Priority spreading and liquidity concerns

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Abstract

This paper investigates why firms spread out the priority structure of their debt claims in response to a credit downgrade. We find that this finding is strongest among firms whose investments occur when profitability is low (i.e. high hedging need firms). We develop a model where firms sequence subordinated claims before senior claims in order to preserve incentives for managerial effort. Together with the presence of liquidity shocks, these generate priority spreading. Two additional predictions of the model – that priority spreading is more likely to be a response to idiosyncratic shocks than to systematic shocks, and that credit line revocations are more likely to occur in response to systematic shocks- are both supported by the data.

Keywords: capital structure, debt structure, leverage, financial flexibility, liquidity management, priority spreading

JEL classification: G32

I. Introduction

Capital structure research has largely focused on explaining the gross amount of debt on firms' balance sheets. However, less attention has been paid to the priority structure of the firm's debt claims, even though economic theory suggests that this is an important aspect of firms' financial policy.[1] Furthermore, empirical results on the priority structure of debt claims document findings that do not fit conventional models of capital structure. Most puzzling is the recent finding that firms engage in priority spreading following a rating downgrade. After a downgrade, firms increase the proportions of senior claims and subordinated claims at the expense of claims of intermediate seniority (Rauh & Sufi 2010).

This paper examines priority spreading and finds that this phenomenon is concentrated among firms whose investments occur when profitability is low (i.e. high hedging need firms). The possibility that changes in the firm's priority structure are related to its investment policy was hinted at by Rauh and Sufi (2010) who find in unreported tests that capital expenditures decline following a rating downgrade. However, to our knowledge, no existing model of debt structure predicts that priority spreading occurs only in high hedging need firms.

An explanation for these results could be pieced together by combining structural models with models of creditor rights such as Aghion and Bolton (1992), but this approach seems unsatisfactory. Instead we develop an extension of Holmstrom and Tirole (1998) that allows for differences in the correlation between investments and operating profits. In the model, the firm must raise initial capital to finance an investment project at time zero. The firm may face a liquidity shock with positive probability at the end of the first period. An investment opportunity can arrive after one period and the probability of arrival varies with whether the firm experiences a liquidity shock. We show that it is optimal to issue a junior claim at time zero to finance the initial investment, and a senior claim at time one to finance the deepening investment.

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[1] Models that emphasize the priority structure of debt claims are in Diamond (1991b), DeMarzo and Sannikov (2006) and in Park (2000) among others.

This arrangement serves two purposes. First, making time-0 lenders senior is not credible because these lenders will accept dilution with the issuance of additional subordinated claims in order to ensure continuation instead of liquidation for low to moderate liquidity shocks. Second, issuing a senior claim to finance the deepening investment preserves the borrower's incentive to exert high effort when there is a deepening investment. Making the time-zero debt claim senior instead would reduce managerial effort because a portion of the manager's rents must then go to the firm's new creditors. Alternatively making initial debt senior and increasing manager rents by enough to ensure high effort reduces the initial investment amount, and therefore borrower utility. In both cases, firm value increases when a junior claim is issued at time zero and a senior claim is issued to finance the firm's subsequent investment needs.

High hedging need firms are defined as firms for whom the likelihood of arrival of an investment opportunity in the liquidity shock state is high. [2] By definition, these firms desire to transfer cash from high-profitability to low-profitability states. In contrast, the investment activity of firms with low hedging needs is not correlated with liquidity shocks. The model's main prediction is that firms with high hedging needs spread out the priority of their debt claims following a liquidity shock. The reason is that subordinated debt is issued to finance the liquidity shock, and a senior claim is issued to finance the deepening investment. Because their investments arrive in low cash-flow states, high hedging need firms are more likely to simultaneously issue both types of debt (i.e. they engage in priority spreading). In contrast, low hedging-need firms either issue subordinated claims or senior secured claims depending on whether they meet liquidity or investment needs, but not both simultaneously. Our model also provides additional testable predictions on how firms respond to idiosyncratic and systematic shocks. Priority spreading is more likely to occur in response to liquidity shocks that are firm specific than to industry-wide shocks. The model also predicts that credit lines are more likely to be revoked in response to systematic shocks than to idiosyncratic shocks.

[2] The distinction between the two types of firms is also used in Acharya *et al.* (2007), who examine the circumstances under which firms prefer to issue debt or save cash. A similar distinction is made in Diamond and He (2014) in the context of debt-maturity structure.

We empirically test the model's predictions with a sample of U.S. industrial firms between 2002 and 2015 that has detailed information on the structure of their debt claims. Debt is classified according to its priority structure based on information provided by Capital IQ and COMPUSTAT. Specifically, we classify the firm's debt into senior secured claims, senior unsecured claims and subordinated claims. We first show that priority spreading occurs around rating downgrades in our sample. This effect is strongest for high hedging need firms. Consistent with the hypothesis that changes in the priority structure reflect changes in investment policy, these firms experience significant declines in operating profits around downgrades, yet they also increase their capital expenditures following the downgrade. In contrast, low hedging need firms' capital expenditures are flat.

We identify liquidity shocks as occurring whenever a firm's operating profits fall below its median industry profits over the past five years. Industry-wide shocks occur when over 50% of firms in an industry experience such shocks in a given year. Consistent with our predictions, the simultaneous issue of senior secured and subordinated claims is more likely to occur in response to firm-specific liquidity shocks than to industry-wide liquidity shocks. However, revocations of the firm's line of credit are more likely to occur in response to industry-wide shocks than to firm-specific shocks.

Our study makes two contributions to the literature. First, we provide an explanation for priority spreading around rating downgrades. In contrast with prior explanations, our theory highlights the role played by the firm's liquidity and investment policies in explaining priority spreading. Both of these features are important as firms experience a shortfall in liquidity and changes in investment policy at these points in time. Second, we provide evidence that the structure of debt claims on the firm's balance sheet is organized in order to enable monitoring by creditors. One of the questions raised in both Rauh and Sufi (2010) and Colla *et al.* (2013) is whether debt structure's primary role is to facilitate monitoring of management or to reduce distress costs. Our study addresses this question.

The rest of the paper is organized as follows. Part II displays empirical evidence on priority structure around credit rating downgrades. Part III argues that existing models of debt structure cannot account for cross-sectional differences in priority structure. This section also outlines the model and illustrates the intuition behind our hypotheses. Part IV validates the model's predictions with data, Part V considers alternative explanations for our results, and Part VI concludes.

II. Priority spreading around rating downgrades and investment cash-flow correlations

Rauh and Sufi (2010) document changes in the priority structure around so-called fallen angels, firms that have been downgraded from investment grade to junk status by a rating agency. We first replicate their result in our sample and show that this finding only holds for firms that have low investment cash-flow correlations.

2.1 Measuring the priority structure of debt claims

Information on debt priority structure of rated firms is obtained from the Capital IQ Database, which provides detailed data on firms' debt claims beginning in 2002. This database provides the amount of total debt, credit lines, senior secured and senior unsecured debt. Subordinated debt is obtained by subtracting senior secured and senior unsecured debt from total debt. Other financial information is obtained from the COMPUSTAT Database. We merge COMPUSTAT and Capital IQ using firms' CIK identifiers.

The final sample includes all U.S. rated firms traded on major U.S. stock exchanges (Amex, Nasdaq and NYSE) anytime between fiscal year 2002 and 2015 that are included in both databases (COMPUSTAT and Capital IQ). To construct the final sample, we delete firm-year observations for which the following is true: 1) the value of any debt priority group in Capital IQ is missing; 2) total debt is always zero during the entire sample period; 3) the difference between total debt from the Capital IQ Database and total debt from the COMPUSTAT Database is higher than 10% relative to maximum between these two numbers; 3) the firms belong to financial (SIC codes 6000-6999) or utility (SIC codes 4000-4999) industries; 4) the book value of total assets is missing. The final sample forms an unbalanced panel, and it includes 8,657 firm-year observations for 1,089 non-financial and non-utility U.S. firms traded on the Amex, Nasdaq, and

NYSE that either have a credit rating with Moody's or Standard and Poor's.[3] All variables are winsorized at the 1% level, and variable definitions are provided in Appendix C.

Table 1 offers summary statistics for the main variables. Panel A indicates that the average proportions of senior secured debt, senior unsecured debt, and subordinated debt relative to total debt are 22%, 54% and 23%, respectively. The median firm's proportion of senior secured claims is approximately 3%, compared with over 63% in senior unsecured claims, and about 8% in subordinated claims, indicating that the median firm's debt structure is concentrated in the middle part of the priority spectrum.

Existing theory suggests that firms for whom the arrival of investments coincides with periods of low profitability have different liquidity policies (Acharya *et al.* 2014) and different maturity policies (Diamond & He 2014). It follows that these firms may also differ in the priority structure of their claims. Following Acharya *et al.* (2007), we empirically identify these differences using industry-level data and classify our sample into high- and low-hedging need firms. Specifically, we calculate annual average cash-flows for each industry based on firms' three-digit SIC code. To mitigate the endogeneity problem that cash-flows may be affected by financing constraints, we calculate three-digit SIC industry average investment opportunities only for financially unconstrained firms (i.e., firms that pay dividends, have assets above $500 million, and have higher than B+ credit ratings).[4]

Firms are divided into two groups based on where their industry-level investment cash-flow correlation lies relative to the median correlation across all industries. Firms belonging to the industries with higher than the median investment cash-flow correlation are classified as low hedging need firms. Firms belonging to the industries with a lower than median investment cash-flow correlations are classified as high-hedging need firms. Panels B and C report summary statistics or high- and low- hedging need firms respectively. As shown, the average value of industry investment cash-flow correlations for high hedging need firms equals -0.19. In contrast, the average value of industry investment cash-flow correlations for

[3] In the following sections, this is the sample used unless otherwise indicated. Also, when we conduct regressions involving other financial information such as profitability, hedging needs, refinancing points, etc., we further restrict the sample to observations with data that are non-missing for these additional variables.
[4] Detailed definitions about cash flows and investment are in Appendix C.

low hedging need firms is 0.35. Therefore, on average, high hedging need firms have a negative correlation between investment opportunities and cash-flows, and low hedging need firms have a positive correlation between investment opportunities and cash-flows. There is little cross-sectional difference in priority structure of debt claims across the two types of firms. The average proportion of subordinated claims is 9.2% for high hedging need firms, compared with 9.6% for low hedging need firms. Likewise, the proportions of secured and senior secured debt are similar between the two types of firms.

We next look at changes in the priority structure of debt claims of the two types of firms around rating downgrades. Following Rauh and Sufi (2010), we construct a sample of fallen angels, i.e. firms that have been downgraded from investment grade to below investment grade credit ratings. In order to maximize the size of the sample, we consider firms that have been downgraded by either of the two main raging agencies, Moody's and Standard and Poor's, and then track the priority structure of debt claims over the three-year period following the rating downgrade. Table 2 Panel A counts the number of downgrades by year by each of the two rating agencies. There are more downgrades by S&P because our Moody's rating data ends in 2012.

We estimate the regression of Rauh and Sufi (2010).

$$\frac{Debt_{it}}{Total\ capital_{it}} = a_i + d_t + b_1 I_{it}^{t-2} + b_2 I_{it}^{t} + b_3 I_{it}^{t+1} + b_4 I_{it}^{t+2} + e_{it} \qquad (1)$$

Table 2 Panel B replicates their main finding in our sample. As shown, downgraded firms spread out the priority structure of debt claims following the rating downgrade. This finding is confirmed in the bottom portion of the panel, which compares the proportion of senior secured and subordinated debt to senior unsecured debt. Downgraded firms issue significantly more senior secured debt and subordinated debt than senior unsecured debt in the year of the downgrade.

Firms that differ in their investment policy react differently to the downgrade. Figure 1 reports the proportion of debt type to total capital (Panel A) and debt issuance of each type (Panel B) for high and low hedging need firms. As shown, the high hedging need firms increase the proportion of both senior secured and subordinated claims in the year of the downgrade, while the increase in senior secured and subordinated debt claims is lower for low hedging need firms. This finding is confirmed in Panels C and D of Table 2, which report the debt proportion regression estimates. The first and third columns of both panels show that both senior secured and subordinated proportions increase for high hedging need firms. The bottom part of Panel C shows that the differences between each type of claim with senior unsecured claims are significantly higher than zero. Low hedging need firms (Panel D) increase secured debt in response to the credit downgrade: the coefficients on the downgrade year dummies are significantly different from zero in the secured debt regression, but not for the other two types of debt.

These results suggest that changes in the priority structure around rating downgrades are related to firms' investment policy. We confirm that this is the case by separately examining the time series of profits and capital expenditures around rating downgrades (year zero) for the two types of firms. These results are reported in Table 3. Not surprisingly, both types of firm experience declines in profitability in the year of the downgrade. As shown in Panel A, both cash-flows and industry-adjusted cash-flows decline in year zero. However, panel B reveals that high hedging need firms increase their capital expenditures over the two years following the downgrade significantly more than low hedging need firms. The reason is that the investment expenditures of high hedging need firms increase after the downgrade, while the investment expenditures of low hedging need firms decline both in raw terms and on an industry adjusted basis (square brackets) in the year of the downgrade.

III. Explaining why there is priority spreading

In this section we briefly consider whether existing theories of debt structure can explain the differences in priority structure and investment behavior around credit rating downgrades for high and low-hedging need firms. As it turns out, none of them can account for the finding that priority spreading following the rating downgrade varies with the correlation between investment and cash-flows.

Hackbarth *et al.* (2007) study the optimal mix of bank debt and public debt and predict that bank debt, because it is easier to renegotiate, better preserves the tax-shield benefits of debt compared with public debt. However, investment policy is held constant, and this model cannot explain why priority spreading occurs in response to future investment needs. Hackbarth and Mauer (2012) consider investment policy jointly with both capital structure and priority structure. Their model predicts that, absent stockholder-bondholder conflicts over the financing of a growth option, as leverage rises firms issue subordinated claims in order to preserve future financing capacity. However, this prediction is reversed when there exist stockholder-bondholder conflicts over the financing of the growth option. In this case, firms prefer to issue senior claims in order to maximize initial debt proceeds. Neither case predicts that priority spreading is more acute when investments arrive in low cash-flow states of the world.

Ravid *et al.* (2015) explain differences in the sequencing of priority of debt claims over time with violations of absolute priority. Their model shows that creditor conflicts and violations of absolute priority explain why firms alternate the priority of debt issuances. However, their model does not predict that rating downgrades lead to the simultaneous issuance of both junior and senior debt claims, nor does it make a cross-sectional prediction in terms of the arrival rate of investments in low cash-flow states of the world. The reason is that, in their model, future investment occurs independently of future cash-flow realizations.

Another potential explanation is that the changes in priority structure are driven by change in the maturity structure of firms' debt claims. Because bank debt is typically short-term and senior, and public debt is long-term and senior or subordinated (Diamond 1991b), it could be that our findings are explained by high hedging need firms minimizing rollover risk by spreading out the maturity of their claims in response to liquidity shocks. However, extant theory predicts that these firms lengthen the maturity of their debt claims when investments arrive in low cash-flow states. Diamond and He (2014) show that debt overhang is minimized with short-term debt when investments are correlated with the value of the firm's assets in place. Such a model would thus predict that high hedging need firms have longer maturities. However, we find that these firms issue both short-term (bank debt) and long-term debt (subordinated) debt.

3.1 Theoretical framework

The analysis is an adaptation of liquidity risk model of Holmstrom and Tirole (1998) and Tirole (2006). At date 0, an investment of variable size I is made that generates a date 2 cash-flow of R with probability p. With probability $1- p$ the investment produces nothing. When there is high effort in the second period the probability of success is p_H. With low effort, the probability of success is $p_L := p_H - \Delta p$, and the borrower earns private benefit B. We assume that the original project has positive NPV when there is high effort in the second period, but not when the entrepreneur shirks in the second period. Following Tirole (2006), we define

$$\rho_0 = p_H\left(R - \frac{B}{\Delta p}\right) < \rho_1 = p_H R. \qquad (2)$$

The ratio $\frac{B}{\Delta p}$ represents the manager's minimum rents received in exchange for incurring high effort. The manager must receive a reward $R_B \geq \frac{B}{\Delta p}$ in order to incur high effort in the second period. The parameter ρ_0 represents pledgeable income, and ρ_1 it the total expected payoff.

At the end of the first period, the firm is exposed to a liquidity shock that occurs with probability λ. The liquidity shock requires an investment $\rho > 0$ in the firm such that $\rho_1 > \rho > \rho_0$, which must be financed externally or else the firm is partially liquidated. The firm can choose to continue only a fraction $x < 1$ of its investment, in which case it requires a date-1 investment of $x\rho$ and there is partial liquidation. The fraction that is liquidated returns $(1 - x)SI$ to the firm's initial lenders, where S is the liquidation value of the firm per unit of investment. The liquidation value can be interpreted as the value of the firm's assets to an outside buyer. The more specialized these assets, the less valuable they are to an outside buyer and the lower is S.

Assuming there is no liquidation (either because there was no liquidity shock or because the firm's liquidity needs were met), there may arrive at the beginning of the second period an opportunity for a deepening investment in the firm's existing assets. The deepening investment requires an additional investment yxI on the part of the firm's external investors when there is a liquidity shock (and yI without a liquidity shock). The deepening investment increases the probability of success by τ. This can be interpreted as having the project increase the rate of return on the initial investment by μ. The reason is that the investors' expected return per unit of initial investment when there is high effort and $x = 1$ is $(p_H + \tau)\left(R - \frac{B}{\Delta p}\right) - y - 1 = (1 + \mu)\rho_0 - y - 1$, where $\mu = \tau/p_H$. Date 2 revenue is proportional to the original investment amount I and this revenue equals $(\rho_1)I$ if there is no new investment opportunity, and it equals $((1+\mu)\rho_1)I$ when there is an investment arrival and no liquidation.

We allow the arrival rate of the deepening investment at the beginning of the second period to be a function of whether there is a liquidity shock. Conditional on a liquidity shock, the arrival rate is z. Conditional on no liquidity shock, the arrival rate is $h \neq z$. In what follows we use the arrival rates z and h to define two types of firms. Firms with high z and low h are firms with high hedging needs. These firms wish to transfer cash-flows from high to low-profit states of the world because their investment opportunities occur in low cash-flow states of the world. In contrast, firms with low levels of z and high levels of h see their investment opportunities arriving in high cash-flow states of the world. Consequently, these firms have low hedging needs.

Figure 2 describes the timeline of events. We solve this model and show that the borrower's program involves issuing subordinated claims at time zero, a credit line, and financing the deepening investment with a senior claim.

3.1. Borrower's utility

Since lenders break-even by assumption and neither lenders nor borrowers wish to finance the project when there is low effort, the borrower's utility equals the project NPV under high effort.

$$\max_{x,I} U = \{(1-\lambda)[(1+h\mu)\rho_1 - hy] + \lambda\big[(1-x)S + x\big((1+z\mu)\rho_1 - zy - \rho\big)\big] - 1\}I \quad (3)$$

Borrower utility consists of the project return across states with and without a liquidity shock, and with and without a deepening investment. Borrower utility is increasing in the initial investment amount I, and it is therefore optimal for the borrower to invest as much as possible. An uncertain cash infusion ρ must be made when there is a liquidity shock. The continuation rule x is endogenous as is the investment amount I. Liquidation returns $(1-x)SI$. We next consider the optimal continuation policy x under different priority structures when the deepening investment is financed by a different lender than the initial lenders.

3.2 Lender's break-even conditions with senior date-1 lenders and junior date-0 lenders

There are two groups of lenders. Date-0 lenders finance the initial project and provide additional financing in case of a liquidity shock. Date-1 lenders finance the deepening investment. We assume for now that date-0 lenders are junior to date-1 lenders. The break-even condition for date-1 lenders is set as follows.

$$(p_H + \tau)R_{L2} = y \quad (IR_2)$$

Date-1 lenders are paid R_{L2} in case of success and nothing in case of failure.[5] Date-0 lenders finance the initial investment and provide liquidity in the case of a liquidity shock. The break-even condition for date-0 lenders is as follows.

$$\{(1-\lambda)[(1+h\mu)\rho_0 - h(p_H+\tau)R_{L2}] + \lambda[(1-x)S + x((1+z\mu)\rho_0 - z(p_H+\tau)R_{L2} - \rho)]\}\mathrm{I}$$
$$\geq \mathrm{I} - \mathrm{A} \quad (\mathrm{IR}_1)$$

In the case of a deepening investment, date-0 lenders get diluted. Substituting the break-even condition for date-1 lenders into the break-even condition for date-0 yields the following condition.

$$\{(1-\lambda)[(1+h\mu)\rho_0 - hy] + \lambda[(1-x)S + x((1+z\mu)\rho_0 - zy - \rho)]\}\mathrm{I} \geq \mathrm{I} - \mathrm{A} \quad (\mathrm{I}R)$$

Because the lenders break-even, the borrower's reward does not show up in the utility function (equation 3), and borrower utility is maximized by minimizing the rents subject to the borrower's incentive compatibility constraint. Constraint ($\mathrm{I}R$) then implies that $I \leq k(x)A$, where the expression for $k(x)$ is given in the Appendix. Since borrower utility is increasing in I, the initial investment amount is set so that lenders break even: $I = I^* := k(x)A$.

3.3 Setting the priority level of debt claims

We next show that borrower utility is maximized when date-0 lenders are junior. Making date-0 lenders subordinated is necessary for two reasons. First, making them senior is not credible for liquidity shocks that fall below pledgeable income $x(\rho_0(1+z\mu) - yz)$. The reason is that these lenders will always

[5] Other break-even conditions can guarantee high effort when there is a deepening investment. For example date-1 lenders could receive a portion θ of date-2 revenue where $\theta = \frac{y}{(p_H+\tau)\left(R - B/_{\Delta p}\right) + R_L}$. Date-1 lenders dilute date-0 lenders' claim when there is a deepening investment.

accept to be diluted and continue instead of liquidation for liquidity shocks that fall below this amount at date 1 as long as the liquidation value S is not too high. In the Appendix we derive a threshold for S such that continuation is preferred over liquidation for $S < \bar{S}$. Second, making date-0 lenders subordinated allows a senior claim to be issued to finance the deepening investment. Were the investment amount y financed with claims subordinated to date-0 lenders' claims, the borrower would have to reduce his stake in order for date-1 lenders to break even. The reason is that both debt claims must satisfy the following budget constraints.

$$R = R_B + R_{L1} \qquad (BC1)$$

$$R = \tilde{R}_B + \tilde{R}_{L1} + R_{L2} \qquad (BC2)$$

where R_{L1} is the stake of the date-0 lenders' claim when there is no deepening investment, $\tilde{R}_B$ is the borrower's stake in the case of a deepening investment, and $\tilde{R}_{L1}$ is the stake of the date-0 lender's claim when there is a deepening investment.

Constraint (BC1) describes the borrower's budget when there is no deepening investment. Constraint (BC2) describes the borrower's budget when there is a deepening investment. When date-0 lenders are senior, they cannot be diluted and $\tilde{R}_{L1} = R_{L1}$. Constraints (BC1) and (BC2) then imply that $\tilde{R}_B + R_{L2} = R_B$. Therefore with senior date-0 claims, the deepening investment must be financed by reducing R_B to $\tilde{R}_B$, thereby promising the borrower lower rents.

Suppose first that the reward R_B is initially set to $R_B = {}^{B}/_{\Delta p}$, which is the minimum rent required for the borrower to put high effort. Then cutting the borrower's reward implies low effort in the second period when there is a deepening investment. Holding the continuation policy x constant, the positive NPV assumption implies that the borrower's utility is smaller in expectation by

$$\lambda xz(\Delta pR - B) + (1 - \lambda)h(\Delta pR - B) > 0. \qquad (4)$$

per unit of investment compared to when date-0 lenders are junior.[6] Moreover date-0 pledgeable income declines by $(1-\lambda)[h(1-\phi)\rho_0]+\lambda[xz(1-\phi)\rho_0]>0$ where $\phi=\frac{p_L}{p_H}$, reducing total investment.

Suppose instead that $\tilde{R}_B = {}^{B}/_{\Delta p}, \tilde{R}_B + R_{L2} = R_B$. In this case, the borrower's reward R_B when there is no deepening investment is set high enough so that reducing it to obtain financing when there is a deepening investment does not affect his effort level in the second period. Constraint (BC1) then implies that R_{L1} must be smaller by $\frac{y}{p_H+\tau}$ per unit of initial investment when date-0 lenders are senior, which means there is less income to pledge to the firm's date-0 lenders. Since the investment level (I) and therefore the borrower's utility are increasing in pledgeable income, increasing R_B above ${}^{B}/_{\Delta p}$ reduces the borrower's utility. Intuitively, the borrower is willing to accept lower rents per unit of investment subject to (IC) in exchange for a higher level of investment. Because lenders must break even in expectation, ex-ante they are indifferent with respect to the priority structure of the firm's claims. Lemma A1 in the appendix provides more detail.

3.4 Optimal debt structure and priority spreading

The firm's investment and borrowing program can be implemented by financing the initial investment with a junior claim and the deepening investment with a senior claim. In order to meet its liquidity need the firm can set up ex-ante sources of liquidity in the form of a credit line with limit $w = x[\rho - \tilde{\rho}_0(z,\mu,y)]I$, where pledgeable income in the liquidity shock state is $\tilde{\rho}_0(z,\mu,y) = (\rho_0(1+z\mu) - yz)$. The firm thus finances part of the liquidity shock by diluting existing creditors, and draws upon a line of credit for the difference between the liquidity shock and pledgeable income. Liquidation occurs when the salvage value S is greater than a threshold amount $\bar{S}$ whose expression is provided in the Appendix.

The implementation of the borrower's program implies that the priority structure of the firm's debt claims is spread out following a liquidity shock. The reason is that the liquidity shock is partly financed by issuing subordinated claims, and the deepening investment is financed with a senior claim in order to

[6] Low effort will also reduce the liquidation threshold $\bar{S}$, further reducing the borrower's utility.

preserve managerial incentives. Because issuance occurs when there is a deepening investment, priority spreading is more likely to occur in firms with a negative correlation between cash-flows and investments (i.e. firms with a high z).

Priority spreading in high hedging need firms following a rating downgrade can be explained as follows. In the model, the realization of idiosyncratic liquidity shocks leads to a credit downgrade because the liquidity shock is financed by issuing additional debt. The increase in leverage and subsequent decline in the credit quality of existing securities leads to a reduction in credit rating for these debt securities (i.e. the firm becomes a fallen angel). The subsequent arrival of an investment opportunity leads to priority spreading because the firm finances its investment with a senior claim. Where the firm to issue a junior claim instead in response to the arrival of the new investment, firm value would be lower because the junior claim would dilute the manager's stake instead of incumbent creditors' stake, leading to a smaller initial investment or lower effort levels by the manager. Issuing a junior claim followed by a senior claim is the firm's best response to its join liquidity and investment needs.

3.5 Correlated liquidity shocks

The liquidity shocks described above are idiosyncratic to each firm. However, firms belonging to a common industry may experience correlated cash shortfalls due to industry shocks such as deregulation (Ovtchinnikov 2010), or reductions in import tariffs (Valta 2012). We consider whether our predictions change when the liquidity shocks are correlated across firms in an industry. The incorporation of systematic shocks follows Acharya *et al.* (2013).

Firms differ in the extent to which their liquidity shocks are correlated with each other. A fraction θ of firms in the industry have perfectly correlated liquidity shocks. The other fraction 1- θ have independent liquidity needs in the sense that the occurrence of a liquidity need ρ is independent across these firms. For both types of firms the likelihood of a liquidity shock is λ. As before, firms must provision liquidity at date-0 in order to be able to meet the liquidity shock at date-1.

The optimal continuation policy described in the previous section can be implemented as long as there is sufficient inside liquidity in the firm's industry. That is, firms can obtain funding as long as there is not too much correlation across liquidity shocks.[7] Denote x^{θ} as the continuation policy of systematic firms, i.e. those with a correlated liquidity shock. Let $x^{1-\theta}$ be the continuation policy of non-systematic firms, i.e. those with uncorrelated liquidity shocks. Similarly let S^{θ} and $S^{1-\theta}$ denote the liquidation value of systematic and non-systematic firms, respectively. Then the bank liquidity constraint is as follows.

$$\theta\left[x^{\theta}(\rho + zy - (1+z\mu)\rho_0)\right] + (1-\theta)\lambda\left[x^{1-\theta}(\rho + zy - (1+z\mu)\rho_0)\right]$$

$$\leq \theta\left(1-x^{\theta}\right)S^{\theta} + (1-\theta)\left[\lambda\left(1-x^{1-\theta}\right)S^{1-\theta} + (1-\lambda)\left((1+h\mu)\rho_0 - hy\right)\right] \qquad (5)$$

The bank must finance the liquidity shock with the liquidation proceeds of systematic and non-systematic firms, as well as the pledgeable income of the non-systematic firms who do not experience a liquidity shock. In order to focus on the behavior of systematic firms, we assume that $S^{1-\theta} < \bar{S}$ so that the optimal continuation policy of non-systematic firms is $x^{1-\theta}$=1.[8]

Suppose that $S^{\theta} < \bar{S}$ and the first-best continuation policy is to set x^{θ}=1. From equation (5), this policy is only feasible if

$$\rho + zy - (1+z\mu)\rho_0 < \frac{(1-\theta)(1-\lambda)\left((1+h\mu)\rho_0 - hy\right)}{\theta + (1-\theta)\lambda} \equiv w_{max} \qquad (6)$$

Or equivalently,

$$\theta < \frac{(1-\lambda)\left((1+h\mu)\rho_0 - hy\right) - \lambda(\rho + zy - (1+z\mu)\rho_0)}{(1-\lambda)[(\rho + zy - (1+z\mu)\rho_0) + (1+h\mu)\rho_0 - hy]} \equiv \theta_{max}. \qquad (7)$$

If $\rho + zy - (1+z\mu)\rho_0 > w_{max}$ then some systematic firms are forced to liquidate and x^{θ} <1. Thus the equilibrium that arises will depend on the fraction of systematic firms in the industry. If this fraction is low ($\theta < \theta_{max}$) then the continuation rule for systematic firms is $x^{\theta} = 1$. Otherwise, there is not enough

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[7] Empirical evidence indicates that loan terms are affected by the performance of other borrowers in a bank's lending portfolio (Murfin 2012). Evidence that lenders have undiversified portfolios is provided in Sufi (2007) who finds that syndicate lead shares of the loan are larger when information asymmetry with respect to the borrower is high, and in Puri and Drucker (2009) to explain the prevalence of loan sales.

[8] Setting $S^{1-\theta} > \bar{S}$ and $x^{1-\theta} = 0$ implies that the systematic firms can withstand a larger liquidity shock ρ than when $S^{1-\theta} < \bar{S}$ as the banking sector owns the liquidation value of the non-systematic firms that experience a liquidity shock. More details are provided in the Appendix.

pledgeable income in the industry to support full continuation when $S^{\theta} < \bar{S}$ and some systematic firms experience liquidation. Since firms are more likely to liquidate in response to systematic shocks, and continuation is required to finance the deepening investment, priority spreading is more likely to occur in response to idiosyncratic shocks than in response to systematic shocks. The appendix derives the expression for x^{θ} when $\theta < \theta_{max}$.

3.6 Use of cash reserves instead of line of credit

Systematic firms may choose to hold cash instead of lines of credit to meet their liquidity needs in order to avoid liquidation when $\rho + zy - (1 + z\mu)\rho_0 > w_{max}$. In this case firms rely on internal sources of liquidity, potentially mitigating the reduction in credit that occurs when liquidity shocks are correlated across firms in an industry. Cash is held in government securities so that systematic firms are not subject to the banking sector's liquidity constraint (equation 6). We can incorporate this policy by allowing firms to purchase liquid assets for a price $q >= 1$. Then the analysis follows Holmstrom and Tirole (1998) where the firm's liquidity need L per unit of investment equals $x(\rho + zy - (1 + z\mu)\rho_0)$ and the aggregate liquidity need of systematic firms equals $\theta x(\rho + zy - (1 + z\mu)\rho_0)I$. The firm's continuation policy is then a function of q and S, and $x^{\theta} \in [0,1]$ if $q = \bar{q}$, $x^{\theta} = 0$ if $q > \bar{q}$ and $x^{\theta} = 0$ if $q < \bar{q}$ where $\bar{q}$ is defined in the Appendix. Let $\bar{L}^s$ be the minimum supply of liquidity such that $\theta(\rho + zy - (1 + z\mu)\rho_0)I = \bar{L}^s$. Then liquidation (i.e. $x^{\theta} < 1$) will occur whenever the total supply of liquidity is below $\bar{L}^s$ and $q > 1$ (see Appendix). It follows that systematic firms can face liquidation when the supply of outside liquidity is low. Whether these firms' best policy is to hold cash or rely on a line of credit will depend on the correlation parameter θ and the price of liquid assets q.

3.8 Empirical implications

The model makes several predictions with respect to the relation between the firm's debt priority structure, the rate of arrival of investment projects in the liquidity shock state, and firm's exposure to aggregate industry risk.

Prediction 1: *Conditional on a liquidity shock, continuation and the arrival of a deepening investment, the firm issues both senior secured debt and subordinated debt (i.e. it engages in priority spreading).* This prediction follows directly from the model, which shows that the firm issues a combination of subordinated and senior secured claims to meet the liquidity shock and finance the deepening investment. The second prediction is cross-sectional.

Prediction 2: *Priority spreading is greater in firms for whom the arrival rate of the deepening investment in the liquidity shock states is high.* Priority spreading occurs when the firm meets its immediate financing needs with subordinated debt and finances a deepening investment with senior secured debt. A high arrival rate during liquidity shock states implies that both continuation and a deepening investment are more likely. The reason is that the probability of continuation is increasing in *z,* the arrival rate of new investments.

Prediction 3: *Priority spreading is more likely to occur in response to idiosyncratic shocks than to industry-wide shocks.* Intuitively, when the correlation of shocks across firms is very high there is not enough pledgeable income in the banking sector, and a fraction of systematic firms are liquidated. In the model non-systematic firms get to implement the first-best investment rule, while systematic firms do not because their shocks are correlated. Systematic firms run the risk of experiencing a liquidity shock when many other firms in their industry experience a liquidity shock. When this happens, contingent sources of liquidity in the form of credit lines are harder to draw upon, and the firm is more likely to be liquidated than to continue and spread out its priority structure.

Prediction 4: *Credit line revocations are more likely to occur in response to systematic than to idiosyncratic shocks.* The intuition is that liquidity is transferred from healthy firms to unhealthy firms when there is a liquidity shock. When the proportion of firms in an industry suffering a liquidity shock is high, the number of healthy firms is low, there is not enough pledgeable income by healthy firms, and unhealthy firms are liquidated. The threshold parameter θ_{max} defined above determines the maximum amount of correlation such that there is enough liquidity in an industry to allow unhealthy firms to continue without liquidation. In contrast, when shocks are idiosyncratic, there are enough healthy firms to allow unhealthy firms to obtain the funding they require by drawing down a line of credit.

IV. Testing the priority structure predictions

To empirically assess the predictions on the priority structure of debt claims and the correlation between investment and liquidity shocks, we first need to identify liquidity shocks for each industry. Liquidity shocks are identified empirically as years in which the firm experiences a large operating cash-flow shortfall. Operationally these firms have cash shortfalls that are below their industry's average operating cash-flows over the past five years. We first make no distinction between idiosyncratic and systematic shocks, but later relax this assumption.

4.1 Liquidity shocks

The first predictions are that firms respond to liquidity shocks by spreading the priority structure of their debt claims, and the propensity to do so is greater for high hedging need firms (Predictions 1 and 2). These are tested in Table 4, which reports the regression specified in equation (1) except that the downgrade year is replaced with a liquidity shock year. There is a significantly positive effect on the proportion of senior secured and subordinated debt in the year of the shock. This effect is more pronounced for subordinated claims in high hedging need firms, indicating that these firms behave as predicted by the model. We formally test for priority spreading in the bottom half of each panel where we compare the proportion of the two extremes to senior unsecured claims. As shown, high hedging need firms significantly increase the proportion of both types of debt claims in relation to senior unsecured claims, an indication of priority spreading by these firms.

The behavior of low hedging need firms is different. These firms issue senior unsecured claims (typically public bonds) and subordinated claims in response to the liquidity shock. The increase in the proportion of these claims does not persist beyond year+1 following the shock, which is consistent with their lower investment activity compared with high hedging need firms. Neither of the test statistics indicate priority spreading on the part of low hedging need firms.

4.2 Issuance activity

The changes in the proportion of debt type relative to total capital reported in Table 4 may arise for different reasons. First, firms may issue all three types of debt in response to a liquidity shock, but issue relatively more senior secured and subordinated claims than senior unsecured claims. Alternatively, firms may issue only senior secured and subordinated claims and use the proceeds to either repurchase senior unsecured claims, or to finance investment. The use of total debt proceeds to repurchase senior unsecured claims is not predicted by the model. In order to distinguish between these explanations, we examine issuance activity on the part of the firm. We estimate the following regression model:

$$Y_{it} = a + b\, X_{it-1} + c_2 HighHedge_{it} + c_3 ShockPeriod_{it} +$$
$$HighHedge_{it} \times ShockPeriod_{it} + dW_t + \varepsilon_{it} \qquad (9)$$

The dependent variable of interest is the annual change of each type of debt scaled by lagged total capital. A positive value indicates issuance activity, and a negative value of this variable indicates reduction or debt repayment activity. We include firm-level and macro-economic controls that are associated with issuance and repurchase decisions. In order to measure changes associated with liquidity shocks, we define a variable $ShockPeriod_{it}$ that equals one in the year of a liquidity shock or the year immediately afterward. The variable $HighHedge_{it}$ equals one if the firm is a high hedging need firm. Results are reported in Table 5.

As shown, the coefficients on $HighHedge_{it}$ imply that high hedging need firms are less likely to issue senior unsecured and subordinated debt than low hedging need firms during non-shock years. The second row implies that both low and high hedging need firms issue senior secured and subordinated claims in response to liquidity shocks. The significance of the interaction term $HighHedge_{it} \times ShockPeriod_{it}$ implies that high hedging need firms issue more subordinated claims than low hedging need firms.

Table 5 shows that high hedging need firms neither issue nor repurchase senior unsecured claims in the shock year. Furthermore, the lack of change in the proportion of senior unsecured claims around the liquidity shock (Table 4) implies that total capital is unchanging even though the proportion of total debt on the balance sheet is increasing. The reason is that high hedging need firms suffer declines in book equity in the shock year and the year after. Table B2 in the appendix shows that net income is declining in the years following the liquidity shock even though the gross amount of debt is increasing in proportion to total assets. Overall, the result imply that total debt proceeds are being used to finance investment and not repurchase existing debt claims.

4.3 Idiosyncratic vs. systematic shocks

The second prediction is that priority spreading is more likely to occur in response to idiosyncratic shocks than to systematic shocks. To assess this prediction, we split the sample of shocks into idiosyncratic and systematic shocks. We identify firms that experience an idiosyncratic shock whenever the firm's operating cash flows are below the average operating cash-flows over the past five years in the firm's industry, but less than 50% of firms in the industry experience a similar cash shortfall. The latter requirement ensures that these firms' liquidity shocks are not too correlated with other firms in the industry. Systematic liquidity shocks are defined as occurring whenever operating cash-flow are less than the average industry cash-flow over the past five years, and more than 50% of firms in the industry experience a similar cash shortfall. We test the robustness of our results by considering a 66% threshold in the Appendix (Table B3). The model counterpart to the cutoff is the correlation coefficient θ.

Table 6 reports the number of shocks per year. In any given year, some firms experience liquidity shocks, and systematic shocks are rarer than idiosyncratic ones. Over 630 firm-years are identified with a liquidity shock, which implies that about 7% of our sample years involve a cash-flow shortfall of some kind for the sample firms. Industry shocks are more widespread during the financial crisis years 2007 to 2009, and they are less frequent during the economic expansions over 2003 to 2006, and 2011-2014.

We re-estimate the baseline regressions described in equation (1) separately for idiosyncratic and systematic liquidity shocks. Results are reported separately in Table 7 for high and low hedging need firms. As shown, high hedging need firms respond to idiosyncratic liquidity shocks by spreading out the priority structure of their debt claims. This result is consistent with prediction 3. Conditional on an idiosyncratic shock occurring, low hedging need firms increase the proportions of senior secured and subordinated claims, but these effects do not persist beyond the shock year. High hedging need firms respond to systematic shocks by issuing subordinated debt claims, which is consistent with the idea that the availability of bank debt such a credit line is restricted when there is a systematic shock. Moreover, they continue to increase the proportion of subordinated claims beyond the shock year, implying that they meet their future investment needs with subordinated claims instead of relying upon secured bank debt. Low hedging need firms do not respond to either type of shock, a finding that is consistent with our earlier results.

Panel C estimates net issuance regressions using the specification described in equation (10):

$$Y_{it} = a + bIdiosyncraticShock_{it} + cSystematicShock_{it} + \ eX_{it-1} + fW_t + \varepsilon_{it} \qquad (10)$$

The dependent variables, firm characteristics, and macro-economic variables are the same as in equation (9). The variable $IdiosyncraticShock_{it}$ equals to one if an observation corresponds to an idiosyncratic shock year or one year after this idiosyncratic shock. $SystematicShock_{it}$ equals one if an observation corresponds to a systematic shock year or one year after this systematic shock. As shown, these regressions confirm that issuance activity by high hedging need firms in response to idiosyncratic and systematic shocks occurs in the form of senior secured and subordinated claims. However, when we compare the amount issued of each type to senior unsecured claims, the relative amount issued is significantly higher than senior unsecured claims only in response to idiosyncratic shocks.

A possible explanation for the lack of issuance of secured debt in response to systematic shocks by high hedging need firms is that systematic shocks limit the extent to which the excess liquidity of healthy firms can be used to support unhealthy firms in an industry. We investigate this explanation in the next section, where we consider the likelihood of credit line revocations around liquidity shocks.

4.4 Credit line revocations in response to idiosyncratic and systematic shocks

If bank liquidity is in short supply when many firms in an industry experience a cash-flow shortfall, then credit line revocations or reductions in the line of credit for a firm should be more likely to occur in response to systematic than idiosyncratic shocks. We test this prediction (Prediction 4) with the following three dependent variables. We construct two binary variables for whether a firm undergoes a credit line revocation. If a firm has positive undrawn credit lines at time t-1, zero undrawn lines at time t, and no increase in drawn credit lines between the two periods, then full revocation of the credit line occurs. If the reduction in undrawn lines from time t-1 to time t is greater than 50% but less than 100%, then partial revocation of the line occurs. The third variable equals the change in undrawn lines scaled by total capital at time t-1. Data on credit line utilization is obtained from CapitalIQ. We regress each variable on binary variables equal to one when there is either an idiosyncratic shock (Idiosyncratic) or a systematic liquidity shock (Systematic). According to Prediction 4, reductions in credit lines are more likely to occur in response to systematic shocks than to idiosyncratic shocks.

Panel A of Table 8 reports summary statistics on the frequency of credit line revocations across the two types of shock years. As shown, credit line revocations are more likely to occur during years when a firm experiences a systematic shock than when it experiences an idiosyncratic shock. A systematic shock is associated with a 14% increase in the likelihood of a credit line revocation, compared with only 10% for an idiosyncratic shock, and the difference between the two frequencies is statistically significant. This finding applies to partial revocations and to the change in the drawdown. The last row shows that drawdowns of existing credit facilities are larger when the shock is idiosyncratic than when it is systematic.

We next examine whether the revocation of credit line in response to systematic shocks is more important for high hedging need firms, as these are firms that are the most likely to have additional investment needs in the near term. The bottom two panels split the sample by whether the firm is a high or a low hedging need firm. As shown, credit lines revocations are common for both types of firms. However, the differences in observed frequencies between idiosyncratic and systematic shocks are significant only for high hedging need firms.

Panel B confirms these results in a multivariate setting that controls for firm and macro-economic characteristics based on equation (10). As shown, revocations are more likely to occur in response to systematic shocks, but this difference is only present in high hedging need firms. The last panel shows that revocations for low hedging need firms are not associated with liquidity shocks. Overall, the results of this section support Prediction 4 that credit line revocations are more likely to occur when other firms in an industry are suffering similar liquidity shocks.

V. Alternative explanations

There are several alternative explanations for our results. The first is based on the notion that priority spreading occurs in firms because of stockholder-debtholder conflicts (Hackbarth & Mauer 2012). According to this explanation, high leverage firms prefer to issue subordinated claims in order to preserve debt capacity for future investments. An initial senior claim issue reduces additional debt capacity; thus firms with future growth opportunities issue subordinated claims in response to an increase in leverage. We rule out this explanation by sorting firms according to their distance to default, as measured in Bharath & Shumway 2008. Since stockholder-debtholder conflicts are strongest when the firm is close to default, priority spreading should be strongest in firms that are the closest to their default threshold. Table 9 shows that this is not the case. As shown, firms with a lower probability of default are more likely to engage in priority spreading in response to liquidity shocks (idiosyncratic or systematic).

A related consideration is that priority spreading arises as a means of mitigating the asset substitution problem. Under this explanation, firms that experience a liquidity shock maximize their debt capacity by issuing claims that reduce stockholder incentives to engage in asset substitution at the expense of creditors. This explanation predicts that firms favor types of debt such as secured and convertible debt that mitigate this incentive Johnson and Stulz (1985). The increased in senior secured issuance supports this alternative explanation. In order to measure convertible issuance, we break up subordinated debt into two classes, convertible and non-convertible debt issues. As shown in Table 10, firms issue a greater proportion of non-convertible subordinated debt than convertible debt in response to liquidity shocks. For high hedging need firms, the average increase in convertible debt following a liquidity shock is close to zero, compared with 2.56% (=1.143+1.418) for non-convertible subordinated debt.

Another explanation is that the spreading of priority occurs in response to rollover risk. Since short-term debt is typically senior and long-term is junior (Diamond 1993), priority spreading could arise because the firm seeks to spread out the maturity structure of its debt claims. We address this explanation by examining whether the maturity of debt claims changes around liquidity shocks. A modified version of

Equation (1) is estimated in which we replace the dependent variable with the proportion of debt maturing within the next three years over total capital. If rollover risk is the reason for priority spreading, then the proportion of short-term debt should decline after the year of the shock. Table 11 shows that neither type of firms engages in any systematic change in the maturity structure of its debt claims around the shock year.

VI. Conclusion

This paper investigates why firms spread out the priority structure of their debt claims around rating downgrades. We find evidence that this phenomenon is concentrated among firms whose investments occur when profitability is low, which suggests explanations of priority spreading must take into account firms' investment policy. This result is robust to a number of specifications that control for firm-specific and macro-economic determinants of debt issuance.

To understand what is driving changes in debt priority structures around rating downgrades, we extend the theoretical literature on capital structure to develop a model that predicts that priority spreading occurs for liquidity reasons. In this model, firms react to liquidity shocks by changing the priority structure of their debt claims. Subordinated debt is used to finance immediate liquidity needs in order to preserve managers' incentives for high effort when there is a deepening investment. Subsequent investments are financed with a senior claim in order to maximize the proceeds from debt issuance.

An important feature of the model is that it distinguishes between idiosyncratic and systematic liquidity shocks. The latter type of shocks occurs across many firms in an industry. We show that priority spreading is less likely to occur in response to systematic shocks. The reason is that there is not enough pledgeable income for healthy firms to subsidize unhealthy firms when the correlation among liquidity shocks is high. Empirically this prediction implies that credit lines are more likely to be revoked in response to systematic shocks than to idiosyncratic shocks.

We test these predictions using detailed data on the structure of firms' debt claims. Specifically, the main empirical analysis examines changes in debt priority structure around liquidity shocks, defined as years in which a firm's profits is below its industry five-year rolling average. We examine changes in each type of debt at these points in time and compare changes in debt structure across firms with high and low hedging needs. We find that the debt structure of firms with high hedging needs is more sensitive to liquidity shocks than firms with low hedging needs. Our principal contribution is to show that firms with the need to transfer cash-flows from high-profitability states to low-profitability states are more likely to adjust their debt structure in response to liquidity shocks. These firms manage their liquidity needs and preserve incentives for the manager by spreading the priority structure of their claims.

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Appendix A

A.1 Optimal continuation policy

The borrowers' break-even constraints imply that optimal investment equals

$$I^* = \frac{A}{1-(1-\lambda)[(1+h\mu)\rho_0 - hy] - \lambda[x((1+z\mu)\rho_0 - zy - \rho + (1-x)S]} \qquad (A1)$$

Inserting this expression for I into equation (2) for the borrower's utility gives after some simplification,

$$U_b = A\frac{(1-\lambda)[(1+h\mu)\rho_1 - hy] + \lambda[x\big((1+z\mu)\rho_1 - zy - \rho + (1-x)S\big] - 1}{1-(1-\lambda)[(1+h\mu)\rho_0 - hy] - \lambda[x((1+z\mu)\rho_0 - zy - \rho + (1-x)S]}$$

$$= A\frac{\rho_1[(1-\lambda)(1+h\mu) + \lambda x(1+z\mu)] - 1 - (1-\lambda)hy - \lambda x(zy+\rho) + \lambda(1-x)S}{1+(1-\lambda)hy + \lambda x(zy+\rho) - \lambda(1-x)S - \rho_0[(1-\lambda)(1+h\mu) + \lambda x(1+z\mu)]}$$

$$U_b = \frac{\rho_1 - C(x,S)}{C(x,S) - \rho_0}A$$

$$C(x,S) = \frac{1+(1-\lambda)hy + \lambda x(zy+\rho) - \lambda(1-x)S}{[(1-\lambda)(1+h\mu) + \lambda x(1+z\mu)]}. \qquad (A2)$$

The first-best investment policy minimizes $C(x,S)$. Taking the derivative of $C(x,S)$ with respect to x and setting it to zero implies that

$$\frac{\delta C(x,S)}{\delta x} = 0, iff$$

$$\lambda(1-\lambda)[(1+h\mu)(zy+\rho) - hy(1+z\mu)] - \lambda(1+z\mu) + \lambda S[\lambda(1+z\mu) + (1-\lambda)(1+h\mu)] = 0$$

The function $C(x,S)$ is increasing in S for S less than $\bar{S}$, and it is decreasing in S for S greater than S, where

$$\bar{S} = \frac{(1+z\mu) - (1-\lambda)[(1+h\mu)(zy+\rho) - hy(1+z\mu)]}{\lambda(1+z\mu) + (1-\lambda)(1+h\mu)}. \qquad (A3)$$

It follows that the optimal continuation policy is to set $x = 1$ when $S < \bar{S}$, $x = 0$ when $S > \bar{S}$ and $x \in [0,1]$ when $S = \bar{S}$.

A.2 Borrower utility is maximized when date-0 lenders are junior

Lemma A1: Setting $\tilde{R}_B = {}^{B}/_{\Delta p}$, $R_B > \tilde{R}_B$, and making date-0 lenders senior reduces borrower utility compared to when $\tilde{R}_B = R_B = {}^{B}/_{\Delta p}$ and date-0 lenders are junior.

Proof:

Case 1: Date-0 lenders are junior and date-1 lenders are senior

Suppose that $\tilde{R}_B = R_B = {}^{B}/_{\Delta p}$, then the budget constraints (BC1) and (BC2) imply that

$$R_{L1} = R - {}^{B}/_{\Delta p}$$
$$\tilde{R}_{L1} = R - {}^{B}/_{\Delta p} - \frac{y}{p_H + \tau}$$
$$R_{L2} = \frac{y}{p_H + \tau}$$
$$R_B = {}^{B}/_{\Delta p} \qquad (A4)$$

Pledgeable income equals

$$P_1(x) = (1-\lambda)[(1+h\mu)\rho_0 - hy] - \lambda\big[x\big((1+z\mu)\rho_0 - zy - \rho\big) + (1-x)S\big] \qquad (A5)$$

The investment multiplier equals $k_1(x) = \frac{1}{1-P_1(x)}$ and investment equals $Ak_1(x)$.

Case 2: Date-0 lenders are senior and date-1 lenders are junior

Suppose that $\tilde{R}_B = {}^{B}/_{\Delta p}$, $R_B > \tilde{R}_B$. With senior date-0 lenders, the date-1 lender's break-even condition is

$$(p_H + \tau)R_{L2} = y \qquad (IR2')$$

The budget constraints (BC1) and (BC2) imply that

$$R_{L1} = \tilde{R}_{L1} = R - {}^{B}/_{\Delta p} - \frac{y}{p_H + \tau}$$
$$R_{L2} = \frac{y}{p_H + \tau}$$
$$R_B = {}^{B}/_{\Delta p} + \frac{y}{p_H + \tau} \qquad (A6)$$

Pledgeable income per unit of investment equals

$$P_2(x) = (1-\lambda)\left[(1+h\mu)\rho_0 - hy - \frac{(1-h)y}{(1+\mu)}\right] - \lambda[x\left((1+z\mu)\rho_0 - zy - \rho - \frac{(1-z)y}{(1+\mu)}\right) + (1-x)S]. \quad (A7)$$

Comparing the expression for pledgeable income in case 1 and case 2 shows that total pledgeable income is reduced by $(1-\lambda)\frac{(1-h)y}{(1+\mu)} + \lambda x\frac{(1-z)y}{(1+\mu)}$ when date-0 lenders are senior. In the case of senior date-0 lenders, the amount $\frac{y}{(1+\mu)}$ is the extra rent that must be promised to the borrower when there is no deepening investment in exchange for putting high effort when there is a deepening investment. Since in equilibrium competitive lenders make no profits, borrower utility is maximized by choosing the contract with the highest possible pledgeable income. This is the contract with junior date-0 lenders and senior date-1 lenders.

A.3 Equilibrium investment policy when there are correlated liquidity shocks

Suppose first that non-systematic firms adopt a continuation policy, i.e. $S^{1-\theta} < \bar{S}$ and $x^{1-\theta} = 1$. Then there are two possible equilibriums.

(1) If $\rho + zy - (1+z\mu)\rho_0 \leq w_{max}$ then

$$x^\theta = \begin{cases} 1 \; if \; S^\theta < \bar{S} \\ \in [0,1] \; if \; S^\theta = \bar{S} \\ 0 \; if \; S^\theta > \bar{S}. \end{cases} \quad (A8)$$

(2) If $\rho + zy - (1+z\mu)\rho_0 > w_{max}$ then some systematic firms experience liquidation and the continuation policy is as follows.

$$x^\theta = \begin{cases} 0 \; if \; S^\theta > \bar{S} \\ \dfrac{\theta L^\theta + (1-\theta)(1-\lambda)[(1+h\mu)\rho_0 - hy] - (1-\lambda)(\rho + zy - (1+z\mu)\rho_0)}{\theta(\rho + L^\theta + zy - (1+z\mu)\rho_0)} < 1 \; if \; S \leq \bar{S}. \end{cases} \quad (A9)$$

Suppose instead that the non-systematic firms adopt a liquidation policy in the event of a liquidity shock, i.e. $S^{1-\theta} > \bar{S}$ and $x^{1-\theta} = 0$. Then w_{max} becomes

$$\widetilde{w}_{max} = \frac{(1-\theta)(1-\lambda)\big((1+h\mu)\rho_0 - hy\big) + (1-\theta)\lambda S^{1-\theta}}{\theta} > w_{max}. \quad (A10)$$

And x^θ becomes

$$\tilde{x}^{\theta} = \begin{cases} 0 \; if \; S^{\theta} > \bar{S} \\ \dfrac{\theta L^{\theta} + (1-\theta)(1-\lambda)[(1+h\mu)\rho_0 - hy] + (1-\theta)\lambda S^{1-\theta}}{\theta(\rho + L^{\theta} + zy - (1+z\mu)\rho_0)} < 1 \;\; if \; S \leq \bar{S}. \end{cases} \qquad (A11)$$

Where $\tilde{x}^{\theta} > x^{\theta}$.

A.4 Equilibrium investment policy when systematic firms hold cash instead of credit lines to meet liquidity needs

The borrowers' break-even constraints imply that optimal investment equals

$$I^* = \frac{A}{1-(1-\lambda)[(1+h\mu)\rho_0 - hy] - \lambda[x((1+z\mu)\rho_0 - zy - \rho + (1-x)S] + (q-1)xL^{\theta}} \qquad (A1)$$

where $L^{\theta} = [\rho + zy - (1+z\mu)]$. Inserting this expression for I into equation (2) for the borrower's utility gives after some simplification,

$$U_b = A\frac{(1-\lambda)[(1+h\mu)\rho_1 - hy] + \lambda[x((1+z\mu)\rho_1 - zy - \rho) + (1-x)S] - 1 - (q-1)xL^{\theta}}{1-(1-\lambda)[(1+h\mu)\rho_0 - hy] - \lambda[x((1+z\mu)\rho_0 - zy - \rho + (1-x)S] + (q-1)xL^{\theta}}$$

$$= A\frac{\rho_1[(1-\lambda)(1+h\mu) + \lambda x(1+z\mu)] - 1 - (1-\lambda)hy - \lambda x(zy+\rho) + \lambda(1-x)S - (q-1)xL^{\theta}}{1 + (1-\lambda)hy + \lambda x(zy+\rho) - \lambda(1-x)S + (q-1)xL^{\theta} - \rho_0[(1-\lambda)(1+h\mu) + \lambda x(1+z\mu)]}$$

$$U_b = \frac{\rho_1 - D(x,S,q)}{D(x,S,q) - \rho_0}A$$

$$D(x,S,q) = \frac{1 + (1-\lambda)hy + \lambda x(zy+\rho) - \lambda(1-x)S + (q-1)xL^{\theta}}{[(1-\lambda)(1+h\mu) + \lambda x(1+z\mu)]}. \qquad (A2)$$

The first-best investment policy minimizes $D(x,S,q)$. Taking the derivative of $D(x,S)$ with respect to x and setting it to zero implies that

$$\frac{\delta D(x,S)}{\delta x} = 0, iff$$

$$\lambda(1-\lambda)[(1+h\mu)(zy+\rho) - hy(1+z\mu)] - \lambda(1+z\mu) + \lambda S[\lambda(1+z\mu) + (1-\lambda)(1+h\mu)] + (1-\lambda)(1+h\mu)(q-1)L^{\theta} = 0 \qquad \text{(A3)}$$

The function $D(x,S,q)$ is increasing in q for q less than $\bar{q}$, and it is decreasing in q for q greater than $\bar{q}$, where

$$\bar{q} = \frac{\lambda(1+z\mu) - \lambda(1-\lambda)[(1+h\mu)(zy+\rho) - hy(1+z\mu)] - \lambda S[\lambda(1+z\mu) + (1-\lambda)(1+h\mu)] + (1-\lambda)(1+h\mu)L^\theta}{(1-\lambda)(1+h\mu)L^\theta}.$$

It follows that the optimal continuation policy is to set $x^\theta = 1$ when $q < \bar{q}$, $x = 0$ when $q > \bar{q}$ and $x \in [0,1]$ when $q = \bar{q}$. Under full continuation, systematic firms' aggregate liquidity need is $\theta L^\theta = \theta[\rho + zy - (1+z\mu)]I^*$. Let $\bar{L}^s$ be the minimum amount of liquidity that can sustain the full continuation policy $x^\theta = 1$:

$$\theta[\rho + zy - (1+z\mu)]I = \bar{L}^s. \qquad \text{(A5)}$$

Then $x^\theta < 1$ and partial liquidation will occur whenever the supply of liquidity is less than $\bar{L}^s$ and $q > 1$.

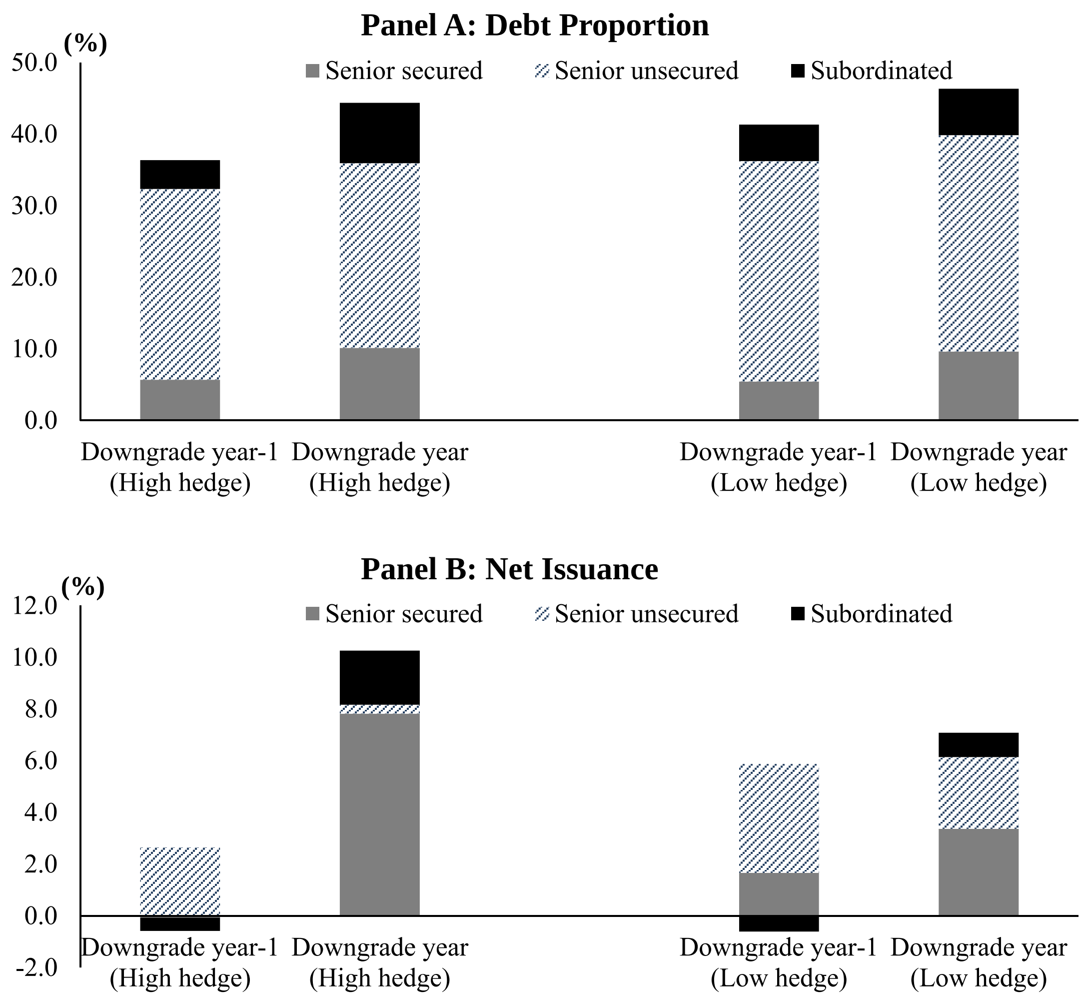

Figure 1: Net debt issuance by type of firm

In this figure, we divide the sample of firms into high and low hedging need firms. We examine the average percentage of senior secured debt, senior unsecured debt, or subordinated debt relative to total capital (Panel A) and net issuance scaled by lagged total capital (Panel B) for the two types of firms. High hedging need firms are those with lower than median industry investment cash-flow correlation, and low hedging need firms are those with higher than median industry investment cash-flow correlation.

Figure 2: Timeline of events

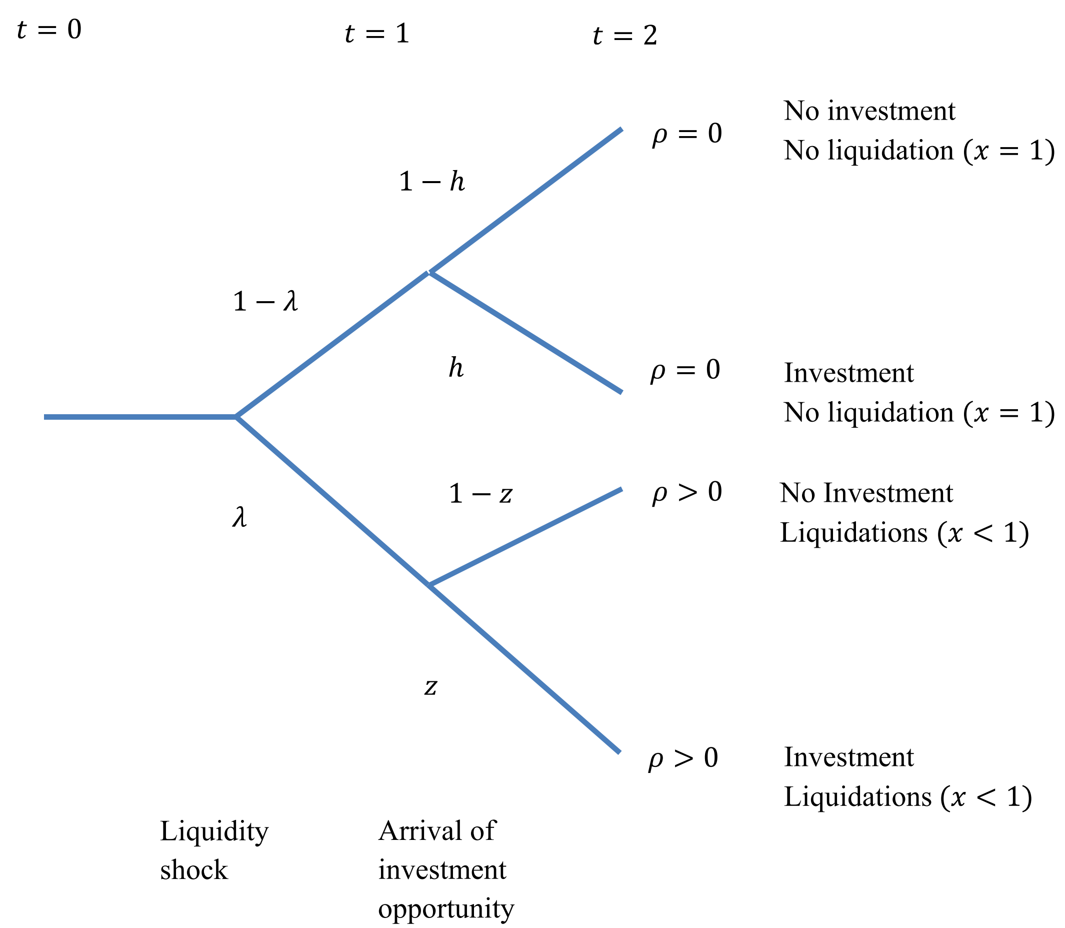

Table 1: Summary statistics

Panel A presents summary statistics across all years for our sample including 8,657 firm-year observations for 1,089 non-financial and non-utility rated firms traded on the Amex, Nasdaq, and NYSE without missing value of debt composition and financial information from year 2002 to 2015. Panels B and C report this information for the subsamples of high and low hedge need rated firms, respectively. In this table, we report the proportions of debt components scaled by total capital and by total debt. All variables are in decimal, and their definitions are in Appendix C.

Panel A: All rated firms

Variable	Mean	Std.Dev	Min	P25	Median	P75	Max
Senior secured/total capital	0.117	0.191	0.000	0.000	0.009	0.169	0.786
Senior unsecured/total capital	0.224	0.185	0.000	0.021	0.218	0.351	0.655
Subordinated/total capital	0.094	0.139	0.000	0.000	0.027	0.133	0.645
Senior secured / total debt	0.229	0.330	0.000	0.000	0.028	0.392	1.000
Senior unsecured / total debt	0.545	0.377	0.000	0.111	0.638	0.898	1.000
Subordinated / total debt	0.228	0.303	0.000	0.000	0.084	0.350	1.000
Book leverage	0.305	0.161	0.000	0.188	0.285	0.405	0.714
Market leverage	0.292	0.203	0.000	0.137	0.246	0.402	0.863
Ln(real total assets)	3.662	1.343	-0.408	2.710	3.512	4.544	6.702
MB	1.337	0.784	0.306	0.824	1.125	1.615	9.619
ROA	0.134	0.085	-1.101	0.092	0.130	0.175	0.427
Tangibility	0.313	0.243	0.002	0.119	0.236	0.472	0.911
CAPX	0.057	0.064	0.000	0.020	0.036	0.064	0.373
R&D	0.018	0.035	0.000	0.000	0.000	0.021	0.435
R&D_dum	0.499	0.500	0.000	0.000	0.000	1.000	1.000
Dividend_dum	0.648	0.478	0.000	0.000	1.000	1.000	1.000
IndMed_lev	0.198	0.091	0.005	0.141	0.210	0.255	0.391
# of obs				8,657			

Panel B: High hedging need rated firms

Variable	Mean	Std.Dev	Min	P25	Median	P75	Max
Senior secured/total capital	0.116	0.186	0.000	0.000	0.011	0.167	0.786
Senior unsecured/total capital	0.228	0.187	0.000	0.030	0.221	0.351	0.655
Subordinated/total capital	0.092	0.136	0.000	0.000	0.028	0.132	0.645
Senior secured/total debt	0.232	0.330	0.000	0.000	0.033	0.399	1.000
Senior unsecured/total debt	0.548	0.374	0.000	0.132	0.645	0.894	1.000
Subordinated/total debt	0.222	0.299	0.000	0.000	0.083	0.329	1.000
MB	1.307	0.714	0.306	0.824	1.115	1.591	6.965
ROA	0.134	0.078	-0.905	0.092	0.129	0.171	0.427
CAPX	0.048	0.044	0.000	0.020	0.035	0.061	0.373
Investment cash-flow correlation	-0.186	0.192	-0.740	-0.297	-0.201	-0.002	0.093

Panel C: Low hedging need rated firms

Variable	Mean	Std.Dev	Min	P25	Median	P75	Max
Senior secured/total capital	0.118	0.196	0.000	0.000	0.007	0.169	0.786
Senior unsecured/total capital	0.219	0.184	0.000	0.010	0.214	0.351	0.655
Subordinated/total capital	0.096	0.142	0.000	0.000	0.027	0.135	0.645
Senior secured/total debt	0.226	0.331	0.000	0.000	0.022	0.387	1.000
Senior unsecured/total debt	0.541	0.380	0.000	0.078	0.630	0.900	1.000
Subordinated/total debt	0.235	0.306	0.000	0.000	0.086	0.373	1.000
MB	1.373	0.857	0.306	0.826	1.135	1.642	9.619

ROA	0.134	0.093	-1.101	0.091	0.132	0.179	0.427
CAPX	0.067	0.080	0.000	0.020	0.036	0.073	0.373
Investment cash-flow correlation	0.346	0.176	0.097	0.172	0.311	0.550	0.704

Table 2: Priority spreading around rating downgrades

This table measures the change in debt structure following a rating downgrade for firms rated by either Standard and Poor's Rating Agency or Moody's Rating Agency. A firm is defined as being downgraded if its long-term debt rating is reduced from investment grade to below investment grade. Panel A shows the yearly distribution of downgraded firms across the sample period and by the type of rating agency. Panel B presents the change in debt priority structure from two years before to two years after a rating downgrade. The regression model is similar to Rauh and Sufi (2010). The dependent variable is each type of debt scaled by total capital (denominated in percentage). We use the year before downgrade year as the baseline, and we include firm and year fixed effects in the regressions. At the bottom of this panel, we conduct one-side test of debt priority spreading: for a given year, we test whether senior secured or subordinated debt is higher than senior unsecured debt. Panel C reports estimates for the subsample of high hedging need firms and panel D reports results for the subsample of low hedging need firms. Hedging needs are identified by 3-digit industry annual average investment cash-flow correlation: High hedging need firms are those with lower than median industry investment cash-flow correlation, and low hedging need firms are those with higher than median industry investment cash-flow correlation. Detailed definitions of relevant variables are in Appendix C. firm-level clustered standard errors are shown in parentheses. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: Distribution of rating downgrade

Fiscal year	by either Moody's rating or S&P rating	by S&P rating	by Moody's rating	by both Moody's rating and S&P rating
2002	20	16	9	5
2003	22	18	9	5
2004	10	5	5	0
2005	25	17	12	4
2006	18	11	8	1
2007	26	19	14	7
2008	32	22	16	6
2009	23	16	10	3
2010	11	4	8	1
2011	8	6	5	3
2012	11	8	5	2
2013	5	5	0	0
2014	1	1	0	0
2015	10	10	0	0
Total	222	158	101	37

Panel B: All firms

	Senior secured	Senior unsecured	Subordinated
Downgrade year-2	-0.362	-1.742	-0.450
	(0.573)	(1.133)	(1.055)
Downgrade year-1		Baseline	
Downgrade year	3.654***	0.458	2.605**
	(0.851)	(1.243)	(1.016)
Downgrade year+1	4.429***	0.853	2.148*
	(0.990)	(1.788)	(1.134)
Downgrade year+2	6.412***	0.563	2.406*
	(1.471)	(2.165)	(1.276)
N	796	796	796
Nfirms	192	192	192
Adj-R2	0.066	0.064	0.061
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Downgrade year	3.196***		2.147*
	(1.506)		(1.605)
Downgrade year+1	3.576**		1.295
	(2.044)		(2.117)
Downgrade year+2	5.849***		1.843
	(2.617)		(2.513)

Panel C: High hedging need firms

	Senior secured	Senior unsecured	Subordinated
Downgrade year-2	0.020	-0.638	-0.593
	(0.653)	(1.523)	(1.232)
Downgrade year-1		Baseline	
Downgrade year	3.297***	-1.361	3.937***
	(1.155)	(1.712)	(1.364)
Downgrade year+1	4.558***	-2.597	3.363**
	(1.379)	(2.582)	(1.687)
Downgrade year+2	5.869***	-4.222	3.671*
	(1.735)	(3.255)	(2.075)
N	485	485	485
Nfirms	117	117	117
Adj-R2	0.056	0.075	0.067
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Downgrade year	4.658***		5.298***
	(2.065)		(2.189)
Downgrade year+1	7.155***		5.960**
	(2.927)		(3.084)
Downgrade year+2	10.091***		7.893***
	(3.689)		(3.860)

Panel D: Low hedging need firms

	Senior secured	Senior unsecured	Subordinated
Downgrade year-2	-1.098	-1.989	-0.331
	(1.096)	(1.494)	(1.894)
Downgrade year-1		Baseline	
Downgrade year	4.254***	0.573	1.037
	(1.240)	(1.565)	(1.792)
Downgrade year+1	4.308***	2.169	1.935
	(1.373)	(2.117)	(2.155)
Downgrade year+2	7.298***	0.592	2.623
	(2.642)	(2.711)	(2.439)
N	311	311	311
Nfirms	76	76	76
Adj-R2	0.073	0.093	0.085
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Downgrade year	3.681**		0.464
	(1.997)		(2.379)
Downgrade year+1	2.139		-0.234
	(2.523)		(3.021)
Downgrade year+2	6.706**		2.031
	(3.785)		(3.647)

Table 3: Cash-flows and capital expenditures around rating downgrades

This table reports average income before extraordinary items and capital expenditures around rating downgrades for high and low hedging need firms. Both variables are scaled by total book assets and numbers are expressed in percentage points. Numbers in square brackets report industry adjusted measures where the variable of interest is net of the industry average over the past five years. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: Cash-flows

	High hedging need	Low hedging need	Diff
Downgrade year-2	6.116***	5.809***	0.307
	[2.952***]	[4.937***]	[-1.986]
Downgrade year-1	2.683*	2.868***	-0.185
	[-0.717]	[1.890]	[-2.607]
Downgrade year	0.184	-0.836	1.020
	[-2.657*]	[-0.689]	[-1.968]
Downgrade year+1	2.475***	0.522	1.953
	[0.244]	[0.166]	[0.078]
Downgrade year+2	3.835***	1.994***	1.841
	[2.265***]	[1.617]	[0.648]

Panel B: Capital expenditures

	High hedging need	Low hedging need	Diff
Downgrade year-2	5.023***	3.495***	1.529**
	[0.858***]	[-0.493]	[1.351]
Downgrade year-1	5.153***	3.538***	1.615**
	[1.016***]	[-0.829]	[1.846***]
Downgrade year	4.744***	3.514***	1.230***
	[0.782***]	[-1.358***]	[2.140***]
Downgrade year+1	5.046***	2.921***	2.126***
	[0.906]	[-1.290**]	[2.196**]
Downgrade year+2	5.148***	3.051***	2.097***
	[1.097**]	[-0.711]	[1.808**]

Table 4: Changes in priority structure around liquidity shocks

This table extends the analysis of Table 2 and measures the change in debt structure following a liquidity shock. Liquidity shocks occur when a firm's cash-flow is below the industry average over the past five years. We track the change in the proportion of each type of debt structure during the two years following the year of the liquidity shock. Panel A reports estimates for the subsample of high hedging need firms and panel B reports results for the subsample of low hedging need firms. Hedging needs are identified by 3-digit industry annual average investment cash-flow correlation: High hedging need firms are those with lower than median industry investment cash-flow correlation, and low hedging need firms are those with higher than median industry investment cash-flow correlation. At the bottom of each panel, we conduct one-side test of debt priority spreading: for a given year, we test whether senior secured or subordinated debt is higher than senior unsecured debt. Detailed definitions of relevant variables are in Appendix C. firm-level clustered standard errors are shown in parentheses. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: High hedging need firms

	Senior secured	Senior unsecured	Subordinated
Shock year-2	-0.533	0.801	-0.901**
	(0.610)	(0.507)	(0.441)
Shock year-1		Baseline	
Shock year	2.512***	0.349	2.821***
	(0.676)	(0.489)	(0.703)
Shock year+1	2.290***	0.423	3.236***
	(0.744)	(0.632)	(0.829)
Shock year+2	2.038**	-0.013	3.754***
	(0.800)	(0.736)	(0.942)
N	2465	2465	2465
Nfirms	421	421	421
Adj-R2	0.082	0.156	0.122
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	2.163***		2.472***
	(0.834)		(0.856)
Shock year+1	1.867**		2.813***
	(0.976)		(1.042)
Shock year+2	2.051**		3.767***
	(1.087)		(1.195)

Panel B: Low hedging need firms

	Senior secured	Senior unsecured	Subordinated
Shock year-2	-1.079	0.566	-1.798***
	(0.908)	(0.689)	(0.619)
Shock year-1		Baseline	
Shock year	1.153	1.365*	1.186*
	(0.774)	(0.807)	(0.609)
Shock year+1	1.440	1.854*	0.865
	(1.086)	(1.006)	(0.760)
Shock year+2	-0.088	1.101	0.780
	(1.097)	(1.146)	(0.794)
N	1900	1900	1900
Nfirms	337	337	337
Adj-R2	0.053	0.218	0.128
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	-0.212		-0.179
	(1.118)		(1.011)
Shock year+1	-0.414		-0.989
	(1.480)		(1.261)
Shock year+2	-1.189		-0.321
	(1.586)		(1.394)

Table 5: Debt issuance and liquidity shocks

This table tests the change in debt priority structure around a liquidity with debt issuance using the following model:

$$Y_{it} = a + b\, X_{it-1} + c_2 HighHedge_{it} + c_3 ShockPeriod_{it} + c_4 HighHedge_{it} \times ShockPeriod_{it} + dW_t + \varepsilon_{it}$$

The dependent variable is the net issuance of different types of debt scaled by lagged total capital: Columns 1 through 3 senior secured debt, senior unsecured debt, and subordinated debt, respectively. X_{it-1} is a vector of firm-level characteristics measured at year t-1, and W_t is a vector of macro-economic variables measured at year t. Except for dummies and MB ratio, all other variables are in percentage. $ShockPeriod_{it}$=1 if the observation is a year with liquidity shock or one year after the liquidity shock. Hedging need is identified by 3-digit industry annual average investment cash-flow correlation: $HighHedge_{it}$ is equal to 1 if the firms are those with lower than median industry investment cash-flow correlation, otherwise $HighHedge_{it}$=0. We test the debt priority spreading at the bottom of this table. For low hedging need firms, we report the coefficients on $ShockPeriod_{it}$ and then calculate the difference between senior secured or subordinated debt regression and senior unsecured debt regression, respectively. For high hedging need firms, we first sum up the coefficients on $ShockPeriod_{it}$, and $HighHedge_{it} \times ShockPeriod_{it}$ ($s_h = c_3 + c_4$), and then calculate the difference in this sum between senior secured or subordinated debt regression and senior unsecured debt regression, respectively. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

	Senior secured	Senior unsecured	Subordinated
HighHedge	1.705	-2.546**	-1.289*
	(2.084)	(1.265)	(0.782)
ShockPeriod	2.087**	0.700	1.095**
	(0.854)	(0.695)	(0.452)
HighHedge*ShockPeriod	0.150	-0.440	1.545***
	(0.836)	(0.907)	(0.596)
ROA	0.208***	0.205***	0.060**
	(0.046)	(0.039)	(0.027)
Ln(real total assets)	-5.494***	-4.956***	-2.384***
	(1.004)	(0.740)	(0.495)
MB	1.148**	1.829***	1.271***
	(0.578)	(0.571)	(0.301)
Tangibility	0.016	0.103***	0.005
	(0.048)	(0.038)	(0.024)
R&D_Dum	4.391**	-1.598	-2.541*
	(2.087)	(1.410)	(1.300)
R&D	-0.142	0.049	0.074
	(0.172)	(0.223)	(0.120)
Dividend_Dum	0.678	2.350***	0.643
	(0.888)	(0.814)	(0.509)
IndMed_Lev	-0.032	-0.142***	-0.040
	(0.066)	(0.054)	(0.034)
DefaultSpread	-3.103***	0.549	-1.681**
	(0.993)	(0.904)	(0.728)
TermSpread	-3.022***	-1.784***	-0.662**
	(0.471)	(0.427)	(0.323)
Real Interest Rate	-2.140***	-1.796***	-0.195
	(0.266)	(0.235)	(0.141)
Real Market Return	0.000	0.056***	-0.039***
	(0.013)	(0.010)	(0.008)
H-P LogGDP	-0.065	0.398	0.066
	(0.516)	(0.463)	(0.387)

Constant	27.038***	21.822***	11.532***
	(4.938)	(3.874)	(2.789)
N	7727	7727	7727
Nfirms	1028	1028	1028
Adj-R2	0.031	0.037	0.030
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
High hedging need	1.977*		2.380**
	(1.525)		(1.207)
Low hedging need	1.387*		0.395
	(0.987)		(0.670)

Table 6: Summary statistics on liquidity shocks

This table reports the number of idiosyncratic and systematic shocks in year of the sample Liquidity shocks occur when a firm's cash-flow is below the industry average over the past five years. A liquidity shock is defined as a systematic shock if 50% or more of firms in the same industry experience a similar shock. Otherwise, a liquidity shock is defined as an idiosyncratic shock. Column 1 and Column 2 list the number of firms experiencing idiosyncratic or systematic shock in a given year, respectively. Column 3 lists the number of industries experiencing systematic shock in a given year.

Fiscal year	Idiosyncratic shock (# of rated firms)	Systematic shock (# of rated firms)	Systematic shock (# of SIC3 industries)
2002	43	39	26
2003	45	25	17
2004	32	10	8
2005	51	8	5
2006	31	20	11
2007	54	41	21
2008	74	62	26
2009	32	80	32
2010	30	22	13
2011	37	19	15
2012	61	31	19
2013	46	28	13
2014	54	19	14
2015	44	66	17
Total	634	470	237

Table 7: Changes in priority structure - idiosyncratic vs. systematic liquidity shocks

This table extends the analyses of Table 4 and Table 5 and compares the change in debt structure between idiosyncratic and systematic liquidity shocks. Liquidity shocks occur when a firm's cash-flow is below the industry average over the past five years. A liquidity shock is defined as a systematic shock if 50% or more of firms in the same industry experience a similar shock. Otherwise, a liquidity shock is defined as an idiosyncratic shock. We track the change in the proportion of each type of debt structure during the two years following the year of the liquidity shock. Hedging needs are identified by 3-digit industry annual average investment cash-flow correlation: High hedging need firms are those with lower than median industry investment cash-flow correlation, and low hedging need firms are those with higher than median industry investment cash-flow correlation. Panel A and Panel B use the regression models as in Table 4 and report estimates for the subsamples of high and low hedging need firms, respectively. Panel C presents the following net issuance regressions for high and low hedging need firms separately:

$$Y_{it} = a + bIdiosyncraticShock_{it} + cSystematicShock_{it} + eX_{it-1} + fW_t + \varepsilon_{it}$$

The dependent variables, firm characteristics, and macro-economic variables are the same as in Table 5. The variable $IdiosyncraticShock_{it}$ equals to one if an observation is at an idiosyncratic shock year or one year after this idiosyncratic shock. $SystematicShock_{it}$ equals one if an observation is at a systematic shock year or one year after this systematic shock. At the bottom of each panel, we conduct one-side test of debt priority spreading: for a given year, we test whether senior secured or subordinated debt is higher than senior unsecured debt. Detailed definitions of relevant variables are in Appendix C. firm-level clustered standard errors are shown in parentheses. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: High hedging need firms

	Idiosyncratic shock			Systematic shock		
	Senior secured	Senior unsecured	Subordinated	Senior secured	Senior unsecured	Subordinated
Shock year-2	-1.334	1.442*	-0.695	0.203	-0.538	-0.213
	(0.898)	(0.820)	(0.599)	(0.844)	(0.722)	(0.659)
Shock year-1		Baseline			Baseline	
Shock year	4.076***	0.577	3.226***	0.915	0.228	2.440**
	(0.989)	(0.579)	(0.976)	(0.837)	(0.798)	(0.969)
Shock year+1	4.514***	-0.154	2.920**	0.670	0.368	4.044***
	(1.113)	(0.862)	(1.292)	(0.935)	(0.904)	(1.198)
Shock year+2	2.988**	-0.163	3.609**	1.937*	-0.664	4.865***
	(1.275)	(1.149)	(1.581)	(1.008)	(0.989)	(1.492)
N	1322	1322	1322	1143	1143	1143
Nfirms	269	269	269	239	239	239
Adj-R2	0.106	0.179	0.070	0.055	0.101	0.054
Test of priority spreading						
	Senior secured > Senior unsecured		Subordinated > Senior unsecured	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	3.499***		2.649***	0.687		2.212**
	(1.146)		(1.135)	(1.156)		(1.255)

Shock year+1	4.668***		3.074**	0.302		3.676***
	(1.408)		(1.553)	(1.301)		(1.501)
Shock year+2	3.151**		3.772**	2.601**		5.529***
	(1.716)		(1.954)	(1.412)		(1.790)

Panel B: Low hedging need firms

	Idiosyncratic shock			Systematic shock		
	Senior secured	Senior unsecured	Subordinated	Senior secured	Senior unsecured	Subordinated
Shock year-2	-1.642	-0.851	-1.621**	-0.523	1.562	-2.184*
	(1.147)	(0.960)	(0.733)	(1.442)	(0.953)	(1.209)
Shock year-1		Baseline			Baseline	
Shock year	1.722*	1.527	1.651**	0.385	1.096	0.180
	(1.007)	(1.135)	(0.759)	(1.248)	(1.318)	(0.982)
Shock year+1	1.925	2.220	1.420	0.840	0.962	0.350
	(1.379)	(1.431)	(0.955)	(1.790)	(1.817)	(1.299)
Shock year+2	-0.374	1.571	1.192	1.187	-0.288	1.057
	(1.520)	(1.673)	(1.066)	(1.555)	(2.057)	(1.329)
N	1164	1164	1164	736	736	736
Nfirms	235	235	235	145	145	145
Adj-R2	0.103	0.195	0.121	0.012	0.264	0.094
Test of priority spreading						
	Senior secured > Senior unsecured		Subordinated > Senior unsecured	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	0.195		0.124	-0.711		-0.916
	(1.517)		(1.365)	(1.815)		(1.644)
Shock year+1	-0.295		-0.800	-0.122		-0.612
	(1.987)		(1.720)	(2.551)		(2.234)
Shock year+2	-1.945		-0.379	1.475		1.345
	(2.260)		(1.984)	(2.579)		(2.449)

Panel C: Issuance regressions

	High hedging need			Low hedging need		
	Senior secured	Senior unsecured	Subordinated	Senior secured	Senior unsecured	Subordinated
Systematic shock	1.743**	0.267	1.608***	1.175	-0.088	1.166*
	(0.773)	(0.884)	(0.539)	(1.229)	(0.955)	(0.691)
Idiosyncratic shock	2.515***	0.006	1.507***	3.158***	1.833*	0.848
	(0.957)	(0.765)	(0.563)	(1.218)	(0.983)	(0.605)
Test of priority spreading						
	Senior secured > Senior unsecured		Subordinated > Senior unsecured	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Systematic shock	1.476		1.341	1.263		1.254*
	(1.174)		(0.884)	(1.556)		(0.955)
Idiosyncratic shock	2.509**		1.501**	1.325		-0.985
	(1.225)		(0.765)	(1.565)		(0.983)

Table 8: Credit line revocations – idiosyncratic vs. systematic shocks

This table analyzes sensitivity of credit lines revocation to liquidity shocks. If a firm has positive undrawn credit lines at *t-1*, zero undrawn credit lines at *t*, and no increase of drawn credit lines between two periods, it is defined as a full revocation of credit lines. If the reduction of undrawn credit lines from *t-1* to *t* is higher than 50% relative to undrawn credit lines at *t-1*, it is defined as a partial revocation of credit lines. We define the change of drawn credit lines as the difference of drawn credit lines between *t* and *t-1* scaled by total capital at *t-1*. Panel A shows univariate comparison for all sample firms, high and low hedging need firms, respectively. Hedging needs are identified by 3-digit industry annual average investment cash-flow correlation: High hedging need firms are those with lower than median industry investment cash-flow correlation, and low hedging need firms are those with higher than median industry investment cash-flow correlation. Panel B reports the following multivariate regression model.

$$Y_{it} = a + bIdiosyncraticShock_{it} + cSystematicShock_{it} + eX_{it-1} + fW_t + \varepsilon_{it}$$

where Y_{it} measures a credit line revocation or a credit line drawdown. Following the definition in Table 6, liquidity shocks occur when a firm's cash-flow is below the industry average over the past five years. A liquidity shock is defined as a systematic shock if 50% or more of firms in the same industry experience a similar shock. Otherwise, a liquidity shock is defined as an idiosyncratic shock. Then, the variable $IdiosyncraticShock_{it}$ equals to one if an observation is at an idiosyncratic shock year or one year after this idiosyncratic shock. $SystematicShock_{it}$ equals one if an observation is at a systematic shock year or one year after this systematic shock. X_{it-1} is a vector of firm-level characteristics measured at year *t-1*, and W_t is a vector of macro-economic variables measured at year *t.* Similar to Table 8 of Acharya et al. (2014), in column 1, dependent variable is a dummy for a full revocation of the credit line. In column 2, dependent variable is a dummy for a decrease in undrawn credit greater than 50% of the outstanding amount. In column 3, dependent variable is the annual change of drawn credit lines as a percentage of total capital at t-1. We use a Probit model to estimate the models in columns 1 and 2, and we use OLS to estimate the model in column3. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: Univariate comparison

	All firms		
	Idiosyncratic shock	Systematic shock	Diff
Full Revocation of Credit Lines (dummy)	0.107	0.143	0.036***
	(0.010)	(0.010)	(0.014)
Full or Partial (50%) Revocation of Credit Lines (dummy)	0.113	0.153	0.039***
	(0.010)	(0.011)	(0.015)
ΔDrawdown of Credit Lines	0.394	0.114	-1.896***
	(0.245)	(0.276)	(0.369)
	High hedging need		
	Idiosyncratic shock	Systematic shock	Diff
Full Revocation of Credit Lines (dummy)	0.098	0.188	0.089***
	(0.012)	(0.014)	(0.019)
Full or Partial (50%) Revocation of Credit Lines (dummy)	0.105	0.198	0.092***
	(0.013)	(0.014)	(0.019)
ΔDrawdown of Credit Lines	-0.361	-3.094	-2.733***
	(0.219)	(0.326)	(0.393)

	Low hedging need		
	Idiosyncratic shock	Systematic shock	Diff
Full Revocation of Credit Lines (dummy)	0.116	0.084	-0.031
	(0.015)	(0.015)	(0.021)
Full or Partial (50%) Revocation of Credit Lines (dummy)	0.122	0.094	-0.028
	(0.016)	(0.016)	(0.023)
ΔDrawdown of Credit Lines	0.633	0.198	-0.435
	(0.432)	(0.490)	(0.653)

Panel B: Multivariate regressions

	All firms		
	Full Revocation of Credit Lines (dummy)	Full or Partial (50%) Revocation of Credit Lines (dummy)	ΔDrawdown of Credit Lines
Systematic shock	0.303**	0.320***	-2.092***
	(0.122)	(0.115)	(0.424)
Idiosyncratic shock	0.039	0.046	0.305
	(0.069)	(0.067)	(0.293)
ROA	-0.002	-0.002	0.057***
	(0.003)	(0.003)	(0.012)
Ln(real total assets)	-0.023	-0.022	-0.206***
	(0.014)	(0.014)	(0.048)
MB	-0.017	-0.025	0.156
	(0.029)	(0.029)	(0.132)
Tangibility	-0.001	-0.001	0.001
	(0.001)	(0.001)	(0.003)
R&D_Dum	0.043	0.060	-0.264*
	(0.047)	(0.046)	(0.135)
R&D	-0.019**	-0.020**	-0.019
	(0.009)	(0.009)	(0.019)
Dividend_Dum	0.049	0.052	-0.114
	(0.041)	(0.041)	(0.147)
IndMed_Lev	0.000	0.000	-0.010
	(0.002)	(0.002)	(0.007)
DefaultSpread	-0.676***	-0.684***	-2.209***
	(0.126)	(0.119)	(0.399)
TermSpread	-0.189***	-0.162***	-0.687***
	(0.047)	(0.044)	(0.180)
Real Interest Rate	-0.088***	-0.064***	-0.240***
	(0.018)	(0.018)	(0.076)
Real Market Return	0.023***	0.020***	-0.050***
	(0.003)	(0.003)	(0.006)
H-P LogGDP	-0.081	-0.102	-0.251
	(0.073)	(0.065)	(0.205)
Constant	-0.184	-0.124	4.912***
	(0.233)	(0.222)	(0.804)
N	7727	7727	7727
Nfirms	1028	1028	1028
Pseudo-R2 or Adj-R2	0.08	0.069	0.032

	High hedging need		
	Full Revocation of Credit Lines (dummy)	Full or Partial (50%) Revocation of Credit Lines (dummy)	ΔDrawdown of Credit Lines
Systematic shock	0.753***	0.632**	-3.330***
	(0.278)	(0.274)	(0.550)
Idiosyncratic shock	-0.019	-0.059	-0.179
	(0.152)	(0.143)	(0.386)
ROA	0.005	0.004	0.032**
	(0.005)	(0.005)	(0.014)
Ln(real total assets)	-0.049**	-0.035*	-0.215***
	(0.019)	(0.019)	(0.070)
MB	-0.063	-0.070	0.098
	(0.044)	(0.044)	(0.170)
Tangibility	-0.001	-0.002*	0.003
	(0.001)	(0.001)	(0.004)
R&D_Dum	0.096*	0.086	-0.283
	(0.057)	(0.059)	(0.176)
R&D	-0.033***	-0.037***	0.021
	(0.012)	(0.012)	(0.026)
Dividend_Dum	0.056	0.039	-0.156
	(0.052)	(0.052)	(0.193)
IndMed_Lev	-0.002	-0.002	-0.004
	(0.003)	(0.003)	(0.009)
DefaultSpread	-0.455***	-0.477***	-1.496***
	(0.162)	(0.152)	(0.471)
TermSpread	-0.152**	-0.120*	-0.541**
	(0.066)	(0.063)	(0.214)
Real Interest Rate	-0.103***	-0.075***	-0.288***
	(0.023)	(0.023)	(0.085)
Real Market Return	0.021***	0.018***	-0.042***
	(0.004)	(0.003)	(0.007)
H-P LogGDP	0.009	-0.014	0.056
	(0.096)	(0.087)	(0.244)
Constant	-0.338	-0.295	4.106***
	(0.311)	(0.291)	(0.920)
N	4124	4124	4124
Nfirms	555	555	555
Pseudo-R2 or Adj-R2	0.071	0.062	0.028

	Low hedging need		
	Full Revocation of Credit Lines (dummy)	Full or Partial (50%) Revocation of Credit Lines (dummy)	ΔDrawdown of Credit Lines
Systematic shock	0.090	0.095	0.357
	(0.143)	(0.133)	(0.474)
Idiosyncratic shock	0.083	0.101	0.528
	(0.081)	(0.081)	(0.385)
ROA	-0.007*	-0.007*	0.075***
	(0.004)	(0.004)	(0.018)
Ln(real total assets)	0.000	-0.012	-0.187***
	(0.021)	(0.020)	(0.066)
MB	-0.001	-0.020	0.317
	(0.040)	(0.042)	(0.206)
Tangibility	0.000	0.000	-0.001
	(0.001)	(0.001)	(0.005)
R&D_Dum	0.032	0.081	-0.356
	(0.077)	(0.072)	(0.222)
R&D	-0.008	-0.005	-0.080***
	(0.012)	(0.011)	(0.030)
Dividend_Dum	0.035	0.059	-0.032
	(0.063)	(0.064)	(0.225)
IndMed_Lev	0.001	0.001	-0.016
	(0.004)	(0.004)	(0.012)
DefaultSpread	-1.044***	-1.004***	-2.859***
	(0.203)	(0.194)	(0.649)
TermSpread	-0.259***	-0.231***	-0.820***
	(0.068)	(0.062)	(0.302)
Real Interest Rate	-0.075***	-0.055**	-0.182
	(0.028)	(0.027)	(0.131)
Real Market Return	0.027***	0.023***	-0.059***
	(0.005)	(0.005)	(0.010)
H-P LogGDP	-0.240**	-0.245**	-0.523
	(0.111)	(0.097)	(0.336)
Constant	0.185	0.224	5.609***
	(0.354)	(0.345)	(1.350)
N	3603	3603	3603
Nfirms	532	532	532
Pseudo-R2 or Adj-R2	0.104	0.09	0.037

Table 9: Alternative explanations—Probability of default

In this table, we split high hedging need firms into two groups based on their probability of default, and conduct similar regressions as in Panel A of Table 4 for each group. The naïve probability of default is calculated using Bharath and Shumway (2008). Columns 1 through 3 presents the estimates for the sub-sample with more than 5% default probability, and columns 4 through 6 present the estimates for the sub-sample with less than 5% default probability. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

	Probability(default)>=0.05			Probability(default)<0.05		
	Senior secured	Senior unsecured	Subordinated	Senior secured	Senior unsecured	Subordinated
Shock year-2	-7.692***	1.814	-0.270	0.231	0.377	-0.956**
	(2.651)	(2.041)	(1.962)	(0.645)	(0.574)	(0.477)
Shock year-1		Baseline			Baseline	
Shock year	5.474**	2.034	2.313	2.007***	0.590	2.617***
	(2.406)	(2.338)	(1.999)	(0.711)	(0.456)	(0.725)
Shock year+1	1.898	2.363	3.296	2.314***	0.352	3.034***
	(2.739)	(3.580)	(2.276)	(0.782)	(0.590)	(0.845)
Shock year+2	1.389	1.961	2.655	2.571***	-0.568	3.586***
	(3.011)	(4.459)	(3.248)	(0.819)	(0.669)	(0.982)
N	233	233	233	1915	1915	1915
Nfirms	56	56	56	333	333	333
Adj-R2	0.175	0.219	0.079	0.090	0.161	0.109
Test of priority spreading						
	Senior secured > Senior unsecured		Subordinated > Senior unsecured	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	-1.209		0.279	1.751***		2.027***
	(3.507)		(3.076)	(0.858)		(0.856)
Shock year+1	-1.826		0.933	3.438***		2.682***
	(4.738)		(4.242)	(1.005)		(1.031)
Shock year+2	-1.119		0.694	2.412***		4.154***
	(5.853)		(5.517)	(1.161)		(1.188)

Table 10: Alternative explanations—Convertible versus non-convertible subordinated debt

This table presents similar issuance regressions as in Table 5, except that the dependent variables are the net issuances of convertible subordinated debt and non-convertible subordinated debt, scaled by total capital at year t-1. Convertible subordinated debt is the variable DCVSUB in Compustat Database. In this table, we only include the observations that DCVSUB is non-missing and not larger than total subordinated debt. Non-convertible subordinated debt is then equal to total subordinated debt minus convertible subordinated debt. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

	Convertible subordinated	Non-convertible subordinated
HighHedge	-0.110**	-0.529
	(0.047)	(0.830)
ShockPeriod	-0.001	1.143**
	(0.015)	(0.455)
HighHedge*ShockPeriod	0.010	1.418**
	(0.021)	(0.583)
ROA	-0.001	0.056**
	(0.001)	(0.026)
Ln(real total assets)	0.031	-2.404***
	(0.022)	(0.477)
MB	0.003	1.342***
	(0.014)	(0.300)
Tangibility	0.001	0.006
	(0.001)	(0.023)
R&D_Dum	0.040	-2.199*
	(0.043)	(1.276)
R&D	0.005	0.110
	(0.005)	(0.120)
Dividend_Dum	0.012	0.531
	(0.023)	(0.501)
IndMed_Lev	0.002	-0.062**
	(0.002)	(0.031)
DefaultSpread	-0.012	-1.651**
	(0.026)	(0.715)
TermSpread	0.000	-0.780**
	(0.011)	(0.308)
Real Interest Rate	-0.005	-0.321**
	(0.007)	(0.133)
Real Market Return	-0.001*	-0.040***
	0.000	(0.008)
H-P LogGDP	0.014	0.043
	(0.011)	(0.378)
Constant	-0.221**	11.906***
	(0.098)	(2.684)
N	7494	7494
Nfirms	1020	1020
Adj-R2	0.004	0.032

Table 11: Alternative explanations—Debt Maturity Structure

In this table, we conduct similar regressions as in Table 4 and Table 6, except that the dependent variable is the percentage of short-term debt scaled by total capital. The proportion of short-term debt is defined as the debt due in next three years divided by total capital. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: All firms

	High hedging need	Low hedging need
Shock year-2	-0.235	-0.415
	(0.573)	(0.671)
Shock year-1	Baseline	
Shock year	-0.015	-0.234
	(0.604)	(0.835)
Shock year+1	-0.274	-0.369
	(0.741)	(0.942)
Shock year+2	-0.325	1.168
	(0.795)	(1.042)
N	2167	1667
Nfirms	400	323
Adj-R2	0.023	0.039

Panel B: High hedging need firms

	Idiosyncratic shock	Systematic shock
Shock year-2	0.029	-0.273
	(0.944)	(0.740)
Shock year-1	Baseline	
Shock year	-0.647	0.409
	(0.794)	(1.049)
Shock year+1	-0.736	-0.491
	(1.129)	(1.105)
Shock year+2	-0.982	-0.217
	(1.193)	(1.236)
N	1162	1005
Nfirms	254	227
Adj-R2	0.015	0.039

Panel C: Low hedging need firms

	Idiosyncratic shock	Systematic shock
Shock year-2	-1.355	0.347
	(0.943)	(1.088)
Shock year-1	Baseline	
Shock year	-1.421	1.023
	(1.115)	(1.342)
Shock year+1	-1.355	0.578
	(1.271)	(1.499)
Shock year+2	0.388	2.241
	(1.449)	(1.487)
N	1002	665
Nfirms	218	144
Adj-R2	0.039	0.049

Appendix B: Supplementary Tests

Table B1: Change in debt priority around liquidity shocks using an alternative threshold

This table presents similar results as in Table 4, except that the cutoff for liquidity shocks is identified by firm cash-flows being half standard deviation below their industry average over the past five years. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: High hedging need firms

	Senior secured	Senior unsecured	Subordinated
Shock year-2	-1.600	1.541	-0.839
	(1.751)	(1.269)	(1.156)
Shock year-1		Baseline	
Shock year	4.267***	1.084	5.651***
	(1.576)	(1.120)	(1.348)
Shock year+1	3.592	2.025	10.032***
	(2.271)	(1.526)	(2.326)
Shock year+2	6.041**	0.243	9.164***
	(2.955)	(2.032)	(3.089)
N	574	574	574
Nfirms	134	134	134
Adj-R2	0.139	0.034	0.312
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	3.183*		4.567***
	(1.933)		(1.753)
Shock year+1	1.567		8.007***
	(2.736)		(2.782)
Shock year+2	5.798*		8.921***
	(3.586)		(3.697)

Panel B: Low hedging need firms

	Senior secured	Senior unsecured	Subordinated
Shock year-2	2.740	-2.864*	0.564
	(1.850)	(1.618)	(0.858)
Shock year-1		Baseline	
Shock year	4.375**	3.454**	-0.362
	(1.889)	(1.759)	(0.968)
Shock year+1	3.851	3.750*	-1.853
	(3.107)	(2.016)	(1.972)
Shock year+2	3.860	2.927	-5.557**
	(3.438)	(2.418)	(2.247)
N	442	442	442
Nfirms	128	128	128
Adj-R2	0.128	0.232	0.048
Test of priority spreading			
	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	0.921		-3.816
	(2.581)		(2.008)
Shock year+1	0.101		-5.603
	(3.704)		(2.820)
Shock year+2	0.933		-8.484
	(4.203)		(3.301)

Table B2: Change in net income and total debt around liquidity shocks for high hedging need firms

This table proves that, for high hedging need firms, net income falls but total debt rises around liquidity shock. The models in this table is entirely similar to the models in Panel A of Table 4, except that the dependent variables here are net income-total assets ratio and book leverage ratio. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

	Net income-total assets ratio	Book leverage ratio
Shock year-2	-0.097	-0.017
	(0.381)	(0.411)
Shock year-1	Baseline	
Shock year	-5.683***	3.150***
	(0.517)	(0.507)
Shock year+1	-3.793***	2.955***
	(0.583)	(0.566)
Shock year+2	-2.623***	2.272***
	(0.538)	(0.623)
N	2464	2465
Nfirms	421	421
Adj-R2	0.148	0.089

Table B3: Changes in priority structure - idiosyncratic vs. systematic liquidity shocks with 66% cutoff

This table conduct similar tests as in Table 6, except that the cutoff for identifying a systematic shock is 66% rather than 50%. In other words, a liquidity shock is a systematic shock if more than 66% of the firm's industry peers experience similar shock. Detailed definitions of relevant variables are in Appendix C. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively.

Panel A: High hedging need firms

	Idiosyncratic shock			Systematic shock		
	Senior secured	Senior unsecured	Subordinated	Senior secured	Senior unsecured	Subordinated
Shock year-2	-1.290*	0.819	-0.568	1.338	-1.937	-0.132
	(0.737)	(0.646)	(0.524)	(1.206)	(1.171)	(0.924)
Shock year-1		Baseline			Baseline	
Shock year	3.103***	0.762	2.750***	0.971	-0.694	3.108***
	(0.804)	(0.486)	(0.818)	(1.203)	(1.177)	(1.148)
Shock year+1	3.074***	0.544	2.595***	0.859	-0.995	6.774***
	(0.897)	(0.703)	(0.978)	(1.393)	(1.329)	(1.567)
Shock year+2	2.272**	0.235	3.354***	2.018	-1.406	8.559***
	(0.990)	(0.889)	(1.164)	(1.604)	(1.314)	(1.935)
N	1813	1813	1813	652	652	652
Nfirms	342	342	342	150	150	150
Adj-R2	0.106	0.150	0.106	0.086	0.148	0.041
Test of priority spreading						
	Senior secured > Senior unsecured		Subordinated > Senior unsecured	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	2.741***		2.388***	1.665		3.802***
	(0.939)		(0.951)	(1.683)		(1.644)
Shock year+1	2.730***		2.251**	1.854		7.769***
	(1.140)		(1.204)	(1.925)		(2.055)
Shock year+2	2.037*		3.119***	3.424**		9.965***
	(1.331)		(1.465)	(2.074)		(2.339)

Panel B: Low hedging need firms

	Idiosyncratic shock			Systematic shock		
	Senior secured	Senior unsecured	Subordinated	Senior secured	Senior unsecured	Subordinated
Shock year-2	-1.354	-0.181	-1.872**	-1.261	2.467	-0.714
	(1.065)	(0.837)	(0.742)	(1.567)	(1.886)	(1.532)
Shock year-1		Baseline			Baseline	
Shock year	1.930**	2.018**	1.943***	-1.272	-1.463	0.100
	(0.903)	(0.960)	(0.684)	(1.416)	(1.556)	(1.348)
Shock year+1	2.564**	2.606**	1.409**	-2.905	-1.800	0.515
	(1.242)	(1.208)	(0.857)	(1.774)	(2.856)	(1.940)
Shock year+2	0.864	2.563*	1.017	-2.722	-2.845	1.641
	(1.269)	(1.388)	(0.941)	(1.859)	(3.654)	(2.697)
N	1489	1489	1489	411	411	411
Nfirms	281	281	281	99	99	99
Adj-R2	0.067	0.201	0.114	-0.002	0.314	0.208
Test of priority spreading						
	Senior secured > Senior unsecured		Subordinated > Senior unsecured	Senior secured > Senior unsecured		Subordinated > Senior unsecured
Shock year	-0.088		-0.075	0.191		1.563
	(1.318)		(1.179)	(2.104)		(2.059)
Shock year+1	-0.042		-1.197	-1.105		2.315
	(1.733)		(1.481)	(3.362)		(3.453)
Shock year+2	-1.699		-1.546	0.123		4.486
	(1.881)		(1.677)	(4.100)		(4.542)

Appendix C: Variable Definitions

Notation	Description
Senior secured debt	Senior secured debt based on Capital IQ data
Senior unsecured debt	Senior unsecured debt based on Capital IQ data
Subordinated debt	Total debt-senior secured debt-subordinated debt, where total debt is the total amount of debt based on Capital IQ data
Used credit line	The amount of used credit lines based on Capital IQ data
Book leverage	Total debt / total assets
Market leverage	Total debt / [stock price×shares outstanding+total debt+preferred stock liquidation value-deferred taxes and investment tax credit]
Industry investment cash-flow correlation	3-digit industry annual average investment cash-flow correlation
HighHedge	Dummy of high hedging need firms, equal to 1 if a firm belongs to an industry with investment cash-flow correlation lower than the median, otherwise=0
Downgrade year	The year when a firm's long-term debt is downgraded from investment grade to junk status based on either S&P rating or Moody's rating.
Shock	Dummy of liquidity shock period, equal to 1 if for a given fiscal year, the firm's cash-flow is below the 3-digit industry average in the past five years, otherwise=0
Idiosyncratic shock	A liquidity shock is idiosyncratic if there are less than 5 firms in the same 3-digit industry, or less than 50% firms in the same industry experience a similar liquidity shock.
Systematic shock	A liquidity shock is systematic if there are at least 5 firms in the same 3-digit industry and at least 50% firms in the same industry experience a similar liquidity shock.
Equity	Stockholders' equity
Total capital	The sum of total debt and stockholders' equity
Ln(real total assets)	Natural logarithm of real total assets in 2002 dollars
MB	[Stock price×shares outstanding+total debt+preferred stock liquidation value-deferred taxes and investment tax credit] / book value of total assets
ROA	Operating income before depreciation / total assets
Tangibility	Net property, plant, and equipment / total assets
R&D	R&D expenses ratio, research and development expenses / total assets
R&D_Dum	Dummy of non-zero R&D ratio, equal to 1 if R&D expenses ratio is positive in year t-1, otherwise=0
Dividend_Dum	Dummy of dividend payers, equal to 1 if a firm has non-zero dividend payments in year t-1, otherwise=0
IndMed_Lev	Industry median of book leverage, equal to median of book leverage within a given industry based on Fama-French 49-industry classification
Default Spread	The difference in yields between Moody's Baa- and Aaa-rated corporate bonds
Term Spread	The difference in yields between Moody 10- and 1-year treasuries
Real Interest Rate	Real annual yield on 1-year treasury bills
Real Market Return	Real annual return on CRSP value-weighted index of stocks traded NYSE, AMEX, and Nasdaq
H-P LogGDP	Hodrick-Prescott filtered log real GDP
Payout	Equity payout ratio, (Dividend payouts+repurchases of stocks-issuance of stocks)/total assets at t-1
ΔCash	Change in cash, (cash holdings at t-cash holdings at t-1)/total assets at t-1
CAPX	Capital expenditure ratio, capital expenditures/total assets
Cash-flow	income before extraordinary items/total assets