The Financial Premium*

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Abstract

We show that bonds issued by financial firms have higher spreads than bonds issued by industrial firms with the same rating and maturity, and we denote this difference the financial premium. During the period 1987–2020 the premium was on average 43bps in the U.S. corresponding to a 31% higher spread and the premium is higher for lower ratings and in financial crises. Furthermore, the premium relates to beta, measures of systemic risk, and predicts economic activity. We derive a model that explains the empirical results: banks hold a diversified portfolio of corporate bonds (loans) and bank bonds therefore reflect more systematic risk than the individual corporate bonds.

Keywords: Credit Spreads, Risk Premia, Financial institutions, Systemic risk

JEL: C23; G12

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1 Introduction

Corporate bond spreads are important predictors of economic activity, recessions, investments, equity and debt issuance[1]. Studies that establish the predictive content of corporate credit spreads, however, disregard a significant part of the market: bonds issued by financial institutions. There are sound reasons for excluding financial bonds such as the complex liability side of financial institutions and the difficulty in measuring their leverage. Yet, excluding bonds issued by financial firms leaves out the majority of the corporate bond market[2] and in fact we know very little about how these bonds are priced. This paper extensively examines the pricing of financial bonds.

We show that financial bonds trade at a higher yield than similarly rated industrial bonds and this result is remarkably robust across ratings and maturities. In fact, financial bonds stand out compared to all other broad industry sectors, whose yields are comparable to each other, but not to financial bonds. We refer to the extra yield of financial bonds as *the financial premium*. We show that the premium is higher during financial crises, higher for lower rated bonds, strongly related to bond betas, and highly related to existing systemic risk measures. Furthermore, consistent with the unique role that the financial sector plays in economic cycles, we find the financial premium adds predictive power when forecasting key macroeconomic variables above and beyond the power already established for non-financial bonds in Gilchrist and Zakrajsek (2012).

We show in a simple model that a financial premium arises naturally in a world where non-financial firms with assets modelled as in Merton (1974) issue corporate bonds, and the assets of financial firms are diversified portfolios of corporate debt. Firms choose a leverage ratio such that they have a given default probability (or expected loss) and their spreads have a simple expression as derived in Chen, Collin-Dufresne, and Goldstein (2009). We then derive a simple closed-form solution for the financial premium, i.e., the additional yield

[1] Gertler and Lown (1999), Gilchrist, Yankov, and Zakrajsek (2009); Gilchrist and Zakrajsek (2012), Gilchrist, Sim, and Zakrajsek (2014), Lopez-Salido, Stein, and Zakrajsek (2017), among others.

[2] In 2021, the value of U.S. bonds issued by financial firms was three times larger than the total value of equity issued in the economy and larger than the combined value of all bonds issued by non-financial firms: According to SIFMA (2022) total equity issuance was USD436.2 billion in 2021 while it was USD1,223 (925) billion for financial (nonfinancial) according to the Board of Governors of the Federal Reserve system (https://www.federalreserve.gov/data/corpsecure/current.htm).

of a financial firm issuing bonds with the same default probability (or expected loss) as a non-financial issuer. The financial premium is strictly positive, because the non-financial bond spread reflects both idiosyncratic and systematic risk, whereas the financial spread because of loan portfolio diversification reflects only systematic risk.

Empirically, we find that U.S. financial firms on average have higher ratings and shorter maturities than U.S. industrial firms and controlling carefully for these differences is essential when comparing financial spreads to industrial spreads. A simple average of credit spreads in the period 1987-2020 is 138bps for financials and 201bps for industrials. However, once we compare average spreads for a given rating and broad maturity group, financial spreads are always higher than industrial spreads.

We extract a single measure of the financial premium by estimating the cross-sectional regression

$$s_{itj} = \beta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj}, \tag{1}$$

where s_{itj} is the credit spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains bond liquidity control variables and μ_{mrt} is a month-rating-maturity fixed effect. The coefficient β is the financial premium and measures the average yield difference between a financial and industrial bond after controlling for maturity, rating, bond liquidity, and a time-fixed effect. The estimated financial premium in our sample period is substantial at 43bps corresponding to 31% of the average industrial spread. We also estimate the regression in subsamples in which bonds are restricted to having the same rating or fall within the same broad maturity category, or both. We find that the premium is higher for lower rated bonds consistent with the predictions of our model.

Furthermore, we compare 25 pairs of eight broad industry groups within industrial and utility firms and find that the premium of one group relative to another is typically small and statistically insignificant. In contrast, the premium of the financial industry to any of the industry groups is large and highly statistically significant. This shows that a sizeable industry premium is unique to financial institutions. Furthermore, we show that the premium is similar when we control for potential differences in loss rates of financial and industrial

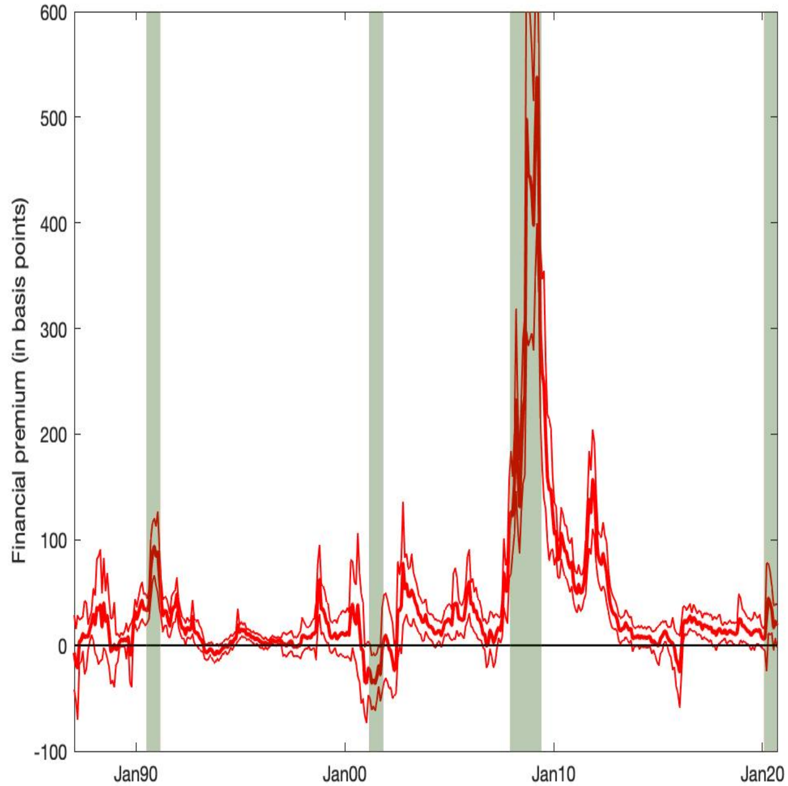

Fig. 1 *The financial premium.* For each month in the sample, we estimate the regression $s_{ij} = \beta 1_{fin,j} + \gamma' X_i + \mu_{mr} + \epsilon_{ij}$, where s_{ij} is the yield spread in the month of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains control variables and μ_{mr} is a rating-maturity fixed effect. The control variables are coupon, bond age, and log(amount issued). The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., B, B-, C). The figure shows the time series of β with a 99% confidence band. The shaded areas are NBER recessions.

firms.

We extract a time series of the financial premium by estimating monthly cross-sectional regressions and as Figure 1 shows there is substantial variation over time. The premium spikes during the savings and loan crisis in 1991 and the financial crisis in 2008 while there is no noticeable increase during the 2001 and 2020 recessions caused by the bursting of the dotcom bubble and the covid crisis. Thus, the premium spikes during financial crises but not during general recessions, consistent with the interpretation as a measure of the health of financial institutions.

Finally, we follow Gilchrist and Zakrajsek (2012) [GZ] and predict economic activity with the financial premium. The premium has substantial predictive power for unemployment, industrial production and GDP and the predictive power persists after including the GZ spread and their excess bond premium, showing that financial bonds contain information orthogonal to the information in industrial bonds.

There is a large literature on credit spreads and the vast majority of studies of the corporate bond market exclusively focus on non-financial bonds (Eom, Helwege, and Huang (2004), Huang and Huang (2012), Chen, Collin-Dufresne, and Goldstein (2009), Bao and Hou (2017), Feldhütter and Schaefer (2018), Chen, Cui, He, and Milbradt (2018), and many others). We therefore have extensive knowledge about the size and variation of industrial corporate bond spreads. Furthermore, the commonly used Moody's BBB–AAA spread is based on industrial bonds. In contrast, our understanding of financial bond spreads is limited. Duffee (1998), Elton et al. (2001), and Campbell and Taksler (2003) are notable exceptions, but their focus is on understanding corporate bond prices overall, while our focus is on understanding differences in pricing between financial and industrial bonds. Theoretically, Gornall and Strebulaev (2018), and Nagel and Purnanandam (2020) also model the asset values of financial institutions and are important contributions to understanding the risk of financial firms better. Our focus is on comparing financial spreads to industrial spreads and we derive a closed-form solution for the financial spread.

The organization of the paper is as follows: Section 2 presents the model and the theoretical results. Section 3 presents the data and Section 4 the empirical results. Section 5 presents further results and robustness checks and Section 6 concludes.

2 The model

The overall goal is to quantify and explain spreads on bonds issued by financial firms which we think of as banks whose asset side consists of loans made to firms. We follow Gornall and Strebulaev (2018), and Nagel and Purnanandam (2020) and model the asset side as a large homogeneous loan portfolio (see Vasiček (1991)) noting that an asset side consisting of loans has an asymmetric distribution: the maximum pay-off of each loan is the face value (plus coupons) giving a bounded upside in contrast to the pay-off of firm assets. Our goal is to develop a closed form solution for the financial premium, i.e., the difference between a corporate bond and a financial bond of the same rating. We will assume throughout that rating can be mapped to an expected loss which most closely resembles Moody's rating approach, but we could perform the same analysis using a mapping from probabilities of default to ratings.

First we look at the loans that constitute the assets of the bank. The loan of an individual firm is modelled through a standard Merton model with fixed recovery of face value in default. We will use a CAPM version of the Merton model to capture systematic and non-systematic risk and assume that the market portfolio evolves under the physical measure P as

$$dV_m(t) = \mu_m V_m(t)dt + \sigma_m V_m(t)dW_0(t), \tag{2}$$

where W_0 is a standard Brownian motion. The asset value of firm i evolves (also under P) according to

$$dV_i(t) = \mu V_i(t)dt + V_i(t)(\beta\sigma_m dW_0(t) + \nu dW_i(t)). \tag{3}$$

W_i is also a standard Brownian motion independent of all Brownian motions driving the market and other firms. The total volatility of firm i's assets is therefore

$$\sigma = \sqrt{(\beta\sigma_m)^2 + \nu^2} \tag{4}$$

and all firms have a common drift term μ given from CAPM as

$$\mu - r = \beta(\mu_m - r),$$

where we assume a constant riskfree interest rate r. The firm's total debt is a zero-coupon bond with face value D^i and we assume that a loan issued by the firm is either the entire loan or a fraction of the face value which is pari passu with the entire structure. We assume an exogenous common recovery R_f on loans, and using the Merton model with exogenous recovery, the price at time 0 per unit of principal of a loan maturing at T is given as

$$B_0^i = E^Q \left(\exp(-rT)\left(1_{\{V^i(T)>D^i\}} + R_f 1_{\{V^i(T)<D^i\}}\right)\right) \tag{5}$$
$$= \exp(-rT)[R_f + (1-R_f)\Phi(d_2(r,\sigma;L_0^i))], \tag{6}$$

where

$$d_2(r,\sigma;L_0^i) = \frac{-\log(L_0^i) + (r - \frac{\sigma^2}{2})T}{\sigma\sqrt{T}}, \tag{7}$$

$L_t^i = \frac{V^i(t)}{D^i}$, and Φ is the standard normal distribution function.

The risk-neutral probability of default is given as

$$Q(L_T^i < 1) = \Phi\left(-d_2(r,\sigma,L_0^i)\right), \tag{8}$$

and the physical probability of default is given by

$$P(L_T^i < 1) = \Phi\left(-d_2(\mu,\sigma,L_0^i)\right). \tag{9}$$

Assume that firm i targets a certain default probability p_i compatible with a given rating. The firm's choice of leverage $L_0(p_i)$ (through choosing D^i) then solves

$$\Phi^{-1}(p_i) = -d_2(\mu,\sigma;L_0)$$

and the leverage is given as

$$L_0(p_i) = \exp\left(\sigma\sqrt{T}\Phi^{-1}(p_i) + (\mu - \frac{\sigma^2}{2})T\right). \tag{10}$$

Plugging the value $L_0(p_i)$ into the expression for the risk-neutral probability in equation (8), we obtain

$$q(p_i) = \Phi\left(s\sqrt{T} + \Phi^{-1}(p_i)\right) \tag{11}$$

where

$$s := \frac{\mu - r}{\sigma}$$

is the asset Sharpe ratio. This corresponds to the expression in Chen, Collin-Dufresne, and Goldstein (2009) linking empirical and risk neutral default probabilities.

In summary, plugging the risk neutral probability (11) into the expression for the bond price in equation (5), we get the value per unit notional of a single zero-coupon debt issue with notional D^i chosen to target a default probability of p_i. Note that the risk neutral probability, and hence the value of the loan, depends not only on the default probability, but also on asset beta and the volatility parameters. Even if the value of debt in a Merton model is a function of total volatility only, two firms with the same total volatility can have different spreads, because their drift terms will differ if their betas are different, and therefore the leverage consistent with a certain default probability will be different.

We now imagine that a bank's asset side consists of a large number of identical firm loans with default probability p_f on its balance sheet. Specifically, we assume that the payoff distribution of the bank's assets follows the large homogenous portfolio approximation, as in Vasiček (1991), so that the distribution of the fraction F of loans that default before maturity T is given as

$$P\left(F \leq x\right) = \Phi\left(\frac{1}{\sqrt{\rho}}\left(\sqrt{1-\rho}\,\Phi^{-1}(x) - \Phi^{-1}(p_f)\right)\right) \tag{12}$$

and the risk-neutral equivalent is

$$Q\left(F \leq x\right) = \Phi\left(\frac{1}{\sqrt{\rho}}\left(\sqrt{1-\rho}\,\Phi^{-1}(x) - \Phi^{-1}(q(p_f))\right)\right) \tag{13}$$

where ρ is the correlation between log asset values of the different firms that have issued loans, i.e.,

$$\rho = \frac{\beta^2\sigma_m^2}{\sigma^2},$$

and $q(p_f)$ is given in equation (11). The bank issues debt with a face value of D^b. Assume without loss of generality that the total notional amount of loans on the bank's asset side is 1. So think of D^b as smaller than (but not far from) 1. When the fraction F of loans default before maturity, the pay-off to bank assets at maturity T is

$$V^b(T) = 1 - F(1 - R_f).$$

Hence there is default on bank debt when

$$1 - F(1 - R_f) < D^b,$$

i.e., when

$$F > \frac{1 - D^b}{1 - R_f}.$$

Note that only the case $R_f < D^b$ is interesting or there is no default risk on the bank's debt.

Assume that the bank targets a default probability of p_b. The face value of bank debt $D^b(p_b, p_f)$ (that depends on the bank's target default probability and the underlying loans' default probability) satisfies

$$p_b = P\left(F > \frac{1 - D^b}{1 - R_f}\right) \tag{14}$$

and the solution can be derived as

$$D^b(p_b, p_f, R_f) = 1 - (1 - R_f)\Phi\left(\frac{\Phi^{-1}(p_f) - \sqrt{\rho}\Phi^{-1}(p_b)}{\sqrt{1-\rho}}\right). \tag{15}$$

We now have the debt threshold for a bank targeting p_b based on the loans' default probability p_f. We also have the associated risk neutral default probability q_b by inserting (14) into (13) and noting that $\Phi(x) = 1 - \Phi(-x)$,

$$q_b(p_b, p_f, R_f) = \Phi\left(\frac{-1}{\sqrt{\rho}}\left(\sqrt{1-\rho}\Phi^{-1}\Big(\frac{1 - D^b(p_b, p_f, R_f)}{1 - R_f}\Big) - \Phi^{-1}(q(p_f))\right)\right). \tag{16}$$

Inserting the expression for the debt threshold (15) into equation (16) we get

$$q_b(p_b, p_f, R_f) = \Phi\left(\frac{1}{\sqrt{\rho}}\left(\Phi^{-1}(q(p_f)) - \Phi^{-1}(p_f)\right) + \Phi^{-1}(p_b)\right),$$

and since

$$\Phi^{-1}(q(p_f)) - \Phi^{-1}(p_f) = \sqrt{\rho}s_m\sqrt{T}$$

we have

$$q_b(p_b, p_f, R_f) = \Phi\left(\Phi^{-1}(p_b) + s_m\sqrt{T}\right).$$

We are now in a position to express the bond yields for the case where both firm loans and bank debt have the common physical default probability p:

Proposition 1. *Assume that bank assets consist of a large number of loans, so that the fraction F of loans that default have physical and risk neutral distributions given as in (12) and (13), respectively. Assume that each individual loan is priced according to (5). Both firm and bank debt are zero-coupon, mature at date T, and have common exogenous recovery rate R. When the physical default probability of bank debt and loans are the same and equal to p, we have that*

1. *The yield-to-maturity of firm debt is*

$$y_f^T(p) = -\frac{1}{T}\log\left(1 - (1-R)\Phi\left(\Phi^{-1}(p) + \sqrt{\rho}s_m\sqrt{T}\right)\right).$$

2. *The yield-to-maturity on bank debt is*

$$y_b^T(p) = -\frac{1}{T}\log\left(1 - (1-R)\Phi\left(\Phi^{-1}(p) + s_m\sqrt{T}\right)\right).$$

Proof. For a loan (or a bond) with principal 1, risk neutral probability of default q, recovery rate R and time to maturity T the (continuously compounded) yield spread is given as

$$y_T = -\frac{1}{T}\log\left(1 - (1-R)q\right). \tag{17}$$

We have already derived the risk neutral probability of the bank before the proposition, and 1 follows from the observation that $s_i = \sqrt{\rho}s_m$. $\square$

We will define the financial premium as the yield difference between two types of bonds (firm debt and bank debt) with the same physical default probabilities. The yield difference arises because they have different risk-neutral probabilities, as shown above.

The fact that the risk-neutral default probability of bank debt does not depend on the composition of firm loans on its asset side, allows us to define the *financial premium* as the difference in yields between bank debt and firm debt with the same physical default probability:

Definition 1. *The financial premium $f_T(p)$ for maturity T is the difference in yield spread $y_T^b(p) - y_T^f(p)$ between bank debt and firm debt with maturity T when both have actual default probability p and recovery rate R:*

$$f_T(p) = y_T^b(p) - y_T^f(p) \tag{18}$$

The financial premium has the following properties:

Proposition 2. *Under the assumptions in Proposition 1, the financial premium given in equation* (18) *is*

1. *positive*

2. *increasing in p on the interval $(0, p^*)$ where p^* solves*

$$\frac{\phi\left(\Phi^{-1}(p^*) + s_m\sqrt{T}\right)}{\phi\left(\Phi^{-1}(p^*) + \sqrt{\rho}s_m\sqrt{T}\right)} = \frac{1-(1-R)q_b}{1-(1-R)q_f}.$$

Proof. Throughout the proof, we use the shorthand notation

$$\begin{aligned} q_b &= \Phi\left(\Phi^{-1}(p) + s_m\sqrt{T}\right) \\ q_f &= \Phi\left(\Phi^{-1}(p) + \sqrt{\rho}s_m\sqrt{T}\right). \end{aligned}$$

Since $\sqrt{\rho} \leq 1$, we immediately have that $q_b \geq q_f$, proving 1. For the second statement we analyze the derivative of $y_T^b(p, R_b) - y_T^f(p, R_f)$, with respect to p.

The derivative of the financial premium with respect to p is given as

$$\frac{1}{T}\left(\frac{1-R}{1-(1-R)q_b}\frac{dq_b}{dp}-\frac{1-R}{1-(1-R)q_f}\frac{dq_f}{dp}\right)$$

and this is positive precisely when

$$\frac{\frac{dq_b}{dp}}{\frac{dq_f}{dp}} > \frac{1-(1-R)q_b}{1-(1-R)q_f}.$$

The factor $\frac{d}{dp}\Phi^{-1}(p)$ cancels out from both derivatives on the left hand side, and we therefore get the condition

$$\frac{\phi\left(\Phi^{-1}(p)+s_m\sqrt{T}\right)}{\phi\left(\Phi^{-1}(p)+\sqrt{\rho}s_m\sqrt{T}\right)} > \frac{1-(1-R)q_b}{1-(1-R)q_f}.$$

The right hand side is smaller than 1 (because $q_b > q_f$), and the left hand side is greater than one for small p and decreases monotonically in p because the function $\phi(x)/\phi(x-h)$ is decreasing in x. This proves our result 2.

□

The necessary condition in statement 2 is not overly restrictive. For example, assuming $s_m = 0.4, \sigma = 0.23, \rho = 0.3, R = 0.4$ and $T = 5$, the financial premium is increasing for all default probabilities less than $p^* = 37\%$.

This corollary has consequences even for variations in the financial premium within a given rating class. Ratings are not mapped to default probabilities exactly. In fact, rating agencies rate 'through-the-cycle' which effectively means that they aim at ranking firm debt correctly according to default probability in the cross-section, but accept that in crisis periods, default probabilities are higher for a given rating than in normal times. In particular, this implies that, for reasonable levels of the default probability, the financial premium should increase in crisis times.

We have stated the theorem for a case where physical default probabilities and recovery rates on the two types of debt are the same. It is possible also to analyze a situation where we keep the expected losses of bank debt and loans the same, i.e, assume that $p_f(1-R_f) = p_b(1-R_b)$. The analysis will be notationally more cumbersome, and we argue in Appendix

B that the effect on the financial premium is small.

We next define the excess beta as the difference in beta of bank debt and firm debt:

Proposition 3. *Define the* excess beta *corresponding to a given rating as the difference between the instantaneous return betas of bank debt and firm debt with the same default probability. The excess beta is given as*

$$\beta_b(p)-\beta_f(p)=\frac{1-R}{\sigma\sqrt{T}}\left(\frac{\phi(\Phi^{-1}(p)+s_m\sqrt{T})}{1-(1-R)\Phi(\Phi^{-1}(p)+s_m\sqrt{T})}-\frac{\phi(\Phi^{-1}(p)+\sqrt{\rho}s_m\sqrt{T})}{1-(1-R)\Phi(\Phi^{-1}(p)+\sqrt{\rho}s_m\sqrt{T})}\beta_V\right) \tag{19}$$

Proof. The proof follows by applying Ito's formula to obtain the dynamics for bond price processes, convert to return processes (whose quadratic covariation with the market portfolio return determines beta), and noting that the derivative of the risk neutral probability with respect to firm asset value satisfies

$$\frac{d}{dV}q_f(b)=\frac{-1}{\sigma V\sqrt{T}}\frac{\phi(\Phi^{-1}(p)+\sqrt{\rho}s_m\sqrt{T})}{\Phi(\Phi^{-1}(p)+\sqrt{\rho}s_m\sqrt{T})}$$

and similarly for the bank bond risk neutral probability derivative with respect to the market portfolio value. □

In Figure 2 we plot the financial premium as a function of excess beta for a typical choice of parameters (given in the caption). We note that the relationship is close to linear within a reasonable range of excess betas and default probabilities observed empirically[3].

3 Data

Corporate bond yield spreads

We use several sources to arrive at our U.S. corporate bond data set for the period January 1987 to September 2020. For the period January 1987 to December 1996 we use monthly data from the Lehman Brothers Fixed Income Database and include only actual quotes. For the period January 1997 to June 2002, we use quotes provided by Merrill Lynch (ML) on

[3]Mathematically, monotonicity breaks down for sufficiently high default probabilities.

all corporate bonds included in the ML investment grade and high-yield indices. For each bond-month we use the last quote in the month. For the period July 2002-September 2020 we use transactions data from TRACE and filter transactions according to Dick-Nielsen (2009, 2014) and focus on transactions with a volume of $100,000 or more. When using TRACE we use the last observed transaction in the month.

Bond information

We obtain bond information from the Mergent Fixed Income Securities Database (FISD) and limit the sample to senior unsecured fixed rate or zero coupon bonds. We exclude bonds that are convertible, putable, perpetual, foreign denominated, have sinking fund provisions, or have a fixed-price call provision.[4] Also, we exclude corporate bonds issued by financial institutions in 2008-2009 that were issued under a debt guarantee program administered by the Federal Deposit Insurance Corporation (see Lewis and Petrasek (2019)). We restrict our sample to bonds with a maturity of more than 6 months (because market microstructure noise can have a significant impact on the calculated yields on short maturity bonds) and less than 10.5 years. Furthermore, we winsorize credit spreads at the 1% and 99% level.

Riskfree rates

We calculate corporate bond yield spreads relative to the swap rate and use on a given date the available rates among the 1-week, 1-month, 2-month, and 3-month LIBOR and 1, 2, 3 ,4 ,5 ,6, 7, 8, 9, 10, 12-year swap rates and linearly interpolate to obtain a swap rate at the exact maturity of the bond.

Default and recovery data

Data on defaults and recovery rates are from Moody's Analytics' Default and Recovery Database (DRD v2.0). In the period from 1919 to 2018, the database contains rating history for 27,750 unique firms and 11,024 default events. There are four events that constitute a debt default: a missed interest or principal payment, a bankruptcy filing, a distressed exchange, and a change in the payment terms of a credit agreement or indenture that results in a diminished financial obligation. Soft defaults ('dividend omission' and 'BFSR default') appear in the database, but we follow Moody's and exclude these when calculating default

[4] For bond rating, we use the lower of Moody's rating and S&P's rating. If only one of the two rating agencies have rated the bond, we use that rating. We track rating changes on a bond, so the same bond can appear in several rating categories over time.

and recovery rates. 'Industrial' includes the broad industry 'industrial' while 'financial' includes the broad industries 'banking' and 'finance'. The database includes information on the (latest) company industry and domicile.

4 Empirical analysis

4.1 A first look at the data

Table 1 shows statistics for the bond sample. There is a total of 3705 firms in the sample distributed among 1142 financial firms and 2564 industrial firms. Within each rating class the average spread for financial firms is higher than for industrial firms; for example the average BBB spread is 160bps for financial firms and 122bps for industrial firms. The average spread of 201bps for industrial firms is substantially higher than the average spread 138bps for financial firms. There are several reasons for this. Most importantly, financial firms typically have a higher rating than industrial firms as Figure 3 Panel A shows. Furthermore, we see in Figure 3 Panel B that financial firms issue shorter maturity bonds and – at least for investment grade firms in normal times – yield spreads are increasing in maturity. Thus, treating maturity and rating carefully is important when comparing spreads of financial and industrial firms. Table 2 shows the 20 financial and industrial firms with the highest number of transactions in our sample. The top financial firms fall in two broad categories, large banks and investment banks such as Bank of America, Morgan Stanley, Goldman Sachs, Merrill Lynch and Citigroup and finance holding subsidiaries of large industrial firms such as General Electrics, General Motors, Ford, Caterpillar and John Deere. The top industrial firms include well-known large firms like Walmart, IBM, Disney, Philip Morris, Pepsi and McDonalds. In Table 3 we take a closer look at the term structure of credit spreads in different periods. We group bond maturity into 0.4-3.5 years (short), 3.5-6.5 years (medium) and 6.5-10.5 (long) and calculate the average spread within a rating group. Specifically, we calculate for each month the average spread for a given rating and maturity bracket and compute the time series average. The table shows that over the whole sample period, the average spread of financial firms is higher than that of industrial firms for all ratings and maturities. For subsamples the financial spread is also significantly positive or insignificant (with a single exception). While Table 3 sorts on rating and maturity, the sorting is coarse and this may for example explain the significantly negative speculative long-term spreads for the period 1998-2007 as there may still be non-trivial maturity and rating differences within the group. Next, we therefore extract the spread difference between financials and industrials in an efficient way taking these differences carefully into account.

4.2 The financial premium

We extract a single measure of the financial-industrial spread and call it the *financial premium*. Specifically, we estimate the regression

$$s_{itj} = \beta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj} \tag{20}$$

where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains control variables and μ_{mrt} is a month-rating-maturity fixed effect. The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., CCC, CCC-, CC, C). The coefficient β is the financial premium and measures the average yield difference between a financial and industrial bond in the same month with the same maturity and same rating.[5] We adjust for potential price effects due to differences in bond liquidity by including coupon, bond age and log(amount issued) in the control variables X.[6]

Table 4 shows that over the whole sample period 1987–2020 and using all bonds the financial premium is 43bps and highly statistically significant (standard errors are clustered at the firm level). Economically, the premium is significant as well, with the premium being 31% of the average industrial spread. We also run regression (20) on subsamples divided into rating and/or maturity. We see that while the premium is substantially larger during the financial crisis 2007-2010 it is economically and statistically significant outside the

[5] The calculation of the financial premium is similar to Liao (2020)'s approach of estimating differences in the credit spreads of bonds of similar risk but different currency denomination.

[6] See Bao, Pan, and Wang (2011), Houweling, Mentink, and Vorst (2005) and Dick-Nielsen, Feldhütter, Pedersen, and Stolborg (2023) and the references therein for a detailed discussion of liquidity proxies.

crisis at 23bps. Furthermore, the premium is positive for all periods and ratings, typically with strong economic and statistical significance. This is consistent with Proposition 2's first prediction that the financial premium is positive for all levels of credit risk and all maturities. Consistent with Proposition 2's second prediction the premium is higher for lower rated bonds with higher default probabilities: the premium increases monotonically from 18bps for AAA to 83b for speculative grade bonds.

Figure 1 plots the time series of the premium where we have estimated regression (20) on a monthly basis. There is substantial variation in the premium and it typically increases during recessions – the shaded areas. An exception is the 2001 recession which was partly due to a price bubble in internet firms during the dotcom bubble. As we show in Section 5 the negative premium during this recession is largely due to rating agencies' slow update of ratings.

The spikes in the financial premium during recessions is empirical evidence backing the model's implication that financial spreads are higher because financial firms are more exposed to systematic risk. Further evidence is given in Table 5 showing correlations between systemic risk measures and the financial premium. Panel A shows pairwise correlations calculated for the longest possible time series using monthly data while Panel B show the same with NBER recessions excluded from the time series. SRISK is for the US financial system (Brownlees and Engle 2017) as available from the NYU Volatility Lab, the Systemic Risk Indicator is published by the Cleveland Federal Reserve Bank following Saldias (2013), the Excess Bond Premium is from Gilchrist and Zakrajsek (2012), the Corporate Bond Market Distress Measure is from Boyarchenko, Crump, Kovner, and Shachar (2022), and VIX is the CBOE volatility index. In general, the financial premium is highly correlated with other systemic risk measures while also containing a unique component. The financial premium has the highest correlation with the corporate bond market distress measure, which is derived from the corporate bond market. The correlations between the financial premium and systemic risk measures remain high when excluding recessions, and, thus, they are not driven exclusively by the common spikes during recessions but also by covariation outside recessions.

4.3 Industry premiums

Is the financial industry special in having high spreads? To answer this question we calculate for any pair of industries – where both industries have at least 300 bonds in the sample – the premium β in regression (20) where we restrict the sample to bonds issued by firms in the two industries (industry is classified using Mergent FISD's two-digit industry code). While we focus on financial and industrial firms in other analyses, we include utility firms in this analysis to get a broader view of industry premiums. Table 6 shows that the financial industry clearly stands out: the average premium relative to other industries is 47bps, while the second-highest absolute premium of any other industry is 15bps, more than three times smaller.[7] Furthermore, the smallest industry difference for finance is 36bps (relative to Media/Communications) and this is substantially higher than the largest industry difference outside finance of 26bps (Media/Manufacturing relative to Service/Leisure).

Although most industry pairs outside of finance have statistically insignificant premiums, an exception is Media/Communications where spreads are significantly higher than five other industries. This may be explained by lower recovery rates in this industry: Jankowitsch et al. (2014) report an average recovery rate for Media/Communications of 34.70% compared to an overall average of 38.61%.

4.4 Bond betas

Our model predicts that a financial bond has a higher beta than an industrial bond with same loss rate, i.e. excess beta is positive, and there is an approximate linear relation between excess beta and financial premium. To test if this is the case, we calculate a financial excess beta by estimating the regression

$$\beta_{itj} = \eta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj} \tag{21}$$

[7] In the table we do not include the controls as this makes the results symmetric, i.e. if industry i's premium to industry j is X then industry j's premium to industry i is -X. Results are similar if we include controls.

where β_{itj} is the beta in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains control variables and μ_{mrt} is a month-rating-maturity fixed effect. The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., CCC, CCC-, CC, C). We calculate the individual bond beta β_{itj} as the slope coefficient in a linear regression of the bond excess return on the corporate bond market excess return[8].

The bond beta-regression in Equation (21) is the same as when we calculate the financial premium except that we have the bond beta on the left-hand side instead of the credit spread. We denote the regression coefficient η for the financial excess beta.

Table 8 shows that when we estimate the regression equation (21) using all bonds in the sample, the excess beta is positive at 0.10 – and highly statistically significant – consistent with the predictions of the model. Overall, the annual bond market excess return is 5.4% in our sample period and an excess beta of 0.10 implies, using a back-of-the-envelope calculation, that a financial bond has an expected annual return that is 0.1*5.4% = 0.54% (54bps) higher than an industrial bond with the same loss rate, close to the overall estimated financial premium of 0.43% (43bps). The table also shows that when we estimate the regression on subsamples of the data where we restrict the rating and/or maturity, all statistically significant excess betas (16 out of 20) are positive, showing that a positive excess beta is robust across credit quality and bond maturity.

Figure 4 shows for each subsample, restricted on maturity and rating, the excess beta and financial premium.[9] The figure shows that there is a relation between the financial premium and excess beta. The figure also shows the regression line of the regression

$$fp_{r,m} = \eta_0 + \eta_1 \beta_{r,m} + \epsilon_{r,m}, \tag{22}$$

[8]We use a rolling window of the latest 36 months bond excess returns and we only calculate the beta if there are at least 24 months with bond returns. The betas are winsorized at 1% and 99%. The excess return is calculated relative to the return of a one-month Treasury bill. Bond returns are calculated and cleaned as in Dick-Nielsen, Feldhütter, Pedersen, and Stolborg (2023) and the bond market return is the (market) value-weighted return of all bonds present in the sample defined in Dick-Nielsen, Feldhütter, Pedersen, and Stolborg (2023).

[9]To compare apples with apples, we use only bond-month observations where we observe both the spread and beta and therefore the results for the financial premium are slightly different than those in Table 4.

where $fp_{r,m}$ ($\beta_{r,m}$) is the financial premium (excess beta) of the sub sample with rating r and maturity m. The regression results in the estimates

$$fp_{r,m} = \underset{(4.04)}{0.59} + \underset{(38.44)}{389.74^{***}}\beta_{r,m}, \qquad R^2 = 0.88, \tag{23}$$

where the numbers in parentheses are standard errors and the high R^2 of 0.88 confirms the close relation between the financial premium and excess beta.

4.5 Firm premiums

Not all financial firms are created equal and to see if there are substantial differences in firms' premium, we calculate a firm specific premium by computing the regression (20) using a single financial firm and all industrial bonds. We do this for all financial firms that have at least 30 bonds in our sample, a total of 43 firms, and Table 7 Panel A shows the top-5 firms. The top-5 consists of four large banks (UBS, Citigroup, Credit Suisse, and Barclays), and one one aircraft lessor, International Lease Fin Corp. Panel B shows that the bottom-5 is dominated by financial subsidiaries of industrial companies and they have a single-digit financial premium.

The top-5 and bottom-5 suggest that there are systematic differences in the premium of banks and financial subsidiaries of industrial firms and we explore this further in Panel C. For the same 43 financial firms, we manually categorize them into banks, financial subsidiaries of industrial firms ('capital arm'), insurance, and others, and the panel shows that both banks and insurance companies have a financial premium that is twice as large as that of capital arms[10]. This shows that bonds of financial arms are priced in-between industrial and financial bonds.

4.6 Forecasting economics activity

Gilchrist and Zakrajsek (2012) find that corporate bond spreads and in particular spreads adjusted for expected loss – the excess bond premium – predicts economic activity. Our

[10]Note that the firms with many bonds have a financial premium that is higher on average than firms with few bonds and therefore the premia in Panel C and D are higher than the premium for the full sample.

model provides a framework for understanding the elements driving their decomposition. They use an average of industrial spreads, where the industrial spread in our model is given as

$$s^{ind} = -\frac{1}{T}\log\left(1 - (1-R)\Phi\left(\Phi^{-1}(p^{ind}) + \sqrt{\rho}s_m\sqrt{T}\right)\right) \tag{24}$$

and decompose the spread into an expected loss component

$$EL = -\frac{1}{T}\log\left(1 - (1-R_i)p^{ind}\right) \tag{25}$$

and an excess bond premium

$$EBP = s^{ind} - EL. \tag{26}$$

Our financial premium calculates the difference between the spread of financial firms, given in our model as

$$s^{fin} = -\frac{1}{T}\log\left(1 - (1-R)\Phi\left(\Phi^{-1}(p^{fin}) + s_m\sqrt{T}\right)\right) \tag{27}$$

and the spread of industrial firms in equation (24). There are two reasons why our measure may contain additional information about economic activity. First, if banks are in distress, their leverage increases and their average default probability p_{av}^{fin} goes up, leading to a higher financial premium as shown in Proposition 2. Note that in the calculation of the premium, the banks are now compared to industrials with the same higher default probability. To the extent that firms maintain the same default risk, the excess bond premium will not change. In contrast, if there is an economic crisis unrelated to the financial system, p_{av}^{fin} is unchanged, but firms are in distress, i.e. higher p_{av}^{ind}. In this case there is no change in the financial premium but the excess premium goes up. Thus, the excess bond premium captures economic crises while the financial premium captures financial crises.

Second, the excess bond premium involves calculating the loss rate for every bond-month and this computation involves estimates based on historical data in combination with using the Merton model. This involves both estimation risk and model risk and leads to a partially backward-looking measure. In contrast, the financial premium is entirely forward-looking as it is a difference between bond spreads observable in the market.

We follow Gilchrist and Zakrajsek (2012) and estimate the following univariate forecasting specification:

$$\nabla^h Y_{t+h} = \alpha + \Sigma_{i=1}^{p} \nabla Y_{t-i} + \gamma_1 TS_t + \gamma_2 RFF_t + \gamma_3 FP_t + \epsilon_{t+h} \tag{28}$$

where $\nabla^h Y_{t+h} \equiv \frac{c}{h+1} \ln\left(\frac{Y_{t+h}}{Y_{t-1}}\right)$, $h \leq 0$ is the forecast horizon, and c is a scaling constant that depends on the frequency of the data (i.e., c = 1,200 for monthly data and c = 400 for quarterly data). In the forecasting regression (28), TS_t denotes the term spread defined as the difference between the three-month constant-maturity Treasury yield and the ten-year constant-maturity yield, RFF_t denotes the real federal funds rate, and FP_t denotes the financial premium as calculated in regression (20). The lag length p of each specification is determined by the Akaike Information Criterion (AIC) and standard errors are calculated as in Hodrick (1992).

Table 9 shows the results of the forecasting specification. We see that the financial premium has substantial predictive power for payroll employment, unemployment, industrial production, and real GDP at different horizons. For example, including the financial premium in the regression (28) when predicting real GDP 12 months into the future increases the adjusted R^2 from 18.2% to 26.6% . When we also include the GZ spread and the excess bond premium, the adjusted R^2 increases further to 33.2% and the financial premium remains significant. Thus, the premium has substantial predictive power not captured by the excess bond premium or GZ spread.

5 Robustness and further issues

In this section we show that differences in default probabilities and recovery rates (Section 5.1) and bond liquidity (Section 5.2) cannot explain the financial premium. In Section 5.3 we show that slow-moving ratings cannot explain the financial premium, but can explain the negative premium in 2002. Finally, we show in Section 5.4 that a "too-big-to-fail" guarantee cannot explain the premium.

5.1 Default and recovery differences

If rating agencies systematically make mistakes when rating financial firms compared to industrial firms, for example if they consistently assign a better rating to financial firms than industrial firms with the same loss rate, then the financial premium may be an outcome of these mistakes.[11]

To investigate if the financial premium is due to differences in loss rates, we estimate the premium after loss-adjusting spreads. Specifically, for a given bond i's yield spread, s_{itj}, issued by firm j in month t with time-to-maturity T_{it} we calculate the average cumulative T-year default rate[12] for the period 1970 to the year prior to the year of month t, π^P_{jtT}, and the average recovery rate for the period 1970 to the year prior to the year of month t, δ_{jt}. That is, we calculate default and recovery rates using information only up until the time the spread is observed. We calculate default and recovery rates separately for financial and industrial firms, hence the subscript j on the default and recovery rate. The loss-adjusted spread is calculated as

$$\tilde{s}_{itj} = s_{itj} - (-\frac{1}{T_{it}}) \log(1 - (1 - \delta_{jt})\Phi[\Phi^{-1}(\pi^P_{jtT}) + s_i\sqrt{T_{it}}]) \tag{29}$$

where s_i is the (bond) Sharpe ratio. For a given default rate, recovery rate and Sharpe ratio, equation (29) subtracts the spread from the standard Merton model (see Section 2).

The first row in Table 10 shows the financial premium for unadjusted spreads estimating the regression (20) without controls X. Without any adjustments the financial premium is 47bps. Column five shows that restricting the sample to investment grade bonds results in a

[11] Moody's "defines credit risk as the risk that an entity may not meet its contractual financial obligations as they come due and any estimated financial loss in the event of default or impairment" (Moody's (2022), p.5) while S&P writes that "some agencies incorporate recovery as a rating factor in evaluating the credit quality of an issue, particularly in the case of non-investment grade debt. Other agencies, such as S&P Global Ratings, issue recovery ratings in addition to rating specific debt issues." (Standard and Poors (2019), p. 17). This implies that Moody's rating reflect the loss rate while S&P's rating reflects the default rate, and since our rating is the lower of the two ratings it will reflect both the default rates and recovery rate.

[12] Details on the default rate calculations are in Appendix A. T is the lowest integer bigger than T_{it}.

similar premium of 43bps. The second row shows that adding the liquidity controls reduces the financial premium by around 10%.

In the case that the Sharpe ratio is zero in equation (29), the adjustment simplifies to

$$\tilde{s}_{itj} = s_{itj} - (-\frac{1}{T_{it}}) \log(1 - (1 - \delta_{jt})\pi^{P}_{jtT})), \tag{30}$$

i.e. the adjustment reduces to subtracting the annualized expected loss and the adjusted spread is the expected excess return.[13] Column 1 shows the financial premium when adjusting spreads using a Sharpe ratio of zero. In this case we can interpret the regression coefficient as the annual excess return of a financial bond relative to an industrial bond with the same rating and maturity. Without liquidity adjustment, the annual excess return is 53bps and with liquidity adjustment it is 49bps. Column 2 and 3 shows that changing the Sharpe ratio to a more reasonable number, a value commonly used in the literature is 0.22 (see for example Chen (2010) and Feldhütter and Schaefer (2018)), and 0.38 is a higher number than found in the literature, does not change results much.

Finally, column 4 shows the premium when we use default and recovery rates estimated using the full sample period 1970-2019. The advantage of doing so are more precise estimates of loss rates, while the disadvantage is a potential look-ahead bias. The liquidity-adjusted financial premium is similar in this case, 38bps, compared to when not adjusting for loss rates, 43bps.

Overall, the results in this section show that differences in loss rates of financial and industrial bonds cannot explain the financial premium; in fact, such an adjustment has only a modest impact on the premium. Given the additional noise imperfect estimates of loss rates induces into our results, we prefer to use purely forward-looking spreads (that are not adjusted for loss rates).

[13] See Campello, Chen, and Zhang (2008) Equation (3) where we set the small term ERND to zero.

5.2 Trading liquidity

Since there is a large literature showing that trading liquidity can impact bond prices[14], we control for liquidity by including the standard liquidity proxies coupon, bond age and amount issued. To examine in more detail the liquidity differences between financial and industrial bonds, we calculate transaction-based liquidity measures for the subperiod 2002-2020 where our data is sourced from the TRACE transaction database. Table 11 shows that financial bonds trade more often, although moderately so. On average, a financial (industrial) bond trades 125.3 (109.7) times per month and of those trades 35.5 (32.9) are large trades, i.e. trades with a transaction volume of $100,000 or more. Furthermore, average monthly trading volume is 71.1 (59.7) $mill. However, there is a large heterogeneity in trading activity across financial bonds and the median trading activity is much less and the median financial bond trades less often than the median industrial bond; for example the median financial (industrial) bond has a monthly trading volume of 16.0 (20.3) $mill.

Turning to roundtrip cost for large trades, measured as the $\frac{P^{buy}-P^{sell}}{\frac{1}{2}(P^{buy}+P^{sell})}$ where P^{buy} (P^{sell}) is the average price an investor buys from (sells to) a dealer[15], the table shows that roundtrip costs are generally higher for financial bonds. On average, roundtrip costs are 0.38 (0.34) % for financial (industrial) bonds and within rating group the difference is larger.

Overall, we see that although some financial bonds trade very often, skewing average trading statistics, the typical financial bond trades less and has higher transaction costs than the typical industrial bond. To test whether our non-transaction based liquidity controls capture these detailed liquidity nuances, we recalculate the financial premium where we add the four transaction-based liquidity measures in Table 11 to the controls in equation (20) in addition to our existing controls. Figure 5 shows the time series of the financial premium calculated with and without the transaction-based liquidity measures as additional controls. Since we need transactions from TRACE for this part of the analysis, the sample period is restricted to 2002-2020. The figure shows that the time series are very similar. The average premium is 55bps (47bps) without (with) the additional controls and the time series

[14]See Bao, Pan, and Wang (2011), Dick-Nielsen, Feldhütter, and Lando (2012), Feldhütter (2012), and others.

[15]For each bond-day a roundtrip cost is calculated as $\frac{P^{buy}-P^{sell}}{\frac{1}{2}(P^{buy}+P^{sell})}$ and for a given bond-month 'Roundtrip costs' is the monthly average of daily roundtrip costs.

correlation is 99.5%. The high correlation alleviates the concern that liquidity is imperfectly controlled for.

5.3 Are rating agencies slow to update ratings

There is strong evidence that rating agencies are slow to update their ratings in response to new information (see Hite and Warga (1997) and others). This is partly by design as rating agencies aim to rate "through-the-cycle" and avoid short-term rating reversals[16]. If the intensity of rating changes for financial and industrial firms is different at different points in time, this may impact the time series of the financial premium.

To examine the potential impact of rating sluggishness, we exclude from the sample those observations where the bond experiences a rating change in the near future. Specifically, we include only spread observations where the bond has the same rating six months later. Figure 6 shows the time series of the financial premium with this sample, called 'adjusted for slow rating updates' along with the premium including all observations ('base case'). The time series variation is very similar and the correlation between the two time series is 95.3%. Interestingly, we see that the negative premiums in 2001–2002 and 2015 basically disappear and the premium is slightly attenuated during the financial crisis 2008-2009. This suggests that the rare periods where the financial premium is negative is at least partially explained by rating agencies being slow at updating the ratings of industrial firms.

5.4 "Too-big-too-fail"

There is a significant literature studying the nature of large financial institutions and their funding costs. On one hand, these "too-big-too-fail" institutions may have lower funding costs because they are backed by an implicit government guarantee (Acharya, Anginer, and Warburton (2016), Merton and Tsesmelidakis (2013), Santos (2014), Berndt, Duffie, and Zhu

[16]For example, Lando and Skodeberg (2002) and Fons, Cantor, and Mahoney (2002) document ratings momentum, i.e. it is more likely to be downgraded further after a downgrade compared to a non-downgraded firm with the same rating, and Moody's write that "The ratings momentum demonstrated in Exhibit 9 is a natural consequence of our rating system-management practices. These do two things in particular: (a) limit rating changes when there are substantial possibilities of near-term rating reversals; and (b) dampen potential ratings volatility by incrementally adjusting ratings in response to changes in credit fundamentals" (Fons, Cantor, and Mahoney (2002)).

(2022) and others). Rating agencies take into account such a guarantee in their rating[17] and therefore it is unclear how a guarantee would impact the financial premium; in fact, if rating agencies correctly assess the impact of the guarantee on the default probability and recovery rate, it should not have any impact. On the other hand, the largest financial institutions are typically considered systemically important and it may be that they are more systemic than small financial institutions in the sense that a potential default is more likely to coincide with a crisis. In this case, their spreads – for a given loss rate – would be higher.

Figure 7 shows the financial premium for small and large financial institutions separately.[18] The correlation is 89.7% and both groups have a high financial premium; on average 32bps (41bps) for small (large) institutions. Thus, a potential implicit government guarantee to the biggest financial institutions does not impact our results materially.

6 Conclusion

We define the financial premium as the difference in credit spreads between financial bonds and industrial bonds with the same rating and maturity. We document for the period 1987-2020 that financial credit spreads are 31% higher than industrial credit spreads when controlling for bond maturity and rating. The financial premium is higher in financial crises, is related to bond betas, and is similar for small and large financial institutions. Furthermore, the premium is related to measures of systemic risk and predicts economic activity. The premium arises naturally in a model where industrial firms face idiosyncratic and systematic risk while financial institutions hold industrial bonds and can diversify idiosyncratic risk away. The risk premium per unit of default risk is higher for financial institutions and the spread for the same loss rate therefore higher.

[17]Moody's write that their rating comprises "an assessment of potential support from governments, specific to each instrument class, to determine the credit rating for each rated instrument." (Moody's (2016), p. 5)

[18]We define small (large) as having an asset value below (above) $50billion. Higher cutoffs give similar results albeit noisier, because the median value is $36.9billion and therefore our choice of cutoff splits the sample up into two roughly equally-sized groups.

A Default rate calculations

Moody's provide an annual report with historical cumulative default rates and these are extensively used in the academic literature as estimates of default probabilities. The default rates are based on a long history of default experience for firms in different industries and different regions of the world. We follow Moody's methodology for calculating cumulative default rates and in this Appendix we detail the calculation.

Assume that there is a cohort of issuers formed on date y holding rating z. The number of firms in the cohort during a future time period is $n_y^z(t)$ where t is the number of periods from the initial forming date (time periods are measured in months in the main text). In each period there are three possible mutually exclusive end-of-period outcomes for an issuer: default, survival, and rating withdrawal. The number of defaults during period t is $x_y^z(t)$, the number of withdrawals is $w_y^z(t)$, and the number of issuers during period t is defined as

$$n_y^z(t) = n_y^z(0) - \sum_{i=1}^{t-1} x_y^z(i) - \sum_{i=1}^{t-1} w_y^z(i) - \frac{1}{2} w_y^z(t). \tag{31}$$

The marginal default rate during time period t is

$$d_y^z(t) = \frac{x_y^z(t)}{n_y^z(t)} \tag{32}$$

and the cumulative default rate for investment horizons of length T is

$$D_y^z(T) = 1 - \prod_{t=1}^{T} \Big[1 - d_y^z(t)\Big]. \tag{33}$$

The average cumulative default rate is

$$\overline{D}^z(T) = 1 - \prod_{t=1}^{T} \Big[1 - \overline{d}^z(t)\Big] \tag{34}$$

where $\overline{d}^z(t)$ is the average marginal default rate[19].

For a number of cohort dates y in a historical data set Y, Moody's calculate the average

[19] Note that this calculation assumes that marginal default rates are independent.

marginal default rate as a weighted average, where each period's marginal default rate is weighted by the relative size of the cohort

$$\overline{d}^z(t) = \frac{\sum\limits_{y \in Y} x_y^z(t)}{\sum\limits_{y \in Y} n_y^z(t)}. \tag{35}$$

We label default rates based on equation (35) for *cohort-weighted* default rates. In the presence of macroeconomic risk as modelled in Feldhütter and Schaefer (2018) it is more robust to use *equal-weighted* default rates where the average marginal default rate is calculated as

$$\overline{d}^z(t) = \frac{1}{N_Y} \sum_{y \in Y} \frac{x_y^z(t)}{n_y^z(t)} \tag{36}$$

where N_Y is the number of cohorts in the historical dataset Y. This is the default rate calculation we use in the main text.

B Appendix

When the recovery rate for bank debt is not the same as that for the loans, the result becomes slightly less clean. The yield of the bank loan is not independent of the selected recovery rate, but as we show in the following, the dependence is of second order importance. To see, this we compare how the financial premium changes for a bank when the expected loss target is unchanged, but the target is achieved through a different combination of physical default probability and recovery rate. Let R_1, R_2 denote recovery rates for two different banks, and let p_1^b, p_2^b denote the physical default probabilities ensuring the same loss, i.e. $p_1^b(1 - R_1) = p_2^b(1 - R_2) = \lambda_k$. The associated risk neutral default probabilities are q_1^b and q_2^b. The difference in spreads for these two banks can be expressed as

$$
\begin{aligned}
\Delta f_k &= \frac{1}{T}\left(\log\left(\frac{1-(1-R_1)p_1^b\frac{q_1^b}{p_1^b}}{1-(1-R_2)p_2^b\frac{q_2^b}{p_2^b}}\right)\right) \\
&= \frac{1}{T}\left(\log\left(\frac{1-\lambda_k\frac{q_1^b}{p_1^b}}{1-\lambda_k\frac{q_2^b}{p_2^b}}\right)\right)
\end{aligned}
$$

where we have used the fact that the expected loss targets are λ_k for both banks. The change in yield (and hence in the financial premium if loan portfolios are the same) depends on the change in the Radon-Nikodym derivative as we change the physical default probability. This change is of second order, as we (will) illustrate numerically.

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All

	AAA	AA	A	BBB	Spec.	All
Number of bonds	938	4522	12511	10749	6180	26133
Number of firms	139	426	1181	1736	2110	3705
Age	3.57	3.53	3.79	4.14	4.22	3.96
Coupon	5.62	5.07	5.67	6.09	7.9	6.19
Amount outstanding ($mm)	509	611	549	502	396	509
Time-to-maturity	4.29	4.25	4.56	4.81	5.17	4.73
Yield spread (in basis points)	28	67	65	136	518	174
Yield-to-maturity	4.83	4.67	4.55	4.78	9.26	5.53
Number of observations	17689	80961	310754	299130	168611	876164

Financials

	AAA	AA	A	BBB	Spec.	All
Number of bonds	769	3745	9206	6086	2068	16254
Number of firms	76	246	575	640	305	1142
Age	3.06	2.97	3.32	3.71	3.8	3.42
Coupon	5.82	4.81	5.67	5.95	6.78	5.73
Amount outstanding ($mm)	478	623	538	504	472	532
Time-to-maturity	4.19	3.91	4.37	4.54	3.91	4.32
Yield spread (in basis points)	35	95	77	160	531	138
Yield-to-maturity	5.27	4.79	4.80	4.87	8.73	5.15
Number of observations	11815	50379	177712	110196	31855	381645

Industrials

	AAA	AA	A	BBB	Spec.	All
Number of bonds	169	777	3324	4663	4112	9898
Number of firms	63	180	607	1097	1806	2564
Age	4.59	4.44	4.41	4.4	4.31	4.38
Coupon	5.2	5.51	5.68	6.18	8.16	6.54
Amount outstanding ($mm)	573	591	563	501	378	490
Time-to-maturity	4.49	4.82	4.81	4.96	5.47	5.05
Yield spread (in basis points)	14	19	49	122	515	201
Yield-to-maturity	3.95	4.47	4.22	4.73	9.39	5.83
Number of observations	5874	30582	133042	188934	136756	494519

Table 1 *Bond summary statistics.* The main sample consists of senior unsecured bonds with fixed coupons and a maturity between 0.5–10.5 years. Bonds that are convertible, asset-backed, putable, perpetual, foreign denominated, have sinking fund provisions, or have a fixed-price call provision are excluded. This table shows summary statistics for the data set. 'Number of bonds' is the number of bonds that appear at some point in the sample period. 'Number of firms' is the number of firms that have issued a bond. For each bond-month we calculate the bond's time since issuance and 'Age' is the average time since issuance across all bond-months. 'Coupon' is the average bond coupon across all quotes. 'Amount outstanding' is the average outstanding amount of a bond issue across all quotes. 'Time-to-maturity' is the average time until the bond matures across all quotes. 'Yield-to-maturity' is the average yield-to-maturity in percent across all quotes and is winsorized at the 1% and 99% level. 'Yield spread (in basis points)' is the average yield spread to the swap rate in basis points across all quotes and the yield spread is winsorized at the 1% and 99% level. The data period is 1987–2020.

Issuer name	# transactions	# bonds
Panel A: financial firms		
GENERAL ELEC CAP CORP	16450	815
GENERAL MTRS ACCEP CORP	14999	1270
FORD MTR CR CO	11447	571
BANK AMER CORP	8333	327
MORGAN STANLEY	6928	299
HOUSEHOLD FIN CORP	6886	437
GOLDMAN SACHS GROUP INC	6663	420
MERRILL LYNCH AND CO INC	6588	277
CATERPILLAR FINL SVCS CORP	6453	634
DEERE JOHN CAP CORP	5411	161
ASSOCIATES CORP NORTH AMER	5001	161
AMERICAN GEN FIN CORP	4930	339
HSBC FINANCE CORP	4282	492
CITIGROUP INC	4202	90
INTERNATIONAL LEASE FIN CORP	4194	392
J P MORGAN CHASE AND CO	3958	272
BEAR STEARNS COS INC	3928	157
CIT GROUP INC	3778	308
LEHMAN BROS HLDGS INC	3344	181
COMMERCIAL CR CO	3196	50
Panel B: industrial firms		
WALMART INC	3631	57
INTERNATIONAL BUSINESS MACHS CORP	3466	79
UNION PAC CORP	2898	43
DISNEY WALT CO	2787	67
PHILIP MORRIS COS INC	2678	36
DU PONT E I DE NEMOURS AND CO	2677	37
ANHEUSER BUSCH COS INC	2454	29
PEPSICO INC	2342	55
BP CAP MKTS PLC	2322	41
PROCTER AND GAMBLE CO	2292	44
HERTZ CORP	2214	37
MCDONALDS CORP	2148	28
XEROX CORP	2146	30
KROGER CO	2115	28
TIME WARNER INC	2104	26
DOW CHEM CO	2067	120
EMERSON ELEC CO	2020	20
CSX CORP	1986	29
UNITEDHEALTH GROUP INC	1984	47
PRAXAIR INC	1983	27

Table 2 *Most common issuers in the bond sample.* This table shows the most common bond issuers by number of bond-month observations. '# transactions' is the number of bond-month observations and '# bonds' is the number of bonds issued by the issuer. The sample period is 1987–2020.

	1987:01-2020:09			1987:01-1998:04			1998:05-2007:06			2007:07-2010:06			2010:07-2020:09		
	Fin.	Ind.	Diff.	Fin.	Ind.	Diff.	Fin.	Ind.	Diff.	Fin.	Ind.	Diff.	Fin.	Ind.	Diff.
AAA															
Short	31	4	27***	23	5	18***	13	4	8**	159	15	144***	10	-1	11*
			(9.8)			(7.0)			(3.8)			(41.7)			(8.1)
Medium	24	17	7	6	2	3	18	16	2	114	27	87***	34	25	8
			(6.8)			(7.5)			(7.4)			(27.4)			(12.1)
Long	28	28	1*	2	4	−2	25	14	11	178	77	102***	100	53	47***
			(7.3)			(4.4)			(7.1)			(29.5)			(3.9)
AA															
Short	70	9	61***	18	11	6**	55	7	48***	414	25	389***	40	8	32***
			(21.5)			(2.7)			(21.9)			(77.4)			(11.0)
Medium	55	21	33***	24	6	17***	40	13	26***	168	46	122***	73	40	33***
			(7.0)			(4.2)			(6.5)			(20.3)			(11.2)
Long	69	37	32***	25	5	20***	42	23	19***	210	89	120***	102	68	34***
			(6.5)			(4.7)			(3.9)			(21.6)			(9.3)
A															
Short	67	35	32***	34	26	8**	49	35	15*	289	92	197***	55	25	29***
			(11.3)			(3.7)			(12.3)			(55.7)			(10.1)
Medium	78	49	29***	40	27	13**	51	44	7*	243	108	135***	100	62	38***
			(8.2)			(5.5)			(6.3)			(32.9)			(13.1)
Long	94	64	30***	46	30	16***	61	49	12***	271	137	134***	129	95	34***
			(7.9)			(5.5)			(4.8)			(27.3)			(12.5)
BBB															
Short	136	92	45**	76	69	7	107	101	7	568	214	354***	105	77	28***
			(21.1)			(9.8)			(16.6)			(134.6)			(8.5)
Medium	149	116	33**	84	72	12	119	107	12*	458	231	227***	160	139	22**
			(14.0)			(12.7)			(10.4)			(78.0)			(10.7)
Long	159	133	25**	88	68	20	119	111	8*	415	254	161***	199	190	8
			(10.8)			(12.6)			(6.5)			(54.8)			(13.9)
Spec.															
Short	547	449	98***	582	380	202***	570	523	48	1237	716	522***	318	332	−15
			(39.9)			(49.6)			(39.8)			(75.7)			(37.1)
Medium	480	453	27	397	349	48	469	513	−44	1068	705	363***	391	420	−29
			(29.8)			(44.8)			(36.7)			(51.0)			(19.9)
Long	423	414	10	357	324	33	381	455	−75*	708	610	97***	433	418	15
			(19.7)			(31.8)			(35.9)			(47.8)			(22.1)

Table 3 *Bond yield spreads of financials and industrial firms.* This table shows average credit spreads for the sample period as well as sub-periods. For each bond-month we record the last transaction in the month for that bond. For this transaction, we calculate the bond spread between the yield-to-maturity of the bond and the swap rate, interpolated to match the maturity of the bond. We group bonds into three maturity buckets, 0-5–3.5 years (short), 3.5–7.5 years (medium), and 7.5–10.5 years (long). For each month, rating, and maturity bucket we calculate the average credit spread. For each rating and maturity bucket, the table shows the average monthly credit spreads. Welch's t-test is shown in brackets and '*', '**', and '***' indicate statistical significance at the 10%, 5%, and 1% level, respectively.

	1987-2020				Ex. Financial crisis				Financial crisis			
	All	Short	Medium	Long	All	Short	Medium	Long	All	Short	Medium	Long
Panel A: The financial premium in basis points												
All	42.76***	47.51***	40.71***	34.33***	23.06***	22.60***	22.37***	20.59***	212.85***	249.78***	202.80***	142.54***
	[3.73]	[4.99]	[3.54]	[3.03]	[2.72]	[3.03]	[2.75]	[2.50]	[21.28]	[28.55]	[20.79]	[14.03]
AAA	17.91**	23.97**	13.19*	13.72*	12.26*	19.49*	7.01	2.68	83.96***	82.06***	79.06*	109.85***
	[7.22]	[10.75]	[7.87]	[7.15]	[6.32]	[9.98]	[5.29]	[4.50]	[32.58]	[28.92]	[41.09]	[30.26]
AA	40.20***	45.55***	34.03***	26.89***	29.80***	30.75***	27.66***	16.88***	145.42***	166.37***	107.47***	125.58***
	[5.89]	[7.93]	[6.16]	[4.45]	[4.66]	[6.17]	[5.61]	[3.02]	[19.52]	[30.56]	[16.38]	[27.15]
A	31.56***	31.81***	30.20***	31.73***	19.38***	18.49***	19.84***	19.60***	149.25***	155.18***	139.20***	135.47***
	[3.93]	[4.73]	[3.56]	[4.00]	[2.80]	[3.44]	[2.68]	[2.35]	[17.75]	[19.40]	[15.80]	[22.68]
BBB	46.10***	50.04***	47.73***	33.34***	21.17***	20.54***	23.21***	16.91***	233.59***	298.65***	224.60***	144.69***
	[5.08]	[7.17]	[5.09]	[3.84]	[3.17]	[3.97]	[3.61]	[3.14]	[31.39]	[47.93]	[29.21]	[18.23]
Spec.	83.32***	104.62***	64.75***	32.27*	36.56***	39.54**	27.60*	16.99	360.21***	394.81***	356.68***	183.02***
	[16.06]	[19.17]	[16.46]	[18.05]	[12.89]	[16.12]	[14.68]	[18.50]	[57.61]	[62.23]	[64.86]	[51.19]
Panel B: The financial premium in percent of the industrial spread												
All	31%	32%	30%	26%	22%	24%	20%	18%	49%	49%	56%	43%
AAA	51%	69%	36%	41%	73%	114%	48%	14%	58%	60%	53%	61%
AA	42%	38%	51%	34%	55%	58%	53%	27%	49%	42%	74%	71%
A	41%	44%	40%	36%	33%	37%	31%	27%	57%	55%	60%	50%
BBB	29%	33%	29%	20%	17%	19%	17%	12%	47%	50%	50%	36%
Spec.	16%	18%	13%	7%	9%	10%	6%	4%	32%	33%	34%	25%

Table 4 *The financial premium.* For each maturity and rating, Panel A shows the regression coefficient β (in basis points) from the regression $s_{itj} = \beta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj}$, where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains control variables and μ_{mrt} is a month-rating-maturity fixed effect. The control variables are coupon, bond age, and log(amount issued). The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., B, B-, C) . Standard errors clustered at the firm level are shown in brackets and '*', '**', and '***' indicate statistical significance at the 10%, 5%, and 1% level, respectively. Panel B shows β as a percentage of the average yield spread of financial firms. There are four maturity buckets, 0.5–10.5 (all), 0.5–3.5 years (short), 3.5–7.5 years (medium), and 7.5–10.5 years (long).The sample period is 1987–2020 and the financial crisis period is 2007:07–2010:06.

Table 5 Systemic risk measure correlations

This table presents correlations between systemic risk measures and the financial premium. Panel A shows pairwise correlations calculated for the longest possible time series using monthly data. Panel B show the same but with NBER recessions excluded from the time series. SRISK is for the US financial system (Brownlees and Engle 2017) as available from the NYU Volatility Lab, the Systemic Risk Indicator is published by the Cleveland Federal Reserve Bank following Saldias (2013), the Excess Bond Premium is from Gilchrist and Zakrajsek (2012), the Corporate Bond Market Distress Measure is from Boyarchenko, Crump, Kovner, and Shachar (2022), and VIX is the CBOE volatility index.

Systemic Risk Proxy	FP	SRISK	SRI	EBP	CMDI	VIX
Panel A: Full time series						
Financial Premium (FP)	1.00					
	[405]					
SRISK	0.71	1.00				
	[244]	[267]				
Systemic Risk Indicator (SRI)	−0.39	−0.47	1.00			
	[150]	[173]	[173]			
Excess Bond Premium (EBP)	0.60	0.31	−0.24	1.00		
	[405]	[263]	[169]	[592]		
Corporate Bond Market Distress (CMDI)	0.76	0.66	−0.44	0.70	1.00	
	[189]	[212]	[173]	[208]	[212]	
VIX	0.58	0.51	−0.40	0.60	0.64	1.00
	[369]	[267]	[173]	[388]	[212]	[392]
Panel B: Excluding NBER recessions						
Financial Premium (FP)	1.00					
	[369]					
SRISK	0.62	1.00				
	[220]	[243]				
Systemic Risk Indicator (SRI)	−0.40	−0.44	1.00			
	[140]	[163]	[163]			
Excess Bond Premium (EBP)	0.36	0.08	−0.19	1.00		
	[369]	[239]	[159]	[519]		
Corporate Bond Market Distress (CMDI)	0.70	0.57	−0.42	0.57	1.00	
	[165]	[188]	[163]	[184]	[188]	
VIX	0.50	0.47	−0.42	0.50	0.60	1.00
	[333]	[243]	[163]	[352]	[188]	[356]

	Finance	Manufacturing	Media/Communications	Oil and Gas	Retail	Service/Leisure	Transportation	Utility: Electric	Utility: Gas
Finance		−45.88***	−36.29***	−49.33***	−56.87***	−46.85***	−42.87***	−52.55***	−47.07***
		[3.65]	[5.15]	[5.58]	[6.70]	[9.75]	[13.61]	[3.97]	[7.83]
Manufacturing	45.88***		13.49**	−5.06	−4.80	−6.06	12.88	−7.45**	−0.73
	[3.65]		[5.43]	[4.38]	[5.92]	[9.01]	[13.37]	[3.66]	[5.68]
Media/Communications	36.29***	−13.49**		−20.86***	−22.17***	−26.22***	11.87	−15.28***	−3.34
	[5.15]	[5.43]		[6.63]	[8.05]	[9.90]	[13.35]	[4.23]	[6.06]
Oil and Gas	49.33***	5.06	20.86***		4.26	5.26	18.00	1.77	19.20***
	[5.58]	[4.38]	[6.63]		[6.57]	[8.22]	[11.11]	[3.11]	[4.69]
Retail	56.87***	4.80	22.17***	−4.26		4.76	17.59	1.74	11.74
	[6.70]	[5.92]	[8.05]	[6.57]		[8.95]	[13.68]	[6.13]	[8.00]
Service/Leisure	46.85***	6.06	26.22***	−5.26	−4.76		17.72	−12.38	−14.09
	[9.75]	[9.01]	[9.90]	[8.22]	[8.95]		[16.26]	[9.31]	[9.71]
Transportation	42.87***	−12.88	−11.87	−18.00	−17.59	−17.72		−7.95	−14.10
	[13.61]	[13.37]	[13.35]	[11.11]	[13.68]	[16.26]		[10.76]	[15.29]
Utility: Electric	52.55***	7.45**	15.28***	−1.77	−1.74	12.38	7.95		1.21
	[3.97]	[3.66]	[4.23]	[3.11]	[6.13]	[9.31]	[10.76]		[6.52]
Utility: Gas	47.07***	0.73	3.34	−19.20***	−11.74	14.09	14.10	−1.21	
	[7.83]	[5.68]	[6.06]	[4.69]	[8.00]	[9.71]	[15.29]	[6.52]	
Average	47.21	-6.02	6.65	-15.47	-14.43	-7.54	7.16	-11.66	-5.90

Table 6 *Industry premiums.* For industry-pair (m, n) we restrict the sample to bond issuers in the two industries and calculate the premium for industry m relative to industry n. Specifically, the premium as calculated as the regression coefficient β (in basis points) from the regression $s_{itj} = \beta 1_{ind,j} + \mu_{mrt} + \epsilon_{itj}$, where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{ind,j}$ is one (zero) if firm j belongs to industry m (n), and μ_{mrt} is a month-rating-maturity fixed effect. Industry is classified according to Mergent FISD's industry_code. The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., B, B-, C) . Industries are classified according to Mergent FISD's two-digit industry code and the table shows industries with at least 300 bonds in the sample. Standard errors clustered at the firm level are shown in brackets and '*', '**', and '***' indicate statistical significance at the 10%, 5%, and 1% level, respectively. The sample period is 1987–2020.

Panel A: Top 5 firms	
UBS AG JERSEY BRH	491.00***
	[64.42]
CITIGROUP FDG INC	349.87***
	[16.69]
CREDIT SUISSE FIRST BOSTON N Y	233.60***
	[9.93]
BARCLAYS BK PLC	187.22***
	[28.82]
INTERNATIONAL LEASE FIN CORP	182.51***
	[9.80]
Panel B: Bottom 5 firms	
NORWEST FINL INC	0.62
	[1.91]
DEERE JOHN CAP CORP	3.37*
	[1.99]
COMMERCIAL CR GROUP INC	6.11***
	[1.46]
BOEING CAP CORP	9.58**
	[3.90]
CATERPILLAR FINL SVCS CORP	10.20***
	[3.38]
Panel C: Sub industry	
Bank	67.77***
	[7.99]
Capital arm	32.87***
	[7.18]
Insurance	76.78***
	[10.48]

Table 7 *Firm premiums.* We calculate the financial premium for financial firms with at least 50 bonds in our sample (43 firms in total) and Panel A reports the firms with the highest premium and Panel B firms with the lowest premium. For the same set of firms we classify them manually into 'bank', 'capital arm', and 'insurance' and calculate in Panel C the financial premium for each of the three sub-industries. Standard errors clustered at the firm level are shown in brackets and '*', '**', and '***' indicate statistical significance at the 10%, 5%, and 1% level, respectively. The sample period is 1987–2020.

	All	Short	Medium	Long
All	0.10^{***}	0.11^{***}	0.11^{***}	0.07^{***}
	[0.01]	[0.01]	[0.01]	[0.01]
AAA	-0.00	-0.02	0.02	0.02
	[0.01]	[0.01]	[0.01]	[0.01]
AA	0.03^{***}	0.03^{***}	0.04^{**}	0.05^{**}
	[0.01]	[0.01]	[0.01]	[0.01]
A	0.07^{***}	0.07^{***}	0.07^{***}	0.09^{***}
	[0.01]	[0.01]	[0.01]	[0.01]
BBB	0.13^{***}	0.12^{***}	0.15^{***}	0.04
	[0.02]	[0.02]	[0.02]	[0.02]
Spec.	0.20^{***}	0.26^{***}	0.16^{***}	0.13^{**}
	[0.04]	[0.04]	[0.04]	[0.04]

,

Table 8 *Financial excess betas.* For each maturity and rating, Panel A shows the regression coefficient η from the regression $\beta_{itj} = \eta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj}$, where β_{itj} is the bond beta in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains control variables and μ_{mrt} is a month-rating-maturity fixed effect. The bond beta is the slope coefficient from the regression of monthly bond excess returns on monthly corporate bond market excess returns in the previous 36 months. The control variables are coupon, bond age, and log(amount issued). The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., B, B-, C) . The maturity buckets in the table are 0.5–10.5 (all), 0.5–3.5 years (short), 3.5–7.5 years (medium), and 7.5–10.5 years (long). Standard errors clustered at the firm level are shown in brackets and '*', '**', and '***' indicate statistical significance at the 10%, 5%, and 1% level, respectively. The sample period is 1987–2020.

Table 9 Forecasting economic activity

This table presents regressions for forecasted economic activity at a 3 month and a 12 month horizon. The regressions are as specified in equation (28). Payroll employment, unemployment rate, and industrial production is with monthly data from January 1984 to February 2020. Real GDP is with quarterly data from January 1984 to December 2019. T-statistics reported in brackets are computed according to Hodrick (1992). Constants and lags of the dependent variable are not reported. Lag length is determined by *AIC*. *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Panel A: Payroll employment

Financial Indicator	3 month			12 month		
Term Spread	-0.178***	-0.187***	-0.148**	-0.845***	-0.853***	-0.854***
	[2.99]	[3.22]	[2.56]	[15.7]	[16.0]	[16.4]
Real Fed Fund Rate	-0.015	-0.034	-0.033	0.091***	0.078***	0.148***
	[0.61]	[1.43]	[1.17]	[3.89]	[3.38]	[5.42]
Financial Premium		-0.006***	-0.003**		-0.004***	-0.002*
		[-4.94]	[2.14]		[3.92]	[1.79]
Pred. GZ spread			-0.254*			0.266*
			[1.66]			[1.89]
Excess Bond Premium			-0.738***			-0.780***
			[6.02]			[7.27]
Adj R^2	0.760	0.788	0.816	0.431	0.438	0.458

Panel B: Unemployment rate

Financial Indicator	3 month			12 month		
Term Spread	0.043***	0.044***	0.040***	0.506***	0.507***	0.536***
	[6.93]	[7.14]	[6.54]	[85.6]	[86.8]	[93.2]
Real Fed Fund Rate	0.007**	0.023***	0.020***	-0.022***	0.012***	-0.045***
	[2.43]	[7.86]	[5.83]	[7.93]	[4.42]	[13.8]
Financial Premium		0.002***	0.001***		0.005***	0.003***
		[15.9]	[8.51]		[42.9]	[24.4]
Pred. GZ spread			0.028*			-0.282***
			[1.74]			[18.2]
Excess Bond Premium			0.225***			0.620***
			[16.9]			[53.3]
Adj R^2	0.392	0.496	0.574	0.252	0.285	0.330

Continued on next page

Table 9 Forecasting economic activity (continued)

Panel C: Industrial production

Financial Indicator	3 month			12 month		
Term Spread	-0.774**	-1.102***	-1.378***	-1.424***	-1.600***	-1.811***
	[2.12]	[3.49]	[4.50]	[4.77]	[5.57]	[6.62]
Real Fed Fund Rate	0.198	0.207	0.588***	0.332**	0.323**	0.586***
	[1.36]	[1.44]	[3.22]	[2.37]	[2.32]	[3.71]
Financial Premium		-0.026***	-0.017**		-0.012*	-0.005
		[3.09]	[2.04]		[1.65]	[0.65]
Pred. GZ spread			0.732			0.561
			[0.90]			[0.75]
Excess Bond Premium			-4.300***			-2.994***
			[5.68]			[5.08]
Adj R^2	0.354	0.419	0.507	0.207	0.226	0.284

Panel D: Real GDP

Financial Indicator	3 month			12 month		
Term Spread	-0.279*	-0.365**	-0.409***	-0.638***	-0.696***	-0.737***
	[1.92]	[2.54]	[3.19]	[5.25]	[5.57]	[6.59]
Real Fed Fund Rate	0.105	0.087	0.253***	0.166**	0.166**	0.301***
	[1.44]	[1.21]	[3.29]	[2.50]	[2.56]	[4.63]
Financial Premium		-0.013***	-0.009***		-0.010***	-0.007**
		[3.72]	[2.61]		[4.26]	[2.53]
Pred. GZ spread			0.631			0.695*
			[1.52]			[1.85]
Excess Bond Premium			-1.534***			-1.003***
			[4.88]			[3.82]
Adj R^2	0.193	0.360	0.475	0.182	0.266	0.332

	SR=0	SR=0.22	SR=0.38	Full	Inv.
Unadjusted	47.10***	47.10***	47.10***	47.10***	42.95***
	[3.62]	[3.62]	[3.62]	[3.62]	[3.26]
Liquidity-adjusted	42.76***	42.76***	42.76***	42.76***	37.97***
	[3.73]	[3.73]	[3.73]	[3.73]	[3.24]
Loss-adjusted	52.69***	53.73***	51.02***	41.69***	33.48***
	[3.92]	[4.32]	[4.82]	[4.14]	[3.32]
Liquidity- and loss-adjusted	48.92***	50.49***	48.31***	38.30***	28.68***
	[4.14]	[4.64]	[5.23]	[4.36]	[3.31]

Table 10 *The financial premium - default and recovery adjusted.* This table shows the additional yield spread in basis points of a bond issued by a financial firm relative to a bond issued by an industrial firm. 'Unadjusted' shows the regression coefficient β (in basis points) from the regression $s_{itj} = \beta 1_{fin,j} + \mu_{mrt} + \epsilon_{itj}$, where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, and μ_{mrt} is a month-rating-maturity fixed effect. The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., B, B-, C) . 'Liquidity-adjusted' shows the regression coefficient β (in basis points) from the regression $s_{itj} = \beta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj}$, where X contains the control variables coupon, bond age, and log(amount issued). 'Loss-adjusted' shows β from the regression $\tilde{s}_{itj} = \beta 1_{fin,j} + \mu_{mrt} + \epsilon_{itj}$ where $\tilde{s}_{itj}$ is the loss-adjusted spread defined as $\tilde{s}_{itj} = s_{itj} - (-\frac{1}{T_{it}}) \log(1 - (1 - \delta_{jt}) N[N^{-1}(\pi^P_{jtT}) + \theta\sqrt{T_{it}}])$ and T_{it} is the maturity of the bond, π^P_{itT} is the T-year cumulative default probability of the bond measured as the historical default frequency of industrial (financial) firms with the same rating as the bond between 1970 and the year preceding month t if the bond is issued by an industrial (financial) firm, δ_{it} is the recovery rate of the bond measured as the historical loss rate of industrial (financial) firms with the same rating as the bond between 1970 and the year preceding month t if the bond is issued by an industrial (financial) firm, and θ is the Sharpe ratio of the bond. 'Liquidity- and loss-adjusted' shows the regression coefficient β from the regression $\tilde{s}_{itj} = \beta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj}$. The first three columns show results for results for different Sharpe ratios, 'Full' shows results when historical default rates and loss rates for the period 1970-2019 are used for all bonds, while 'Inv' shows results when the sample is restricted to investment grade bonds (where we in both cases use a Sharpe ratio of 0.22). Standard errors clustered at the firm level are shown in brackets and '*', '**', and '***' indicate statistical significance at the 10%, 5%, and 1% level, respectively. The sample period is 1987–2020.

All

	AAA	AA	A	BBB	Spec.	All
# trades	152.8	130.6	120.4	105.0	125.1	116.6
	(61.0)	(67.0)	(56.0)	(40.0)	(55.0)	(50.0)
	[10468]	[50591]	[192617]	[222941]	[94379]	[570996]
# large trades	38.6	39.2	34.6	29.1	41.4	34.0
	(17.0)	(24.0)	(19.0)	(12.0)	(19.0)	(16.0)
	[10468]	[50591]	[192617]	[222941]	[94379]	[570996]
Volume ($mm)	70.7	75.6	65.3	57.7	74.1	64.8
	(15.5)	(26.2)	(19.6)	(14.8)	(25)	(18.6)
	[10468]	[50591]	[192617]	[222941]	[94379]	[570996]
Roundtrip costs	0.00386	0.00291	0.00309	0.00355	0.00492	0.00359
	(0.00241)	(0.00163)	(0.00177)	(0.00203)	(0.00309)	(0.00209)
	[6744]	[37019]	[131702]	[140275]	[71294]	[387034]

Financials

	AAA	AA	A	BBB	Spec.	All
# trades	160.8	121.1	128.7	117.2	134.8	125.3
	(47.0)	(58.0)	(54.0)	(38.0)	(63.0)	(49.0)
	[6798]	[34458]	[103275]	[85208]	[24817]	[254556]
# large trades	38.9	36.5	36.9	31.2	41.9	35.5
	(12.0)	(22.0)	(18.0)	(9.0)	(15.0)	(14.0)
	[6798]	[34458]	[103275]	[85208]	[24817]	[254556]
Volume ($mm)	76.7	76.8	75.2	61	79.8	71.1
	(12)	(24.9)	(19.6)	(10.1)	(17.7)	(16)
	[6798]	[34458]	[103275]	[85208]	[24817]	[254556]
Roundtrip costs	0.00429	0.00303	0.00332	0.00408	0.00599	0.0038
	(0.00262)	(0.00153)	(0.00176)	(0.00223)	(0.0037)	(0.00203)
	[3943]	[24170]	[67653]	[47368]	[16712]	[159846]

Industrials

	AAA	AA	A	BBB	Spec.	All
# trades	137.8	150.8	110.7	97.4	121.6	109.7
	(76.0)	(84.0)	(59.0)	(42.0)	(53.0)	(51.0)
	[3670]	[16133]	[89342]	[137733]	[69562]	[316440]
# large trades	37.9	44.9	32.0	27.8	41.2	32.9
	(23.0)	(28.0)	(19.0)	(13.0)	(20.0)	(17.0)
	[3670]	[16133]	[89342]	[137733]	[69562]	[316440]
Volume ($mm)	59.6	73	53.8	55.7	72	59.7
	(19)	(28.4)	(19.5)	(17.3)	(26.8)	(20.3)
	[3670]	[16133]	[89342]	[137733]	[69562]	[316440]
Roundtrip costs	0.00325	0.00268	0.00286	0.00328	0.00459	0.00344
	(0.00216)	(0.0018)	(0.00179)	(0.00192)	(0.00294)	(0.00213)
	[2801]	[12849]	[64049]	[92907]	[54582]	[227188]

Table 11 *Liquidity summary statistics.* This table shows liquidity summary statistics for the main data set in the period 2002–2020 for which transaction data are available. The table shows the average, the median in parenthesis, and the number of observations in square brackets. On a monthly basis, '# trades' is the number of transactions, '# large trades' is the number of transactions with a volume of $100,000 or more, 'Volume' is the total volume, and 'Roundtrip costs' is the average transaction costs. For each bond-day a roundtrip cost is calculated as $\frac{P^{buy}-P^{sell}}{\frac{1}{2}(P^{buy}+P^{sell})}$, using large trades, and for a given bond-month 'Roundtrip costs' is the monthly average of daily roundtrip costs.

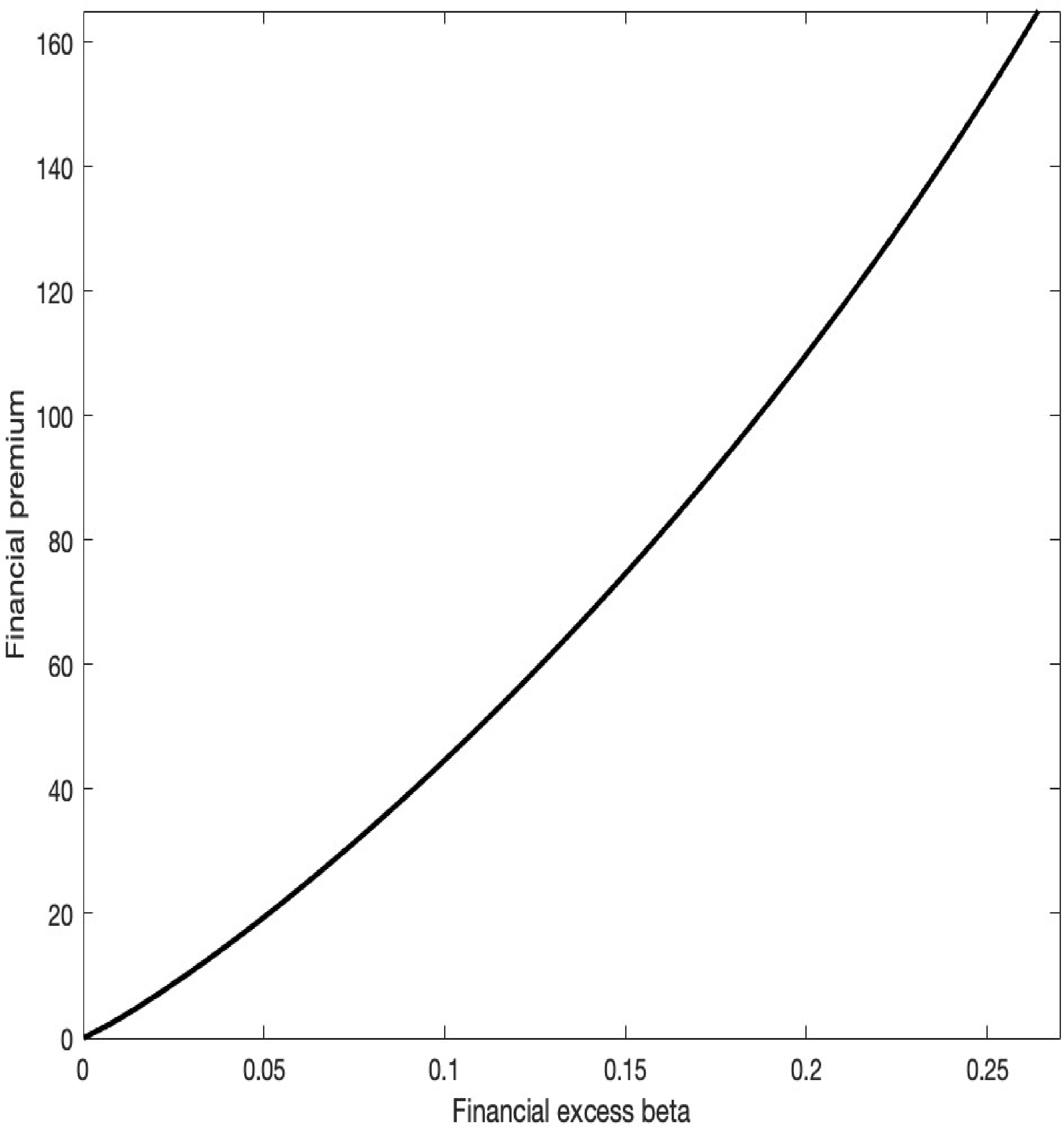

Fig. 2 *Financial premium and excess beta, model results.* For a range of default probabilities we calculate the financial premium (in basis points) and financial excess beta in the model and the figure shows a plot of the results. We use the model parameters $s_m = 0.4$, $\rho = 0.2$, $R = 0.35$, $T = 4$, $\sigma = 0.2$, and $\beta_V = 0.8$.

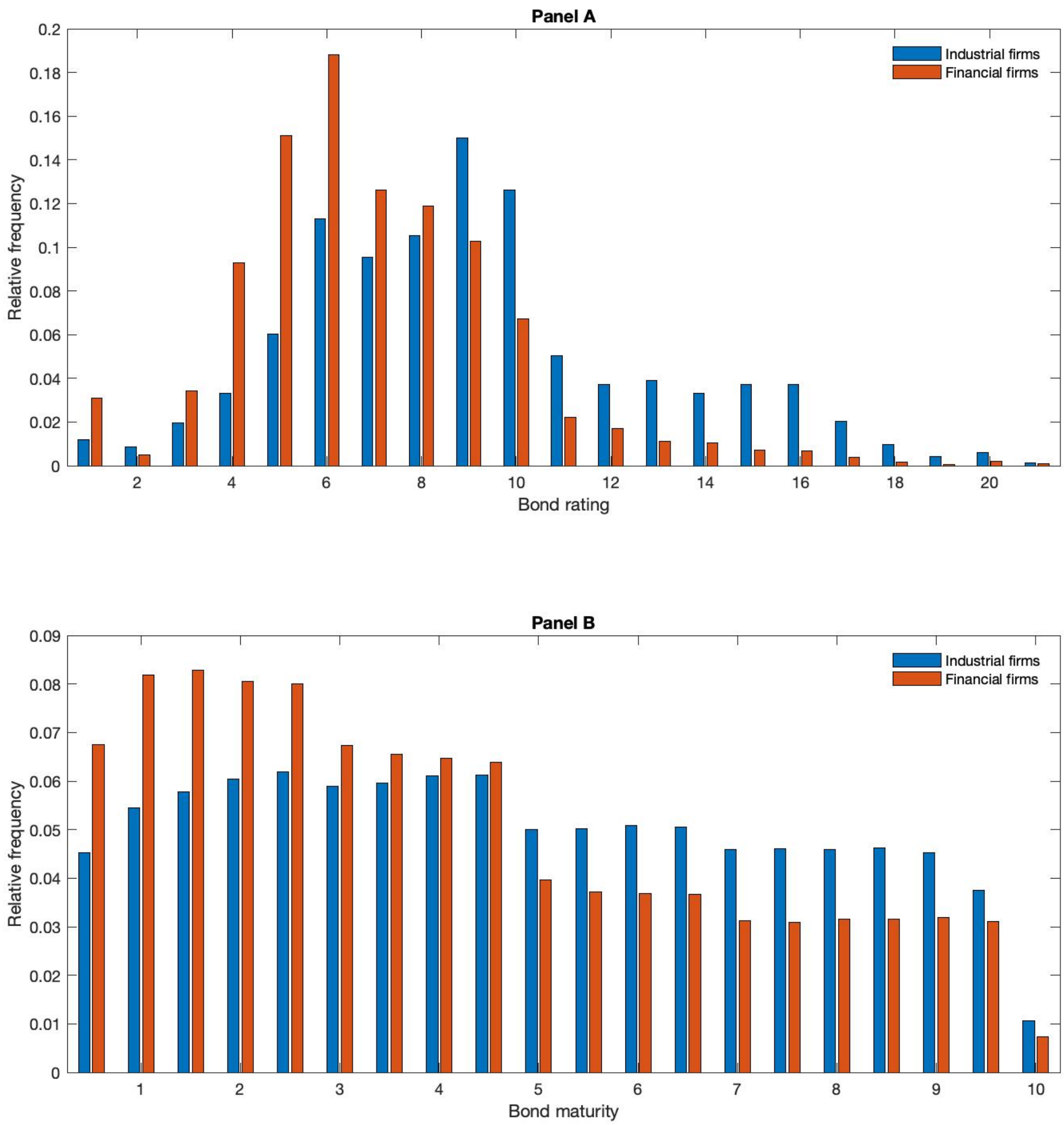

Fig. 3 *Distribution of bond maturity and rating.* Panel A shows the fraction of data observations within different bond maturity brackets. Panel B shows the fraction of data observations within different bond ratings. 1 corresponds to 'AAA', 2 to 'AA+', 3 to 'AA', ..., 19 to 'CCC-', 20 to 'CC', and 21 to 'C'.

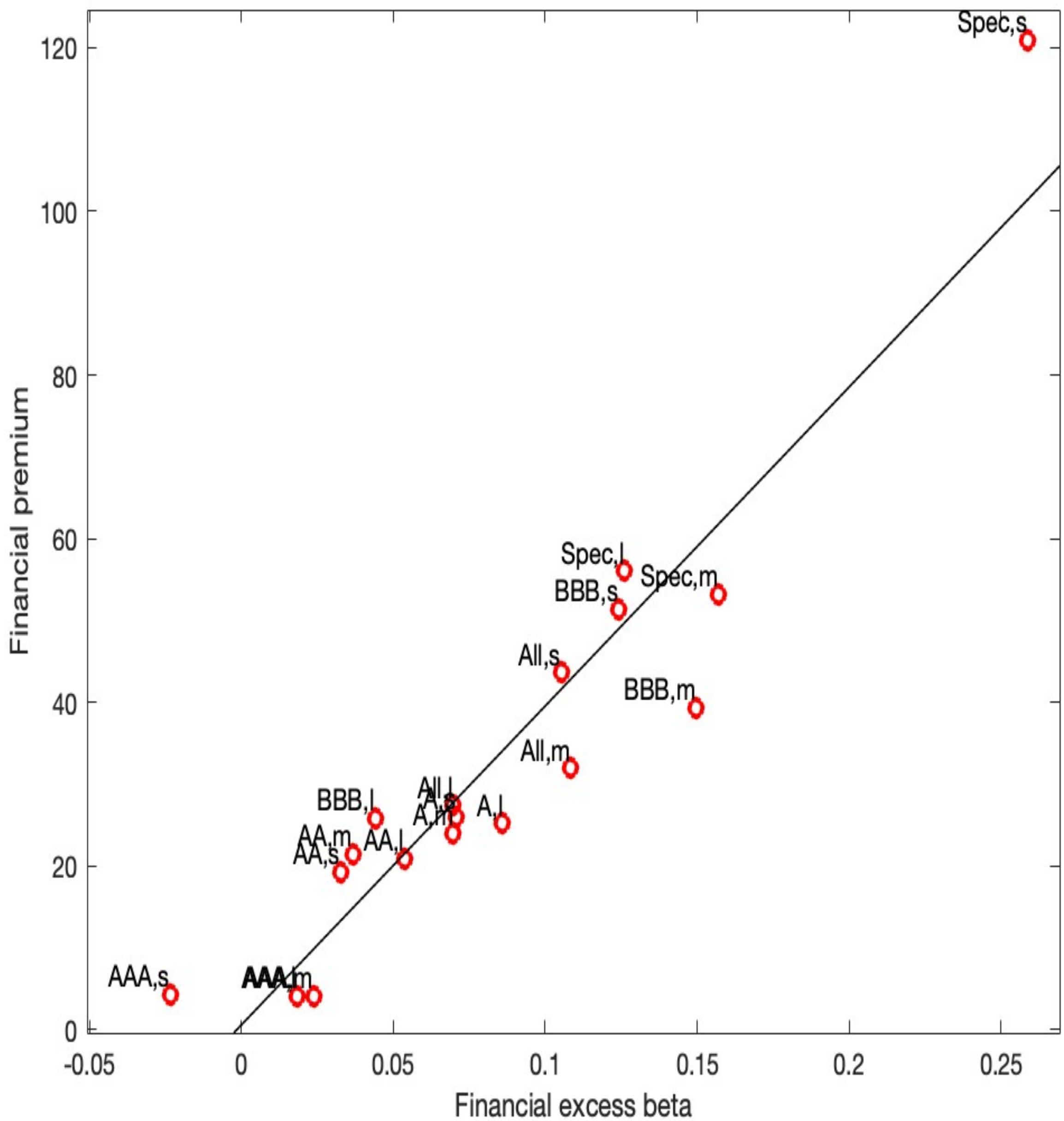

Fig. 4 *Financial premium and excess beta.* For each rating class and maturity group, we calculate the financial premium (in basis points) and financial excess beta and the figure shows a plot of the results. The black line is the regression line when regressing the financial excess beta in the financial premium. We restrict the data sample to bond-month observations where we observe both a spread and beta. The rating classes are AAA, AA, A, BBB, Speculative grade, and all ratings while maturities are 0.5–3.5 years (short), 3.5–7.5 years (medium), and 7.5–10.5 years (long). The sample period is 1987–2020.

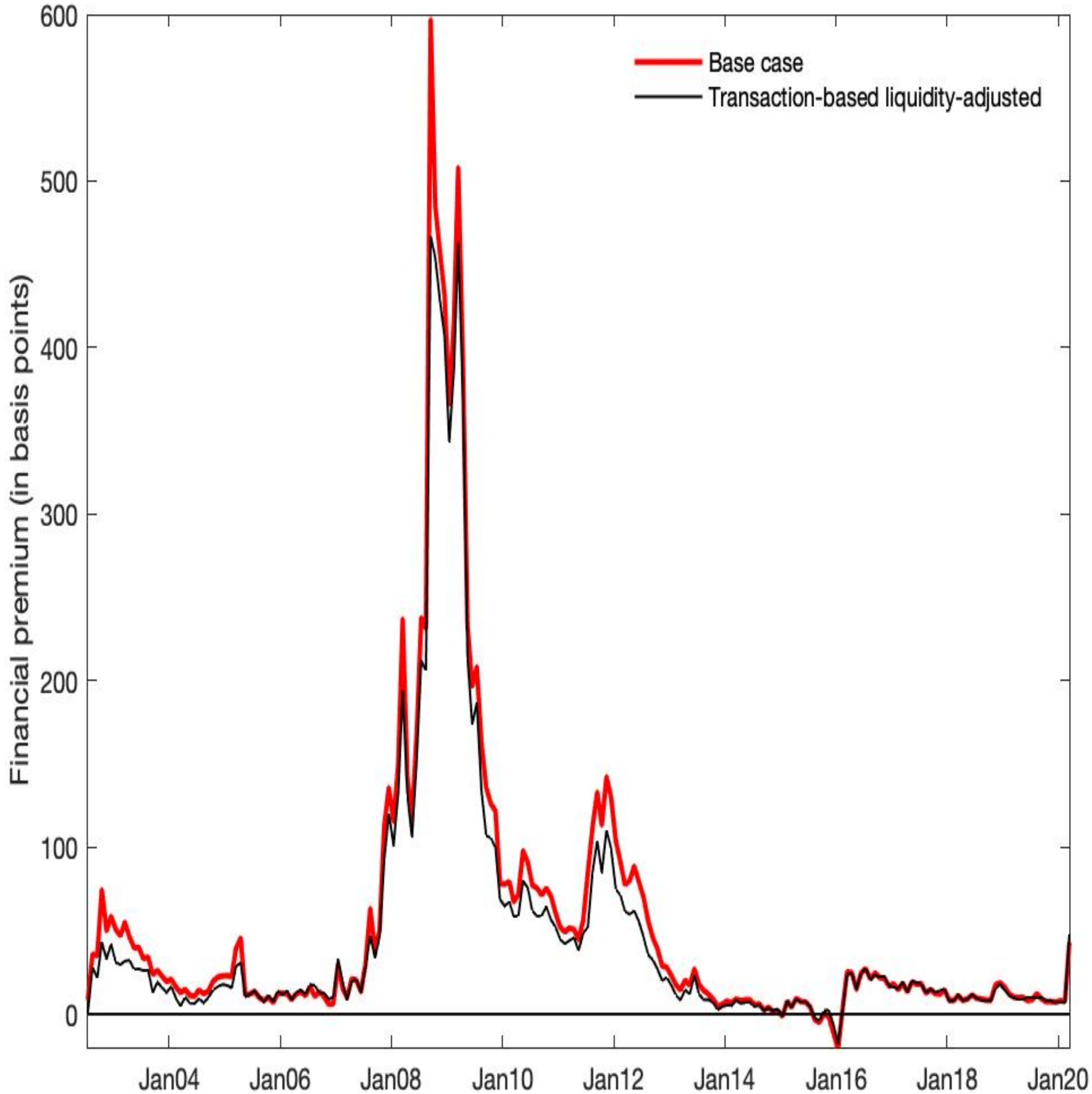

Fig. 5 *The transaction-based liquidity-adjusted financial premium.* For each month in the period 2002:07–2020:03, we estimate the regression $s_{itj} = \beta 1_{fin,j} + \gamma' X^1_{it} + \mu_{mrt} + \epsilon_{itj}$, where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X^1 contains the control variables coupon, bond age, and log(amount issued) and μ_{mrt} is a month-rating-maturity fixed effect. The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., BBB-). 'Base case' shows the time series of β. 'Liquidity-adjusted' shows the time series of β from the regression $s_{itj} = \beta 1_{fin,j} + \gamma_1' X^1_{it} + \gamma_2' X^2_{it} + \mu_{mrt} + \epsilon_{itj}$, where X^2 contains the liquidity control variables number of trades, number of large trades, trading volume, and roundtrip costs and μ_{mrt} is a month-rating-maturity fixed effect. Both regressions are estimated on the same data set of bond-month observations where a monthly roundtrip cost can be calculated, in total 315,740 bond-month observations.

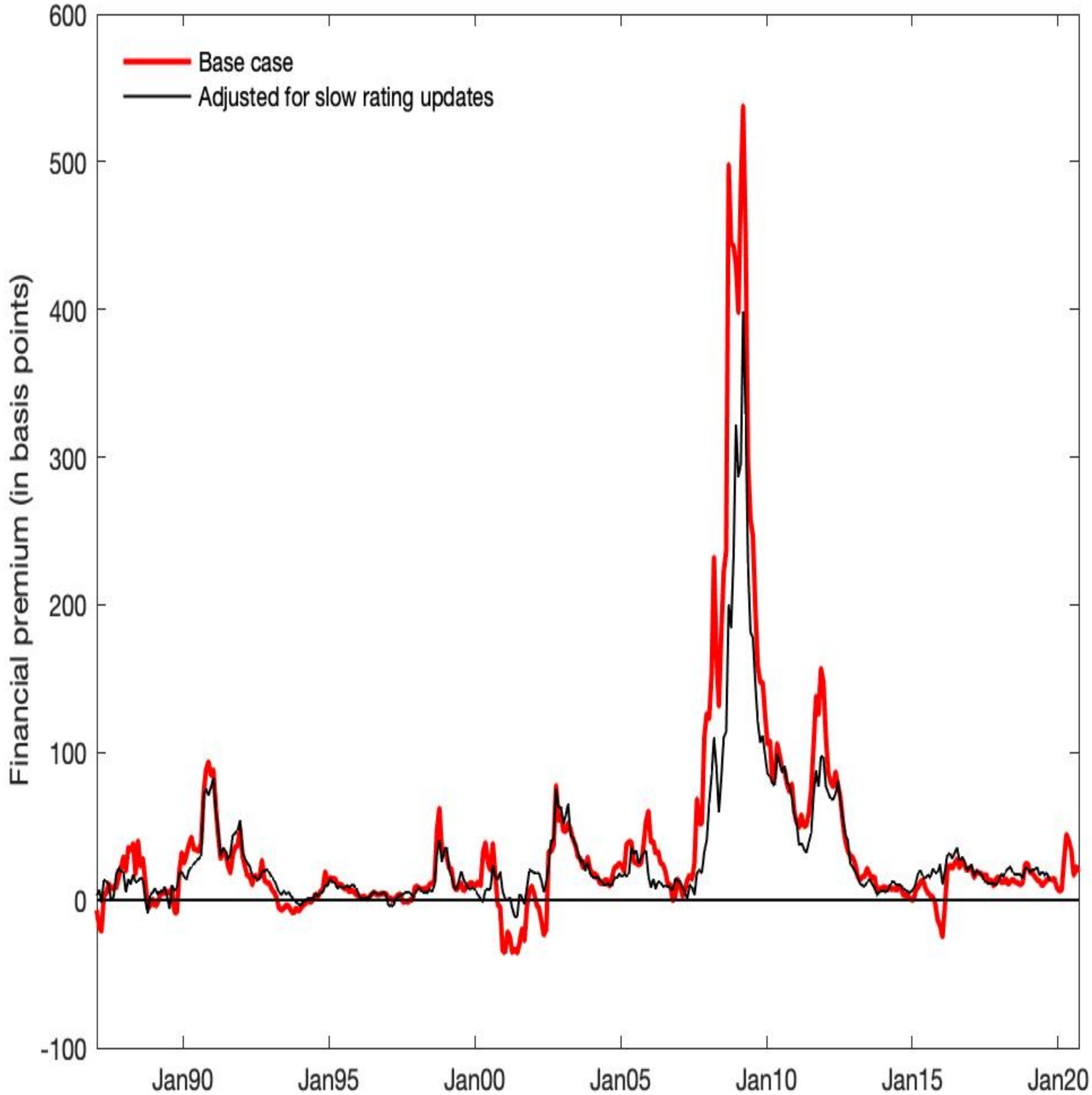

Fig. 6 *The financial premium adjusted for slow rating updates.* For each month in the period 2002:07–2020:03, we estimate the regression $s_{itj} = \beta 1_{fin,j} + \gamma' X^1_{it} + \mu_{mrt} + \epsilon_{itj}$, where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X^1 contains the control variables coupon, bond age, and log(amount issued) and μ_{mrt} is a month-rating-maturity fixed effect. The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., BBB-). 'Base case' shows the time series of β for the whole sample. 'Adjusted for slow rating updates' shows the time series of β from the same regression, but where the data sample is restricted to observations of s_{itj} where the bond has the same rating six months later.

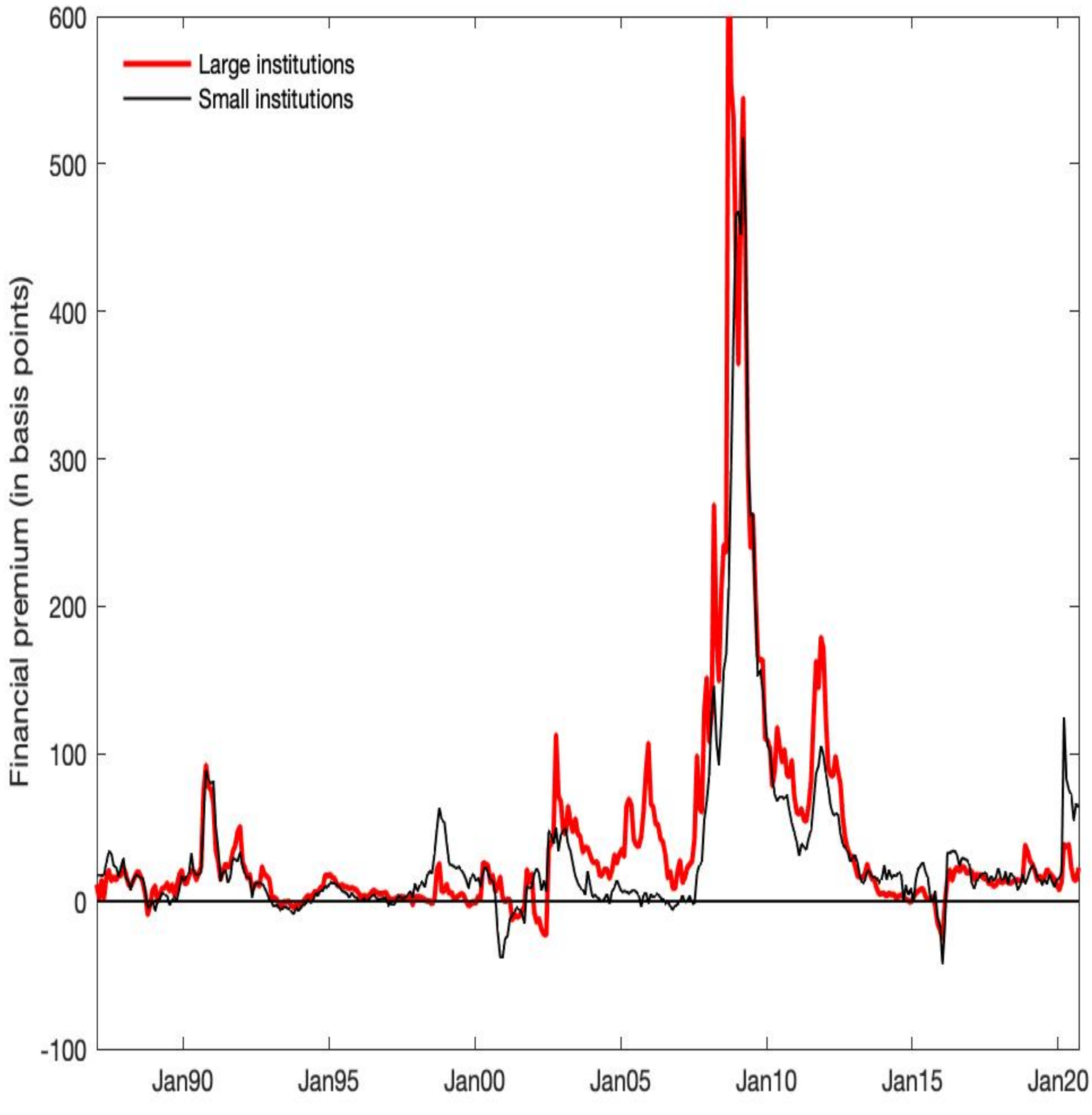

Fig. 7 *Too-big-to-fail: the financial premium for small and large financial institutions.* For each month in the sample, we estimate the regression $s_{itj} = \beta 1_{fin,j} + \gamma' X_{it} + \mu_{mrt} + \epsilon_{itj}$, where s_{itj} is the yield spread in month t of bond i issued by firm j, $1_{fin,j}$ is one (zero) if firm j is a financial (industrial) firm, X contains control variables and μ_{mrt} is a month-rating-maturity fixed effect. The control variables are coupon, bond age, and log(amount issued). The fixed effect maturity intervals are 0.5-1.5, 1.5-2.5, ..., 8.5-9.5, and 9.5-10.5 years while the fixed effect rating are at notch level (AAA, AA+, AA, ..., BBB-). The figure shows the time series of β for small financial institutions (less than \$50billion in total assets) and large financial institutions (more than \$50billion in total assets) .