		(12.15)	(12.34)	(12.27)	(10.71)	(10.90)	(9.69)	(9.62)
Tightening in lending standards * SA constraint (level or dummy)			0.049***	0.048***		0.055***		0.063***
			(7.45)	(7.32)		(7.69)		(8.99)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	-	-	Y	Y	Y	Y	Y
Number of Obs.	76,319	76,319	76,319	76,319	76,319	76,319	76,319	76,319

Panel C: Tightening in Lending Standard and Monetary Policy Shocks

In Panel C, we consider both the survey measure on the tightening in bank lending standards and the measures of monetary policy (MP) shocks in the macroeconomics literature. In columns (1)-(4), we use the Romer and Romer (2004)'s measure on monetary policy shocks. In columns (5)-(8), we use the Barakchian and Crowe (2010)'s measure on monetary policy shocks. We interact the measures of monetary policy shocks with the debt inflexibility dummy (SA financial constraint dummy) defined over the entire the sample period as in column (6) of Panel A. For brevity we only report the variables of interest.

	MP Shocks: Romer and Romer (2004)				MP Shocks: Barakchian and Crowe (2010)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tightening in lending standards	0.107***	0.049***	0.014**	0.018***	0.121***	0.069***	0.033***	0.036***
	(22.65)	(8.14)	(2.06)	(2.62)	(24.80)	(12.18)	(5.32)	(5.83)
Monetary policy shocks	0.020***	0.004	-0.010*	-0.009	0.048***	0.027***	0.003	0.002
	(4.90)	(0.77)	(-1.88)	(-1.61)	(15.47)	(6.57)	(0.63)	(0.53)
Tightening in lending standards * Debt inflexibility dummy		0.114***	0.115***	0.112***		0.103***	0.103***	0.100***
		(13.56)	(13.86)	(13.81)		(13.52)	(13.81)	(13.58)
Monetary policy shocks * Debt inflexibility dummy		0.035***	0.035***	0.036***		0.036***	0.035***	0.034***
		(5.11)	(5.11)	(5.38)		(5.86)	(5.79)	(5.60)
Tightening in lending standards * SA constraint dummy			0.070***	0.069***			0.071***	0.071***
			(8.35)	(8.40)			(9.44)	(9.57)
Monetary policy shocks * SA constraint dummy			0.029***	0.028***			0.050***	0.050***
			(4.30)	(4.12)			(8.21)	(8.20)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	-	-	Y	-	-	-	Y
Number of Obs.	76,319	76,319	76,319	76,319	76,319	76,319	76,319	76,319

Table IV (Cont'd)

Panel D: Alternative Measures of Tightening in Lending Standards

In Panel D, we consider two alternative and "indirect" measures of tightening in bank lending standards. In columns (1)-(4), we use the under-performance of banking stocks, i.e., difference between the market return and the value-weighted stock returns of public commercial banks, as the measure of tightening in lending standards. In columns (5)-(8), we use the change in non-performing loans as a proxy for the tightening in lending standards. We calculate the quarterly change in the ratio of non-performing loans (past due 90+ days plus nonaccrual) over total loans for all US commercial banks. The debt inflexibility dummy and the SA financial constraint dummy are defined as in column (6) of Panel A. For brevity we only report the variables of interest.

	Under-performance of Banking Stocks				Change in Non-performing Loan Ratio			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tightening in lending standards	0.146***	0.107***	0.083***	0.086***	0.181***	0.115***	0.074***	0.077***
	(38.78)	(19.67)	(13.73)	(14.63)	(39.74)	(17.37)	(10.24)	(11.07)
Tightening in lending standards * Debt inflexibility dummy		0.064***	0.063***	0.059***		0.111***	0.109***	0.105***
		(9.14)	(9.02)	(8.58)		(12.20)	(12.29)	(12.05)
Tightening in lending standard * SA constraint dummy			0.050***	0.051***			0.087***	0.091***
			(7.11)	(7.41)			(9.61)	(10.26)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	-	-	Y	-	-	-	Y
Number of Obs.	76,319	76,319	76,319	76,319	76,319	76,319	76,319	76,319

Panel E: Control for Interaction with Other Local Conditions

In Panel E, we interact the tightening in lending standards with other regional conditions. Specifically, we consider local bank supply, local bond supply, an urban dummy and the average state household income. The definition of these variables can be found in the appendix. To facilitate the interpretation of the coefficients, for the interaction terms, we always use dummy variables (1 if above median and 0 otherwise), defined year by year, to eliminate concerns that these variables may have strong time trends). In columns (1)-(4), we interact the tightening in lending standards with the local bank supply dummy, the local bond supply dummy, the urban dummy and the state household income dummy, respectively. Columns (5)-(8) follow the same specifications as in columns (1)-(4), except that we further control for the interaction of the tightening in lending standards and the SA financial constraint dummy. For brevity we only report the variables of interest.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tightening in lending standards	0.078***	0.074***	0.076***	0.084***	0.043***	0.036***	0.048***	0.051***
	(12.23)	(10.64)	(9.86)	(12.97)	(6.35)	(4.77)	(6.34)	(6.97)
Tightening in lending standards * Debt inflexibility dummy	0.068***	0.067***	0.067***	0.064***	0.069***	0.070***	0.063***	0.064***
	(9.85)	(9.04)	(8.31)	(8.92)	(10.07)	(9.54)	(7.96)	(9.09)
Tightening in lending standards * Local bank supply dummy	-0.021***				-0.016**			
	(-3.07)				(-2.36)			
Tightening in lending standards * Local bond supply dummy		-0.012*				-0.004		
		(-1.68)				(-0.53)		
Tightening in lending standards * Urban dummy			-0.015*				-0.025***	
			(-1.85)				(-3.12)	
Tightening in lending standards * State household income dummy				-0.030***				-0.028***
				(-4.32)				(-4.08)
Tightening in lending standards * SA constraint dummy					0.064***	0.065***	0.068***	0.064***
					(9.34)	(9.40)	(9.74)	(9.33)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of Obs.	76,319	76,319	76,319	76,319	76,319	76,319	76,319	76,319

Table V: Debt Inflexibility and the Amplification Effect of Tightening in Lending Standards: Subsample Comparison

This table presents the results of subsample comparisons on the amplification effect of debt inflexibility as documented in Table IV. We always use the same specification as column (5) in Table IV, Panel A. In Panel A, we separate the sample by firm size (book value of assets, above median vs. below median) and by credit rating category (above BBB3 vs. below BBB3). In Panel B, we separate the sample by firm leverage (total debt/asset, above median vs. below median) and by "bank-specific" leverage (bank debt/total asset, above median vs. below median). We obtain the amount of bank debt from Capital IQ over the period 2001-2008. In Panel C, we separate the sample by local bank solvency (average non-performing loan ratio of local banks, above median vs. below median), and by local insurance company solvency (average risk-based capital (RBC) ratio of local insurance companies, above median vs. below median). We calculate the RBC ratio as the total capital divided by the risk-based capital. As before, we identify the local region as a 300-mile circle centered at the firm's headquarter. We perform CHOW tests to evaluate the differences in coefficients between subsamples on the interaction term and report the Chi-squared statistics. For brevity we only report the variables of interest.

Panel A: Sample Separation by Firm Size and Credit Rating

	Firm size≥median	Firm size<median	Investment Grade	High Yield
	(1)	(2)	(3)	(4)
Tightening in lending standards	0.045***	0.071***	0.049***	0.044***
	(8.00)	(8.28)	(11.06)	(3.14)
Tightening in lending standards * Debt inflexibility dummy	0.061***	0.102***	0.068***	0.114***
	(7.55)	(10.11)	(10.21)	(7.36)
Same as column (5), Panel A, Table IV	Y	Y	Y	Y
Number of Obs.	38,172	38,147	56,093	20,226
Test in difference in the interaction term: Chi-squared statistic	10.05***		7.34***	

Panel B: Sample Separation by Debt/Asset and Bank Debt/Asset

	Debt/Asset ≥median	Debt/Asset <median	Bank Debt/Asset ≥median	Bank Debt/Asset <median
	(1)	(2)	(3)	(4)
Tightening in Lending Standard	0.048***	0.060***	0.004	0.027***
	(5.79)	(10.08)	(0.25)	(2.81)
Tightening in Lending Standard * Debt inflexibility dummy	0.115***	0.063***	0.145***	0.072***
	(11.08)	(7.23)	(7.98)	(5.13)
Same as column (5), Panel A, Table IV	Y	Y	Y	Y
Number of Obs.	38,122	38,197	11,908	11,924
Test in difference in the interaction term: Chi-squared statistic	14.62***		9.91***	

Panel C: Sample Separation by Local Bank Solvency and Local Insurance Solvency

	Local Bank Solvency ≥ median	Local Bank Solvency < median	Local Insurance Solvency ≥ median	Local Insurance Solvency < median
	(1)	(2)	(3)	(4)
Tightening in Lending Standard	0.088***	0.029***	0.042***	0.071***
	(11.49)	(4.09)	(5.44)	(10.36)
Tightening in Lending Standard * Debt inflexibility dummy	0.050***	0.129***	0.111***	0.058***
	(4.78)	(14.28)	(11.76)	(5.81)
Same as column (5), Panel A, Table IV	Y	Y	Y	Y
Number of Obs.	38,153	38,165	37,738	38,580
Test in difference in the interaction term: Chi-squared statistic	33.58***		14.95***	

Table VI: Loan Covenants Violation, Debt Inflexibility and Change in Yield Spreads

This table explores the impact of loan covenants violation on the change in bond yield spreads, depending on the degree of debt inflexibility. The analysis is done at the bond-quarter level. The dependent variable is the quarterly change in yield spreads. "Covenants violation dummy" takes a value of 1 if there is an occurrence of loan covenants violation in the quarter and 0 otherwise. The data on loan covenants violation are obtained directly from Amir Sufi's website. Our variable of interest is the interaction between the covenant violation dummy and debt inflexibility. Panel A presents the main results. We consider alternative specifications for the interaction term. In columns (2)-(4), we use the level of debt inflexibility to interact with the covenants violation dummy, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. In columns (7)-(8), we redefine the debt inflexibility year by year to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. In columns (3), (4), (6) and (8), we further interact the covenant violation dummy with the Size and Age (SA) financial constraint index (with level or dummy variables defined consistently with debt inflexibility). In columns (4)-(8), we control for credit rating fixed effects (from AAA to CCC3) and industry fixed effects at the two-digit SIC level. We cluster the standard errors at the bond level in all specifications. ***, ** and * represent significance levels at 1%, 5% and 10% respectively using heteroscedasticity robust standard errors with t-statistics given in parentheses.

Panel A: Main Results

	Inflexibility Level				Inflexibility Dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covenants violation dummy	0.193***	-0.463	-0.152	-0.174	0.080*	-0.024	0.051	-0.029
	(5.62)	(-1.58)	(-0.37)	(-0.43)	(1.95)	(-0.39)	(1.20)	(-0.48)
Covenants violation dummy * Debt inflexibility (level or dummy)		0.836**	0.797**	0.830**	0.176***	0.180***	0.210***	0.210***
		(2.22)	(2.09)	(2.18)	(2.66)	(2.71)	(3.19)	(3.17)
Debt inflexibility (level or dummy)		0.025	0.019	-0.009	0.006	0.005	0.000	-0.000
		(1.14)	(0.88)	(-0.39)	(1.23)	(1.12)	(0.02)	(-0.06)
Covenants violation dummy * SA constraint (level or dummy)			0.072	0.075		0.150**		0.120*
			(1.35)	(1.41)		(2.17)		(1.75)
SA constraint (level or dummy)			0.039***	0.024***		0.019***		0.019***
			(9.51)	(4.94)		(3.83)		(3.90)
Stock return	-0.238***	-0.238***	-0.239***	-0.237***	-0.237***	-0.237***	-0.237***	-0.237***
	(-39.74)	(-39.73)	(-39.76)	(-39.86)	(-39.93)	(-39.94)	(-39.96)	(-39.97)
Change in leverage	0.016***	0.016***	0.016***	0.016***	0.016***	0.016***	0.017***	0.016***
	(4.41)	(4.53)	(4.48)	(4.72)	(4.79)	(4.69)	(4.84)	(4.75)
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	-	-	Y	Y	Y	Y	Y
R-squared	0.276	0.277	0.278	0.282	0.281	0.282	0.281	0.282
Number of Obs.	74,881	74,881	74,881	74,881	74,881	74,881	74,881	74,881

Table VI (Cont'd)

Panel B: Control for Interaction with Local Conditions

In Panel B, we control for the interaction of covenants violation dummy with other regional conditions. Specifically, we consider local bank supply, local bond supply, an urban dummy and average state household income. The definition of these variables can be found in the appendix. To facilitate the interpretation of the coefficients, for the interaction terms, we always use dummy variables (1 if above median and 0 otherwise), defined year by year, to eliminate concerns that these variables may have strong time trends). In columns (1)-(4), we interact the covenants violation dummy with the local bank supply dummy, the local bond supply dummy, the urban dummy and the state household income dummy, respectively. Columns (5)-(8) follow the same specifications as in columns (1)-(4), except that we control for the interaction of the covenant violation dummy and the SA financial constraint dummy. For brevity we only report the variables of interest.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covenants violation dummy	-0.019	-0.022	0.126**	0.045	-0.108	-0.102	0.033	-0.039
	(-0.34)	(-0.35)	(2.04)	(0.67)	(-1.50)	(-1.27)	(0.42)	(-0.50)
Covenants violation dummy * Debt inflexibility dummy	0.232***	0.260***	0.187***	0.222***	0.228***	0.254***	0.192***	0.218***
	(3.44)	(3.52)	(2.76)	(3.26)	(3.37)	(3.41)	(2.80)	(3.16)
Covenants violation dummy * Local bank supply dummy	0.194***				0.193***			
	(2.64)				(2.61)			
Covenants violation dummy * Local bond supply dummy		0.164**				0.155*		
		(2.07)				(1.95)		
Covenants violation dummy * Urban dummy			-0.104				-0.080	
			(-1.54)				(-1.18)	
Covenants violation dummy * State household income dummy				0.035				0.031
				(0.48)				(0.42)
Covenants violation dummy * SA financial constraint dummy					0.129*	0.120*	0.111	0.124*
					(1.91)	(1.78)	(1.64)	(1.82)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of obs.	74,882	74,882	74,882	74,882	74,882	74,882	74,882	74,882

Table VI (Cont'd)

Panel C: Further Interaction with Drop in Financial Ratio

In Panel C, we examine the impact of covenants violation and debt inflexibility on the change in yield spreads, by further interacting debt inflexibility with an indicator representing a drop in net worth and current ratio of the bond issuer. We define "Drop dummy in net worth & current ratio" as a dummy equal to 1 if there is both a drop in net worth (total assets minus total liabilities) and a drop in the current ratio (the ratio of current assets to current liabilities) in the previous quarter. Our variable of interest is the triple interaction term among the covenants violation dummy, the drop dummy and debt inflexibility. In columns (2)-(4), we use the level of debt inflexibility variable to calculate the interaction terms, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median over the entire sample period and 0 otherwise. In column (7)-(8), we redefine the inflexibility dummy *year by year* to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. We also control for the interaction terms with the SA financial constraint (level or dummy variables used consistently with debt inflexibility). In columns (4)-(8), we add credit rating fixed effects (20 rating dummies from AAA to CCC3) and industry fixed effects at the two-digit SIC level. We include time fixed effects at year-quarter level and cluster the errors at the bond level. ***, ** and * represent significance levels at 1%, 5% and 10% respectively using heteroscedasticity robust standard errors with t-statistics given in parentheses.

	Inflexibility Level				Inflexibility Dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covenants violation dummy	0.120***	-0.052	0.401	0.388	0.075	-0.020	0.026	-0.026
	(3.35)	(-0.16)	(0.91)	(0.90)	(1.53)	(-0.30)	(0.52)	(-0.39)
Drop dummy in net worth	0.033***	-0.030	0.161	0.124	0.030***	0.018	0.027***	0.016
	(4.30)	(-0.46)	(1.59)	(1.21)	(2.71)	(1.61)	(2.58)	(1.54)
Covenants violation dummy* Drop dummy in net worth	0.232***	-1.182*	-1.514*	-1.469*	0.018	-0.068	0.082	-0.052
	(3.16)	(-1.94)	(-1.84)	(-1.79)	(0.20)	(-0.55)	(0.87)	(-0.42)
Covenants violation dummy* Debt inflexibility (level or dummy)		0.220	0.124	0.164	0.059	0.056	0.137*	0.132*
		(0.54)	(0.30)	(0.40)	(0.86)	(0.82)	(1.93)	(1.89)
Drop dummy in net worth * Debt inflexibility (level or dummy)		0.081	0.054	0.062	0.003	-0.001	0.009	0.006
		(0.97)	(0.65)	(0.74)	(0.19)	(-0.07)	(0.64)	(0.42)
Covenants violation dummy* Drop dummy in net worth * Debt inflexibility (level or dummy)		1.786**	1.961**	1.908**	0.343**	0.388***	0.231	0.267*
		(2.29)	(2.54)	(2.46)	(2.51)	(2.81)	(1.63)	(1.87)
Debt inflexibility (level or dummy)		0.011	0.007	-0.017	0.006	0.006	-0.001	-0.001
		(0.52)	(0.32)	(-0.73)	(1.20)	(1.17)	(-0.30)	(-0.32)
Covenants violation dummy* SA constraints (level or dummy)			0.096*	0.101*		0.142**		0.083
			(1.67)	(1.76)		(1.99)		(1.16)
Drop dummy in net worth * SA constraint (level or dummy)			0.038**	0.032*		0.036**		0.031*
			(2.30)	(1.91)		(2.27)		(1.94)
Covenants violation dummy* Drop dummy in net worth * SA constraint (level or dummy)			-0.045	-0.044		0.091		0.164
			(-0.42)	(-0.40)		(0.63)		(1.14)
SA constraint (level or dummy)			0.034***	0.020***		0.015***		0.016***
			(8.20)	(3.90)		(2.77)		(2.99)
Stock return	-0.238***	-0.238***	-0.238***	-0.237***	-0.237***	-0.237***	-0.237***	-0.237***
	(-39.76)	(-39.74)	(-39.80)	(-39.88)	(-39.90)	(-39.93)	(-39.95)	(-39.98)
Change in leverage	0.012***	0.012***	0.012***	0.013***	0.013***	0.012***	0.013***	0.012***
	(3.56)	(3.88)	(3.73)	(4.01)	(4.18)	(3.96)	(4.16)	(3.94)
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, Industry FE	-	-	-	Y	Y	Y	Y	Y
R-squared	0.277	0.278	0.279	0.283	0.282	0.283	0.282	0.283
Number of Obs.	74,881	74,881	74,881	74,881	74,881	74,881	74,881	74,881

Table VII: Debt Inflexibility and the Link between Bond Yield Spreads and Cash Flow Volatility

This table analyzes the effect of debt inflexibility on the link between the level of bond yield spreads and cash flow volatility. The analysis is done at the bond-quarter level. For each firm-quarter, we calculate cash flow volatility as the standard deviation of operating cash flows in the past 24 quarters divided by the absolute value of the mean during the calculation period (Minton and Schrand, 1999). We require a minimum of 15 quarters of non-missing observations during the 24 quarters. In Panel A, we present the main results. As before, we consider alternative specifications for the interaction term. In columns (2)-(4), we use the level of debt inflexibility to interact with cash flow volatility, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. In column (7)-(8), we redefine the inflexibility dummy year by year to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. In columns (3), (4), (6) and (8), we further interact cash flow volatility with the Size and Age (SA) financial constraint index (with level or dummy variables used consistently with debt inflexibility). In columns (4)-(8), we control for credit rating fixed effects (20 rating dummies from AAA to CCC3) and industry fixed effects at the two-digit SIC level. We cluster the standard errors at the bond level in all specifications. ***, ** and * represent significance levels at 1%, 5% and 10% respectively using heteroscedasticity robust standard errors with t-statistics given in parentheses.

Panel A: Main Results

	Inflexibility Level				Inflexibility Dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash flow volatility	0.631***	-1.649***	-1.182**	-0.106	0.048	-0.008	0.031	-0.045
	(12.36)	(-4.83)	(-2.24)	(-0.27)	(1.05)	(-0.15)	(0.70)	(-0.83)
Cash flow volatility * Debt inflexibility (level or dummy)		3.024***	3.001***	1.724***	0.259***	0.253***	0.316***	0.310***
		(6.70)	(6.65)	(4.85)	(3.69)	(3.62)	(4.56)	(4.49)
Debt inflexibility (level or dummy)	1.148***	-1.332***	-1.317***	-0.919***	-0.128**	-0.124**	-0.142**	-0.137**
	(8.31)	(-3.61)	(-3.57)	(-3.14)	(-2.29)	(-2.22)	(-2.57)	(-2.49)
Cash flow volatility * SA constraint (level or dummy)			0.104	0.237***		0.109		0.145**
			(1.15)	(3.67)		(1.56)		(2.11)
SA constraint (level or dummy)	0.248***	0.246***	0.159**	-0.128**	0.023	-0.068	0.028	-0.094
	(9.12)	(9.08)	(2.12)	(-2.34)	(1.05)	(-1.18)	(1.29)	(-1.63)
Bond maturity	0.004***	0.004***	0.004***	0.010***	0.010***	0.010***	0.010***	0.010***
	(3.20)	(3.15)	(3.15)	(13.53)	(13.72)	(13.70)	(13.77)	(13.75)
Index weight	-3.235***	-3.254***	-3.260***	-2.396***	-2.328***	-2.318***	-2.372***	-2.361***
	(-3.35)	(-3.43)	(-3.43)	(-4.23)	(-4.15)	(-4.13)	(-4.23)	(-4.21)
Coupon rates	0.296***	0.295***	0.294***	0.088***	0.090***	0.089***	0.089***	0.088***
	(25.77)	(25.65)	(25.58)	(10.79)	(10.91)	(10.90)	(10.83)	(10.80)
Callability	0.212***	0.212***	0.210***	0.098***	0.107***	0.107***	0.106***	0.105***
	(5.90)	(5.91)	(5.87)	(4.55)	(5.00)	(4.99)	(4.95)	(4.92)
Market-to-book	-0.117***	-0.118***	-0.120***	-0.100***	-0.096***	-0.097***	-0.096***	-0.098***
	(-6.38)	(-6.37)	(-6.41)	(-6.21)	(-5.92)	(-5.95)	(-5.97)	(-6.02)
Book leverage	1.056***	1.078***	1.069***	0.678***	0.691***	0.689***	0.705***	0.704***
	(12.98)	(13.31)	(13.02)	(8.22)	(8.34)	(8.32)	(8.50)	(8.48)
Firm size	-0.316***	-0.312***	-0.313***	-0.092***	-0.095***	-0.096***	-0.094***	-0.095***
	(-23.58)	(-23.33)	(-23.33)	(-7.32)	(-7.60)	(-7.68)	(-7.50)	(-7.62)
ROA	-6.514***	-6.519***	-6.520***	-3.485***	-3.506***	-3.515***	-3.495***	-3.504***
	(-21.35)	(-21.44)	(-21.42)	(-15.73)	(-15.92)	(-15.96)	(-15.91)	(-15.96)
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, Industry FE	-	-	-	Y	Y	Y	Y	Y
R-squared	0.592	0.594	0.594	0.723	0.722	0.722	0.723	0.723
Number of Obs.	61,701	61,701	61,701	61,701	61,701	61,701	61,701	61,701

Table VII(Cont'd)

Panel B: Tightened versus Loosened Lending Standards

In Panel B, we separate the sample by periods of tightened and loosened lending standards. We sort the tightening in lending standards, as used in Panel A of Table IV, and define the period of tightened lending standards and the period of loosened lending standards accordingly (above median vs. below median). We define the inflexibility dummy and the SA constraint dummy year by year as the ones used in column (8), Panel A. For brevity we only report the variables of interest.

	Tightened Lending Standards				Loosened Lending Standards			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash flow volatility	0.734***	0.531***	0.046	0.143**	0.482***	0.351***	0.047	-0.079
	(10.73)	(6.72)	(0.78)	(1.98)	(9.22)	(5.49)	(1.07)	(-1.48)
Cash flow volatility * Debt inflexibility dummy		0.555***	0.320***	0.325***		0.379***	0.234***	0.207***
		(4.67)	(3.47)	(3.53)		(3.74)	(3.13)	(2.85)
Cash flow volatility * SA constraint dummy				-0.176*				0.268***
				(-1.91)				(3.94)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	-	Y	Y	-	-	Y	Y
R-squared	0.588	0.592	0.750	0.750	0.499	0.505	0.693	0.694
Number of obs.	31,630	31,630	31,630	31,630	30,071	30,071	30,071	30,071

Panel C: Interaction with Local Conditions

In Panel C, we further control for the interaction of cash flow volatility with other regional conditions. Specifically, we consider local bank supply, local bond supply, an urban dummy and average state household income. The definition of these variables can be found in the appendix. To facilitate the interpretation of the coefficients, for the interaction terms, we always use dummy variables (1 if above median and 0 otherwise), defined year by year, to eliminate concerns that these variables may have strong time trends. In columns (1)-(4), we interact cash flow volatility with the local bank supply dummy, the local bond supply dummy, the urban dummy and the state household income dummy, respectively. Columns (5)-(8) follow the same specifications as in columns (1)-(4), except that we also control for the interaction of cash flow volatility and the SA financial constraint dummy. For brevity we only report the variables of interest.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash flow volatility	0.024	0.034	-0.111*	0.211***	-0.065	-0.064	-0.184***	0.135*
	(0.39)	(0.46)	(-1.75)	(3.05)	(-0.91)	(-0.76)	(-2.75)	(1.82)
Cash flow volatility * Debt inflexibility dummy	0.311***	0.314***	0.396***	0.244***	0.304***	0.317***	0.385***	0.234***
	(4.50)	(4.22)	(5.50)	(3.30)	(4.40)	(4.27)	(5.35)	(3.17)
Cash flow volatility * Local bank supply dummy	0.004				0.022			
	(0.06)				(0.31)			
Cash flow volatility * Local bond supply dummy		-0.009				0.019		
		(-0.12)				(0.24)		
Cash flow volatility * Urban dummy			0.216***				0.210***	
			(2.90)				(2.79)	
Cash flow volatility * State household income dummy				-0.277***				-0.281***
				(-3.69)				(-3.75)
Cash flow volatility * SA financial constraint dummy					0.153**	0.150**	0.149**	0.151**
					(2.22)	(2.15)	(2.18)	(2.22)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of obs.	61,701	61,701	61,701	61,701	61,701	61,701	61,701	61,701

Table VIII: Debt Inflexibility and the Link between Bond Yield Spreads and Equity Volatility

This table analyzes the effect of debt inflexibility on the link between the level of bond yield spreads and equity volatility. The analysis is done at the bond-quarter level. For each firm-quarter, we calculate equity volatility as the standard deviation of daily stock returns of the bond issuer in the quarter. In Panel A, we present the main results. As before, we consider alternative specifications for the interaction term. In columns (2)-(4), we use the level of debt inflexibility to interact with equity volatility, while in columns (5)-(6) we use a dummy variable equal to 1 if debt inflexibility is above the sample median (over the entire sample period) and 0 otherwise. In column (7)-(8), we redefine the inflexibility dummy year by year to be equal to 1 if debt inflexibility is above the yearly median and 0 otherwise. In columns (3), (4), (6) and (8), we further interact equity volatility with the Size and Age (SA) financial constraint index (with level or dummy variables used consistently with debt inflexibility). In columns (4)-(8), we control for credit rating fixed effects (20 rating dummies from AAA to CCC3) and industry fixed effects at the two-digit SIC level. We cluster the standard errors at the bond level in all specifications. ***, ** and * represent significance levels at 1%, 5% and 10% respectively using heteroscedasticity robust standard errors with t-statistics given in parentheses.

Panel A: Main Results

	Inflexibility Level				Inflexibility Dummy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Equity volatility	60.314***	20.825***	19.439**	18.797**	38.415***	37.001***	35.927***	33.810***
	(45.20)	(3.03)	(2.08)	(2.34)	(29.23)	(22.17)	(29.19)	(21.50)
Equity volatility * Debt inflexibility (level or dummy)		50.891***	50.860***	48.320***	9.166***	9.198***	14.137***	14.154***
		(5.95)	(5.95)	(6.50)	(6.54)	(6.55)	(10.30)	(10.30)
Debt inflexibility (level or dummy)	0.800***	-0.306*	-0.306*	-0.708***	-0.117***	-0.117***	-0.223***	-0.223***
	(7.13)	(-1.78)	(-1.78)	(-4.75)	(-4.17)	(-4.18)	(-8.32)	(-8.33)
Equity volatility * SA constraint (level or dummy)			-0.339	3.239**		2.175		3.265**
			(-0.22)	(2.57)		(1.42)		(2.15)
SA constraint (level or dummy)	0.078***	0.080***	0.088***	-0.080***	-0.022	-0.069**	-0.019	-0.089***
	(3.67)	(3.76)	(2.80)	(-2.82)	(-1.18)	(-2.20)	(-1.03)	(-2.90)
Bond maturity	0.005***	0.005***	0.005***	0.010***	0.010***	0.010***	0.010***	0.010***
	(4.72)	(4.77)	(4.76)	(14.53)	(14.53)	(14.55)	(14.63)	(14.67)
Index weight	-2.055***	-2.029***	-2.031***	-1.772***	-1.853***	-1.837***	-1.882***	-1.860***
	(-2.91)	(-2.89)	(-2.89)	(-3.73)	(-3.93)	(-3.89)	(-4.01)	(-3.96)
Coupon rates	0.243***	0.243***	0.243***	0.083***	0.084***	0.083***	0.083***	0.082***
	(27.07)	(27.11)	(27.07)	(11.92)	(11.92)	(11.89)	(11.86)	(11.80)
Callability	0.149***	0.149***	0.149***	0.058***	0.063***	0.062***	0.063***	0.061***
	(5.49)	(5.48)	(5.49)	(3.22)	(3.50)	(3.41)	(3.52)	(3.39)
Market-to-book	-0.190***	-0.192***	-0.192***	-0.169***	-0.170***	-0.170***	-0.171***	-0.172***
	(-12.47)	(-12.59)	(-12.58)	(-11.92)	(-11.91)	(-11.96)	(-11.99)	(-12.06)
Book leverage	0.820***	0.818***	0.819***	0.486***	0.503***	0.500***	0.523***	0.518***
	(12.42)	(12.39)	(12.35)	(7.38)	(7.61)	(7.57)	(7.90)	(7.83)
Firm size	-0.289***	-0.289***	-0.289***	-0.105***	-0.107***	-0.106***	-0.106***	-0.105***
	(-28.16)	(-28.18)	(-28.18)	(-10.33)	(-10.57)	(-10.52)	(-10.49)	(-10.41)
ROA	-3.876***	-3.873***	-3.875***	-1.907***	-1.901***	-1.903***	-1.876***	-1.877***
	(-17.58)	(-17.48)	(-17.42)	(-11.43)	(-11.44)	(-11.44)	(-11.29)	(-11.28)
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	-	-	Y	Y	Y	Y	Y
R-squared	0.655	0.656	0.656	0.753	0.753	0.753	0.754	0.754
Number of Obs.	73,845	73,845	73,845	73,845	73,845	73,845	73,845	73,845

Table VIII (Cont'd)

Panel B: Interaction with Local Conditions

In Panel C, we further control for the interaction of equity volatility with other regional conditions. Specifically, we consider local bank supply, local bond supply, an urban dummy and average state household income. The definition of these variables can be found in the appendix. To facilitate the interpretation of the coefficients, for the interaction terms, we always use dummy variables (1 if above median and 0 otherwise), defined year by year, to eliminate concerns that these variables may have strong time trends. In columns (1)-(4), we interact equity volatility with the local bank supply dummy, the local bond supply dummy, the urban dummy and the state household income dummy, respectively. Columns (5)-(8) follow the same specifications as in columns (1)-(4), except that we also control for the interaction of equity volatility and the SA financial constraint dummy. For brevity we only report the variables of interest.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Equity volatility	37.339***	39.309***	38.354***	38.286***	35.201***	37.394***	36.162***	36.157***
	(25.03)	(23.65)	(23.53)	(24.63)	(19.26)	(18.49)	(20.46)	(19.98)
Equity volatility * Debt inflexibility dummy	13.573***	12.065***	12.642***	13.135***	13.625***	12.197***	12.463***	13.139***
	(9.61)	(7.68)	(8.67)	(8.89)	(9.64)	(7.74)	(8.54)	(8.88)
Equity volatility * Local bank supply dummy	-2.357				-2.111			
	(-1.58)				(-1.41)			
Equity volatility * Local bond supply dummy		-5.036***				-4.713***		
		(-3.03)				(-2.81)		
Equity volatility * Urban dummy			-3.828**				-4.284***	
			(-2.48)				(-2.73)	
Equity volatility * State household income dummy				-4.046***				-4.063***
				(-2.61)				(-2.62)
Equity volatility * SA constraint dummy					3.182**	2.748*	4.050***	3.448**
					(2.09)	(1.80)	(2.62)	(2.27)
Other controls	Y	Y	Y	Y	Y	Y	Y	Y
Year-quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of obs.	73,847	73,847	73,847	73,847	73,847	73,847	73,847	73,847

Panel C: Compare with Campbell and Taksler (2003)

In Panel C, we compare the explanatory power of equity volatility on bond yield spreads, depending on the degree of debt inflexibility. Our focus is on the coefficient of equity volatility and the R-square in the regression. To be consistent with Campbell and Taksler (2003), we only include non-callable bonds for this analysis. We define high and low debt inflexibility subsamples year by year based on the sample median. In columns (3)-(8), we include time fixed effects at the year-quarter level. In columns (5)-(8), we split the sample by both high/low debt flexibility and tightened/loosened lending standards, and report the results separately for the four subsamples. For brevity we only report the variables of interest.

	Full Sample Period				Tightened	Loosened	Tightened	Loosened
	High Inflex.	Low Inflex.	High Inflex.	Low Inflex.	High Inflex.	High Inflex.	Low Inflex.	Low Inflex.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Equity volatility	85.962***	42.544***	92.604***	48.579***	97.843***	80.298***	52.831***	42.487***
	(25.33)	(17.05)	(22.71)	(11.45)	(22.84)	(10.10)	(12.12)	(5.95)
Bond maturity			0.005**	0.009***	0.003	0.007***	0.009***	0.009***
			(2.19)	(4.85)	(1.23)	(3.16)	(3.39)	(5.38)
Index weight			-12.300***	-5.004***	-16.342***	-6.573***	-7.149***	-2.455**
			(-4.60)	(-4.38)	(-3.51)	(-6.05)	(-5.80)	(-2.42)
Coupon rates			0.222***	0.124***	0.239***	0.215***	0.154***	0.106***
			(9.99)	(6.54)	(7.86)	(8.85)	(5.85)	(6.34)
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	-	-	Y	Y	Y	Y	Y	Y
R-squared	0.293	0.141	0.509	0.359	0.471	0.436	0.281	0.291
Number of Obs.	12,212	14,679	12,212	14,679	6,147	6,065	7,966	6,713

Table IX: Debt Inflexibility and the Connection between Equity and Debt Markets

In this table, we explore the impact of debt inflexibility on the connection between equity and debt markets. In particular, we estimate the correlation between equity returns and changes in bond yield spreads, as well as the correlation between equity returns and changes in CDS spreads. We proceed as follows. First, we obtain the weekly stock returns from CRSP, the weekly CDS spread changes from the Markit CDS database, and the weekly value (issue outstanding)-weighted changes in bond yield spreads from BofA Merrill Lynch bond index database. Then, for each firm-year, using the weekly data, we calculate the correlation between equity returns and changes in bond yield spreads, and the correlation between equity returns and changes in CDS spreads. In columns (1)-(4), we relate debt inflexibility to the correlation between equity returns and changes in bond yield spreads. In columns (2)-(4), we control for credit rating fixed effects (SP long-term credit rating from AAA to CCC) and industry fixed effects at the two-digit SIC level. Columns (1)-(2) are based on the full sample, while in column (3) and (4), we separate the sample into periods of tightened and loosened lending standards and report the results accordingly. In columns (5)-(8), we relate debt inflexibility to the correlation between equity returns and changes in CDS spreads. Columns (5)-(8) follow the same specifications as in columns (1)-(4). The errors are always clustered at the firm level. ***, ** and * represent significance levels at 1%, 5% and 10% respectively using heteroscedasticity robust standard errors with t-statistics given in parentheses.

	Corr(Equity return, Δ Yield spread)				Corr(Equity return, Δ CDS spread)			
	Full Sample Period		Tightened	Loosened	Full Sample Period		Tightened	Loosened
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debt Inflexibility	-0.282***	-0.219***	-0.288**	-0.093	-0.248**	-0.214**	-0.284**	-0.134
	(-2.98)	(-2.64)	(-2.13)	(-0.95)	(-2.57)	(-2.30)	(-2.20)	(-1.24)
Market-to-book	0.006**	0.005*	0.002	0.009**	0.024***	0.016***	0.010	0.032***
	(2.28)	(1.77)	(0.55)	(2.43)	(5.07)	(3.11)	(1.43)	(3.83)
Book leverage	-0.092***	-0.007	-0.001	-0.008	-0.064***	-0.060**	-0.083**	-0.034
	(-5.07)	(-0.34)	(-0.06)	(-0.30)	(-3.09)	(-2.39)	(-2.55)	(-0.99)
Firm size	-0.008***	-0.025***	-0.022***	-0.027***	-0.032***	-0.045***	-0.048***	-0.042***
	(-3.44)	(-8.86)	(-6.25)	(-7.03)	(-10.21)	(-12.56)	(-10.13)	(-8.31)
ROA	0.079**	-0.025	-0.010	-0.058	0.008	0.055	0.088	-0.050
	(2.14)	(-0.66)	(-0.18)	(-1.09)	(0.13)	(0.90)	(0.99)	(-0.53)
SA constraint	-0.023***	-0.011*	-0.011	-0.011	-0.012*	-0.005	-0.012	0.002
	(-4.26)	(-1.90)	(-1.44)	(-1.37)	(-1.68)	(-0.60)	(-1.26)	(0.17)
Local bank supply	0.026*	0.018	0.038*	0.002	0.015	0.011	0.011	0.007
	(1.74)	(1.36)	(1.77)	(0.16)	(0.91)	(0.68)	(0.55)	(0.36)
Local bond supply	-0.023*	-0.020*	-0.036*	-0.007	-0.022	-0.020	-0.028	-0.012
	(-1.72)	(-1.67)	(-1.76)	(-0.56)	(-1.49)	(-1.45)	(-1.56)	(-0.73)
Urban dummy	-0.009	-0.008	-0.007	-0.008	-0.005	-0.004	-0.000	-0.011
	(-1.54)	(-1.36)	(-0.95)	(-0.99)	(-0.62)	(-0.59)	(-0.00)	(-1.03)
Local household income	-0.019	-0.006	0.024	0.009	-0.018	0.002	-0.012	0.018
	(-0.81)	(-0.27)	(0.75)	(0.32)	(-0.57)	(0.06)	(-0.32)	(0.49)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Credit rating FE, industry FE	-	Y	Y	Y	-	Y	Y	Y
R-squared	0.110	0.167	0.237	0.152	0.117	0.172	0.205	0.187
Number of Obs.	5,189	5,189	2,607	2,582	3,060	3,060	1,655	1,405

Figure I: Loan Officer Survey on Tightening in Lending Standards and Change in Loan Demand

In this graph, we plot the historical data of the Senior Loan Officer Survey on the tightening in lending standard and the change in loan demand. The sample period is from 1997: Q1 to 2008: Q4. The Federal Reserve's Senior Loan Officer Opinion Survey of Bank Lending Practices (SLOOS) has queried banks about changes in their lending standards for major categories of loans since 1990:Q2 and about changes in demand for those loan categories since 1991:Q4. The survey is conducted four times per year by the Federal Reserve Board, and up to 60 U.S. commercial banks participate in each survey. We focus on the commercial and industrial loans. We plot the fraction of banks (in percentage) reporting that they have tightened their standards during the survey period, as well as the fraction of banks (in percentage) reporting that the loan demand has increased during the survey period. The solid line depicts the tightening in bank lending standards, and the dashed line depicts the increase in loan demand. Positive values indicate a net tightening (increase) in lending standards (loan demand), while negative values indicate a net easing (decrease) in lending standards (loan demand).