Which Financial Frictions? Parsing the Evidence from the Financial Crisis of 2007-9*

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Abstract

The financial crisis of 2007-9 has sparked keen interest in models of financial frictions and their impact on macro activity. Most models share the feature that borrowers suffer a contraction in the quantity of credit. However, the evidence suggests that although bank lending contracts during the crisis, bond financing actually increases to make up much of the gap. This paper reviews both aggregate and micro level data and highlights the shift in the *composition* of credit between loans and bonds. Motivated by the evidence, we formulate a model of direct and intermediated credit that captures the key stylized facts. In our model, the impact on real activity comes from the spike in risk premiums, rather than contraction in the total quantity of credit.

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1 Introduction

The financial crisis of 2007-9 has given renewed impetus to the study of financial frictions and their impact on macroeconomic activity. Building on existing models of financial frictions, economists have refined and developed them to construct narratives of the recent crisis. Although the recent innovations to the modeling of financial frictions share many common elements, they also differ along some key dimensions. These differences may not matter so much for story-telling exercises that focus on constructing logically consistent narratives that highlight one or other aspect of the crisis. However, the differences begin to take on more significance as soon as economists turn their attention to empirical questions, or to policy-related questions that bear on the economic costs of financial frictions. Since policy questions must make judgments on the relative weight given to specific features of the models, the details underpinning the model must then be taken into account to a greater extent.

One purpose of our paper is to review the evidence on the fluctuations in credit to non-financial firms during the recent crisis in order to draw up a checklist of key empirical stylized facts that may be used to guide the modeling exercise at the micro level.

Although the workhorse models of financial frictions used by macroeconomists capture some of the key features, they fail to address others. A good example of the gap between the widely used models and the evidence is the fluctuation in the quantity of credit to non-financial firms over the cycle. Most models of financial frictions share the feature that the total *quantity* of credit to the non-financial corporate sector decreases in a downturn. However, even this basic proposition needs some qualification when we examine the evidence in any detail.

Figure 1 plots the main categories of credit to the US non-farm, non-financial corporate business sector from 1990. The left hand panel is in levels, taken from table L102 of the US Flow of Funds, while the right hand panel plots the quarterly changes, taken from table F102 of the Flow of Funds.

The plots reveal some distinctive divergent patterns in the various components of credit. In the left hand panel, the lower three components are (broadly speaking) credit that is provided by banks and other intermediaries, while the top series is the total credit obtained in the form of corporate bonds. While the loan series show the typical procyclical pattern of rising during the boom and then contracting sharply in the downturn, bond

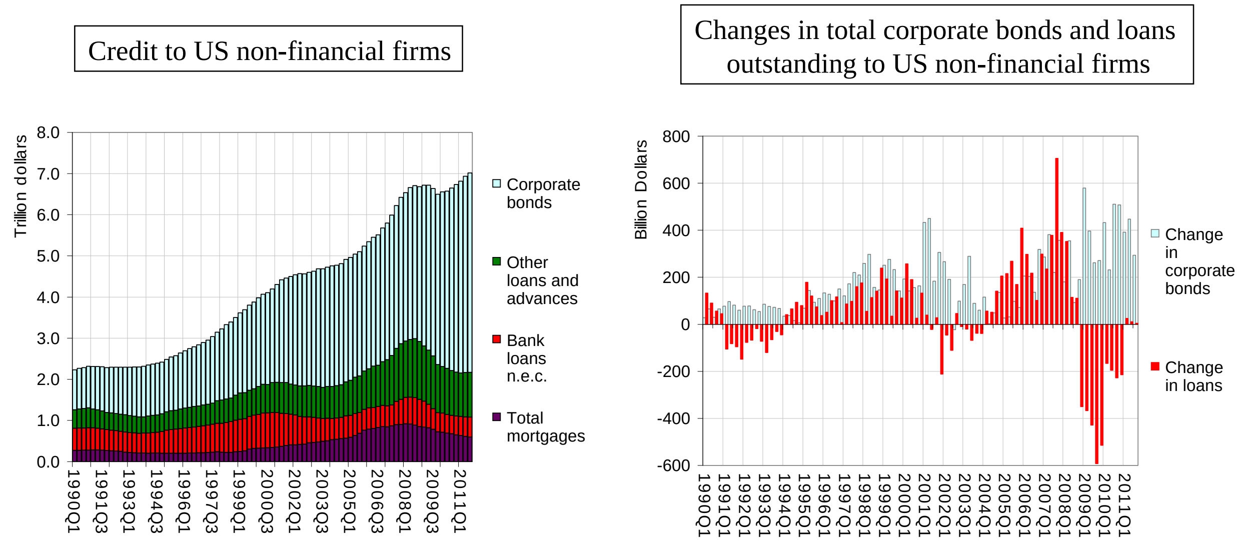

Figure 1. Credit to US non-financial firms (left hand panel) and changes in outstanding corporate bonds and loans to US non-financial firms (right hand panel). The left panel is from US Flow of Funds, table L102. Right panel is from table F102. Loans in right panel are defined as sum of lower three categories in left panel.

financing behaves very differently. On the right hand panel, we see that bond financing surges during the crisis period, making up most of the lost credit due to the contraction of loans.

In particular, there is evidence that bond financing and loan financing are negatively related during times of contracting loans. Consider the three most recent recessionary periods in the US, namely 1990-1, 2001-2 and the recent downturn. In each case, we see that loans declined but corporate bonds rose to make up some of the gap.

Figure 2 examines the negative relationship betwen bond and loan financing in more detail by plotting the information in the right hand panel of Figure 1 as a scatter chart of changes in the outstanding amounts of loans and bonds. The horizontal axis measures the quarterly change in the outstanding corporate bonds, while the vertical axis gives the change in the outstanding loans. We see that in those quarters when loans contracted (dots below the horizontal axis) the change in corporate bonds is negatively related to the change in loans. In particular, when loans to the corporate sector fell sharply during the recent crisis, there was a compensating surge in credit through corporate bonds.

Due to the aggregate nature of the data from the Flow of Funds, some caution would be needed in drawing any firm conclusions on the apparently negative relationship between loan and bond financing. Two questions spring to mind. The first is whether the

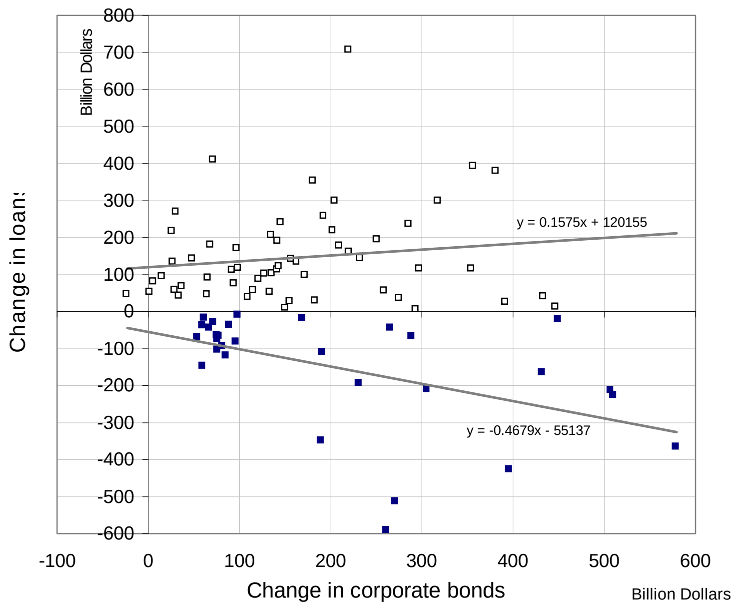

Figure 2. Scatter chart of quarterly change in corporate bonds against quarterly change in loans (Source: US Flow of Funds, table F102)

aggregate nature of the Flow of Funds data masks sharp differences across firms. If the bulk of the bond financing is raised by a few large firms with access to the bond market, then the apparent negative relationship in the aggregate would have limited implications for the typical firm. The second issue has to do with the fact that the Flow of Funds data are snapshots of the total amounts outstanding, rather than actual flows associated with new credit, and it is silent about the *price* at which the new credit is obtained.

To address these justified concerns, we build on recent corporate finance studies (such as Becker and Ivashina (2011)) to construct a micro-level dataset on new loan and bond issuance to determine whether the features we observe in the aggregate also hold at the micro level. We find that they do. The following empirical features are robustly catalogued in the micro-level data:

Feature 1. In the economic downturn of 2007-9, new loan financing declines but new bond financing increases.

Feature 2. In the economic downturn of 2007-9, the cost of both loan financing and bond financing increases.

Feature 1 however poses challenges for financial friction models that are widely used by macroeconomists. Perhaps the three best-known workhorse models of financial frictions used in macroeconomics are Bernanke and Gertler (1989), Kiyotaki and Moore (1997) and Holmstrom and Tirole (1997). However, in the benchmark versions of these models the creditor sector is competitive and the focus of the attention is on the *borrower's* net worth instead.

Bernanke and Gertler (1989) use the costly state verification (CSV) approach to derive the feature that the borrower's net worth determines the cost of outside financing. The collateral constraint in Kiyotaki and Moore (1997) introduces a similar role for the borrower's net worth through the market value of collateral assets whereby an increase in borrower net worth due to an increase in collateral value serves to increase borrower debt capacity. But in both cases, the lenders are treated as being competitive and no meaningful comparisons are possible between bank and bond financing.[1]

In contrast, the evidence from Figures 1 and 2 points to the importance of understanding the heterogeneity across lenders and the composition of credit. The role of the banking sector in the cyclical variation of credit emerges as being particularly important.

A bank is simultaneously both a borrower and a lender - it borrows in order to lend. As such, when the bank itself become credit-constrained, the supply of credit to the ultimate end-users of credit (non-financial firms and households) will be impaired. In the version of the Holmstrom and Tirole (1997) model with banks, credit can flow either directly from savers to borrowers or indirectly through the banking sector. The ultimate borrowers face a borrowing constraint due to moral hazard, and must have a large enough equity stake in the project to receive funding.

Banks also face a borrowing constraint imposed by depositors, but banks have the useful purpose of mitigating the moral hazard of ultimate borrowers through their monitoring. In Holmstrom and Tirole (1997), the greater monitoring capacity of banks eases the credit constraint for borrowers who would otherwise be shut out of the credit market altogether. Firms follow a pecking order of financing choices where small net worth firms can only obtain financing from banks and are shut out of the bond market, while firms with high net worth have access to both, but use the cheaper bond financing. Repullo and Suarez's (2000) model is in a similar spirit. Bolton and Freixas (2000) focus instead on the greater flexibility of bank credit in the face of shocks, with the implication that firms with higher default probability favor bank finance relative to bonds.

However, the cyclical predictions of these models have not fared well in the recent crisis.

[1] See Brunnermeier, Eisenbach and Sannikov (2011) for a survey of financial friction models.

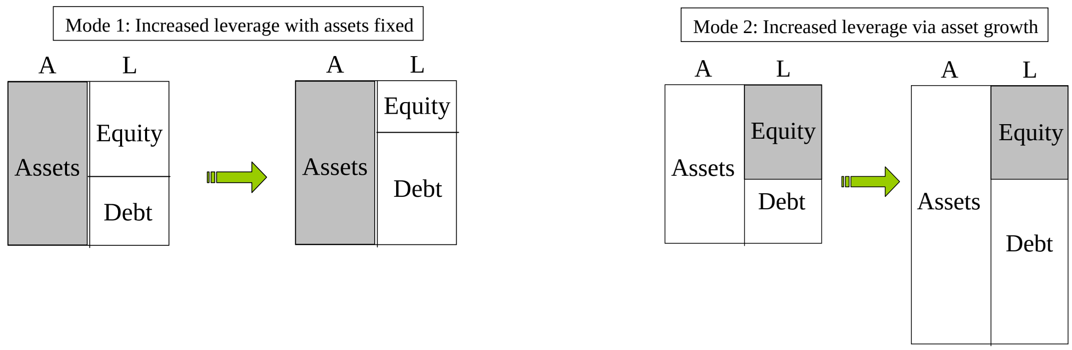

Figure 3. **Two Modes of Leveraging Up.** In the left panel, the firm keeps assets fixed but replaces equity with debt. In the right panel, the firm keeps equity fixed and increases the size of its balance sheet.

In a downturn, when firms' net worth declines overall, we would expect less bond financing and greater reliance on bank financing. Yet, the evidence from Figures 1 and 2 suggests that bond financing increases while bank financing declines. This evidence should give us pause for thought, as many recent contributions to the financial frictions literature share a similar starting point to Holmstrom and Tirole (1997) in building on a fixed "skin in the game" constraint, such as Gertler and Kiyotaki (2009) and Brunnermeier and Sannikov (2009, 2010), as well as the asset pricing model of He and Krishnamurthy (2007). Taking a different tack, Curdia and Woodford (2008) introduce borrowing spreads introduced by banks, although the banking sector is modeled in reduced form. Geanakoplos (2009) examines perhaps the most general approach where collateral constraints lead to a rich set of possible outcomes, but the financial intermediary sector is not modeled explicitly so that direct comparisons with existing models are not always possible.

Understanding the tradeoff between bank and bond financing points to the need for a better understanding of banking sector and its balance sheet management. In textbook discussions of corporate financing decisions, the set of positive net present value (NPV) projects is often taken as being exogenously given, with the implication that the size of the balance sheet is fixed. Leverage increases by substituting equity for debt, such as through an equity buy-back financed by a debt issue, as depicted by the left hand panel in Figure 3.

However, the left hand panel in Figure 3 turns out not to be a good description of the way that the banking sector leverage varies over the financial cycle. For US investment banks, Adrian and Shin (2008, 2010) show that leverage fluctuates through changes in the total size of the balance sheet with equity being the pre-determined variable. Hence,

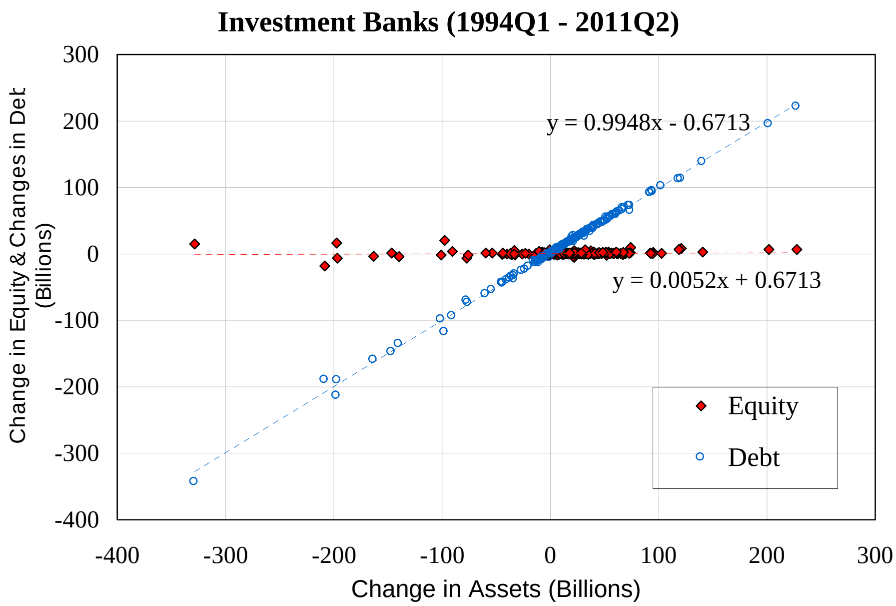

Figure 4. Scatter chart of $\{(\Delta A_t, \Delta E_t)\}$ and $\{(\Delta A_t, \Delta D_t)\}$ for changes in assets, equity and debt of US investment bank sector consisting of Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch and Morgan Stanley between 1994Q1 and 2011Q2 (Source: SEC 10Q filings).

leverage and total assets tend to move in lock-step, as depicted in the right hand panel of Figure 3.

Figure 4 is the scatter plot of the quarterly change in total assets of the sector consisting of the five US investment banks examined in Adrian and Shin (2010) where we plot both the changes in assets against equity, as well as changes in assets against equity. More precisely, it plots $\{(\Delta A_t, \Delta E_t)\}$ and $\{(\Delta A_t, \Delta D_t)\}$ where ΔA_t is the change in total assets of the investment bank sector at quarter t, and where ΔE_t and ΔD_t are the change in equity and change in debt of the sector, respectively.

We see from Figure 4 that US investment banks conform to the right hand panel of Figure 3 in the way that they manage their balance sheets. The fitted line through $\{(\Delta A_t, \Delta D_t)\}$ has slope very close to 1, meaning that the change in assets in any one quarter is almost all accounted for by the change in debt, while equity is virtually unchanged. The slope of the fitted line through the points $\{(\Delta A_t, \Delta E_t)\}$ is close to zero. Both features capture the picture of bank balance sheet management given by the right hand panel in Figure 3.

Notice that the slopes of the two fitted lines add up to 1 in Figure 4. This is a consequence of the balance sheet identity: $\Delta A_t = \Delta E_t + \Delta D_t$. The sum consisting of

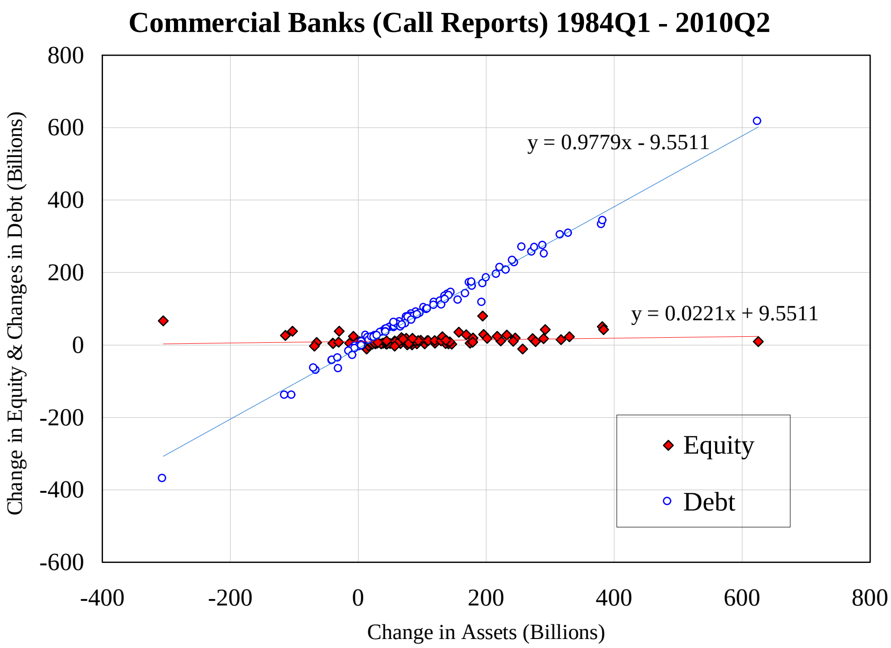

Figure 5. Scatter chart of $\{(\Delta A_t, \Delta E_t)\}$ and $\{(\Delta A_t, \Delta D_t)\}$ for changes in assets, equity and debt of US commercial bank sector at t between 1984Q1 and 2010Q2 (Source: FDIC call reports).

the slope of the fitted line through $\{(\Delta A_t, \Delta D_t)\}$ and the slope of the fitted line through $\{(\Delta A_t, \Delta E_t)\}$ is given by

$$\begin{aligned} \text{sum of slopes} &= \frac{Cov\,(\Delta A_t, \Delta D_t)}{Var\,(\Delta A_t)} + \frac{Cov\,(\Delta A_t, \Delta E_t)}{Var\,(\Delta A_t)} \\ &= \frac{Cov\,(\Delta A_t, \Delta D_t + \Delta E_t)}{Var\,(\Delta A_t)} \\ &= 1 \end{aligned}$$

Commercial banks show a similar pattern to investment banks in the way they manage their balance sheets. Figure 5 is the analogous scatter plot of the quarterly change in total assets of the US commercial bank sector which plots $\{(\Delta A_t, \Delta E_t)\}$ and $\{(\Delta A_t, \Delta D_t)\}$ using the FDIC Call Reports. The sample period is between Q1:1984 and Q2:2010. We see essentially the same pattern as for investment banks, where every dollar of new assets is matched by a dollar in debt, with equity remaining virtually unchanged. We can summarize this feature as follows.

Feature 3. Bank lending rises and falls dollar for dollar through a change in debt financing, while equity remaining largely unchanged.

A consequence of Feature 3 is that equity should be seen as the pre-determined variable when modeling bank lending, and we can see banks as choosing their leverage given the fixed level of bank equity. This is the approach we will take in Section 4 when proposing our own model of financial frictions after reviewing the evidence.

The way that banks manage their balance sheets over the cycle is likely to be important in determining financial conditions faced by borrowers. If banks were simply a veil, and merely reflected the preferences of the depositors who provide funding to the banks for on-lending, then banks would be irrelevant for financial conditions. In particular, a challenge for any macro model with a banking sector is to explain how one dollar that goes through the banking system is different from one dollar that goes directly to borrowers from savers. Holding savers' wealth fixed, when the banking sector contracts in a deleveraging episode, money that used to flow to borrowers through the banking sector now flows to borrowers directly. Thus, showing that the banking sector "matters" in a macro context entails showing that the relative size of the direct and intermediated finance in an economy matters for financial conditions.

A crucial first step in this demonstration is the cyclical behavior of leverage. We have already seen in Figures 4 and 5 that banks' equity is little changed from one quarter to next, implying that total lending is closely mirrored by the bank's leverage decision. Bank lending expands when its leverage increases, while a sharp reduction in leverage ("deleveraging") results in a sharp contraction of lending. Adrian and Shin (2008, 2010) showed that US investment banks have *procyclical* leverage where leverage and total assets are positively related.

Figure 6 is the analogous scatter chart for US commercial banks plotting quarterly asset growth and quarterly leverage growth for the period Q1:1984 - Q2:2010. We see that leverage is procyclical for US commercial banks, also. However, we see that the sharp deleveraging in the recent crisis happened comparatively late, with the sharpest decline in assets and leverage taking place in Q1:2009. Even up to the end of 2008, assets and leverage were increasing, possibly reflecting the drawing down of credit lines that had been granted to borrowers prior to the crisis.

The explicit recognition of the role of financial intermediaries holds much promise in explaining the economic impact of financial frictions. When intermediaries curtail lending, directly granted credit (such as bond financing) must substitute for bank credit, and market risk premiums must rise in order to induce non-bank investors to enter the market for risky corporate debt and take on a larger exposure to the credit risk of non-financial

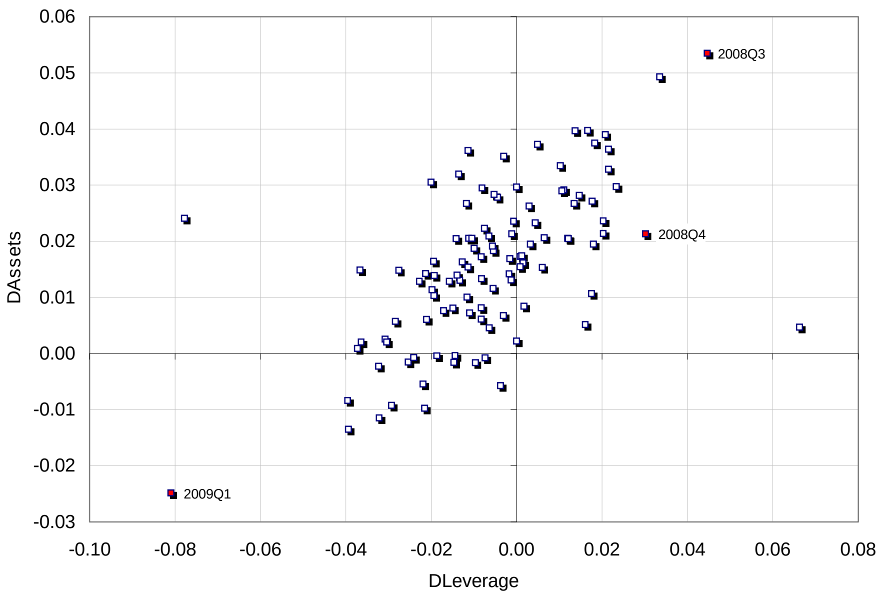

Figure 6. Scatter chart of quarterly asset growth and quarterly leverage growth of the US commercial bank sector, Q1:1984 - Q2:2010. Leverage is defined as the ratio of sector assets to sector equity, and growth is measured as log differences (Source: FDIC Call Reports).

firms. The sharp increase in risk spreads during financial crises would be consistent with such a mechanism. The recent work of Gilchrist, Yankov and Zakrajsek (2009) and Gilchrist and Zakrajsek (2011) point to the importance of excess credit spreads (i.e. spreads in excess of default probabilities) as an important predictor of subsequent economic activity as measured by industrial production or employment.

Procyclical leverage, where intermediaries expand lending during booms but contract lending sharply during downturns, is likely to be an important part of the story for the fluctuations in excess credit spreads over the cycle, but has so far been an elusive feature from the recent literature. He and Krishnamurthy (2007) and Brunnermeier and Sannokov (2010) have the feature that leverage is *countercyclical*. We will show in our theory section how a theoretical model based on viewing a credit risk model as the flip side of a credit supply model may account for the key cyclical properties of bank balance sheet management.

Motivated by the initial evidence, we now turn to a detailed empirical study that uses micro-level data, and one on flows (of new lending). We will see that the aggregate evidence is confirmed in the micro-level data. After sifting through the evidence, we turn our attention to sketching out a possible model of direct and intermediated credit that can address the relative size of the credit supplied through the bond and banking sectors. The key to understanding the fluctuations in the relative size of the two sectors is the fluctuations in the "as if" preferences of the banking sector, with the banking sector's behavior being more procyclical.

The main feature of our model is that as bank lending contracts sharply through deleveraging, the direct credit from bond investors must expand to take up the slack. However, for this to happen, prices must adjust in order that the risk premium rises sufficiently to induce risk-averse bond investors to make up for the lost banking sector credit. Thus, a fall in the relative credit supplied by the banking sector is associated with a rise in risk premiums. For macro activity, such a rise in the excess bond spread is contractionary, as shown by Gilchrist and Zakrajsek (2011) and Gilchrist, Yankov, and Zakrajsek (2009). Financial frictions during the crisis of 2007-9 appear to have worked through prices rather than through a contraction in the total quantity of credit.

We outline a theory in Section 4 that can generate these features. But first, we begin with a more detailed look at the empirical evidence.

2 Evidence from Micro Data

2.1 Sample

We use micro level data to investigate the fluctuations in financing received by U.S. listed firms during the period 1998-2010, with special focus on the crisis period 2007-2009. In our data analysis below, we will identify the eight quarters from Q3:2007 to Q2:2009 as the crisis period.

Our sample consists of non-financial firms incorporated in the U.S. that lie in the intersection between the Compustat quarterly database, the Loan Pricing Corporation's Dealscan database (LPC) of new loans issued, and the Securities Data Corporation's New Bond Issuances database (SDC). For a firm to be in our sample, we require the firm-quarter observation in Compustat to have positive total assets, and have data available for its incremental financing from LPC and SDC. Our sample construction procedure, described below, identifies 4,902 firms (out of the 11,856 in the Compustat sample) with new financing between 1998 and 2010. Firm-quarter observations with new financing amount to 6% of the Compustat sample, and represent 20% of their total assets (see Table 1).

Table 1. Frequency of new debt issuances, and assets of issuers. Full Compustat sample refers to all U.S. incorporated non-financial firm-quarters in the Compustat quarterly database with positive total assets. Our sample merges the Compustat sample with loan issuances from the Loan Pricing Corporation's Dealscan database (LPC) and bond issuances from the Securities Data Corporation's New Bond Issuances database (SDC). Percentages of the full Compustat sample are reported in square brackets. Total assets are expressed in January 1998 constant $bln.

	Firm-quarters	
	Observations	Total Assets
Full Compustat sample	322,824	547,050
	[100]	[100]
Our sample:		
-with new debt issuances	19,073	110,482
	[5.9]	[20.2]
-with new loan issuances	15,964	72,371
	[4.9]	[13.2]
-with new bond issuances	4,105	48,160
	[1.3]	[8.8]

Loan information comes from the June 2011 extract of LPC, and includes information on loan issuances (from the facility file: amount, issue date, type, purpose, maturity and all-in-drawn spread) and borrowers (from the borrower file: identity, country, type, and public status). We apply the following filters: 1) the issue date is between January 1998 and December 2010 (172,243 loans); 2) the loan amount, maturity, and spread are non-missing, and the loan type and purpose are disclosed (90,131 loans). We then use the Compustat-LPC link provided by Michael Roberts (Chava and Roberts 2008) to match loan information with our Compustat sample, and end up with 23,809 loans issued by 4,781 unique firms.[2]

Our screening of bond issuances follows similar steps to the ones we use for loan issuances. We retrieve from SDC information on bond issuances (amount, issue date, spread over base rate, purpose, and maturity) and apply the following filters: 1) the issue date is between January 1998 and December 2010, and the borrower is a non-financial U.S. firm (39,034 bonds); 2) the bond amount, maturity, purpose and spread are non-missing (9,729 bonds).[3] We then merge bond information with the Compustat sample

[2]The May 2010 linking table provided by Michael Roberts enables us to match 23,026 loans with our Compustat sample; we further link 783 loans issued in 2010. We match a loan (and a bond) issued in a given quarter with the accounting information for the previous quarter.

[3]The spread (in basis point) is computed by SDC over the treasury rate with comparable maturity. We refer to this spread as "spread over base rate".

Table 2. Characteristics of new issuances. This table presents means and medians aggregated across all years for our sample of new debt issuances. Full LPC sample includes tranches with valid amount, maturity, purpose and spread issued by non-private U.S. corporations. Full SDC sample includes tranches with valid amount, maturity, purpose and spread issued by non-financial U.S. public firms and subsidiaries. Amount is expressed in January 1998 constant $bln, maturity is expressed in months, and spread is expressed in bps (relative to the reference rate). We test for difference between our sample of issuances and the full LPC and SDC samples using the t-test and the two-sample Wilcoxon rank-sum test (z-stastistic). ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

		Loan issuances			Bond issuances		
		Our sample	Full LPC sample	t-stat (z-stat)	Our sample	Full SDC sample	t-stat (z-stat)
Amount	Total	6787.98	7557.88		1696.06	2469.55	
Issuances	#	23,809	29,981		5,554	8,509	
Amount	Mean	0.285	0.252	6.012***	0.305	0.290	2.724***
	(Md)	(0.111)	(0.091)	(10.546***)	(0.223)	(0.206)	(5.189***)
Maturity	Mean	44.95	45.52	-2.463**	104.69	103.94	0.776
	(Md)	(48)	(48)	(-2.606***)	(120)	(97)	(2.878***)
Spread	Mean	217.66	229.26	-8.639***	256.67	267.60	-2.777***
	(Md)	(200)	(225)	(-9.336***)	(184)	(182)	(-0.677)

using issuer CUSIPs, and obtain 5,554 bonds issued by 1,324 unique firms.

Table 2 presents summary statistics of new issuances characteristics in our sample, and compares them to the overall LPC and SDC sample. Our sample includes 80% of loans issued by non-private U.S. corporations, and represents 90% in terms of dollar amount. On average, loans in our sample are issued for 285 $mln, have maturity of 45 months, and are priced at 220 bps above the reference rate. These are very similar to the full sample in LPC. In terms of bond financing, our sample captures 65% of U.S. non-financial public firms' issuances (about 70% in terms of dollar amount). Relative to loans, bonds in our sample are issued for larger amounts ($305m), longer maturities (105 months), and are more expensive (260 bps).

2.2 Patterns of new issuances

We start documenting the pattern of total new credit financing that includes both bank and bond financing. We will see that the recent financial crisis witnessed a marked decline in new debt issuances and a simultaneous increase in their cost. We then turn to analyse separately the evolution of new bank and bond financing. We show that these funding sources behave quite differently during the financial crisis. We document a decrease in the supply of loans, i.e. lower amounts issued and at a higher price, and a simultaneous increase in the demand of bonds, i.e. higher amounts issued and at a higher price.

2.2.1 Total financing

The evolution of new debt issuances is presented in Figure 11. Panel A (resp. Panel B) in Figure 11 graphs the quarterly total (resp. average) amount of new debt (loans plus bonds) issued expressed in billions of January 1998 dollars, while Panel C graphs the total number of new debt issuances. Due to seasonality in new debt financing activity, we also graph the smoothed version of both total amounts and total numbers (a moving average filter including the current term as well as two lagged and two forward terms, solid line). Figure 11 highlights the steep reduction in total financing as the recent financial crisis unfolds: the number of new issuances during Q2:2009 is 250 –almost a half relative to the 465 issuances during Q2:2009-, and the total amount of new debt dropped from $233.45 billions to $62.11 billions.

We now consider what happens to the cost of debt and its maturity. For every quarter, we use a weighted average of the spread over the base rate (in bps) and the maturity (in months) of individual facilities, where the weights are given by the amount of each facility relative to the amount of issuances in that quarter. Figure 11-Panel D highlights that the cost of new debt more than tripled during the financial crisis from 112bps in Q3:2007 to 400bps in Q2:2009. One potential concern with this finding is that the all-in-drawn spread may overestimate the cost of revolvers when firms are not using them. With our datasets we cannot determine whether a credit line, after being extended, is indeed used. Campello, Giambona, Graham and Harvey (2011) provide evidence that firms drew down on their lines during the recent financial crisis, which makes us believe that the all-in-drawn spread is indeed the proper measure of the cost of revolvers during the crisis. Notwithstanding this evidence, we alternatively measure the cost of bank (and thus total) financing during the financial crisis using the all-in-undrawn spread for revolvers, and graph the results in Figure 11-Panel E. Again, we document a steep increase in the cost of new financing during the crisis, which doubled relative to pre-crisis levels (331bps during Q2:2009, 134bps during Q2:2007).

2.2.2 Bank financing

Figure 12 presents the evolution of loan issuances, by quarter (total amount of loans, Panel A, average amount of loans, Panel B, total number of loans issued, Panel C). The reduction of bank financing during the recent financial crisis is evident: loan issuances at the peak of the financial crisis totaled \$50.51 billion, representing about one fourth of loan issuances at the peak of the credit boom (\$240.39 billions during Q2:2007). Looking at the number of loan issuances reveals a similar pattern: 147 loans were issued during Q1:2009 against 492 during Q2:2007. Figure 12 also highlights that bank financing at the peak of the financial crises represents about 35% of the bank financing at the trough of the previous recession in Q4:2001 (total amount of loans \$141.72 billions). We conclude that the financial crisis not only witnessed a sharp decline in bank financing relative to the peak of the credit boom, but also relative to the trough of the previous recession.

Figure 12-Panel D graphs our results for the cost of loans. We show that the cost of bank financing tripled during the financial crisis from 108bps in Q4:2007 to 355bps in Q2:2009. If we used the all-in-undrawn spread for revolvers during the financial crisis, the cost of bank financing would almost double from 122bps during Q2:2007 to 221bps during Q2:2009. Moreover, we note that the 2001 recession did not witness a substantial increase in loan spreads, which oscillated between 106bps (Q2:2001) and 127bps (Q1:2001). Finally, maturities shorten during recessions and increase during booms.

Table 3 reports yearly loan issuances between 1998 and 2010, together with the split according to their type and purpose. Depending on their type and purpose, both the amount (in billions of January 1998 dollars) and the percentage[4] of total loans are reported. Figure 13 graphs the quarterly total amount of loan by type and purpose. In the aftermath of the credit boom, both credit lines and term loans fell sharply. New credit lines totaled \$16.04 billions in Q1:2009, which corresponds to roughly 10% of the credit lines initiated at the peak of the credit boom; new term loans at the peak of the financial crisis totaled \$6.76 billions, which represent about 7.5% of the term loans during Q2:2007. Issuances of credit lines start trending upwards from 2010 and, as of Q4:2010, total credit lines correspond to about 45% of their values at the peak of the credit boom. Issuances of term loans increase at a slower pace, and during Q4:2010 reach about 15% of their

[4]Percentages do not sum up to one because some loans could not be included in our categories. Our type split (revolvers and term loans) covers 81% of all loans in our sample, while the purpose split (investment and restructuring loans) covers 92% of all loans in our sample.

Table 3. Total loan issuances, type and purpose. This table reports total loan issuances (last column) together with the split by type and purpose. Table 9 contains the definition of loans by type and purpose.

	Type				Purpose				Total
Year/	Revolver		Term Loan		Investment		Restructuring		
Quarter	Amount	%	Amount	%	Amount	%	Amount	%	
1998	372.58	0.73	101.99	0.20	51.05	0.1	363.37	0.71	511.38
1999	384.12	0.76	92.77	0.18	65.41	0.13	298.31	0.59	504.91
2000	504.16	0.82	80.83	0.13	86.44	0.14	309.69	0.50	616.37
2001	499.24	0.83	56.14	0.09	178.63	0.3	183.94	0.31	602.86
2002	385.05	0.81	69.25	0.15	206.25	0.43	96.41	0.20	477.12
2003	325.35	0.74	96.63	0.22	236.03	0.54	65.09	0.15	437.76
2004	453.06	0.71	147.52	0.23	376.02	0.59	135.65	0.21	639.87
2005	497.55	0.72	158.21	0.23	446.23	0.64	182.94	0.26	691.84
2006	454.64	0.64	216.82	0.31	436.7	0.62	227.6	0.32	707.29
2007	438.47	0.54	281.23	0.34	453.35	0.55	338.34	0.41	817.71
2008	158.49	0.45	131.21	0.37	154.17	0.44	182.42	0.52	352.21
2009	85.47	0.53	37.54	0.23	115.55	0.71	45.51	0.28	162.53
2010	180.94	0.68	68.48	0.26	194.63	0.73	62	0.23	266.12
Q4:2001	120.13	0.85	12.98	0.09	50.12	0.35	46.69	0.33	141.72
Q2:2007	142.35	0.59	89.9	0.37	161.52	0.67	72.11	0.30	240.39
Q1:2009	16.04	0.32	6.76	0.13	28.34	0.56	22.18	0.44	50.51

Q2:2007 levels. Table 3 further shows that, relative to the trough of the 2001 recession, credit lines have fell more sharply than term loans: the percentage of new credit lines issued in Q1:2009 relative to Q4:2001 is 13%, while that of term loans is 52%.

2.2.3 Bond financing

The evolution of bond issuances is presented in Figure 14. As for previous figures, we also graph the smoothed version of both total amounts and total numbers (solid line). Contrary to bank financing, Figure 14 highlights that bond issuances have increased during the recent financial crisis: bond issuances during Q2:2009 totaled $62.56 billions, which is more than twice the total amount bond issuances at the beginning of the crisis ($25.90 billions during Q3:2007). Moreover, Figure 14 confirms that the credit boom leading to the most recent recession was not exclusively a bank credit boom, since total bond issuances increase from 2005 onwards.

Figure 14 also graphs the evolution over time of the cost and maturity of bonds (Panel

Table 4. Total bond issuances, purpose. This table reports total bond issuances (last column) together with the split by purpose.Table 9 contains the definition of bonds by purpose.

	Purpose				Total
Year/	Investment		Restructuring		
Quarter	Amount	%	Amount	%	
1998	36.86	0.41	53.92	0.59	90.78
1999	34.44	0.37	57.28	0.62	92.14
2000	43.36	0.60	28.8	0.40	72.17
2001	121.28	0.64	67.34	0.36	188.62
2002	86.65	0.67	42.37	0.33	129.02
2003	61.31	0.42	85.18	0.58	146.92
2004	63.29	0.65	33.88	0.35	97.38
2005	40.78	0.53	35.25	0.46	76.58
2006	34.14	0.28	84.76	0.71	119.87
2007	48.35	0.34	91.28	0.65	141.24
2008	39.37	0.29	96.36	0.71	136.35
2009	72.38	0.34	137.75	0.65	210.93
2010	68.26	0.35	125.82	0.65	194.08
Q4:2001	16.55	0.34	32.29	0.66	48.85
Q2:2007	24.29	0.62	15.09	0.38	39.38
Q1:2009	56.24	0.74	20.05	0.26	76.29

D and E, respectively). Several similarities emerge between bank and bond financing. First of all, bond maturities shorten during recessions and increase during booms: this is confirmed by comparing maturities during the years leading to the peak of the credit boom to maturities during the latest recession. Second, the increase in issuances during the period leading to the credit boom is accompanied by a reduction in spreads. Finally, bond spreads almost tripled during the financial crisis, from 140bps during Q3:2007 to 432bps during Q2:2009, similar to the change experienced by bank financing.

Restructuring and investment bond issuances are graphed in Figure 15, and Table 4 reports yearly bond issuances. Figure 15 highlights that restructuring purposes have the lion share in bond issuances starting from 2005.

3 Financing Choice

3.1 One Dimensional Sorts

Our focus is to investigate the role of firms' likelihood of default and financial positions (financial constraints, short-term liquidity) in dampening (or sharpening) the impact of the crisis on corporate financing. We identify the beginning of the crisis with Q3:2007 and define the after crisis period with the two years from Q3:2007 to Q2:2009, and the before crisis period with the two years from Q3:2005 and Q2:2007.

Our object of interest is the sample firms that issue loans and/or bonds after the financial crisis. We first provide evidence of these firms' issuances before and after the crisis at the univariate level, controlling for relevant firm characteristics. For a firm in our sample to be included in our analysis ('new debt issuer') we require that: 1) it issues at least one loan or one bond between Q3:2007 and Q2:2009, and has positive assets the quarter before issuance; 2) it has positive assets at least during one quarter between Q2:2005 and Q1:2007; 3) it has non-missing observation for a relevant variable (which we refer to as the sorting variable) during Q2:2005. Finally, in order to investigate possible substitution effects between the two sources of financing, we require a firm to have a choice between bank and arm's-length financing, before the crisis. We follow Faulkender and Petersen (2006) and use rating as a proxy for access to the bond market, thus requiring firms to be rated during Q2:2005.

We use (issuer) credit ratings to proxy for a firm likelihood of default. We first assign to each monthly S&P long-term credit rating an integer number ranging from 1 (AAA) to 21 (SD or D). Then, for every firm and quarter we compute the quarterly rating as the average of monthly ratings. Note that low (resp. high) values for the rating variable correspond to low (resp. high) likelihood of default. Following Almeida, Campello and Weisbach (2004), Kaplan and Zingales (1997) and Whited and Wu (2006) we employ four measures of financial constraints: size, payout ratio, the Kaplan-Zingales index, and the Whited-Wu index. Finally, following Duchin, Ozbas and Sensoy (2010) we use two measures of short-term liquidity: cash reserves and short-term debt. All variables are defined in Table 9. Table 5 provides summary statistics of these variables. The last six columns in Table 5 report the fraction of per-period new financing that is due to new debt issuers, conditional on the availability of each sorting variable: for instance, our sample includes 645 new debt issuers with valid total assets during Q2:2005, and these new debt issuers account for 58.4% and 82.9% of the new issuances in our sample, respectively before and after the crisis.

We first sort into terciles our sample of new issuers along each of our variables, and for the first and third tercile we report in Table 6 cross-sectional means and medians of firm-level cumulative total, loan and bond financing before and after the crisis. Table 6 also reports for the same terciles the cross-sectional means and medians of firm-level total, loan and bond spreads. To assess the impact of crisis on firms' new financing, we test for difference in means after versus before the crisis using the paired (resp. unpaired) t-test and Wilcoxon test for amounts (resp. spreads). Table 6-Panel A shows that for the vast majority of firms the crisis did not significantly reduce the amount of total financing: we find some evidence that only the firms with high likelihood of default and those with low dividend payout issue less debt after the crisis.[5] The main effect of the crisis is on the cost rather than the amount of new debt, with two to four times wider spreads on average. Splitting new financing into loan and bond issuances (Panel B and Panel C, respectively), reveals that loan financing was significantly lower after the crisis for the firms with low dividend payout and high short-term debt, while cash rich firms and firms facing less severe financial constraints (large firms, low KZ index, low WW index) significantly increased their bond issuance activity in the aftermath of the crisis. Finally, the cost of new financing significantly increased for all firms: loan spreads are two to three times larger after the crisis relative to their pre-crisis levels, while bond spreads register a threefold increase.

3.2 Regression Evidence on Financing Choice

We now investigate the determinants of new issuances in a regression framework. Our object of interest is to understand the effect of the crisis on firms' choices between bank and bond financing, and how the severity of firm-specific financing constraints affected this choice. To be included in the multivariate analysis, we require a firm to issue new debt in

[5] Table 6 also shows that smaller firms issued significantly more debt in the aftermath of the crisis. However, this difference is likely driven by sector effects, rather than variation across firms: we have re-performed the analysis in Table 6 after regressing quarterly amounts and spreads on sector (two-digit SIC level) dummies and do not detect significant differences for the smaller firms. Similar, the reduction in total financing detected for firms with low cash balances and a high fraction of short-term debt in Table 6 is no longer significant after accounting for sector effects. Results from this analysis are available on the authors' webpages.

Table 5. Summary statistics. This table reports summary statistics for the sample of new debt issuers. A new debt issuer is defined as a firm issuing new debt between Q3:2007 and Q2:2009, with positive assets during at least one quarter between Q3:2005 and Q2:2007, and rated during Q2:2005. Table 9 contains the definition of all variables. Assets are expressed in January 1998 constant $ millions. All variables are measured at Q2:2005.

Variable	Mean	Median	5^{th} %	95^{th} %	N. Obs.	Before crisis (%)			After crisis (%)		
						Total	Loan	Bond	Total	Loan	Bond
Rating	10.1(BBB-)	10(BBB-)	5(A+)	15.3(B)	645	58.4	57.4	64.4	82.9	80.2	89.3
Assets	9808.5	3202.3	448.7	28894.9	645	58.4	57.4	64.4	82.9	80.2	89.3
Payout ratio	0.246	0.120	0	0.795	617	56.3	55.2	63.4	79.4	76.5	86.7
KZ Index	1.258	1.148	0.411	2.396	414	37.8	36.8	44.2	60.6	59.5	63.0
WW Index	-0.402	-0.405	-0.521	-0.269	615	56.3	55.2	63.3	79.4	76.4	86.7
Cash reserves	0.068	0.038	0.001	0.237	645	58.4	57.4	64.4	82.9	80.2	89.3
Short-term debt	0.035	0.015	0.000	0.143	627	56.2	55.4	60.6	79.3	76.0	87.2

at least one quarter between 1998 and 2010, and to have non-missing firm characteristics (specified below) during the quarter prior to issuance. For every firm-quarter (i, t) in our sample with new debt issuance -be it either a loan or bond, or both- we set the indicator variable $Loan\ Issuance_{i,t}$ to equal one (resp. zero) if firm i issues a loan (resp. bond) during quarter t. For a firm issuing both types of debt during a given quarter we set $Loan\ Issuance_{i,t} = 1$ if the total amount of bank financing exceeds that of bond financing, and zero otherwise. To identify firms having a choice between the two sources of debt, we require a firm to be rated during the quarter prior to issuance. We use total assets and the KZ index as measures of financing constraints. Our results are qualitatively unchanged if we used the payout ratio and the WW index instead. Finally, following Denis and Mihov (2003) we include in our analysis variables that proxy for information asymmetry (tangibility), project quality (profitability), default risk (credit rating), and growth opportunities (Tobin's Q). We further control for other potential determinants of the debt source such as firm leverage and issue size. Table 7 reports summary statistics for our sample. All firm characteristics except default risk are winsorized at the 1% level.

Table 8-Column (1) report the results of logit regressions of the source of debt on $Crisis$ (an indicator variable equal to one for each of the eight quarters between Q3:2007 and Q2:2009, and zero otherwise), our two measures of financing constraints (Size, Panel A, and KZ index, Panel B), and the above mentioned control variables. For reasons of space, Table 8 reports only the point estimates (and associated standard errors) associated with the crisis indicator and the variables proxying for financing constraints. The entire set of coefficient estimates is available in the online appendix. We document that the probability of issuing a loan is significantly lower during the crisis and for financially unconstrained firms, i.e. large firms or firms with small values for the KZ index. In terms of economic significance, the estimates in Table 8 imply an increase in the probability of issuing bonds during the crisis of between 14.52% and 18.09%, depending on whether size or the KZ index is used to proxy for financing constraints.[6] Our results overall certify the reduction in the probability of loan issuances during the recent financial crisis which, together with the above evidence of simultaneous increase in bank financing costs,

[6] Consistent with Denis and Mihov (2003), we further document that firms with better credit quality are less likely to resort to bank financing, and that the probability of issuing bonds is positively associated with firm leverage and negatively associated to the amount issued. Firm profitability and tangibility are also positively associated with the decision to issue bonds, even though their significance varies depending on the model specification, i.e. the variable we use to proxy for financing constraint.

we ascribe to a reduction in bank credit supply. In order the better understand the importance of bank credit supply over the business cycle (not just the recent financial crisis), we employ a variety of measures quarterly time-series variables:

- Monetary policy. Residual of a regression of the federal funds target rate on the inflation rate (annual inflation, from core consumer price index) and the output gap. Higher values certify tighter monetary policy, and are thus expected to correspong to a contraction in bank credit supply. Values range from -2.11 (Q4:2001) to 1.57 (Q2:2007).

- Broker dealer leverage. Semi-annual growth in broker-dealer leverage. Higher values correspond to larger risk appetite, and are expected to correlate positively with bank credit supply. Values range from -70.99% (Q1:2009) to 85.92% (Q3:2008)

- Lending practice. Net percentage of domestic respondents tightening standards for residential mortgage loans. Higher values correspond to a tightening in lending standards, and are expected to be associated with a contraction in bank credit supply. Values range from -9.4% (Q2:2006) to 78.7% (Q3:2008) (source: Federal Reserve Board).

- Net Interest Margin (NIM). Difference between the interest income generated by banks and the interest paid on deposits, scaled by interest-earning assets. Higher values correspond to high profitability of bank lending activity, and are thus expected to correlate positively with bank credit supply. Values range from 3.14% (Q4:2008) to 4.14% (Q3:1999).

- Non-performing loans. Non-performing loans as a ratio of total assets. Higher values are expected to correspond to a reduction in bank credit supply. Values range from 0.7% (Q2:2006) to 5.64% (Q1:2010).

- EBP. Excess bond premium (in percentage points) as computed in Gilchrist and Zakrajšek (2011).[7] Higher values correspond to a reduction in the effective risk-bearing capacity of the financial sector, and thus a contraction in credit supply. Values range from -0.89% (Q1:2005) to 2.05% (Q1:2009). This measure is not available during Q4:2010.

[7] We thank Simon Gilchrist for sharing this series with us.

In the remainder, we refer to a contraction in bank credit supply as an increase in Monetary policy, Lending practice, Non-performing loans, or EBP from its 5th to 95th percentile, or a decrease in BD leverage or NIM from its 95th to 5th percentile. Table 8-Columns (2) to (7) report logit regression results including the above measures of bank credit supply in lieu of the crisis indicator. We document that the probability of loan issuance is negatively and significantly associated with firm size, and overall positively associated with the KZ index -albeit not always significant at the 10% level. Moreover, all our measures for bank credit supply measures significantly affect firms' financing decisions: larger broker-dealer leverage growth or higher bank profitability (as proxied by NIM) increase the probability of loan issuance, while a tighter monetary polity, tighter lending standards, a larger fraction of non-performing loans, and a higher excess bond premium increase the probability of bond issuance. In terms of economics significance, the increase in the probability of bond issuance during a contraction in credit supply ranges between 8.83% and 41.45%.

4 Model of Bank and Bond Finance

Motivated by our empirical results, we will now sketch a model of direct and intermediated credit that is consistent with the main features of the evidence discussed above. To set the stage, it is useful to take stock of the desired empirical features of a model based on the evidence encountered along the way.

- First, the contrast between bank and bond financing points to the importance of accommodating both direct and intermediated credit.

- Second, we noted that during the recent downturn in the US, credit in the form of loans contracted but bond financing increased sharply to make up most of the gap. The model should be able to accommodate such a feature.

- Third, even as the two categories of credit diverged in *quantity*, the spreads on both types of credit rose. The model should accommodate this feature.

- Fourth, bank lending changes dollar for dollar with a change in debt, with equity being "sticky". So, credit supply by banks is the consequence of their choice of leverage for a given level of equity. The credit supply modeling should conform to this feature.

- Fifth, as a consequence of the above bullet point, bank leverage is procyclical. Leverage is high when assets are large.

We now proceed to sketch a model that accommodates these five features. It is a model of direct and intermediated credit where lending by banks is seen as the flip side of a credit risk model.[8] Credit can either be granted *directly* by the household sector or it can be intermediated through financial intermediaries, who take in deposits from the households in order to lend to the ultimate borrowers. We call all intermediaries "banks" for simplicity, but we intend this term to cover all the possible forms of intermediation, including the shadow banking system and the institutions involved in the securitization process. Also, the term "deposit" could encompass any short-term liquid claim on a financial intermediary, such as holdings in money market funds.

4.1 Bank Credit Supply

Bank credit supply is modeled as the flip side of a credit risk model, where banks adjust lending so as to satisfy a risk constraint. In particular, banks are risk neutral and maximize profit subject only to a Value-at-Risk (VaR) constraint that limits the probability of bank failure. The VaR constraint stipulates that the probability of bank failure has to be no higher than some (small) threshold level $\alpha > 0$.[9] In keeping with market practice, the particular model of credit risk that drives the VaR constraint will be the Vasicek (2002) model, adopted by the Basel Committee for Banking Supervision (BCBS (2005)).

The notation to be used is as follows. The bank lends out amount C (with "C" standing for "credit") at date 0 at the lending rate r, so that the bank is owed $(1+r)\,C$ in date 1 (its notional assets). The lending is financed from the combination of equity E and debt funding L, where L encompasses deposit and money market funding. The cost of debt financing is f so that the bank owes $(1+f)\,L$ at date 1 (its notional liabilities).

The economy has a continuum of binary projects, each of which succeeds with probability $1-\varepsilon$ and fails with probability ε. Each project uses debt financing of 1, which the borrower will default on if the project fails. Thus, if the project fails, the lender suffers credit loss of 1. The correlation in defaults across loans follows the Vasicek (2002) model. Project j succeeds (so that borrower j repays the loan) when $Z_j > 0$, where Z_j is the

[8] The model was introduced in Shin (2011) in the context of cross-border banking and capital flows.

[9] See Adrian and Shin (2008) for a possible microfoundation for the VaR constraint as a consequence of constraints imposed by creditors.

random variable

$$Z_j = -\Phi^{-1}(\varepsilon) + \sqrt{\rho}Y + \sqrt{1-\rho}X_j \tag{1}$$

where $\Phi(.)$ is the c.d.f. of the standard normal, Y and $\{X_j\}$ are independent standard normals, and ρ is a constant between zero and one. Y has the interpretation of the economy-wide fundamental factor that affects all projects, while X_j is the idiosyncratic factor for project j. The parameter ρ is the weight on the common factor, which limits the extent of diversification that investors can achieve. Note that the probability of default is given by

$$\begin{aligned}
\Pr(Z_j < 0) &= \Pr\left(\sqrt{\rho}Y + \sqrt{1-\rho}X_j < \Phi^{-1}(\varepsilon)\right) \\
&= \Phi\left(\Phi^{-1}(\varepsilon)\right) = \varepsilon
\end{aligned} \tag{2}$$

Conditional on Y, defaults are independent. The bank can remove idiosyncratic risk by keeping C fixed but diversifying across borrowers. We assume that loans are packaged into bonds and banks hold such diversified bonds, rather than loans directly. By holding bonds, banks can diversify away all idiosyncratic risk, and only the systematic risk from the common factor Y is reflected in the credit risk. The realized value of the bank's assets at date 1 is then given by the random variable $w(Y)$ where

$$\begin{aligned}
w(Y) &\equiv (1+r)C \cdot \Pr(Z_j \geq 0|Y) \\
&= (1+r)C \cdot \Pr\left(\sqrt{\rho}Y + \sqrt{1-\rho}X_j \geq \Phi^{-1}(\varepsilon)|Y\right) \\
&= (1+r)C \cdot \Phi\left(\tfrac{Y\sqrt{\rho}-\Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right)
\end{aligned} \tag{3}$$

Then, the c.d.f. of $w(Y)$ is given by

$$\begin{aligned}
F(z) &= \Pr(w \leq z) \\
&= \Pr\left(Y \leq w^{-1}(z)\right) \\
&= \Phi\left(w^{-1}(z)\right) \\
&= \Phi\left(\frac{1}{\sqrt{\rho}}\left(\Phi^{-1}(\varepsilon) + \sqrt{1-\rho}\Phi^{-1}\left(\frac{z}{(1+r)C}\right)\right)\right)
\end{aligned} \tag{4}$$

The density over the realized assets of the bank is the derivative of (4) with respect to z. Figure 7 plots the densities over asset realizations, and shows how the density shifts to changes in the default probability ε (left hand panel) or to changes in ρ (right hand

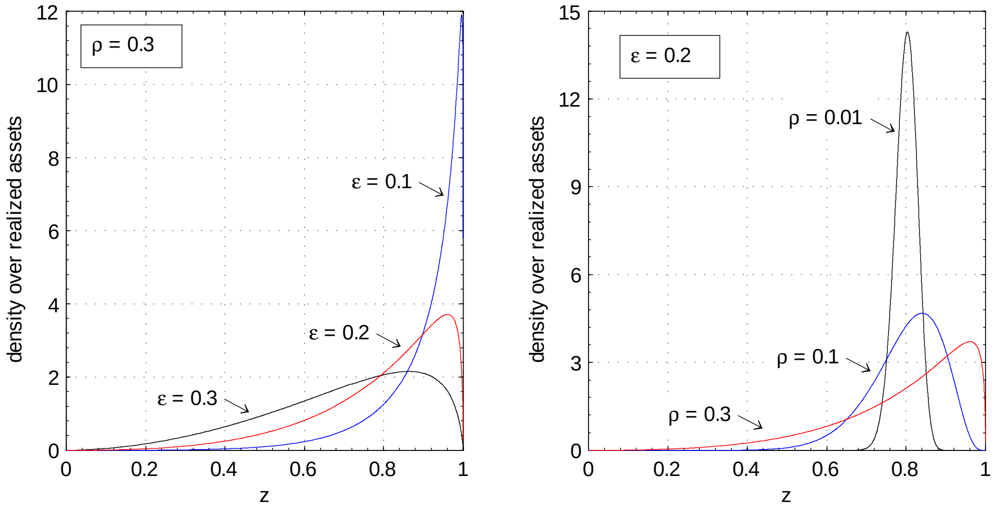

Figure 7. The two charts plot the densities over realized assets when $C(1+r) = 1$. The left hand charts plots the density over asset realizations of the bank when $\rho = 0.1$ and ε is varied from 0.1 to 0.3. The right hand chart plots the asset realization density when $\varepsilon = 0.2$ and ρ varies from 0.01 to 0.3.

panel). Higher values of ε imply a first degree stochastic dominance shift left for the asset realization density, while shifts in ρ imply a mean-preserving shift in the density around the mean realization $1 - \varepsilon$.

As mentioned above, the leveraging/deleveraging by banks is modeled as in mode 2 in Figure 3. That is, banks adjust the size of its asset book C and funding L given equity E so as as to keep its probability of default to $\alpha > 0$. Since the bank is risk-neutral and maximizes profit, the VaR constraint binds whenever expected return from the bond is positive. The constraint is that the bank limits total assets so as to keep the probability of its own failure to α. Since the bank fails when the asset realization falls below its notional liabilities $(1+f)L$, the bank's total assets C satisfies

$$\Pr(w < (1+f)L) = \Phi\left(\frac{\Phi^{-1}(\varepsilon)+\sqrt{1-\rho}\Phi^{-1}\left(\frac{(1+f)L}{(1+r)C}\right)}{\sqrt{\rho}}\right) = \alpha \tag{5}$$

Re-arranging (5), we can derive an expression for the ratio of notional liabilities to notional assets for the bank.

$$\frac{\text{Notional liabilities}}{\text{Notional assets}} = \frac{(1+f)L}{(1+r)C} = \Phi\left(\frac{\sqrt{\rho}\Phi^{-1}(\alpha) - \Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right) \tag{6}$$

From here on, we will use the shorthand φ to denote this ratio of notional liabilities to notational assets. That is,

$$\varphi(\alpha,\varepsilon,\rho) \equiv \Phi\left(\frac{\sqrt{\rho}\Phi^{-1}(\alpha)-\Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right) \tag{7}$$

φ can be seen as a normalized leverage ratio, lying between zero and one. The higher is φ, the higher is bank leverage and the greater is credit supply.

We can solve for the bank's total assets C and liability aggregate L from (6) and the balance sheet identity $C = E + L$ to give

$$C = \frac{E}{1-\frac{1+r}{1+f}\cdot\varphi} \qquad \text{and} \qquad L = \frac{E}{\frac{1+f}{1+r}\cdot\frac{1}{\varphi}-1} \tag{8}$$

Note that both C and L are proportional to bank equity E, so that an aggregation property holds for bank lending and bank funding. Therefore, the leverage of the *bank* and the *banking sector* are interchangeable in our model, and is given by

$$\text{Leverage } = \frac{C}{E} = \frac{1}{1-\frac{1+r}{1+f}\cdot\varphi} \tag{9}$$

4.2 Direct Credit

Now consider the credit coming directly from bond holders. Bond holders ("households") are risk averse with mean-variance preferences, and have identical risk tolerance τ. Households hold a portfolio consisting of three component assets - risky bonds, cash and deposits in the bank. As stated already, deposits include claims on money market funds that serve as the base of the shadow banking system. We assume that deposits are guaranteed by the government (at least implicitly) so that households treat cash and deposits as being perfect substitutes. We also assume that the households have sufficient endowments so that the wealth constraint is not binding in their choice of holding for the risky bonds. The demand for bonds (supply of credit) of mean-variance investor i with risk tolerance τ is then given by the first-order condition:

$$C_i = \frac{\tau\left[(1-\varepsilon)(1+r)-1\right]}{\sigma^2(1+r)^2} \tag{10}$$

where σ^2 is variance of one unit of the bond that promises payment of $(1+r)$ next period. Suppose there is measure N of mean-variance investors in the economy, and that $T = \tau N$. Aggregating the bond holdings across all households, the aggregate supply of credit from

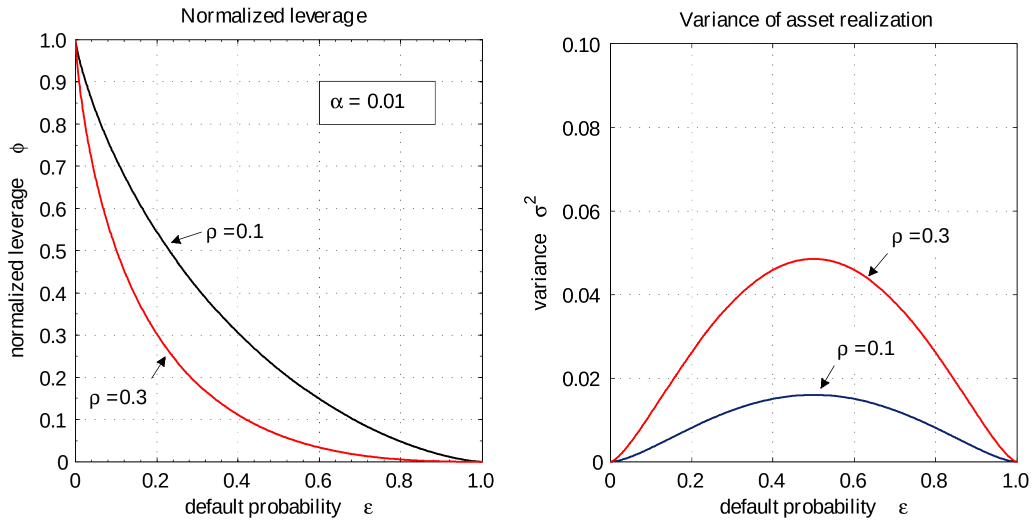

Figure 8. Left hand panel plots the normalized leverage ratio φ as a function of ε. The right hand panel plots the variance σ^2 as a function of epsilon for two values of ρ.

bond investors is thus given by:

$$C_H = \frac{T\left[(1-\varepsilon)(1+r)-1\right]}{\sigma^2 (1+r)^2} \tag{11}$$

"H" stands for the "household" sector. In the appendix, we show that the variance σ^2 is given by

$$\sigma^2 = \Phi_2\left(\Phi^{-1}(\varepsilon), \Phi^{-1}(\varepsilon); \rho\right) - \varepsilon^2 \tag{12}$$

where $\Phi_2(\cdot, \cdot; \rho)$ is the cumulative bivariate standard normal with correlation ρ.[10]

The right hand panel of Figure 8 plots the variance σ^2 as a function of ε. The variance is maximized when $\varepsilon = 0.5$, and is increasing in ρ. The left hand panel of Figure 8 plots the normalized leverage φ as a function of ε.

Since bank liabilities are fully guaranteed by the government they earn the risk-free rate. Further, let the risk-free rate be zero, so that $f = 0$. Since bank credit supply is increasing in φ while bond investor credit supply is decreasing in σ^2, the effect of an increase in ε (assuming that $\varepsilon < 0.5$) is to decrease credit supply from both groups of creditors.

[10]See Vasicek (2002) for additional properties of the asset realization function $w(Y)$.

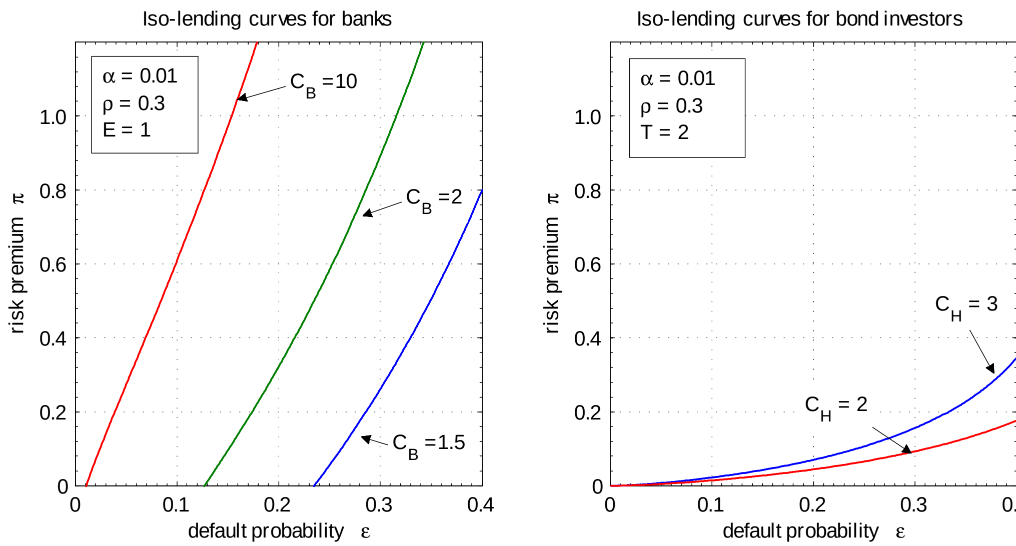

Figure 9. Iso-lending curves in (ε, π)-space for banks (left panel) and bond investors (right panel). Parameter values are as indicated in the boxes.

4.3 Comparative Statics of Credit Supply

The risk premium on the bond is given by its return in excess of the risk-free rate. Given our assumption that the risk-free rate is zero, the risk premium π is given by

$$\pi = (1 - \varepsilon)(1 + r) - 1 \tag{13}$$

Consider the iso-lending curves for banks that plot the combination of default probability ε and risk premium π that give rise to the same credit supply by banks. The iso-lending curve for banks corresponding to bank credit C_B is given by

$$\pi(\varepsilon) = \left(1 - \frac{E}{C_B}\right) \frac{1 - \varepsilon}{\varphi(\varepsilon)} - 1 \tag{14}$$

For banks, the iso-lending curve has the property that when ε is small, the iso-lending curve is close to being vertical in (ε, π)-space. From (14), we have

$$\pi'(\varepsilon) = -\left(1 - \frac{E}{C_B}\right) \left[\frac{1 - \varepsilon}{\varphi^2} \varphi'(\varepsilon) + \frac{1}{\varphi}\right] \tag{15}$$

where $\varphi'(\varepsilon) \to -\infty$ as $\varepsilon \to 0$. Hence, the slope of the iso-lending curve tends to $+\infty$ as $\varepsilon \to 0$. Figure 9 plots the iso-lending curves in (ε, π)-space for banks (left panel) and bond investors (right panel).

The vertical limiting case of the bank iso-lending curves is revealing about the behavioral traits of banks. To say that the iso-lending curve is vertical is to say that bank lending decisions depend only on the "physical" risk ε, rather than the risk premium π. This feature comes from the combination of the risk-neutrality of the bank, and the constraint that limits its probability of failure. Risk neutrality means that the risk premium π enters only through its VaR constraint. Conventional risk-averse portfolio investors would focus on the tradeoff between physical risk ε and the risk premium π. The right hand panel of Figure 9 shows the iso-lending curves of the bond investors, to be derived shortly. Although we have used mean-variance preferences for convenience for the bond investors, any conventional risk averse preferences would imply a non-trivial tradeoff between physical risk and risk premium.

The bond investors' iso-lending curves in (ε, π)-space follow from the supply of credit by households given by (11), from which we can derive the following quadratic equation in π

$$\frac{C_H \sigma^2}{T(1-\varepsilon)^2}(1+\pi)^2 - (1+\pi) + 1 = 0 \tag{16}$$

The iso-lending curve for bond investors corresponding to bond credit supply of C_H is given by

$$\pi(\varepsilon) = \frac{1 - \sqrt{1 - 4C_H\sigma^2/T(1-\varepsilon)^2}}{2C_H\sigma^2/T(1-\varepsilon)^2} - 1 \tag{17}$$

We now close the model through a market clearing condition. Let S be the fixed supply of the risky bond in the economy. The market clearing condition is then

$$\underbrace{\frac{E}{1 - \frac{1+\pi}{1-\varepsilon}\varphi}}_{C_B} + \underbrace{T\frac{(1-\varepsilon)^2 \pi}{\sigma^2 (1+\pi)^2}}_{C_H} = S \tag{18}$$

We can verify that the risk premium π varies with physical risks ε. Provided that ε is small - so that it lies in the plausible range for the probability of default - and provided that the risk premium is not too large, the risk premium π is an increasing function of ε.

Proposition 1 *Suppose ε is small so that $|\partial\varphi/\partial\varepsilon| > \varphi/(1-\varepsilon)$ and the risk premium is small so that $\pi < 1$. Then the risk premium π is strictly increasing in ε.*

To see Proposition 1, note first that credit supply by bond investors is declining in ε. We can show that bond holding by banks declines in ε if $|\partial\varphi/\partial\varepsilon| > \varphi/(1-\varepsilon)$. Also, we can also show $\partial C_B/\partial\pi > 0$ and - assuming $\pi < 1$ - we also have $\partial C_H/\partial\pi > 0$. Defining the excess supply of credit function $G(\varepsilon, \pi) \equiv C_B + C_H - S$, we have

$$\frac{d\pi}{d\varepsilon} = -\frac{\partial G/\partial\varepsilon}{\partial G/\partial\pi} = -\frac{\frac{\partial C_B}{\partial\varepsilon} + \frac{\partial C_H}{\partial\varepsilon}}{\frac{\partial C_B}{\partial\pi} + \frac{\partial C_H}{\partial\pi}} > 0 \tag{19}$$

4.4 Relative Size of Banking Sector

We now come to our key result, which address the relative size of the banking sector and its relationship to risk premiums.

Proposition 2 *Suppose that ε is small enough so that the iso-lending curve of banks is steeper than the iso-lending curve of bond investors. Then, an increase in ε is associated with a contraction in banking sector credit, but an expansion in directly granted lending through the bond market. In addition, the risk premium π increases with ε.*

Proposition 2 can be demonstrated using a graphical argument using the iso-lending curves for banks and bond investors. Figure 10 illustrates an initial equilibrium given by the crossing point for the iso-lending curves for banks and bond investors. In this illustration, total credit supply is 20, with 10 coming from banks and 10 coming from bond investors. The four regions indicated in Figure 10 correspond to the four combinations of credit supply changes by banks and bond investors. Region A is when both banks and bond investors increase credit supply, while Region C is where both reduce credit supply.

Now, consider a negative economic shock that increases the default probability ε. Such a shock shifts the economy to the right hand side of the banks' iso-lending curve, implying a decrease in bank credit. In addition, the market risk premium π rises, as a consequence of Proposition 1. Since bank credit supply contracts, bond credit supply must increase for the market to clear. Thus, the new equilibrium (ε, π) pair must lie in Region D in Figure 10. In Region D, bank credit supply contacts while bond credit supply expands.

In this way, when default risk starts to increase as the financial cycle turns, there will be an amplifying effect through the risk premium π. As ε increases due to the deterioration of fundamentals, we have the combination of sharply higher risk premiums and the contraction in bank lending. Bond investors are then induced by the higher risk premiums to close the credit supply gap in the market. The recoiling from risks, sharply

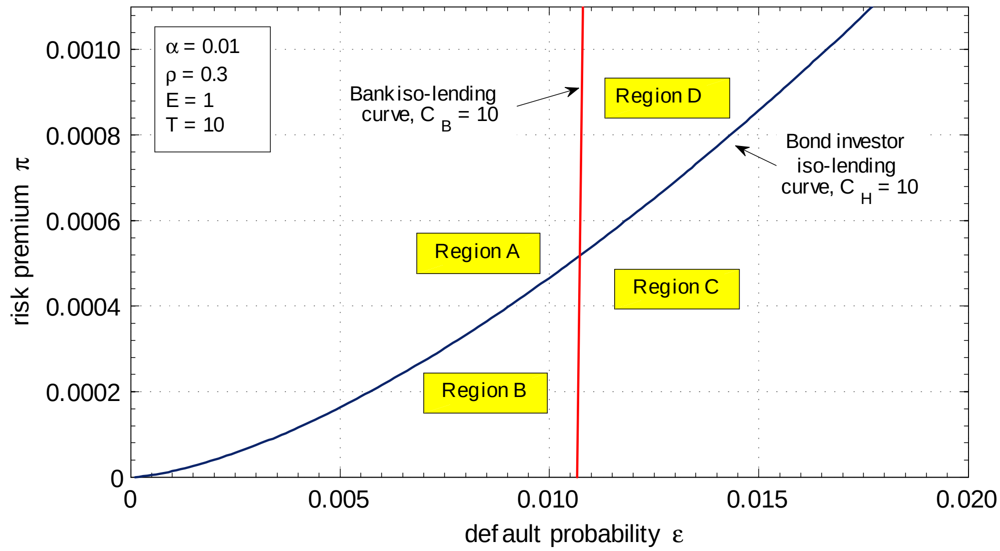

Figure 10. Crossing point for the iso-lending curves of banks and households.

higher risk premiums and the substitution of bank lending by bond financing explains the substitution away from bank financing to bond financing that we see in the data. Given a fairly inelastic credit demand curve (at least in the short run), the sharp contraction in loans from financial intermediaries will have to be made up somehow. The slack is taken up by the increse in bond financing. However, for this to happen, prices must adjust in order that the risk premium rises sufficiently to induce risk-averse bond investors to make up for the lost banking sector credit. Thus, a fall in the relative credit supplied by the banking sector is associated with a rise in risk premiums.

For macro activity, such a rise in the risk premium exerts contractionary effects on the real economy. Gilchrist, Yankov, and Zakrajsek (2009) documents evidence that credit spreads have substantial effect on macro activity measures. Thus, the financial friction that such a mechanism generates is one that works through prices, rather than through a shrinkage in the total quantity of credit.

Taken together, the empirical evidence both from an aggregate and disaggregated study suggest that the model of bank and bond credit supply sketched here holds some promise in explaining the recent experience in the United States.

Appendix

In this appendix, we present the derivation of the variance of the asset realization $w(Y)$ in Vasicek (2002). Let $k = \Phi^{-1}(\varepsilon)$ and $X_1, X_2, \cdots, X_n$ be i.i.d. standard normal.

$$
\begin{aligned}
E[w^n] &= E\left[\left(\Phi\left(\tfrac{Y\sqrt{\rho}-k}{\sqrt{1-\rho}}\right)\right)^n\right] \\
&= E\left[\prod_{i=1}^n \Pr\left[\sqrt{\rho}Y + \sqrt{1-\rho}X_i > k \middle| Y\right]\right] \\
&= E\left[\Pr\left[\sqrt{\rho}Y + \sqrt{1-\rho}X_1 > k, \ldots, \sqrt{\rho}Y + \sqrt{1-\rho}X_n > k \middle| Y\right]\right] \\
&= \Pr\left[\sqrt{\rho}Y + \sqrt{1-\rho}X_1 > k, \ldots, \sqrt{\rho}Y + \sqrt{1-\rho}X_n > k\right] \\
&= \Pr[Z_1 > k, \ldots, Z_n > k]
\end{aligned}
$$

where $(Z_1, \ldots, Z_n)$ is multivariate standard normal with correlation ρ. Hence

$$E[w] = 1 - \varepsilon$$

and

$$
\begin{aligned}
\text{var}[w] &= \text{var}[1-w] \\
&= \Pr[1 - Z_1 \leq k, 1 - Z_2 \leq k] - \varepsilon^2 \\
&= \Phi_2(k, k; \rho) - \varepsilon^2 \\
&= \Phi_2\left(\Phi^{-1}(\varepsilon), \Phi^{-1}(\varepsilon); \rho\right) - \varepsilon^2
\end{aligned}
$$

where $\Phi_2(\cdot, \cdot; \rho)$ cumulative bivariate standard normal with correlation ρ.

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Table 6. Financing before and after the crisis. This table presents means and medians of new debt issuers' financing in billions of dollars. A new debt issuer is defined as a firm with at least one loan or bond issue after the crisis, with positive assets during at least one quarter before the crisis, and rated during Q2:2005. Sorting is conducted in terciles based on variables measured during Q2:2005. Table A1 contains definitions of all variables. "Before crisis" refers to the eight quarters between Q3:2005 and Q2:2007, "after crisis" refers to the eight quarters between Q3:2007 and Q2:2009. Firm-level loan and bond amounts are cumulated over the relevant periods, and the table reports cross-sectional means and medians. The After-Before column reports the t-statistic for the paired (unpaired) t-test for differences in amounts (spreads) after and before the crisis. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: total financing						
	Amount			Spread		
	Before crisis	After crisis	t-stat After-Before	Before crisis	After crisis	t-stat After-Before
Sorting variable: Default likelihood						
1st Terc	2.337	2.751	1.067	43.20	186.97	13.530***
	1.022	0.937	-0.574	35.00	158.48	13.530***
3rd Terc	0.969	0.647	-2.401**	211.27	368.35	7.510***
	0.303	0.294	-0.866	183.64	315.55	7.576***
Sorting variable: Size						
1st Terc	0.322	0.411	2.246**	164.35	286.09	6.321***
	0.181	0.25	3.400***	150.00	245.78	6.350***
3rd Terc	3.368	3.341	-0.059	77.44	258.83	11.495***
	2.007	1.244	-2.836***	49.90	215.11	11.915***
Sorting variable: Payout ratio						
1st Terc	1.029	0.743	-2.903***	168.87	309.90	6.797***
	0.404	0.387	-1.317	157.32	250.00	7.113***
3rd Terc	1.680	2.535	2.259**	63.15	229.40	12.281***
	0.735	0.686	0.506	47.55	190.32	12.534***
Sorting variable: Kaplan-Zingales index						
1st Terc	1.861	2.394	1.174	80.90	231.26	7.628***
	0.601	0.739	1.419	51.38	184.96	8.879***
3rd Terc	1.339	1.545	0.530	144.95	304.78	7.571***
	0.633	0.465	-1.929*	143.50	252.39	7.430***
Sorting variable: Whited-Wu index						
1st Terc	3.108	3.382	0.590	61.73	228.73	13.519***
	1.683	1.244	-1.592	47.50	190.00	12.577***
3rd Terc	0.509	0.485	-0.480	172.90	294.17	6.489***
	0.234	0.286	1.423	160.00	250.00	6.844***
Sorting variable: Cash reserves						
1st Terc	1.338	1.438	0.343	105.64	261.28	10.787***
	0.592	0.44	-2.266**	74.24	230.00	10.384***
3rd Terc	1.658	1.906	0.887	113.48	280.54	8.673***
	0.633	0.612	0.757	76.30	225.00	9.577***
Sorting variable: Short term debt						
1st Terc	1.160	1.143	-0.068	133.29	296.45	8.266***
	0.399	0.453	1.313	107.92	248.73	8.718***
3rd Terc	2.019	1.929	-0.303	82.60	233.41	9.679***
	0.805	0.644	-2.306**	51.91	190.86	10.452***

Panel B: loan financing						
		Amount			Spread	
	Before crisis	After crisis	t-stat After-Before	Before crisis	After crisis	t-stat After-Before
Sorting variable: Default likelihood						
1st Terc	1.949	1.745	-0.583	34.57	90.33	7.284***
	0.805	0.344	-4.380***	28.29	40.00	5.149***
3rd Terc	0.828	0.525	-2.648***	196.23	298.47	5.755***
	0.263	0.211	-1.701*	175.00	250.00	5.248***
Sorting variable: Size						
1st Terc	0.292	0.352	1.556	150.82	242.51	5.200***
	0.141	0.222	2.194**	146.42	200.00	4.832***
3rd Terc	2.858	2.227	-1.547	69.49	144.96	6.054***
	1.627	0.485	-5.627***	40.48	75.00	4.299***
Sorting variable: Payout ratio						
1st Terc	0.877	0.558	-3.314***	151.54	244.68	5.329***
	0.369	0.293	-1.899*	150.00	200.23	5.179***
3rd Terc	1.455	1.741	0.855	54.96	152.33	7.415***
	0.636	0.223	-3.551***	41.17	85.00	6.510***
Sorting variable: Kaplan-Zingales index						
1st Terc	1.569	1.472	-0.248	72.86	161.05	4.463***
	0.507	0.362	-0.716	45.00	87.50	4.694***
3rd Terc	1.152	1.257	0.274	135.53	236.56	5.211***
	0.518	0.229	-4.843***	37.42	62.50	4.873***
Sorting variable: Whited-Wu index						
1st Terc	2.615	2.248	-0.875	53.29	128.55	6.928***
	1.488	0.567	-4.843***	37.42	62.50	4.873***
3rd Terc	0.452	0.412	-0.763	155.96	246.31	5.406***
	0.181	0.224	0.463	150.00	200.00	5.459***
Sorting variable: Cash reserves						
1st Terc	1.115	1.036	-0.273	97.12	195.41	7.372***
	0.481	0.257	-4.660***	56.56	165.15	6.581***
3rd Terc	1.417	1.289	-0.581	101.87	196.00	5.593***
	0.508	0.316	-1.504	60.00	162.50	5.183***
Sorting variable: Short term debt						
1st Terc	0.979	0.901	-0.311	118.50	228.58	5.855***
	0.372	0.303	-0.953	93.18	175.00	5.671***
3rd Terc	1.697	1.19	-1.984**	72.27	140.53	6.062***
	0.743	0.282	-5.264***	45.00	86.25	4.895***

Panel C: Bond financing						
	Amount			Spread		
	Before crisis	After crisis	t-stat After-Before	Before crisis	After crisis	t-stat After-Before
Sorting variable: Default likelihood						
1st Terc	0.388	1.006	5.314***	87.65	291.85	11.106***
	0.000	0.369	7.486***	78.14	245.11	12.184***
3rd Terc	0.142	0.122	-0.553	294.21	618.59	7.207***
	0.000	0.000	1.381	275.23	603.00	6.302***
Sorting variable: Size						
1st Terc	0.030	0.059	3.075***	264.03	495.25	4.596***
	0.000	0.000	3.087***	239.00	445.00	4.423***
3rd Terc	0.509	1.114	4.935***	117.60	353.45	10.017***
	0.000	0.531	5.817***	95.00	282.00	11.174***
Sorting variable: Payout ratio						
1st Terc	0.151	0.185	0.911	264.63	503.50	5.295***
	0.000	0.000	2.284**	246.00	438.00	5.072***
3rd Terc	0.225	0.794	5.244***	103.81	322.31	10.042***
	0.000	0.207	7.941***	88.00	275.00	10.314***
Sorting variable: Kaplan-Zingales index						
1st Terc	0.292	0.922	3.916***	120.68	355.23	7.513***
	0.000	0.127	5.055***	85.00	313.89	7.512***
3rd Terc	0.186	0.288	1.688*	200.74	438.61	6.085***
	0.000	0.000	1.808*	200.00	410.00	5.290***
Sorting variable: Whited-Wu index						
1st Terc	0.493	1.134	5.068***	103.04	328.96	11.496***
	0.000	0.492	6.459***	93.03	271.29	11.774***
3rd Terc	0.057	0.073	1.037	279.18	514.62	5.233***
	0.000	0.000	2.722***	248.82	463.05	5.043***
Sorting variable: Cash reserves						
1st Terc	0.222	0.401	2.497**	160.45	394.45	9.040***
	0.000	0.000	3.305***	118.00	332.00	8.662***
3rd Terc	0.241	0.617	3.864***	164.96	389.71	6.215***
	0.000	0.039	5.341***	100.00	322.32	7.008***
Sorting variable: Short term debt						
1st Terc	0.180	0.242	1.288	202.70	462.20	7.313***
	0.000	0.000	3.257***	162.00	412.00	7.115***
3rd Terc	0.322	0.740	4.155***	128.47	344.01	8.433***
	0.000	0.222	5.823***	97.36	290.00	9.593***

Table 7. Descriptive statistics.

Variable	Mean	Median	25th %	75th %	N. Obs.
Tobin's Q	1.592	1.332	1.072	1.810	6754
Tangibility	0.403	0.372	0.185	0.598	6754
Profitability	0.035	0.032	0.022	0.046	6754
Default risk	10.259(BBB-)	10(BBB-)	8(BBB+)	13(BB-)	6754
Leverage	0.371	0.347	0.245	0.467	6754
Amount issued	0.615	0.325	0.176	0.692	6754
Size	8.116	7.977	7.095	9.168	6754
KZ index	1.446	1.345	1.004	1.773	6754

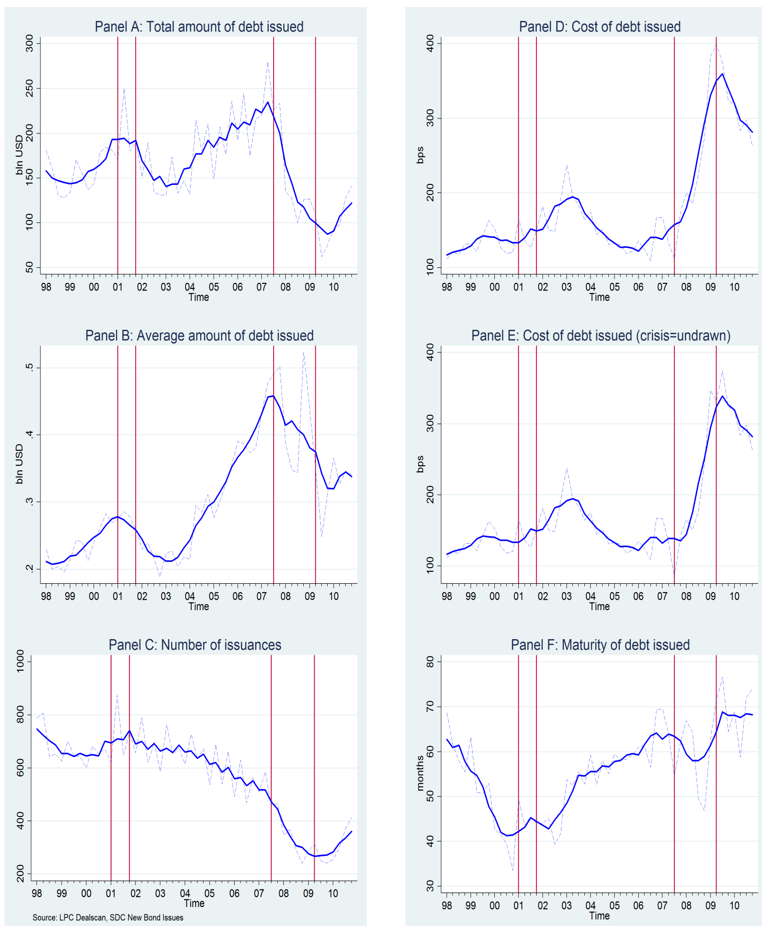

Figure 11. **New debt issuances.** Panel A: total amount of debt issued (billion of January 1998 USD, dashed line) and its smoothed version (solid line). Panel B: average amount of debt issued (dashed line) and its smoothed version (solid line). Panel C: number of debt issuances (dashed line) and its smoothed version (solid line). Panels D and E: cost of debt issued (dashed line) and its smoothed version (solid line). In Panel D we use the all-in-drawn spread for all loan issuances, while in Panel E we use the all-in-undrawn spread for revolving credit lines between Q3:2007 and Q2:2009. Panel F: maturity of debt issued measured in months (dashed line) and its smoothed version (solid line).

Table 8. Credit supply contraction, financing constraints, and financing choices. This table presents logit regression results to explain firms' financing choices. The dependent variable is Loan issuance, a dummy variable that takes a value of one if a firm issues a loan in a given quarter, and zero if it issues a bond. All regressions include a set of (untabulated) control variables (Tobin's Q, tangibility, profitability, default risk, leverage, and the amount issued), and a constant. All variables are defined in the Appendix. Credit supply contraction reports the change in the dependent variable (in percentage) following an increase in Monetary policy, Lending practice, Non-performing loans, or EBP from its 5th to its 95th percentile, or a decrease in BD leverage or NIM from its 95th to 5th percentile. Standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Panel A			
Size	-0.628***	-0.649***	-0.619***	-0.648***	-0.629***	-0.598***	-0.638***
	(0.045)	(0.046)	(0.046)	(0.045)	(0.045)	(0.046)	(0.046)
Crisis	-0.716***						
	(0.085)						
Monetary policy		-0.157***					
		(0.026)					
Lending practice			-0.016***				
			(0.001)				
BD leverage				0.009***			
				(0.001)			
NIM					0.627***		
					(0.115)		
Non-performing loans						-0.385***	
						(0.021)	
EBP							-0.269***
							(0.040)
Observations	6,754	6,754	6,754	6,754	6,754	6,754	6,626
Pseudo R-squared	0.126	0.122	0.133	0.122	0.121	0.160	0.122
Credit supply contraction	-14.52	-9.81	-19.40	-11.65	-8.83	-36.78	-9.26
				Panel B			
KZ index	0.336**	0.448***	0.273*	0.446***	0.289*	0.125	0.412***
	(0.151)	(0.155)	(0.152)	(0.152)	(0.157)	(0.151)	(0.149)
Crisis	-0.843***						
	(0.082)						
Monetary policy		-0.156***					
		(0.025)					
Lending practice			-0.018***				
			(0.001)				
BD leverage				0.009***			
				(0.001)			
NIM					0.862***		
					(0.115)		
Non-performing loans						-0.421***	
						(0.021)	
EBP							-0.283***
							(0.038)
Observations	6,754	6,754	6,754	6,754	6,754	6,754	6,626
Pseudo R-squared	0.0738	0.0657	0.0830	0.0666	0.0683	0.114	0.0680
Credit supply contraction	-18.09	-10.34	-23.12	-12.73	-12.80	-41.45	-10.31

Variable	Description	Source
Assets	Total assets (atq)	Compustat
Cash flow	Operating income before depreciation (oibdqp) / Assets	Compustat
Cash reserves	Cash and short-term investments (cheq) / Assets	Compustat
Debt	(Debt in current liabilities (dlcq) + Long-term debt (dlttq)) / Assets	Compustat
Short-term debt	Debt in current liabilities (dlcq) / Assets	Compustat
Long-term debt	Long-term debt (dlttq) / Assets	Compustat
Dividends	Quarterly cash dividends / Assets. Quarterly cash dividends are cash dividends (dvy) for fiscal quarter 1, and the first difference in cash dividends for fiscal quarters 2,3, and 4.	Compustat
Dividend dummy	Dummy equal to one if dividends>0, and zero otherwise.	Compustat
Size	Log(1+Assets)	Compustat
Sales growth	Growth rate in quarterly sales (saleq).	Compustat
Industry sales growth	Median sales growth at the three-digit SIC level.	Compustat
Tobin's Q	(Assets + Market value of equity (prccq*cshprq) – Common equity (ceqq) – Deferred taxes (txditcq)) / Assets. Bounded above at 10.	Compustat
KZ index	–1.002*Cash flow + 0.283*Tobin's Q + 3.319*Debt –39.368*Dividends –1.315*Cash reserves	Compustat
WW index	–0.091*Cash flow –0.062*Dividend dummy +0.021*Long-term debt –0.044*Size +0.102*Industry sales growth –0.035*Sales growth	Compustat
Profitability		Compustat
Tangibility		Compustat
Default likelihood	Average of monthly S&P long-term issuer rating (splticrm).	Compustat
Revolver	Loan type is "Revolver/Line <1 Yr.", "Revolver/Line >= Yr.", "Revolver/Term Loan", or "364-Day Facility"	LPC
Term loan	Loan type is "Term Loan", or "Term Loan" with tranche indicator A to H.	LPC
Restructuring (loan)	Primary purpose is "Acquis. Line", "Debt Repay.", "Debtor-in-poss.", "IPO Relat. Fin.", "LBO", "MBO", "Merger", "Rec. Prog.", "Recap.", "Restructuring", "SBO", "Securities Purchase", "Spinoff", "Stock buyback" or "Takeover".	LPC
Investment (loan)	Primary purpose is "Aircraft finance", "Capital expend.", "Corp. purposes", "Cred Enhanc", "Equip. Purch.", "Infrastructure", "Lease finance", "Mort. Warehse.", "Work. cap.", "Proj. finance", "Real estate" "Ship finance", "TelcomBuildout", or "Trade finance"	LPC
Restructuring (bond)	Primary use is "Acq'n of Securities", "Acquisition Fin.", "Future Acquisitions", "Leveraged Buyout", "Pay on Borrowings", "Recapitalization", "Redeem Shares", "Reduce Indebtedness", "Refinancing", "Restructuring", "Stock Repurchase"	SDC
Investment (bond)	Primary use is "Aircraft Financing", "Buildings", "Capital Expenditures", "Construction", "Education", "Energy", "Gas", "Investment", "Leases", "Project Finance", "Property Development", "Railways", "Ship Financing", "Telecommunications", "Working Capital"	SDC

Table 9. Variable description. Assets and sales are expressed in January 1998 constant USD

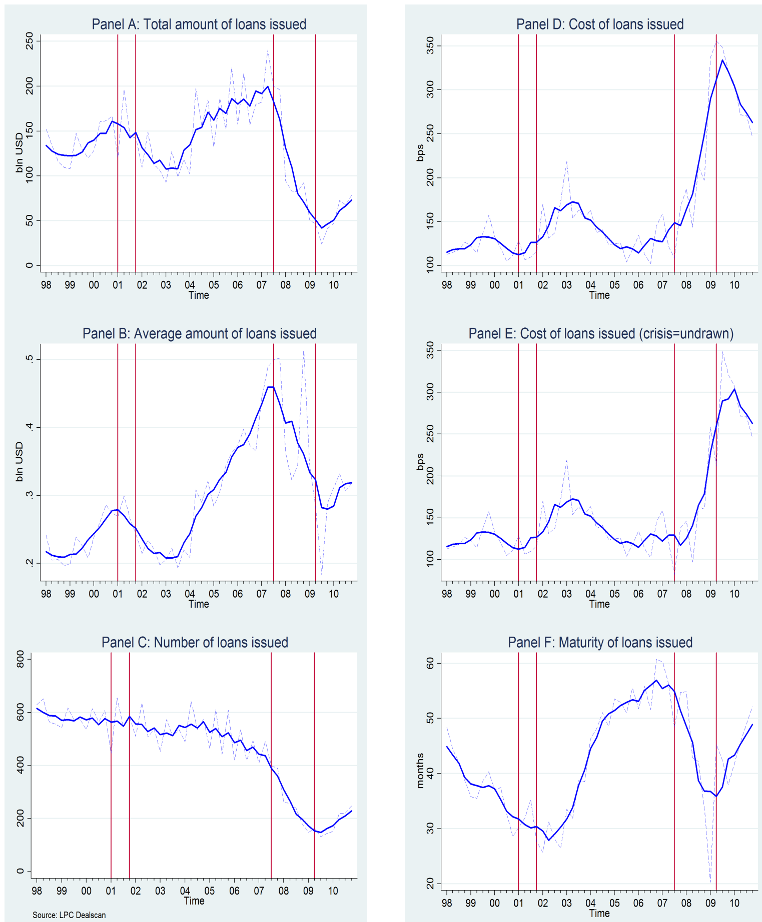

Figure 12. **New loan issuances.** Panel A: total amount of loans issued (billion of January 1998 USD, dashed line) and its smoothed version (solid line). Panel B: average amount of loans issued (dashed line) and its smoothed version (solid line). Panel C: number of loans issued (dashed line) and its smoothed version (solid line). Panels D and E: cost of loans issued (dashed line) and its smoothed version (solid line). In Panel D we use the all-in-drawn spread for all loan issuances, while in Panel E we use the all-in-undrawn spread for revolving credit lines between Q3:2007 and Q2:2009. Panel F: maturity of loans issued measured in months (dashed line) and its smoothed version (solid line).

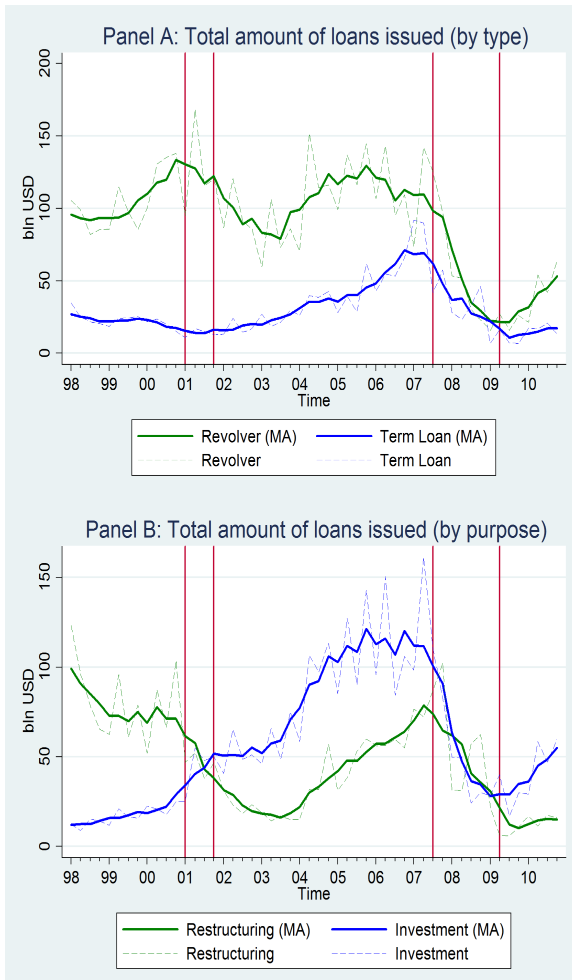

Figure 13. **New loan issuances, type and purpose.** Panel A: total amount of credit lines and term loans issued. Panel B: total amount of restructuring and investment loans issued.

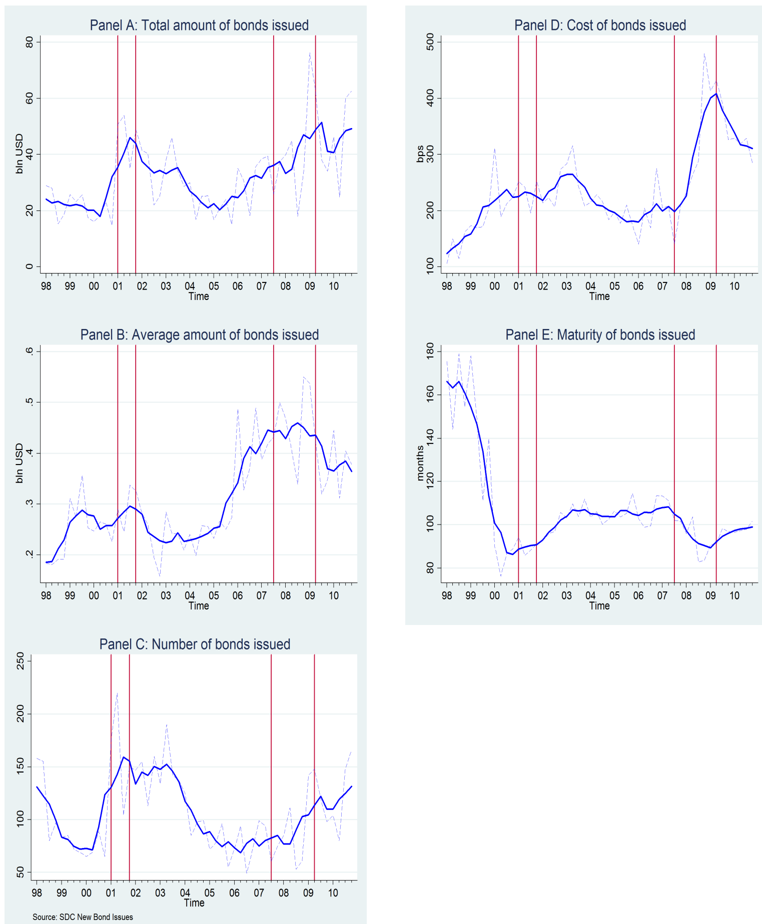

Figure 14. **New bond issuances.** Panel A: total amount of bonds issued (billion of January 1998 USD, dashed line) and its smoothed version (solid line). Panel B: average amount of bonds issued (dashed line) and its smoothed version (solid line). Panel C: number of bonds issued (dashed line) and its smoothed version (solid line). Panels D: cost of bonds issued (dashed line) and its smoothed version (solid line). Panel F: maturity of bonds issued measured in months (dashed line) and its smoothed version (solid line).

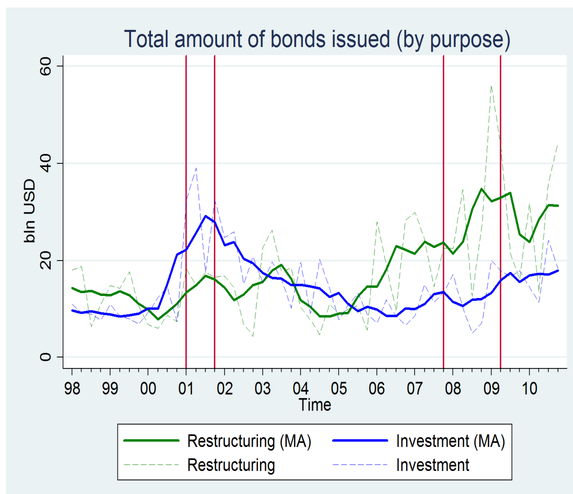

Figure 15. **New bond issuances, by purpose.** Total amount of restructuring and investment bonds issued.