Why firm access to the bond market differs over the business cycle: A theory and some evidence

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Abstract

This paper argues that firms' access conditions to the bond market vary over the business cycle. The reason is that they rely on information gathering agencies to access this market and the "quality" of the signal these agencies produce varies with firms' creditworthiness. This increases the cost of accessing the bond market in recessions. Importantly though this cost increase is not uniform across firms. It may, for instance, be largest for mid-credit quality firms. The analysis of the bonds issued in the last two decades by American nonfinancial firms produces evidence in support of the model's key assumptions. We find that rating agencies are more likely to produce split ratings, our proxy for the "quality" of the signal produced by information agencies, on bonds of mid-credit quality issuers in recessions as well as in expansions. Our analysis of bond-credit spreads at issue date, in turn, shows that split ratings do not affect the relative cost of bond financing across firms in expansions, but they increase the relative cost of this funding source for mid-credit quality issuers in recessions. Furthermore, our analysis shows that split ratings make bond financing more expensive for these mid-credit quality issuers in recessions than in expansions. These findings confirm the model's key result that information gathering agencies influence access conditions to the bond market across firms and over the business cycle. They also suggest that recessions alter the substitutability between bank funding and market funding, and that the extent of this effect is largest for mid-credit quality firms. This has several potentially important implications, in connection, for example, with firm choices of funding sources, bank lending policies and the credit channel of monetary policy.

1 Introduction

Why does bond issuance and credit spreads vary over the business cycle? In a world where access conditions to the bond market were independent from the state of the economy, these differences would reflect firms' investment opportunities and, possibly, investors' risk preferences. In this paper, we argue, however, that firms' ability to raise bond funding *do vary* over the business cycle. Our theory builds on the assumption that the "quality" of the signal produced by information gathering agencies, which firms use to access the bond market, varies with firms' creditworthiness. This increases the cost of bond financing in recessions. Importantly, though, this cost increase does not impact all firms equally. Our analysis of the bonds issued in the last two decades by American nonfinancial firms produces evidence in support of both the model's assumptions as well as its results that firms' reliance on information agencies to access the bond market makes the cost of bond funding dependent on the state of the economy and it increases the cost of this funding source in recessions the most for mid-credit quality firms.

The early literature on financial intermediation was mainly concerned with the identification of conditions under which bank loans dominated public debt.[1] Diamond (1991) began to expand this literature to explain the coexistence of direct and intermediate lending. A distinct feature of Diamond's reputation theory is that some firms (younger firms) borrow exclusively from banks while other firms (those with established track records) borrow exclusively from the bond market.[2] Besanko and Kanatas (1993) added to this literature by providing a theory of firms' simultaneous use of bank loans and public debt. Firms borrow the sufficient amount from a bank to give it the correct monitoring incentives and then borrow additional funds in the bond market. In this case bondholders can free ride on the bank's monitoring services.[3]

An aspect missing from the literature on the coexistence of public debt and bank debt is the potential impact of state of the economy on firms' choice of funding sources. Evidence shows, though, that recessions lower the number of bond issues and the impact varies with issuers' creditworthiness. On average, in recessions there are fewer A and lower rated issues

[1] See, for example, Leland and Pyle (1977), Diamond (1984), Boyd and Prescott (1986) and Allen (1990).

[2] Other explanations to the coexistence of public debt and bank loans that produce a similar implication include Rajan (1992), Chemmanur and Fulghieri (1994), Yosha (1995), Bhattacharya and Chiesa (1995), Boot and Thakor (1997), Repullo and Suarez (1999) and Bolton and Freixas (2000a).

[3] Other theories of firm simultaneous use of bank loans and bonds include Holmstrom and Tirole (1997), Repullo and Suarez (1998) and Carey and Rosen (2001).

but more AA and higher rated issues (top panel of Table 1). Recessions also increase the credit spreads at issue date and once again the impact is not uniform across issuers (bottom panel of Table 1). Even among investment-grade issues, recessions have a larger impact on lower rated issues, as downturns increase the difference between spreads of issues with different ratings.[4] Firm investment opportunities and investor risk preferences will certainly account for some of these differences in bond issuance and credit spreads, but given that the impact of recessions is not uniform across firms suggests that there may exist other factors that also influence firms' ability to raise funding in the bond market over the business cycle.

In this paper we provide a theory of firms' access conditions to the bond market over the business cycle which builds on the screening services provided by information gathering agencies, like rating agencies. These agencies are important because virtually all firms use them access the bond market. Despite that, it is somewhat surprising that they are absent from the existing theories on public debt. Of course, the widespread use of credit ratings by bond issuers could be partly attributed to institutional factors like regulations.[5] However, researchers have advanced theories explaining intermediaries whose main function is to produce information to be used by investors. Moreover, they have also unveiled evidence showing that these intermediaries produce valuable information.[6] The signal these agencies produce about borrowers' creditworthiness is valuable because entrepreneurs are better informed about their investment projects than investors. However, the asymmetry of information that makes these agencies valuable may also lead them to produce incorrect assessments. In this case, as we will show, information gathering agencies can influence the cost of bond financing across firms and over the business cycle.

In order to focus on the impact of information agencies on firms' access to market

[4]These results assume, as rating agencies claim, that ratings are comparable over the business cycle. For example, Moody's states "As a rule of thumb, we are looking through the next economic cycle or longer. Because of this, our ratings are not intended to ratchet up and down with business or supply-demand cycles $\cdots$.

[5]Early regulatory uses of ratings, including the 1936 prohibition for banks to invest in speculative securities and the 1982 permission for investment-grade securities to disclose less information, drew only on the distinction between investment and speculative securities. Over time regulations have been tied to other letter grades. Since 1989 banks can only use AA (or higher) foreign bonds as collateral for margin lending, and since 1990 insurance companies face a lower capital charge for their investments in A (or higher) bonds (Cantor and Packer (1996)).

[6]Ramakrishnan and Thakor (1984), Millon and Thakor (1984) and Boot and Milbourn (2001) provide explanations for information gathering agencies, and Hand, Holthausen an Leftwich (1982), Liu and Thakor (1984), Ederington, Yawitz, and Roberts (1987), in turn, provide evidence that credit rating agencies convey relevant information about the issuing firm that investors cannot obtain from other sources.

funding, the model that we present makes some simplifying assumptions. We assume that firms' only source of funding is bond financing. In addition, we disregard the potential impact of such things as differences in both investors' risk preferences as well as firms' investment opportunities over the business cycle. We create a role for information agencies by assuming that there is adverse selection. This makes it worthwhile for firms that want to issue bonds to contract with an information agency in exchange for a signal on their creditworthiness. Information agencies, however, can make incorrect assessments about the firm's creditworthiness. To reduce the costs of these assessments, we assume each firm contracts with two agencies.[7] This introduces a novelty, the possibility of split ratings, that is, circumstances where the information agencies announce different ratings for the same firm. Split ratings are important because they are a determinant of the "quality" of the signal produced by information agencies which is observable by investors.

We assume that split ratings arise from unsystematic differences in the information sets that agencies use to screen each firm and/or in their interpretation of the information in these sets with regards to the creditworthiness of the firm. Even if both agencies have access to the same information sources, the information sets they use to screen a firm may still differ. As rating agencies, for example, indicate they use public information and are given access to confidential information. Moreover, they take into account not only quantitative information, such as the specific terms of the issue and the issuer's financial reports, but they also gather qualitative information, such as information on the creditworthiness of the guarantors and on the quality of the issuer's management.[8] Thus, throughout this process rating agencies may collect different pieces of information or focus on different aspects of the firm, resulting in some cases in a different credit rating.

We make two assumptions about the likelihood of information agencies announcing split ratings. First, we assume that these agencies are more likely to announce a split rating for mid-credit quality firms than for either high or low credit quality firms. The rationale for this assumption is that because rating agencies use rating scales that are bounded on both ends this makes it relatively easier for them to "agree" on firms on either tail of the

[7]To simplify the analysis, we do not endogeneize the number of information agencies that the firm contracts with. Since both Moody's and S&P rate virtually all public corporate bond issuers, a dual rating is fairly automatic for firms that issue in the United States.

[8]For example, both Moody's and S&P indicate that during the rating process they visit the issuing firm premises, meet with management to discuss operating and financial plans as well as general management policies. See Crouhy, Galai and Mark (2001) for a detailed description of the processes used by rating agencies.

distribution on firm creditworthiness. However, as firms' creditworthiness is further away from these tails, rating agencies are increasingly more likely to make incorrect assessments on the firm's creditworthiness.

Second, we assume that given a firm creditworthiness the likelihood of it getting a split rating in recessions is equal or larger than the likelihood of getting a split rating in expansions. A rationale for this assumption is that recessions bring new uncertainties and information frictions and these increase the likelihood of differences in the information sets used by each rating agency to rate a firm thus leading to a higher frequency of incorrect assessments. Alternatively one could rationalize this assumption following Morgan (2000) idea that bond-rating splits are a proxy for firm opacity. Morgan (2000) shows that rating agencies disagree more often over bank bonds than nonfinancial bonds and argues that this difference arises because banks are relatively more opaque for the purpose of credit risk measurement than nonfinancial firms. In the current context this idea would suggest that if there are more information frictions in recessions and these make firms more opaque, then companies that are in the business of judging risk will find it more difficult to perform their jobs during these periods resulting in a higher frequency of rating splits for bonds issued during recessions.

Building on these assumptions, we show that information gathering agencies, though valuable, influence the cost of accessing the bond market. More specifically, we show that a reduction in the "quality" of the signal that they produce increases the cost of this funding source for high and mid-credit quality borrowers and it lowers the cost of it for low-credit quality borrowers. We then extend the model to consider the impact of the state of the economy on the cost of accessing the bond market. We assume that the distribution of firm types in expansions exhibits first order stochastic dominance over the corresponding distribution in recessions. Under these conditions, we show that recessions can make information agencies' incorrect assessments costlier to *all* firms. When this happens, recessions increase the cost of bond financing to *all* firms, but mid-credit quality firms face the largest cost increase. If recessions, in addition, lower the "quality" of the signal produce by information agencies, then this will further increase the cost of bond financing for high and mid-credit quality firms.

To test our theory we analyze the bonds issued in the last two decades in the United States by American nonfinancial firms. We first try to find support for the model's key assumptions on the "quality" of the signal produced by information gathering agencies. We proxy the quality of this signal by the frequency of rating splits between Moody's and S&P ratings of bonds at issued date. The results of this analysis confirm the model's assumptions. In particular, we find that, *ceteris paribus*, rating agencies are more likely to announce different ratings on bonds of mid-credit quality issuers, and the increase in the likelihood of rating splits as a result of recessions is largest for mid-credit quality issuers.

We then investigate bond credit spreads at issue date in an attempt to find support for the model's results on the cost of accessing the bond market. Our results show that, *ceteris paribus*, rating splits increase the cost of bond financing in recessions. Importantly, though, this impact im downturns is not uniform across firms. Instead, it is largest for mid-credit quality issuers. These results, therefore, lend support to our theory that information gathering agencies influence the cost of bond financing and that their impact on the cost of this funding source varies across firms and over the business cycle.

Our paper is related to various strands of the literature. At the theoretical level, our paper adds to the literature on the coexistence of bank and market funding as this literature has not considered the impact of firms reliance on information gathering agencies to access market funding.[9] Even though we do not consider bank lending, our theory of firm access to the bond market suggests that information agencies influence the substitutability between bank lending and market funding and their impact on this regard varies across firms and over the business cycle. Our paper also complements the literature that has investigated the link between firms' financial condition and their ability to borrow from banks over the business cycle as this literature does not consider bond financing and the possibility of accessing this funding source not being neutral to the state of the economy.[10]

Our theory is also relevant to the credit-channel literature. This literature explicitly assumes that bank lending and market financing are imperfect substitutes. It usually justifies this assumption on the general idea that banks are special because of their ability to extend credit to borrowers who would find it difficult to raise funding in the market. This literature, however, does not relate these difficulties to the state of the economy.[11] The present model suggests that recessions increase the importance of the bank lending channel, particularly

[9]See Diamond (1991), Besanko and Kanatas (1993) and references in footnotes 2 and 3 for models that explain the coexistence of bank and market funding.

[10]Bernanke and Gertler (1987) present a formal analysis of the role of borrowers' balance sheets on the cost of external funds over the business cycle. Borrowers' net worth tend to be lower in downturns, which in the presence of asymmetric information increases agency costs, thus making external funds relatively more expensive during these periods. Because they employ Towsend's (1979) "costly state verification" model to motivate agency costs of investment they consider only bank funding. See Williamson (1987), Bernanke and Gertler (1989) and Rajan (1994) for other models that generate a correlation between bank credit policies and the state of the economy.

[11]See Bernanke and Blinder (1988) and Bolton and Freixas (2000b) for a formal analysis of the credit channel along these lines.

through mid-credit quality borrowers, as these are the borrowers whose access conditions to market funding can be the most negatively affected by downturns.[12]

At the empirical level, our findings besides providing support for this paper's theory, they also offer support for the claim often made that it is more expensive to raise market funding in downturns. Fama and French (1989) report that the spread between Aaa bonds and the one-month bill rate tends to be low around NBER business-cycle peaks and high near troughs, and Bernanke (1993) notes that the Baa corporate-Treasury bond spread widened significantly during the Great Depression. Stock and Watson (1989) and Friedman and Kuttner (1992), in turn, report that the commercial paper-Treasury bill spread increases in downturns in the United States. This literature does not account for the effects of other determinants of credit spreads, and in contrast with the theory put forward in this paper it argues that the widening of spreads in downturns is demand driven.[13]

Finally, our results contribute to the literature on the determinants of bond pricing at issue date. This literature has focused on such determinants as the characteristics of the issuer and the design of the issue, and paid less attention to the potential implications of the market-access conditions these firms face at the time they issue bonds and the potential impact of rating agencies disagreements on the cost of this funding source.[14]

The remainder of the paper is organized as follows. The next section presents a model of firm access to the bond market and derives the model's empirical implications on the cost of firm access to this form of funding over the business cycle. Section 3 introduces the data we use to test these implications. Section 4 tests the model's key assumptions on the "quality" of the signal produced by information agencies across firms and over the business cycle and section 5 tests the model's empirical implications on the impact of the "quality" of this signal

[12]Implicit here is the assumption that banks ability to raise funding and their monitoring and lending capabilities are not equally affected by the state of the economy.

[13]According to Bernanke, bond spreads widened due to lenders' preferences for safe and more liquid assets. Friedman and Kuttner, in turn, argue that during downturns a combination of falling cashflows and unintended inventory accumulation creates a financing deficit for firms and forces them into the commercial paper market provoking in turn an increase in the commercial paper spread.

[14]This literature controls for the bond credit rating by including the ratings attributed by one agency alone. Cantor, Packer and Cole (1997) and Jewell and Livingston (1998) investigate the impact of split ratings on bond spreads, but they do not control for the state of the economy at the time of the issue. Harrison (2001), in turn, control for the macroeconomic conditions at the time of the issue but by including the 10-year constant Treasury yield and the Treasury yield curve premium and he does do not account for the potential impact of split ratings.

on the cost of bond financing in expansions and recessions. Section 6 concludes the paper.

2 A Model of firm access to the bond market

Consider an economy where entrepreneurs and investors are risk neutral. Entrepreneurs have investment opportunities but they have no funds of their own. To focus on market funding, we assume that there are no banks in this economy and that entrepreneurs choose to raise the funding necessary to undertake their investment opportunity in the bond market.

There are three types of firms, denoted as type A, B, and C, respectively. Each entrepreneur has an investment opportunity which requires one unit of funding and generates a cashflow equal to X_i with probability p_i and a cashflow equal to zero with probability $(1-p_i)$. We make the following assumptions about these firms investment opportunities.

Assumption 1 *Firms' investment opportunities meet the following conditions:*

(i) Each firm has a positive net present value investment opportunity, $p_i X_i > 1$ *for all* $i \in \{A, B, C\}$.

(ii) The probability of failure of mid-quality firms, type-B firms, is at equal distance (in absolute terms) from the probability of failure of the safest firms, type-A firms, and that of the riskiest firms, type-C firms. Thus $p_A > p_B > p_C$ *with* $p_A - p_B = p_B - p_C$.

There is adverse selection. Entrepreneurs know their own type but investors are unable to distinguish among firms. Investors, however, know the distribution of firm types, θ. Let θ_A, θ_B, and θ_C be the portions of firm types A, B, and C, respectively. We assume that the adverse selection problem is important in the sense of the following assumption.

Assumption 2 *The most common firms in the economy are mid-quality firms but low-quality firms dominate high-quality firms,* $\theta_B > \theta_C > \theta_A$.

Finally, we assume that the success of the investment undertaken by each entrepreneur is verifiable at no cost by outsiders, but not the investment's return. Under these conditions each firm can promise to repay a fixed amount D (its nominal debt) only in case it succeeds. Because entrepreneurs have no funds, their repayment is zero in case their investment fails. Assuming the riskless interest rate in the economy is zero, we can then define the competitive equilibrium when firms apply for funding without the services of information gathering agencies. Let $\Gamma(D)$ be the probability of investors being repaid given they demand a repayment D

when firms are sucessfull. We have that

$$\Gamma(D) = \begin{cases} p_A\theta_A + p_B\theta_B + p_C\theta_C & if \quad\quad D \leq X_A, \\ \dfrac{p_B\theta_B + p_C\theta_C}{\theta_B + \theta_C} & if \quad X_A < D \leq X_B, \\ p_C & if \quad X_B < D \leq X_C. \end{cases}$$

Definition 1 Equilibrium without information agencies: *When firms raise funding directly from investors, the competitive equilibrium of the credit market is obtained for a value of D such that*

$$\Gamma(D^\star)D^\star = 1.$$

Assuming the parameters of the model are such that $D^\star \leq X_A$, we have in equilibrium

$$D^* = \frac{1}{\theta_A p_A + \theta_B p_B + \theta_C p_C},$$

with $\{\frac{1}{p_A}, \frac{1}{p_B}\} < D^\star < \frac{1}{p_C}$.[15]

2.1 Using information gathering agencies to access the bond market

An obvious problem of the previous equilibrium is the cost of asymmetry of information. Adverse selection penalizes high and mid-quality firms as these are bundled with lower quality firms and charged a "weighted" average interest rate. In contrast, asymmetry of information benefits low-quality firms. This gives firms, particularly the higher quality ones, an incentive to contract with an information gathering agency in exchange for a signal on their creditworthiness, which they could then use to separate themselves from law-quality firms.

In what follows we assume firms can contract with information agencies and receive in exchange for a fee f a rating, R_i, that is, a verifiable signal about their creditworthiness. If information agencies were able to screen firms without making incorrect assessments, assuming f is not too large, types-A and B firms would buy this service, which would then lead to the identification of type-C firms. In this case, in equilibrium type i firms would pay $D_i = \dfrac{1}{p_i}$, with $i \in \{A, B, C\}$.

Suppose, however, that information agencies are not able to identify correctly the firm type all the time, that is, $P[R_i \backslash i] < 1$. This has several important implications. It gives an incentive for firms, particularly of higher quality, to apply for a second rating. This may reduce the probability of being assigned the wrong rating and it may improve the "quality" of the

[15] It is possible to show that $\frac{1}{p_A} < D^\star < \frac{1}{p_C}$ derives from assumption A1.(ii) while $D^\star > \frac{1}{p_B}$ derives from assumptions A1.(ii) and A2.

signal sent to investors when both information agencies announce the same signal. This choice, in turn, may "force" low-quality firms to follow suit in order to avoid reaving their type.[16] Applying for a rating from a second agency, besides being costly, creates the conditions for split ratings, that is, circumstances where the same company gets a different rating from two agencies. In what follows, rather than fully modeling which firms apply to two information agencies and what implications this choice may have on the quality of the screening services provided by agencies, we assume all firms apply for two ratings. Furthermore, we make the following simplifying assumptions about the two ratings each firm receives.

Assumption 3 *The ratings attributed by information agencies meet the following conditions:*

(i) Firms get at least one correct rating, $P[R_{ij}\backslash k] = 0$ *for* $i, j, k \in \{A, B, C\}$ *with* $i \neq j \neq k$.

(ii) When information agencies make an incorrect assessment, they make at most a one-notch error, $P[R_{AC}\backslash i] = 0$ *for* $i \in \{A, C\}$.

(iii) Conditional on the firm type, the probability of each (possible) split-rating combination is the same regardless of the firm type, $P[R_{AB}\backslash A] = P[R_{AB}\backslash B] = P[R_{BC}\backslash B] = P[R_{BC}\backslash C] = \mu$.

This assumption has some important implications. First, given A(i), that is, that each firm gets at least one correct rating, then μ fully determines the "quality" of the signal produced by the ratings of the two information agencies. The higher the value of μ the lower the "quality" of this signal, where $0 \leq \mu \leq \frac{1}{2}$.

Second, given A.3(ii) and A.3(iii) mid-quality firms, type-B firms, are more likely to get a rating split than firms on either tail of the creditworthiness distribution. As a result, the "quality" of the signal produced by the ratings of the two agencies is lower for type-B firms. In particular we that

$$P[R_{BB}\backslash B] = (1 - 2\mu) < P[R_{AA}\backslash A] = P[R_{CC}\backslash C] = (1 - \mu).$$

Lastly, this assumption has some implications for probability of a firm's type conditional on the ratings that they receive. It implies, for instance, that when a firm gets the same rating from the two different agencies its type is fully revealed, that is

$$P[i\backslash R_{ii}] = 1 \qquad \text{for} \qquad i \in \{A, B, C\}.$$

[16]There is evidence that two (or more) equal ratings reduce investors' required yield (Hsueh and Kidwell (1988) and Thompson and Vaz (1990)).

In contrast, when the firm receives different ratings, the conditional probabilities are

$$
\begin{aligned}
P[A \backslash R_{AB}] &= \frac{\theta_A}{\theta_A + \theta_B}, \\
P[B \backslash R_{AB}] &= \frac{\theta_B}{\theta_A + \theta_B} \quad \text{and} \quad P[B \backslash R_{BC}] = \frac{\theta_B}{\theta_B + \theta_C}, \\
P[C \backslash R_{BC}] &= \frac{\theta_C}{\theta_B + \theta_C}.
\end{aligned}
$$

Using these probabilities in turn we can compute the probability that investors will be repaid conditional on the two ratings attributed to the firm, R_{ij}, and the face value of debt D_{ij}. These conditional probabilities are:

$$
\begin{aligned}
\Gamma_{ii}(D_{ii}) &= p_i \qquad\quad if \quad D_{ii} \leq X_i \quad for\, i \in \{A, B, C\} \\
\Gamma_{ij}(D_{ij}) &= \frac{\theta_i p_i + \theta_j p_j}{\theta_i + \theta_j} \quad if \quad D_{ij} \leq X_A \quad \text{for} \quad (ij) \in \{(AB), (BC)\}.
\end{aligned}
$$

We can now characterize the equilibrium when all firms in the economy issue bonds after they receive two ratings.

Definition 2 Equilibrium with information agencies: *When all firms in the economy issue bonds using their two ratings, R_{ij}, the competitive equilibrium of the credit market is obtained when D_{ii} and D_{ij} are such that*

$$
\begin{aligned}
\Gamma_{ii}(D^*_{ii})D^*_{ii} &= 1 \quad for \quad i \in \{A, B, C\}, \\
\Gamma_{ij}(D^*_{ij})D^*_{ij} &= 1 \quad for \quad (ij) \in \{(AB), (BC)\}.
\end{aligned}
$$

In equilibrium we have, therefore, that firms pay

$$
\begin{aligned}
D^*_{ii} &= \frac{1}{p_i} \quad \text{for} \quad i \in \{A, B, C\}, \\
D^*_{ij} &= \frac{\theta_i + \theta_j}{\theta_i p_i + \theta_j p_j} \quad \text{for} \quad (ij) \in \{(AB), (BC)\}.
\end{aligned}
$$

This implies that the expected cost of bond financing, EC_i, is

$$
\begin{aligned}
EC^*_A &= (1-\mu)D^*_{AA} + \mu D^*_{AB}, \\
EC^*_B &= (1-2\mu)D^*_{BB} + \mu D^*_{AB} + \mu D^*_{BC}, \\
EC^*_C &= (1-\mu)D^*_{CC} + \mu D^*_{BC}.
\end{aligned}
$$

Comparing the cost of external funds under the new equilibrium with the cost of external funds under the equilibrium without information agencies, we find that $EC^*_A < D^*$. Thus, as long as credit ratings are not too expensive, type-A firms are better off applying for them. With respect to type-C firms, even though $EC^*_C > D^*$, if type-B firms apply for ratings, they too are better off applying for ratings. Otherwise, investors will infer (correctly) that they are a type-C firm and charge them $\frac{1}{p_C} > EC_C^*$. Regarding, type-B firms, if information agencies were able to produce flawless screening services we would have $EC_B^* = \frac{1}{p_B}$. In this case, as we saw above, our assumption A3.(i) implies $EC_B^* < D^*$. Thus, as long as $\theta_C > \theta_A$, mid-quality firms are better off applying for ratings. Similarly, given that when $\mu = \frac{1}{2}$, $EC_B^* \lesseqgtr D^*$ then mid-quality firms are better off applying for ratings as long as the "quality" of the signal produced by these ratings is not too low, that is, $\mu \leq Min\{\frac{1}{2}, \hat{\mu}\}$, where $\hat{\mu}$ is determined by $EC_B^*(\hat{\mu}) = D^*$.

An important feature of the equilibrium we just established is that the cost of accessing the bond market depends on the "quality" of the signal produced by information agencies, μ. Changes in the "quality" of this signal, however, affect firms differently. To see this, consider the cost of rating splits, $CRS_i = \frac{\partial EC_i^*}{\partial \mu}$, for each firm type

$$\begin{aligned} CRS_A &= -D_{AA} + D_{AB}, \\ CRS_B &= -2D_{BB} + D_{AB} + D_{BC}, \\ CRS_C &= -D_{CC} + D_{BC}. \end{aligned}$$

It is possible to show that $CRS_A > 0$. This is because $D_{AB} > D_{AA}$. Thus, as the "quality" of the rating agencies' signal decreases the cost of bond financing increases for high-quality firms. Intuitively, as the "quality" of the signal decreases type-A firms are pooled more often with type-B firms. In contrast, a reduction in the "quality" of the rating agencies' signal is beneficial to low-quality firms, that is, $CRS_C < 0$. This is because $D_{BC} < D_{CC}$. Intuitively, as the "quality" of the signal decreases, type-C firms are pooled more often with type-B firms.

Regarding mid-quality firms, type-B firms, it is possible to show that our assumption A3.(i) that $\theta_C > \theta_A$ implies $CRS_B > 0$. Intuitively, as the "quality" of rating agencies' signal decreases, type-B firms are pooled (equally) more often with higher-quality firms, type-A firms, and with lower-quality firms, type-C firms. Given that by assumption A.1(ii) the probability of solvency of both types of firms is at equal distance from that of type-B firms and given that type-C firms predominate, then the cost of getting bundled with lower quality firms is higher than the subsidy of getting bundled with higher quality firms. This difference, in fact, may be large enough to make mid-quality firms the most penalized by a reduction in the "quality" of information gathering agencies' signal. Specifically, when $\theta_C > \frac{p_B}{p_B + (p_A - p_C)}(1 - \theta_A)$, we have that $CRS_B > CRS_A$, that is, the cost of a reduction in the "quality" of rating agencies' signal is larger for mid-quality firms than for high quality firms. Otherwise a reduction in the "quality" of the ratings' signal will affect high-quality firms the most.

Based on these results, we can now establish our first proposition about the equilibrium in the bond market in this economy.

Proposition 1 *Provided that low-quality firms dominate high-quality firms and the "quality" of the signal produced by rating agencies is not too low, then in equilibrium:*

(i) All firms are better off applying for ratings and using these to issue bonds.

(ii) The cost of bond financing will depend on the "quality" of the signal produced by information agencies. A reduction in the "quality" of this signal increases the cost of bond financing for high and mid-quality firms and reduces it for low quality firms.

(iii) If the distribution of firms types is such that $\theta_C > \frac{p_B}{p_B+(p_A-p_C)}(1-\theta_A)$, *then a reduction in the "quality" of information agencies' signal affects mid-quality firms the most.*

2.2 Accessing the bond market over the business cycle

The model of firm access to the bond market presented above does not consider the potential impact of the state of the economy on the cost of bond financing. While this impact may occur through various channels, such as investors' risk preferences or changes in firms' investment opportunities over the business cycle, in what follows we focus exclusively on the impact that may arise due to firms' reliance on information gathering agencies to access the capital markets.

As proposition (1) shows, the cost of bond financing varies with the "quality" of the signal produced by information agencies. Given that the cost of rating splits varies with the distribution of firm types in the economy, systematic changes in this distribution over the business cycle will affect the cost of bond financing. If in addition, as we discussed in the introduction to this paper the "quality" of the signal produced by information agencies varies systematically over the business cycle, this will add another link between the cost of accessing the bond market and the state of the economy. In what follows we make the following two assumptions about these links.

Assumption 4

(i) The distribution of firm types in expansions, θ^{exp}, *exhibits first order stochastic dominance over the corresponding distribution in recessions,* θ^{rec}, *that is,*

$$\begin{aligned} \theta_C^{rec} - \theta_C^{exp} &= d\theta_C \geq 0, \\ (\theta_B^{rec} + \theta_C^{rec}) - (\theta_B^{exp} + \theta_C^{exp}) &= d\theta_B + d\theta_C \geq 0. \end{aligned}$$

(ii) Recessions may lower the "quality" of the signal produced by information agencies. If that happens it will affect mid-quality firms the most, that is,

$$\mu^{rec} - \mu^{exp} = d\mu \geq 0.$$

We now investigate the impact of each of these assumptions on the cost of bond financing separately. We start by studying the impact of the changes in the distribution of firm types over the business cycle. Changes in the composition of this distribution affect the cost of bond financing by altering the cost of rating splits. As a result, it is possible to show that, *ceteris paribus*, recessions increase the cost of rating splits to mid-quality firms. They may even increase the cost of rating splits to all firms, in which case mid-quality firms will face the largest cost increase. To see these results, consider the definitions of CRS_i. Taking into account assumption A.4(i) and given that $d\theta_A + d\theta_B + d\theta_C = 0$, we find that the impact of a recession on the cost of a rating split is

$$\begin{aligned} dCRS_A &= \frac{p_A - p_B}{(\theta_A p_A + \theta_B p_B)^2}\Big[\theta_B d\theta_C + (1-\theta_C)d\theta_B\Big], \\ dCRS_B &= dCRS_A + dCRS_C, \\ dCRS_C &= \frac{p_B - p_C}{(\theta_B p_B + \theta_C p_C)^2}\Big[\theta_B d\theta_C - \theta_C d\theta_B\Big]. \end{aligned}$$

Figure 1 plots these functions in the feasible region, that is, the region that satisfies the conditions for the distribution of firms types in expansions to be first order stochastic dominant over the corresponding distribution in recessions. This region corresponds to the lighted shaded region of Figure 1.

Given that $dCRS_A$ has a negative slope and $dCRS_C$ has a positive slope, then there exists an area of the feasible region where both $dCRS_A > 0$ and $dCRS_C > 0$. This coincides with the darker region of Figure 1. Given that $dCRS_B = dCRS_B + dCRS_C$, then within this region we have that $dCRS_B > \{dCRS_A, dCRS_C\}$. Within this region all firms will find it more expensive to access the bond market in recessions, but mid-quality firms will be affected the most.

Outside this region, a reduction in the "quality" of information agencies' signal benefits either the high-quality firms, as $dCRS_A < 0$ in the light region where $D\theta_B < 0$, or the low-quality firms, as $dCRS_C < 0$ in the light region where $D\theta_B > 0$. Despite these results, it is possible to show, however, that in both regions assumption A.2 is a sufficient condition for $dCRS_B > 0$. Thus, recessions increase the cost of rating splits for mid-quality firms.

Combining these results with those of the previous subsection, it becomes apparent that recessions by affecting the composition of firm types in the economy and possibly the "quality" of the signal produced by information agencies, they will increase the cost of bond financing to mid-quality firms. They may even increase the cost of this funding source to *all* firms. To see this, consider the expected cost of market funding in equilibrium that we determined above, EC_i for $i \in \{A, B, C\}$. Given assumption A.3 it is possible to show that the variation in the expected cost of market funding due to a recession is

$$dEC_i^* = CRS_i d\mu + \mu dCRS_i.$$

If the "quality" of the signal produced by information agencies does not vary over the business cycle $d\mu = 0$ then $dEC_i^* = \mu dCRS_i$, where $dCRS_i$, is determined as above. If in addition, recessions also bring a reduction in the "quality" of the signal produced by information agencies then $d\mu > 0$ and CRS_i is as determined in the previous subsection. We summarize these results in the next proposition:

Proposition 2

(i) If the distribution of firm types in expansions exhibits first order stochastic dominance over the corresponding distribution in recessions then recessions increase the cost of bond financing for mid-quality firms. Recessions may increase the cost of bond financing for all firms. When this happens mid-quality firms will be affected the most.

(ii) If in addition recessions lower the "quality" of the signal produced by information gathering agencies then this will further increase the cost of accessing the bond market in recessions for high and mid-quality firms.

In the rest of this paper we use data on bonds issued by American nonfinancial firms in the United States to test our hypotheses on the likelihood of a firm getting a rating split and to test our model's predictions on the influence of information agencies on the cost of bond financing over the business cycle.

3 Data and methodology

3.1 Data

The data for this paper came from SDC's Domestic New Bond Issuances database. The unit of the study is, therefore, a bond issue. Our sample of bonds includes only new bonds issued in the United States in US dollars by American nonfinancial companies between 1982:2 and 2002:2. We exclude from the sample bonds issued prior to the second quarter of 1982 because Moody's started to use alpha-numeric ratings only in April of 1982. We use information on bonds issued since 1970:1, though, to identify the first time firms issued bonds and to measure the frequency firms have issued bonds over time.

Our sample of bonds includes both shelf and non-shelf issues, and bonds issued in the public market as well as those privately placed. We exclude from the sample bonds with maturities shorter than 6 months and bonds with maturities longer than 30 years. Furthermore, in order to simplify comparisons among bonds, we exclude asset-backed and convertible bonds. Lastly, we exclude bonds for which we do not have the necessary information to compute their credit spreads over the Treasury at issue date and bonds that do not have ratings from both Moody's and S&P at issue date. These criteria left us with a sample of 10,050 straight bonds.

We use NBER's identification of troughs and peaks to find out if a bond was issued in a recession or an expansion. We define a recession as the time period between a peak and a through and an expansion as the time period between a through and a peak. Using this definition, we classify a quarter to be a recession (expansion) if either all months or the majority of months in the quarter are in a recession (expansion) period. This left us with 70 quarters of expansion and 11 quarters of recession during the period 1982:2-2002:2 (Table 2).[17] Of the 10,050 bonds in our sample, 86% of them were issued in expansions and the remaining 14% were issued in recessions.

Table 3 characterizes our sample of bonds along various dimensions. Recession cohorts have a larger percentage of bonds of higher credit quality (single A and higher) than expansion cohorts. According to our sample, in recessions firms tend to issue bonds with shorter maturities, and fewer firms issue bonds with call and put provisions, and bonds with a sinking fund.[18] In recessions there are also more shelf-registration issues and private placements.[19] 144A issues account for the vast majority of private placements in recessions as well as in expansions.[20]

Finally, our sample shows that fewer firms issue for the first time in recessions. We identify first-time bond issuers over the period 1982:2-2002:2 by examining the 6-digit cusip match among all issuers in the SDC bond database since 1970:1.

[17]All of the results presented in the paper use this definition of recessions and expansions. We also considered a modified version of it which defines a quarter to be a recession (expansion) if either all of its months were in a recession (expansion) period or the through (peak) occurred in that quarter and found similar results.

[18]Callable bonds are bonds that have a clause which entitle the issuing company to buy them back at a predetermined price prior to the maturity date. In contrast, bonds with a put provision give bondholders the option of selling the bond back to the issuing firm prior to the maturity date.

[19]Shelf-registration gives firms the ability to pre-register bonds that are issued up to two years in the future.

[20]Rule 144A was adopted by SEC in April 1990 establishing conditions under which private placements could be freely traded among "qualified institutional buyers". The most immediate implication of this rule was the development of a more liquid class of private placement.

3.2 Methodology

Our methodology has two parts. The first part attempts to provide evidence in support of the model's assumptions on the "quality" of the signal produced by information gathering agencies. The second part, in turn, attempts to provide evidence in support of the model's results regarding the cost of accessing the bond market over the business cycle.

3.2.1 Determinants of the "quality" of information gathering agencies' signal

In our model of firm access to the bond market, the "quality" of the signal provided by the ratings of information gathering agencies is fully determined by the likelihood of rating splits between these agencies. This resulted from our assumption that when firms apply to two information agencies they always get at least one correct rating. Absent this simplifying assumption, it would still seem reasonable to assume the existence of an inverse relationship between the frequency of rating splits and the "quality" of the signal provided by information gathering agencies' ratings. We, therefore, use the frequency of bond-rating splits between Moody's and S&P at issue date as our proxy for the "quality" of signal produced by information gathering agencies.[21]

Bond rating splits between Moody's and S&P are a good proxy for this purpose for various reasons. First, they are comprehensive because both agencies have the policy of rating all taxable corporate bonds regardless of whether they have been hired by the issuer. As a result, they are not likely to introduce sample selection problems.[22] Second, they are comparable. Both rating agencies have a similar objective with their ratings of debt instruments. In the words of S&P, "A credit rating is S&P's opinion of the creditworthiness of an obligor with respect to a particular debt security or other financial obligation, based on relevant risk factors." In Moody's words a rating is "...an opinion of the future ability and legal obligation of an issuer to make timely payments of principal and interest on a specific fixed income instru-

[21]Note that our data includes information on the rating of the issue while our model is about the rating of the issuer, that is, the issuer's probability of default. We are therefore implicitly assuming that these two ratings are correlated. This seems to be a reasonable assumption because the rating of an issue is determined by the probability of default on the issue which is largely an issuer-level characteristic and the loss given default which may be affected by such things as collateral and seniority considerations.

[22]Virtually all bonds issued in the United States are rated by Moody's and S&P. The vast majority of issuers pay Moody's and S&P for their ratings despite no legal obligation so they can put their best case before the agencies in the context of a cooperative rating process (Cantor and Packer (1996)). The two other main rating agencies, Fitch and Duff & Phelps, have had a long standing policy of rating bonds only on request of the issuer.

ment."[23] In addition, both rating agencies use similar systems to map the creditworthiness of bonds into a credit rating. This makes their rating categorization systems comparable except, perhaps, for very high levels of risk.[24] Third, there is evidence neither agency is systematically more lenient than the other and that neither agency carries more influence than the other in determining bond yields.[25]

Lastly, bond-rating splits between Moody's and S&P at issue date are a good proxy for the "quality" of signal produced by information gathering agencies because both agencies have access to the same information channels. Under these conditions, we assume, as in our model, that rating splits between these agencies arise from unsystematic differences in the information sets they use to rate each bond and/or unsystematic differences in their interpretation of the information in these sets with regards to the creditworthiness of the bond.

We are particularly interested in the relationship between the likelihood of a rating split and the creditworthiness of the issuer. Specifically, we want to find out if rating agencies are more likely to announce split ratings for mid-credit quality issuers than for issuers on either tail of the distribution on firm creditworthiness. We are also interested in finding out how this relationship varies over the business cycle. For these reasons, we estimate the following probit model.

$$\text{Split} = c + \alpha_i \sum_{i=1}^{2} \bar{R}^i + \beta_i \text{Rec} \sum_{i=0}^{2} \bar{R}^i + \gamma_i \sum_{i=0}^{K} X_i + \epsilon \qquad (1)$$

where the dependent variable *Split* is a dummy variable that takes the value 1 when rating agencies announce different ratings for a new bond issue and zero otherwise. We define rating splits based on the alpha-numeric ratings. In order to identify instances where a rating split occurred, we started by converting the long-term debt rating symbols that Moodys and S&P currently use into a numeric variable. We followed Cantor and Packer (1996) and attributed the value 1 to Moody's Aaa, 2 to Aa1, 3 to Aa2, $\cdots$, and 17 to Caa and any other Moody's rating below Caa. I then assigned the value 1 to S&P' AAA, 2 to AA+, 3 to AA, $\cdots$, and 17 to CCC+ and any other S&P's rating below CCC+ (see Table 4). We pooled the low ratings

[23]See S&P Corporate Ratings Criteria, 1998, p.3 and Moody's Credit ratings and Research 1998 p.4, respectively.

[24]Cantor and Packer (1996) argue that categorization systems rating agencies use are difficult to compare when Moody's rate below Caa and S&P rates below CCC+.

[25]See Jewell and Livingston (1998), and Billingsley, Lamy, Marr and Thompson (1985), Liu and Moore (1987) and Kish, Hogan and Olson (1999) and Cantor, Packer and Cole (1997) respectively.

in the category 17 because according to Cantor and Packer (1996) the categorization systems rating agencies use for these levels of risk are difficult to compare. Note, for instance, that while S&P uses qualifyers to its CCC rating, Moody's uses does not have qualifyers for its Caa rating.

We control for the rating of the bond by including in the regression the average of the two numeric ratings given by the agencies, $\bar{R}$. This approach while subject to the usual problems that arise with averages has an advantage over the approach that would define the rating of a bond based on the ratings of any single rating agency in that it incorporates information from both agencies. It also has the advantage of preserving degrees of freedom over the alternative approach that includes dummy variables for each unique pair of Moody's and S&P ratings in the sample. Because we want to ascertain if mid-credit quality issuers are more likely to get a rating split than issuers on either tail of the rating distribution we consider both linear and quadratic functional forms on the issue's rating.

Because we want to find out if the economic conditions at the time the bond is issued play a role on the likelihood of rating agencies announcing different ratings, we include a dummy variable, *Rec*, that takes the value 1 if the bond is issued during a recession as defined by NBER (see Table 2) and zero otherwise. Lastly, because we want to find out how the impact of recessions on the likelihood of rating splits vary with the rating of the issue, we interact these two variables.

We estimate this model controlling for a set of factors related to the design of the bond and a set of features of the issuing company. With respect to the bond design, we include dummy variables to control for bonds that are privately placed, bonds with a call option, a put option, and a sinking fund. We also control for floaters and shelf bonds. Finally, we control for the maturity of the bond and for the amount issued.

With respect to the issuing company, we include dummy variables to control for the issuer's sector of activity as defined by SIC one-digit code, and whether it is a public company. We also control for the first bond issued by the company, the number of times the company has raised funding in the bond market in the past, and the length of time since the company's last bond issue.

Finally, we include a time trend to control for factors such as learning, and the number of bonds issued in each of the main credit rating classes to control for potential systematic rating differences among these segments.[26] The results for our model on bond rating splits

[26]The ratings used to assign bond issues to each main rating class were those of Moody's. We include therefore

are reported in Table 7. Before we analyze them, we introduce in the next subsection the methodology we use to find out the impact of the rating agencies on the cost of accessing the bond market over the business cycle.

3.2.2 The "quality" of information agencies' signal and the cost of bond financing

As we noted in the previous subsection, we proxy the "quality" of the signal of information gathering agencies by the frequency of rating agencies' split ratings. Our premise is that the higher the frequency of these splits the lower the "quality" of that signal. Accordingly, our model of firm access to the bond market then suggests that rating splits affect the cost of this funding source but the impact will vary with the issuer's creditworthiness and over the business cycle. To study these relationships, we estimate the following model of the bond credit spreads.

$$\text{Spread} = c + \delta_i \sum_{i=1}^{2} \bar{R}^i + \zeta_i \,\text{Rec} \sum_{i=0}^{2} \bar{R}^i + \eta_i \,\text{Split} \sum_{i=0}^{2} \bar{R}^i + \phi_i \,\text{Rec Split} \sum_{i=0}^{2} \bar{R}^i + \psi_i \sum_{i=1}^{L} X_i + \epsilon \quad (2)$$

where *Spread* is the bond's spread over Treasury at issue date. Our bond spreads are market prices; they are from the primary market, though, not the secondary market, that is, they are based on the price required to place the bonds not to trade them. Typically the bond will be priced at par, the roadshow will determine the required yield (coupon) to place the desired par amount.

Following the literature on bond pricing, which shows that bond ratings help explain bond credit spreads, we control for the bond rating at issue date.[27] The rating variable, $\bar{R}$, is set equal to the average of the Moody's and S&P's numeric rating variables as defined in Table 4. Thus, when there is a rating split the bond is assigned the average of the ratings attributed by the two agencies. We chose to assign the average rating on these occasions because of the existing evidence showing that when a split occurs, the bond yield on the split-rated bond lies between the typical yields for the higher rating and the lower rating (Jewell and Livingston (1998)).[28]

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nine variables, each measuring the number of bond issues with a rating equal to Aaa, Aa, A, Baa, Ba, B, Caa, Ca and C respectively.

[27] Fenn (2000), Elton, Gruber, Agrawal and Mann (2001), Harrison (2001), among others, show that bond ratings help explain bond credit spreads. Like these studies, we abstract from the potential effect of liquidity in the pricing of corporate bonds.

[28] Cantor, Packer and Cole (1997) show that when bonds are rated by both Moody's and S&P, both ratings

Because we coded ratings on a (discrete) continuum and assigned the lowest numeric rating to the highest credit quality, a higher average numeric rating means greater risk. An important advantage of this approach over the alternative approach sometimes used in bond pricing models to control for ratings which includes dummy variables for each unique pair of Moody's and S&P ratings in the sample is that it conserves degrees of freedom. This is particularly important in this study because we consider rating notches.[29] A downside of the approach we adopt is that it implicitly assumes that each unit change in ratings has the same effect on credit spreads. Fenn (2000), however, compares the two approaches and find that the results obtained using the numeric rating variable are virtually identical to those obtained using the full set of rating dummies.

We control for the conditions of the economy at the time the bond is issued by including a dummy variable *Rec*, which takes the value 1 if the bond is issued during a recession and zero otherwise. Recessions and expansions are defined according to NBER (see Table 2). In order to ascertain the impact of split ratings on the cost of accessing the bond market we include the dummy *Split*, which takes the value 1 if rating agencies rate the bond differently at issue date and 0 otherwise. Because we want to ascertain if the impact of split ratings in recessions is different from the corresponding impact in expansions, we include the interaction dummy *Rec Split*. Because our model of firm access to the bond market predicts that the impact of rating splits in recessions varies with the creditworthiness of the issuing firm, we interact the three dummies *Rec*, *Split* and $\bar{R}$. Finally, given that the model predicts that under certain conditions such an impact is largest for mid-credit quality issuers we consider both linear as well as quadratic functional forms.

According to our econometric model of bond spreads we have that, *ceteris paribus,* the impact of rating splits on the cost of accessing the bond market in expansions is given by the parameters η_i. The similar impact in recessions is given by the sum $\eta_i + \delta_i$. Thus, the key parameters of the econometric model to test our theory on the differential conditions of firm access to the bond market over the business cycle are the parameters δ_i. These parameters measure the additional cost of a rating split in recessions vis-à-vis the cost of a rating split in

affect bonds yields. Pricing models that rely on either rating produce unbiased but highly inefficient estimates. If models rely instead on simply the higher or the lower of the two ratings (but not both), greater bias is introduced with insignificant gains in efficiency. Overall the best results in terms of bias and forecast precision are obtained when yields are inferred from the average of the two ratings.

[29] Had we used this alternative approach, we would need to consider 119 dummies because in our sample we have 120 Moody's-S&P rating combinations (see Table 5).

expansions. Given that we consider a quadratic specification we can ascertain how this cost difference varies across borrowers of different creditworthiness.

These marginal effects are estimated controlling a set of factors which other studies of of bond pricing have shown help explain bond credit spreads.[30] These include the design of the issue and the features the issuing company that we used as controls in our model of rating splits, as well as the 10-year constant treasury yield and the yield curve premium defined as the difference between the 30 and 5 year treasury yields.[31] Finally, we control for the number of bonds issued in each of the main credit rating classes to control for potential systematic rating differences among these segments.[32]

4 Evidence on the determinants of bond rating splits

4.1 Bond rating splits between Moody's and S&P

Table 5 summarizes the ratings attributed by Moody's and S&P to each of the 10,050 bond issues in our sample. These rating agencies attributed the same rating on 5,203 issues and on 4,847 bonds they attributed different alpha-numeric ratings. On these instances, Moody's assigned a rating better than S&P 44% of the time. Even though we do not use information about the size of the rating split, that is, the "distance" between the two ratings, the concentration along the table's diagonal suggests that when there is a rating split rating agencies often announce ratings that are not two different. Note, however, that had we considered whole ratings rather than alpha-numeric ratings we would still find that the two rating agencies announced different ratings for 1,550 of the 10,050 bonds in the sample.

Based on the information in Table 5, it is somewhat difficult to ascertain how the relative frequency of rating splits varies with the bond rating. The reason is that when there is a rating split the bond has two different ratings. What is the rating of these bonds? One way to answer this question is to assign the bond, as we do in the multivariate analysis of the next subsection, the average of the two ratings. This, however, makes it difficult to carry out a

[30] See, for example, Blackwell and Kidwell (1988), Fenn (2000), Collin-Dufresne, Goldstein and Martin (2001), Harrison (2001).

[31] See Collin-Dufresne, Goldstein and Martin (2001) for a discussion on the importance of these variables for the pricing of corporate bonds.

[32] The ratings used to assign bonds to each rating class were those of Moody's. We include therefore nine variables, each measuring the number of issues with a rating equal to Aaa, Aa, A, Baa, Ba, B, Caa, Ca and C respectively.

discrete analysis. To obviate this problem, in this subsection we assign every bond that gets a split rating to each of the buckets associated with its two ratings. After doing this, we compute for the bonds in each rating bucket the percentage that received the same rating from both agencies and the percentage that received a split rating. The results are reported in Table 6. They are reported for the overall sample and also for the expansion and recession subsamples separately.

The results from the overall sample do not seem to suggest any clear pattern for the frequency of rating splits across bond ratings. However, the results for the expansion and recession cohorts seem to indicate that split rating are more common in recessions, particularly among mid-credit quality issuers. Comparing the frequencies of split ratings in expansions and recessions, respectively, it is apparent that when the latter are larger than the former this happens most often for bonds with ratings towards the middle of the distribution on credit ratings.[33] To obviate the usual limitations of a single-variable analysis inherent in these results, in the next subsection we discuss the results of our probit model on the likelihood of split ratings.

4.2 Rating splits over the business cycle

Table 7 presents the results for our probit model on bond rating splits between Moodys and the S&P at issue date. Recall that we are particularly interested in investigating how rating splits vary with the credit quality of the borrower, which we proxy by the credit quality of the bond the borrower issues, and how this relationship varies over the business cycle.

Comparing models 1 and 2, it is immediate to see that the quadratic specification explains better the likelihood of rating splits than the linear specification. As we can see from the latter model, the likelihood of getting a rating split first increases and then decreases as the creditworthiness of the issuer decreases. Firms with an average credit rating equal to 9, which is equivalent to Moody's Baa2 and S&P BBB, are the most likely to get a rating split on their bonds. These results confirm our assumption that the "quality" of the signal produced by rating agencies as determined by the likelihood of rating splits is lower for mid-credit quality firms than for firms on either tail of the distribution on firms' creditworthiness.

Models 3 and 4 investigate the impact of the state of the economy on the relationship

[33]The frequency of split ratings in recessions is higher than the frequency of split ratings in expansions for ratings A2, Baa1, Baa2, Baa3, Ba1, Ba2, B1 and $< B3$. For the remaining ratings, that is, Aaa, Aa1, Aa2, Aa3 A1, A3, Ba3, B2 and B3, the opposite holds.

we just identified. These models show that on average firms are less likely to get a rating split in recessions than in expansions. The impact of recessions on the likelihood of getting a rating split, however, varies significantly with the firm's creditworthiness. While recessions lower this likelihood for firms on either tail of the distribution on firms' creditworthiness, in particular for firms of high-credit quality, it increases the chances of getting a rating split for mid-credit quality firms.

Models 5 and 6 test the robustness of these results by dropping from our econometric model the explanatory variables that are not statistically significant. The concave relationship between the likelihood of a rating split and the creditworthiness of the issuer remains unchanged as does the increase in the likelihood of a rating split for middle-credit quality issuers during recessions. Note that all the parameters defining these relationships are statistically significant at either 1% or 5% confidence level. With respect to the remaining controls that are statistically significant, according to Model 6, firms that issue more often and those that issue off the shelf are less likely to get a rating split. Contrary to what we might expect first issues are less likely to get a rating split. Note, though, that the coefficient on this variable is statistically significant only at 10%. Also, somewhat surprisingly we find that public companies as well as large issues are more likely to get a rating split. These variables, in particular the latter one, tend to be correlate with firm size and larger firms are usually more complex and thus more difficult to rate. Finally, we find that the time trend is statistically significant and indicate a reduction in the frequency of rating splits over time, possibly the result of a learning effect.

In order to facilitate the interpretation of the results of our probit models, we plot in Figure 2a the estimated probability of a rating split given the average rating attributed by Moody's and S&P for bonds issued in expansions and recessions, respectively. To compute these estimates we set all of the remaining variables in Model 6 to their means. Figure 2a confirms that in expansions as well as in recessions, mid-credit quality borrowers are more likely to get a rating split than borrowers on either tail of the credit rating distribution. Note, for example, that in expansions while the probability of a triple-A or below-B firm getting a rating split is 38% and 40% respectively, the probability of triple-B firm getting a rating split is 52%.

Figure 2b, in turn, shows that recessions can add, on average, about 4 percentage points to the probability of mid-credit quality borrowers getting a rating split. This increase stands in sharp contrast to the reduction in the probability of rating splits that issuers on either tail of the distribution on credit ratings, particularly high-rated issuers, observe in recessions. It is worth noting, though, that this reduction is likely an artifact of the quadratic functional form being fitted and probably a result not very robust as there is a small number of observations on the tails of that distribution in recessions (see Table 6). Note, for instance, that the probability of a rating split for the highest quality borrowers in expansions is not statistically different from this probability in recessions. The same is true of the difference in this probability for the lowest rated issuers.

In sum, our evidence on the likelihood of bond rating splits supports our assumption that mid-credit quality firms are more likely to get a rating split on their bonds at issue date than either high or low credit quality firms. Our evidence on the impact of the state of the economy on the likelihood of getting a rating split, in turn, lends mixed support to our assumption that the "quality" of the signal produced by information gathering agencies is either independent from the state of the economy or it is lower in recessions, in which case mid-quality firms will be affected the most. We find that the state of the economy at the time the bond is issued affects the likelihood of getting a rating split, but we do not find that recessions increase this likelihood for all firms. We do find, however, that recessions increase the likelihood of mid-credit quality firms getting a rating split on their bonds at issue date.

5 Evidence on the cost of bond issuance over the business cycle

5.1 Bond credit spreads when rating agencies disagree on ratings

In order to ascertain the impact of split ratings on the cost of bond issuance over the business cycle, we start in this subsection by comparing the average bond spreads over the Treasury at issue date for the cohort of bonds issued in recessions with the corresponding average for the cohort issued in expansions. We also compare for each cohort the average spreads of those bonds that got the same rating from Moody's and S&P with the corresponding average for the bonds that got a split rating.

We compute the bond credit spread as the percentage point difference between the yield to maturity of the issue and the yield on an equivalent maturity US Treasury Bond/Bill/or Note. The yield of the issue was obtained from SDC. The yield on the US Treasury was based on the Treasury's Constant Maturity Daily Series as reported in the Federal Reserve H15 report.[34]

[34] To compute spreads for issues with maturities that do not match the maturities of the Treasury's Constant Maturity series, Treasury yields were interpolated between the data points using a natural cubic spline function. This spline curve was computed on the assumption that the coefficients of the spline functions of the first two segments were equal, and likewise that the coefficients of the final two segments were equal. The result of this

The average credit spread at issue date for all 10,050 bonds in the sample is 2.07 percentage points. The top panel of Table 8 confirms the established results that recessions and disagreements between rating agencies with respect to the creditworthiness of bonds increase bond credit spreads. On average recessions add 24 basis points and split ratings add 8 basis points to the credit spreads of bonds at issue date.

The bottom panel of Table 8 compares the impact of rating splits on credit spreads of bonds issued during expansions with the similar impact on bonds issued in expansions. Interestingly, rating splits have a statistically significant impact only on bonds issued during expansions. For these bonds, rating splits increase on average 8 basis points to their credit spreads at issue date. For bonds issued in recessions, split ratings lower on average their credit spreads by 6 basis points but this difference is not statistically significant. These comparisons, however, do not account for the credit rating of the bond. In order to evaluate how split ratings affect credit spreads over the business cycle across issuers of different creditworthiness, we present in Table 9 the same information included in Table 8 but broken done by the rating of the issue. We account for bonds that get a rating split the same way we did in Table 6, that is, by assigning every bond that gets a split rating to each of the buckets associated with its two ratings.

The statistics in Table 9, left-hand panel, suggest that when we do not account for the state of the economy at the time bonds are issued split ratings have a negative impact on credit spreads. These statistics also suggest that this effect is more prevalent for mid-credit quality issuers. Note that of the five differences between the credit spreads of same-rating bonds and split-rating bonds that are statistically different from zero, four of them indicate that split-rating bonds have higher credit spreads. This happens for bonds with ratings equal to Moody's A2, Baa2, Baa3 and B2. When we investigate these statistics for the cohorts of bonds issued in expansions and recessions, respectively, middle and right-hand side panels of Table 9, we also find that split-rating bonds tend to have higher credit spreads than same-rating bonds and this affects predominantly middle credit quality issuers. However, when we compare the credit spreads of the expansion cohort with those of the recession cohort the results suggest

computation was a smooth daily yield curve. The interpolated Treasury yield was then read from this function at the exact maturity of the issue, and the bond spread calculated as the difference. The Treasury did not have a 20 year constant maturity series from 1/1/1987 to 9/30/1993. In order to compute the spline function over the 10 to 30 year interval during this period, the outstanding Treasury bond with the remaining maturity closest to twenty years was used on each day to substitute for the 20 year constant maturity data point. For bonds that were callable and deep in the money, the yield and maturity to the date of first call were used.

that split ratings appear to have larger negative impact on credit spreads in recessions than the similar impact in expansions. Note that the difference between the credit spreads of same-rating bonds and split-rating bonds in recessions tends to be larger (in absolute terms) than the same difference in expansions.

These results appear to be consistent with our theory that firm access conditions to the bond market vary with the state of the economy because of their reliance on information gathering agencies and that this impact is not uniform across firms. These results suffer, however, from all of the usual problems of any univariate analysis. For this reason, we look at these issues more carefully in the next subsection by estimating the model of bond pricing we presented in the previous section.

5.2 Bond credit spreads over the business cycle

As we noted earlier, we estimate our model of bond pricing for 10,050 straight bonds issued in the United States by American nonfinancial firms over the 1982:2-2002:2 time period. The results are presented in Table 10. Model 1, confirms that credit ratings help explain bond credit spreads. In particular, the results show that credit spreads increase as the issue's rating decreases. The credit rating of the issue is defined as the average rating attributed by Moody's and S&P using the correspondence presented in Table 4. Model 2 indicates that this relationship is convex. Therefore, as the rating decreases credit spreads increases at an increasing rate.[35]

These models do not account for the potential impact on credit spreads of the state of the economy at the time the bond is issued. To evaluate this impact we added to Model 2 the dummy variable *Rec* which takes the value 1 if the bond was issued during a recession as defined by the NBER (see Table 2). The results of this new model, Model 3, confirm the existing evidence that it is more expensive to issue bonds in recessions than in expansions. On average recessions add 33 basis points to the credit spreads at issue date. In an attempt to see how the impact of recessions varies across firms, we interact in Model 4 the recession dummy with the credit rating of the issue. The results of this model show that recessions do not increase the cost of bond financing to all firms equally. The lower the credit quality of the issuer the larger is the cost of this funding source in recessions.[36]

[35] According to our results on bond credit spreads, AA issues have a lower credit spread than AAA issues, a difference which may be related to a difference in the liquidity of these issues.

[36] According to the results of Model 4, recessions are beneficial to high-credit quality issuers as the credit

An aspect absent from these models is the potential influence rating agencies may have on firms' access conditions to the bond market when they announce different ratings on a given bond. To ascertain the potential influence of these differences we started by adding to Model 2 the dummy variable *Split* which takes the value 1 when Moody's and S&P announce different credit ratings. We use the correspondence between the rating scales of the two agencies presented in Table 4 to establish for each pair of ratings if there is a split or not. The results of the new variable are presented in Model 5. They indicate that on average split ratings add 7 basis points to the credit spread of the bond at issue date. This result, therefore, suggests that rating agencies by announcing split ratings they can increase the cost of accessing the bond market. This result is potentially important because as saw in the previous subsection, mid-credit quality issuers are more likely to get a rating split than issuers on either tail of the distribution on credit ratings.

In order to further evaluate the importance of split ratings on firm access conditions to the bond market, we investigated how split ratings affected bond credit spreads across firms. To that end, we extended Model 5 and included the interaction of our *Split* dummy with the rating of the issue. The results are presented in Model 6. They suggest that the impact of split ratings does not vary with firm's credit rating as the coefficients on the new variables are not statistically different from zero. Note also that once we include these new interaction variables the coefficient on the *Split* dummy looses its statistical significance. As Model 7 shows, this is still the case when we control for the state of the economy at the time the bond is issued by expanding Model 6 and including both our recession dummy and the interaction of this variable with the rating of the issue.

An important limitation of the models that we presented thus far which attempt to evaluate the impact of rating splits on the cost of accessing the bond market is that they do not distinguish if these splits occurred in a recession or in an expansion. According to our theory this difference matters because the distribution of bond issuers varies over the business cycle. It may also matter if the likelihood of rating splits varies with the state of the economy. We, therefore, extended Model 7 by including a new variable, the interaction of our recession dummy with the split-ratings dummy, *RecSplit*. As the results of Model 8 indicate, effectively rating splits are costlier in recessions than in expansions, as the coefficient on the new variable is statistically significant at the 5% level. On average getting a rating split in a recession is 12 basis points more expensive than doing so in an expansion. This model, however, does not

spreads of their bonds at issue date are lower than in expansions.

account for the potential difference of this impact of rating splits in recessions across firms. Recall that according to our theory rating agencies' splits are more likely to have a larger impact on the cost of accessing the bond market in recessions for either high or mid-credit quality issuers.

In order to evaluate the difference in the impact of split ratings over the business cycle but across issuers of different creditworthiness we extended our Model 8 and included the interaction of the dummy *Rec Split* with the rating of the issue. The results are presented in Model 9. They confirm that the additional cost of a rating split in recessions does not affect all firms equally. Before we analyze this impact more closely, we first discuss some robustness checks we performed and the other controls we include in our models. In Models 10-12 we successively drop the three variables we had included in our regression analysis that were not statistically significant. These variables are the size of the issue, the time that elapsed since the last time the firm issued in the bond market, and the number of times the firm has issued in this market since 1970.[37] A comparison between Models 9 and 12 shows that removing these control variables does not affect any of the coefficients on the variables we have discussed thus far.

With respect to the remaining controls that are statistically significant, as we can see from Model 12, they influence bond credit spreads as expected. Specifically, we find that public companies pay lower credit spreads and that bonds with a put provision as well as shelf issues have lower credit spreads. In contrast, first issues and private placements have higher spreads. The same applies to callable bonds, floaters, bonds with longer maturities and bonds with a sinking fund. Interestingly, note that over time credit spreads have been declining (at a decreasing rate) as our time trend variable (log of time trend) is negative and statistically.[38] Lastly, our results show that in periods where the the treasury yield is high or the yield curve is steeper it is less expensive to access the bond market.[39]

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[37]Like us, Blackwell and Kidwell (1988) and Crabe and Turner (1995) find no significant link between issue size and credit spread. In contrast, Fenn (2000) and Harrison (2001) find that larger issues have lower credit spreads.

[38]Fenn (2000) study of 144A bond spreads also shows a secular decline in spreads over the 1993-98 period of 13 basis points per year.

[39]Like us, Collin-Dufresne, Goldstein and Martin (2001) and Harrison (2001) also find a negative relationship between bond credit spreads and the yield-curve slope. The former paper and Duffee (1996) also finds, like us, an inverse relationship between credit spreads and the Treasury yield, but Harrison (2001) finds the opposite result. It is worth noting though that the exclusion of these variables from our models does not alter our results on the impact of rating splits over the business cycle on credit spreads.

To highlight the results of our model on bond pricing that have implications for our theory of firm access to the bond market, we compare for the cohort of bonds issued in expansions the estimated credit spreads of split-rating bonds with the spreads of same-rating bonds. The results, which were computed with Model 12, are plotted in Figure 3a for each given rating of the issue. All of the remaining variables of our model on bond spreads were set equal to their sample mean. Figure 3b, plots the same credit spread estimates but for the cohort of bonds issued in recessions. Comparing these two figures it is apparent that rating splits are more important in recessions than in expansions. This was to be expected given that the coefficients on $Split\,\bar{R}$, which measures the marginal impact of split ratings in expansions, are not statistically significant while those on $Rec\,Split\,\bar{R}$, which measure the marginal impact of split ratings in recessions, are all highly significant.

Figure 4a plots for each of the two cohorts of bonds the difference between the spreads of split-rating bonds and those of same-rating bonds for each credit rating. The lower line in the figure represents the cost of the rating split for bonds issued in expansions, and the upper line represents the same cost but for bonds issued in recessions. As this figure shows, the cost of rating splits in expansions does not vary significantly across firms of different creditworthiness. In contrast, during recessions this cost is significantly larger for mid-credit quality firms. This difference in the impact of rating splits in expansions and recessions makes access to the bond market dependent on the state of the economy.

This is evident in Figure 4b, which plots the difference between the cost of rating splits in recessions and the cost of rating splits in expansions. According to this figure, it is apparent that for mid-credit quality firms issuing in a recession and getting a rating split can cost them almost an additional 30 basis points than if they issue in expansions and get a rating split. Note that rating splits are more expensive in recessions that in expansions to firms with ratings above 5 (Moody's A1 and S&P A+) and below 16 (Moody's B3 and S&P B-). In contrast, on either tail of the distribution of credit ratings, getting a rating split in recessions as opposed to getting it in expansions is beneficial. It is worth noting though that at least for firms with ratings on the two extremes of the distribution this difference in the cost of rating splits is not statistically different from zero. This is due to he reduced number of observations in those areas of the distribution.

In the previous section, we showed that mid-credit quality firms are more likely to get a rating split than firms on either tail of the distribution in expansions as well as in recessions. Combining this result with the results of this section showing that in expansions rating splits do not affect credit spreads across firms but in recessions they increase these spreads for mid-credit quality firms we conclude that rating agencies do not alter the relative cost of accessing the bond market for firms of different creditworthiness in expansions but they make bond financing relatively more expensive for mid-credit quality firms in recessions. Consequently, they alter firms' access conditions to the bond market over the business cycle, making it more expensive for mid-credit quality firms to access this market in recessions than in expansions. This cost is further amplified by our finding of the previous section that recessions increase the likelihood of mid-credit quality firms getting a rating split. These results support our theory that firms' reliance on information gathering agencies to raise bond funding, though, valuable it influences the access conditions to the bond market across firms and over the business cycle. In the next subsection we attempt to ascertain if this influence is economically meaningful.

5.3 Economic significance

According to our results, in expansions mid-credit quality firms are more likely to get a rating split than firms on either tail of the distribution on firm creditworthiness, but the cost of a rating split is not statistically different across firms. Note, for example, that during expansions the estimated probability of getting a rating split for a mid-credit quality firm, say a Moody's Baa2 or an S&P BBB-rated firm, is 52% and the cost of rating split is 3 basis points, which implies an expected cost of a rating split of 2 basis points. During these periods, the expected cost of a rating split for the lowest-rated firms is 6 basis points.

Our results, however, indicate that rating splits alter the relative cost of bond financing among firms in recessions. Recall that in recessions, like in expansions, mid-credit quality firms are more likely to get a rating split than firms on either tail of the distribution on firm creditworthiness, but during downturns the cost of a rating split is statistically different across firms. In fact it is largest for mid-credit quality firms. According to our models, in recessions the expected cost of a rating split for a Moody's Baa2 or an S&P BBB-rated is 17 basis points, but the expected cost of a rating split for the lowest-rated firms is only 2 basis points. This implies for a mid-credit quality firm that makes an issue of $100 million an additional cost of $150,000.

This difference in the impact of rating splits besides altering the relative cost of bond financing across firms in recessions it also alters the access conditions to the bond market over the business cycle. This impact, furthermore, is largest for mid-credit quality firms. As Figure 4b shows, for these firms issuing in recessions rather than in expansions can imply an increase to firm's bond spread at issue date of as of as much as 30 basis points. As Figure 2a shows, when these firms issue in expansions the likelihood of them getting a rating split can be as high as 50%. As Figure 2b, in turn, shows for these firms issuing in recessions instead can increase this likelihoog by as much as 4 percentage points. Taking these values into account it is possible to show that for these firms rating splits can add as much as 15 basis points to the cost of bond financing in recessions (see Figure 5). This will imply an additional $150,000 for an issue of $100 million.

These results seem to suggest that the cost of rating splits between Moody's and S&P is economically significant for mid-credit quality firms. This raises an important question. Why don't these firms find ways, such as getting a rating from a third agency, to reduce this cost? A possible reason for not doing so is that this is cost efficient. A rating from a third agency may not be as valuable as a rating from the two main credit rating agencies in the country.[40] Moreover, ratings are costly. According to Kliger and Sarig (2000) it costs $25,000 for issues up to $500 million, and half a basis point of the issued amount for issues greater than $500 million.

6 Final remarks

In this paper we have presented a theory of firm access to the bond market in which information gathering agencies provide a valuable service but they alter the relative cost of this funding source across firms of different creditworthiness and over the business cycle. Even if the "quality" of the signal produced by information agencies does not vary with the state of the economy, recessions will increase the cost of bond financing for mid-quality firms and it may increase the cost of this funding source for all firms. This result hinges on the assumption that the "quality" of the signal produced by information agencies is lower for mid-credit quality firms than for firms on either tail of the distribution on firm creditworthiness. If recessions lowers the 'quality" of the signal produced by information agencies, then this will further increase the cost of bond financing for high and mid-quality firms.

The analysis of the bonds issued in the last two decades by American nonfinancial firms in the United States showed that rating agencies are more likely to produce split ratings, our proxy for the "quality" of the signal produced by information agencies, on bonds of mid-credit quality issuers. It also showed that recessions increase the likelihood of rating splits for mid-

[40] Some firms have their bonds also rated by Fitch Investor Services and Duff & Phelps Credit Rating Co, the other two nationally recognized statistical rating organizations by the SEC for rating all US corporate bond issues, but the data we have currently available does not include information on these agencies' ratings.

credit quality firms, but not for high and low-credit quality firms. Our analysis of bond-credit spreads at issue date, in turn, showed that split-ratings do not affect the relative cost of bond financing across firms in expansions, but they increase the relative cost of this funding source during recessions for mid-credit quality firms. This analysis also showed that split ratings make bond financing more expensive for these mid-credit quality issuers in recessions than in expansions. When we account for both the likelihood of rating splits and the cost of rating splits our results suggested that the cost of rating splits is not only statistically significant but also economically meaningful for mid-credit quality firms.

These findings confirm the model's key result that information gathering agencies influence access conditions to the bond market across firms and over the business cycle. Even though we do not consider bank lending, our model and the supporting evidence suggest that recessions alter the substitutability between bank funding and market funding, and that the extent of this effect is largest for mid-credit quality firms. This has several potentially important implications, in connection, for example, with firm choices of funding sources, bank lending policies and the credit channel of monetary policy. Implicit in this assertion is our assumption that recessions do not have a similar effect on bank lending. This suggests that a fruitful area for future research is to investigate if recessions affect banks' ability to raise funding as well as their ability to extend loans.

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Table 1 Bond issues and spreads issue date over the business cycle [a]					
Variables	All issues	Expansions	Recessions	Difference	P value
Bond issuance over the business cycle (1970:1-2002:2)[a]					
Average number of issues per quarter					
All issues	277.51	294.87	204.56	-90.32	0.029
Average number of issues per quarter by credit rating					
Aaa	5.94	5.33	8.48	3.15	0.002
Aa	19.96	19.84	20.48	0.64	0.834
A	57.61	58.98	51.84	-7.14	0.448
Baa	39.86	42.56	28.52	-14.04	0.111
Ba	11.57	12.45	7.88	-4.57	0.078
B	26.21	29.31	13.16	-16.15	0.010
Below B	1.92	2.22	0.68	-1.54	0.041
Spreads on investment-grade bonds at issue date over the business cycle (1980:1-2002:2)[c]					
Average spreads over Treasury per quarter					
Aaa	0.8549	0.7935	1.1391	0.3456	0.000
Aa	1.0668	0.9823	1.4573	0.4750	0.000
A	1.4030	1.2812	1.9663	0.6851	0.000
Baa	1.8725	1.7227	2.5654	0.8427	0.000
Difference in the average spreads over Treasury per quarter					
Aa-Aaa	0.2119	0.1889	0.3182	0.1294	0.000
A-Aaa	0.5481	0.4877	0.8272	0.3395	0.000
A-Aa	0.3362	0.2989	0.5090	0.2101	0.000
Baa-Aaa	1.0176	0.9293	1.4263	0.4970	0.000
Baa-Aa	0.8058	0.7404	1.1081	0.3677	0.000
Baa-A	0.4695	0.4415	0.5991	0.1575	0.009

[a] Recessions and expansions defined according to NBER (see Table 2).

[b] It includes all new bonds issued by American nonfinancials in the United States. Ratings are from Moody's. When a Moody's rating was not available, the S&P rating was used. If neither rating was available the bond was excluded from the above calculations.

[c] Computations based on Salomon Smith Brother's index of the yield on industrials' new issues (long-term bonds) and the long-term (over 10 years) Treasury Composite index.

Source: Top panel: Author's computations based on the Domestic New Bond Issuances database of Securities Data Company. Bottom panel: Author's computations based on USECON database.

Figure 1 Impact of recessions on the cost of rating splits by firm type

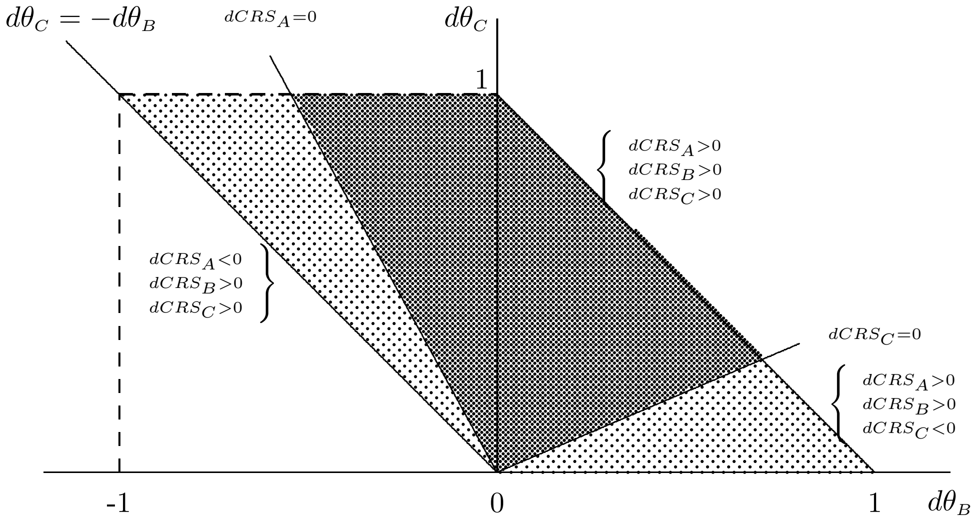

Table 2 Expansions and recessions over the 1980:1-2002:2 period[a]					
Expansions			Recessions		
From	To	# of quarters	From	To	# of quarters
1980:3	1981:2	4	1980:1	1980:2	2
1983:1	1990:2	30	1981:3	1982:4	6
1991:2	2001:1	40	1990:3	1991:1	3
			2001:2	2002:2	5
Quarters in expansion		74	Quarters in recession		14

[a] A recession is defined as the time period between a peak and a through and an expansion is defined as the time period between a through and a peak. Between 1980:1 and 2002:2, the peaks occurred in (months in brackets): 1980(1), 1981(7), 1990(7) and 2001(3), and the troughs occurred in: 1980(7), 1982(11) and 1991(3). A quarter was defined as a recession (expansion) when the largest number of months in the quarter were in a recession (expansion).
Source: Author's computations based on NBER definition of peaks and troughs.

Table 3 Data sample[a]			
Variables	1982:2-2002:2	Expansions	Recessions
Volume and number of issues			
Amount issued[b]	11,653.56	9,605.14	2,048.42
Number of issues	10,050	8,658	1,392
Shares of the number of issues by credit rating[c]			
Aaa	1.930	1.502	4.598
Aa	8.318	8.108	9.626
A	32.179	31.058	39.152
Baa	26.030	26.311	24.282
Ba	8.617	8.767	7.687
B	21.791	22.973	14.440
Below B	1.134	1.282	0.216
Shares of the number of issues by design of the issue			
Callable bonds	36.856	37.595	32.256
Bonds with a sinking fund	7.602	8.074	4.670
Floaters	0.498	0.554	0.144
Off the Shelf bonds	59.602	59.344	61.207
Private placements	20.985	19.912	27.658
144A issues	20.756	19.693	27.371
Average maturity (years)	11.380	11.542	10.348
Bonds with a putable provision on maturity[d]	1.622	1.848	0.216
Shares of the number of issues by issuer features			
First issue	26.886	27.870	20.761
Public company	68.706	68.896	67.529
Shares of the number of issues by issuer sector of activity			
Agriculture	5.114	5.094	5.244
Manufacturing	35.532	34.708	40.661
Communications	36.418	36.914	33.333
Trade	9.562	9.621	9.195
Services	12.318	12.555	10.848
Real estate	1.055	1.109	0.718

[a] It includes all new non-convertible bonds issued by American nonfinancials in the United States in US dollars over the period 1982:2-2002:2 that had ratings from both Moodys and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER (see Table 2). Over our sample period there are 70 quarters of expansion and 11 quarters of recession.
[b] Millions of US dollars. Issues deflated by the Core Urban Consumer CPI with the average of 1982-1984=100.
[c] Shares computed based on Moody's ratings.
[d] Bondholders have the option of selling the bond back to the issuing firm before the maturing date. Source: Author's computations.

Table 4 Moody's and S&P's long-term debt rating symbols			
Interpretation	Moody's	S&P'	Conversion scale
Investment grade ratings			
Highest quality	Aaa	AAA	1
High quality	Aa1	AA+	2
	Aa2	AA	3
	Aa3	AA-	4
Strong payment capacity	A1	A+	5
	A2	A	6
	A3	A-	7
Adequate payment capacity	Baa1	BBB+	8
	Baa2	BBB	9
	Baa3	BBB-	10
Below grade ratings			
Likely to fulfill obligation,	Ba1	BB+	11
ongoing uncertainty	Ba2	BB	12
	Ba3	BB-	13
High-risk obligations	B1	B+	14
obligations	B2	B	15
	B3	B-	16
All ratings below B3 or B-[a]			17

[a] These ratings were pooled because according to Cantor and Packer (1996) rating agencies use categorization systems for these levels of risk that are difficult to compare.
Source: Cantor and Packer (1996).

Table 5 Number of issues by Moody's and S&P's ratings at issue date[a]

S&P ratings	Moody's ratings																		
	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	<B3	Below S&P	Above S&P
AAA	**168**	9	4	2	1	·	·	·	·	·	·	·	·	·	·	·	·	16	·
AA+	20	**23**	21	9	·	·	·	1	·	·		·	·	·	·	·	·	31	20
AA	6	69	**199**	105	26	2	·	·	·	·	·	·	·	·	·	·	·	133	75
AA-	·	6	95	**198**	166	39	17	1	1	·	·	·	·	·	·	·	·	224	101
A+	·	1	24	54	**545**	276	27	25	1	·	·	·	·	·		·	·	329	79
A	·	·	1	7	226	**642**	257	34	5	1	·	·	·	·	·	·	·	297	234
A-	·	·	·	5	15	156	**588**	163	40	2	·	·	·	·	·	·	·	205	176
BBB+	·	1	·	1	1	32	169	**485**	238	37	2	1	·	·	·	·	·	278	204
BBB	·	·	2	·	·	18	31	216	**554**	182	22	3	2	·	·	·	·	209	265
BBB-	·	·	·	·	·	·	·	18	145	**408**	79	27	5	1	·	·	·	112	163
BB+	·	·	·	·	·	·	·	·	2	39	**77**	66	29	10	1	·	·	106	41
BB	·	·	·	·	·	·	·	·	·	9	40	**65**	121	19	5	1	·	146	49
BB-	·	·	·	·	·	·	·	·	1	7	15	44	**136**	66	20	3	·	89	67
B+	·	·	·	·	·	·	·	·	·	·	3	13	85	**164**	195	50	3	248	101
B	·	·	·	·	·	·	·	·	1	·	2	5	18	142	**361**	223	8	231	168
B-	·	·	·	·	·	·	·	·	·	·	·	·	7	33	243	**543**	56	56	283
<B-	·	·	·	·	·	·	·	·	·	·	·	·	1	1	28	81	**47**	·	111
Below Moodys	26	76	122	67	242	206	200	234	148	55	60	62	111	176	271	81	·		2,137
Above Moodys	·	9	25	116	193	317	301	224	285	222	103	97	157	96	221	277	67	2,710	

[a] It includes all new non-convertible bonds issued by American nonfinancials in the United States over the period 1982:2-2002:2 that had ratings from both Moodys and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER (see Table 2).

Source: Author's computations.

Table 6 Relative frequencies of agencies' agreements and disagreements by bond rating[a]						
Bond	All bonds		Expansion issues		Recession issues	
rating	Agreements	Disagreements	Agreements	Disagreements	Agreements	Disagreements
Aaa	0.800	0.200	72.603	27.397	96.875	3.125
Aa1	0.144	0.856	16.197	83.803	100	0
Aa2	0.359	0.641	34.549	65.451	43.182	56.818
Aa3	0.280	0.720	27.931	72.069	28.571	71.429
A1	0.393	0.607	39.152	60.848	40.000	60.000
A2	0.379	0.621	37.980	62.020	36.967	63.033
A3	0.400	0.600	35.882	64.118	54.859	45.141
Baa1	0.340	0.660	34.367	65.633	32.000	68.000
Baa2	0.378	0.621	38.185	61.815	35.484	64.516
Baa3	0.425	0.575	43.185	56.815	38.168	61.832
Ba1	0.200	0.800	21.148	78.852	12.963	87.037
Ba2	0.156	0.844	15.804	84.196	14.000	86.000
Ba3	0.243	0.757	23.663	76.337	28.378	71.622
B1	0.209	0.791	21.045	78.955	19.481	80.519
B2	0.288	0.712	27.926	72.074	37.097	62.903
B3	0.438	0.562	43.739	56.261	44.444	55.556
<B3	0.209	0.791	21.101	78.899	14.286	85.714

[a]It includes all new non-convertible bonds issued by American nonfinancials in the United States over the period 1982:2-2002:2 that had ratings from both Moodys and S&P. Recessions and expansions defined according to NBER (see Table 2).
Source: Author's computations.

Table 7 Determinants of a probit model of a bond rating split at issue date[a,b]						
Dep. variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.5920	0.2195	0.2164	0.3050	0.3101	0.2582
	(0.000)	(0.060)	(0.064)	(0.012)	(0.009)	(0.009)
$\bar{R}$	0.0072	0.1098	0.1100	0.0914	0.0906	0.0904
	(0.115)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}^2$		-0.0058	-0.0058	-0.0049	-0.0049	-0.0049
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rec			-0.0238	-0.4738	-0.4757	-0.4778
			(0.604)	(0.010)	(0.010)	(0.009)
Rec·$\bar{R}$				0.0993	0.0994	0.1010
				(0.022)	(0.022)	(0.019)
Rec·$\bar{R}^2$				-0.0044	-0.0044	-0.0045
				(0.053)	(0.055)	(0.048)
Other issuer features						
Public company	0.1140	0.0927	0.0926	0.0952	0.0941	0.0926
	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
First issue	-0.1190	-0.0886	-0.0889	-0.0873	-0.0845	-0.0824
	(0.015)	(0.072)	(0.071)	(0.077)	(0.059)	(0.065)
Order of issue	-0.1172	-0.1199	-0.1196	-0.1191	-0.1190	-0.1172
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Time since prev. issue	-0.0008	-0.0012	-0.0012	-0.0013		
	(0.911)	(0.876)	(0.876)	(0.864)		
Issue design						
Call provision	-0.0762	-0.0003	0.0013	0.0008	0.0001	
	(0.024)	(0.994)	(0.970)	(0.983)	(0.997)	
Put provision	-0.0008	-0.0378	-0.0395	-0.0384	-0.0394	
	(0.994)	(0.712)	(0.700)	(0.708)	(0.700)	
Sinking fund	0.0361	0.0339	0.0355	0.0312	0.0278	
	(0.524)	(0.551)	(0.532)	(0.584)	(0.621)	
Floater	-0.0772	0.0175	0.0159	0.0135		
	(0.672)	(0.924)	(0.931)	(0.941)		
Shelf	-0.0700	-0.0984	-0.0992	-0.1022	-0.1113	-0.1133
	(0.102)	(0.022)	(0.021)	(0.018)	(0.002)	(0.002)
Maturity	-0.0141	-0.0241	-0.0245	-0.0242	-0.0237	
	(0.549)	(0.306)	(0.299)	(0.304)	(0.315)	
Other controls						
Amount issued	0.0368	0.0351	0.0352	0.0332	0.0338	0.0316
	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)
Priv. placement	0.0038	0.0321	0.0335	0.0232		
	(0.937)	(0.511)	(0.494)	(0.639)		
Time trend	-0.0041	-0.0038	-0.0037	-0.0038	-0.0038	-0.0038
	(0.001)	(0.002)	(0.004)	(0.003)	(0.003)	(0.001)
Scalled R^2	0.0328	0.0369	0.0369	0.0376	0.0376	0.0374
Log likelihood	-6794.45	-6773.45	-6773.32	-6769.78	-6769.92	-6770.67
Expansion argmax						
Recession argmax						

[a] Total number of observations 10,050. Number of positive observations 4,847. P-values in parenthesis.

[b] The dependent variable is a dummy variable that takes the value 1 when Moody's and S&P announce different alpha-numeric ratings (see Table 4) for a new bond issue. $\bar{R}$ is the average of the two numeric ratings given by Moody's and S&P. It is higher for issues with lower ratings (see Table 4). *Rec* dummy that equals 1 if the bond is issued during a recession as defined by NBER (see Table 2). *Publiccompany* dummy that equals 1 if the issuer is a public company. *Firstissue* dummy equals 1 if the bond was the company's first bond issue since 1970:1. *Orderofissue* Number of times the firm issued bonds since 1970:1. *Timesinceprev.issue* Number of years since the firm made its latest bond issue. *Callprovision* dummy that equals 1 if the bond is callable. *Putprovision* dummy that equals 1 if bondholders can sell the bond back to the company prior to maturity.

Sinkingfund dummy that equals 1 if the bond has a sinking fund. *Floater* dummy that equals 1 if the bond is a floater. *Shelf* dummy that equals 1 if the bond is a shelf issue. *Maturity* maturity of the bond in years. *Amountissued* in millions of US dollars. Issues deflated by the Core Urban Consumer CPI with the average of 1982-1984=100. *Priv.placement* dummy that equlas 1 if the bond was privately placed. *Timetrend* linear time trend. Included in the regressions but not shown in the table are dummy variables for the issuer's sector of activity as defined by SIC one-digit code, and the number of bonds issued in the quarter in each of the nine main credit rating classes as defined by Moody's whole ratings, Aaa, $\cdots$, C.
Source: Author's computations.

Figure 2a. Probability of a split rating given the rating of the issue

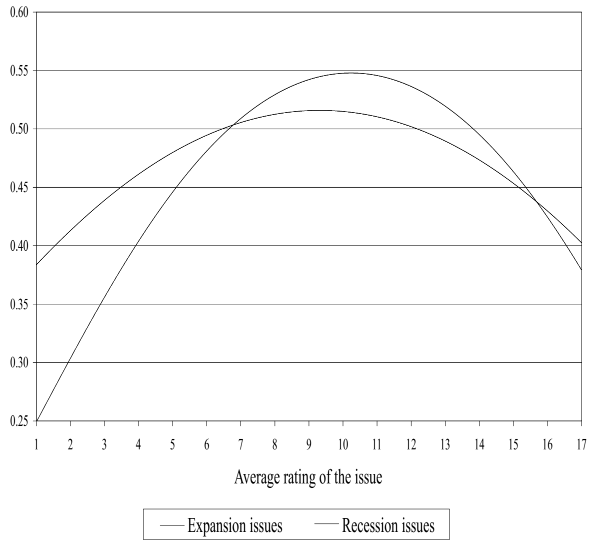

Figure 2b Additional probability of a rating split in recessions given the rating of the issue

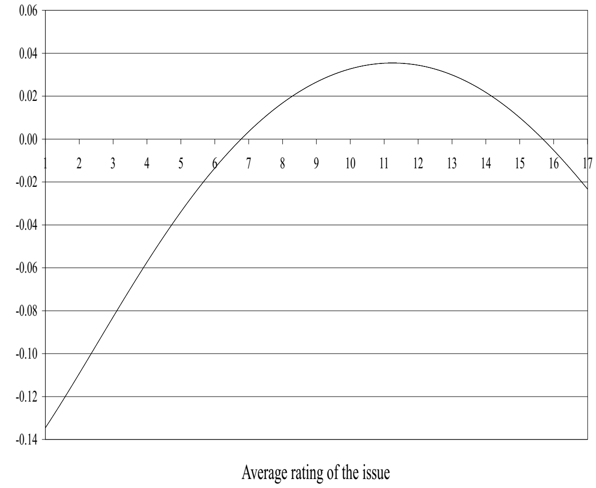

Table 8 Bond spreads over Treasury at issue date[a]			
All bonds			
Expansion issues	Recession issues	Differemce	P value
2.0569	2.2924	-0.2355	0.000***
Same rating issues	Split rating issues	Differemce	P value
2.0763	2.1623	-0.0860	0.092*
Expansion issues			
Same rating issues	Split rating issues	Differemce	P value
2.0400	2.1501	0.1101	0.047*
Recession issues			
Same rating issues	Split rating issues	Differemce	P value
2.3026	2.2374	-0.0652	0.617

[a] It includes all new non-convertible bonds issued by American nonfinancials in the United States in US dollars over the period 1982:2-2002:2 that had ratings from both Moodys and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER (see Table 2).
Source: Author's computations.

Table 9 Bond spreads over Treasury at issue date by rating of the issue[a]												
	All bonds				Expansion issues				Recession issues			
	Same Rat.	Split Rat.	Difference	P-value	Same Rat.	Split Rat.	Difference	P-value	Same Rat.	Split Rat.	Difference	P-value
Aaa	0.7207	0.6139	0.1069	0.186	0.6548	0.6096	0.0451	0.595	0.8335	0.6983	0.1352	0.694
Aa1	0.5672	0.6242	-0.0570	0.492	0.5672	0.6102	-0.0429	0.603		0.7168	-0.7168	
Aa2	0.6474	0.6235	0.0239	0.505	0.6193	0.5666	0.0527	0.130	0.7664	0.9702	-0.2039	0.075
Aa3	0.7156	0.7377	-0.0220	0.561	0.6922	0.6683	0.0239	0.545	0.8211	1.0597	-0.2386	0.011
A1	0.8394	0.8169	0.0225	0.373	0.7626	0.7764	-0.0138	0.589	1.3282	1.0841	0.2441	0.001
A2	0.8498	0.9179	-0.0681	0.006	0.7961	0.8531	-0.0570	0.020	1.2385	1.3665	-0.1280	0.112
A3	1.0687	1.1162	-0.0475	0.130	0.8949	0.9958	-0.1009	0.001	1.4789	1.7333	-0.2544	0.000
Baa1	1.2933	1.3506	-0.0572	0.144	1.2054	1.2254	-0.0199	0.597	1.8718	2.0909	-0.2191	0.048
Baa2	1.3364	1.4467	-0.1103	0.007	1.2337	1.3066	-0.0729	0.051	2.0956	2.3690	-0.2734	0.051
Baa3	1.6067	1.7334	-0.1267	0.027	1.4795	1.5521	-0.0726	0.157	2.5178	2.7874	-0.2696	0.150
Ba1	2.4357	2.5281	-0.0924	0.540	2.3080	2.3405	-0.0326	0.819	3.7127	3.5695	0.1432	0.795
Ba2	2.9185	2.9019	0.0166	0.917	2.8002	2.7074	0.0928	0.531	3.8984	4.2998	-0.4014	0.467
Ba3	3.3084	3.3859	-0.0776	0.506	3.1873	3.2561	-0.0688	0.568	3.9714	4.2945	-0.3232	0.301
B1	4.0406	4.1635	-0.1230	0.273	3.9869	4.0955	-0.1086	0.348	4.5735	4.7767	-0.2032	0.597
B2	4.5382	4.6798	-0.1416	0.096	4.4485	4.6265	-0.1780	0.043	5.1523	5.2354	-0.0831	0.775
B3	5.1104	5.0769	0.0335	0.697	5.0512	5.0351	0.0160	0.851	5.8553	5.6172	0.2380	0.596
<B3	6.7996	5.7033	1.0963	0.000	6.7484	5.6422	1.1062	0.000	9.1549	7.4557	1.6992	0.291

[a] Recessions and expansions defined according to NBER (see Table 2).

Source: Author's computations.

Table 10 Bond spreads over Treasury at issue date[a]						
Dep. variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	3.8186	5.7926	5.5322	5.7169	5.7316	5.7148
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}$	0.3072	-0.1701	-0.1724	-0.2197	-0.1731	-0.1668
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}^2$		0.0264	0.0265	0.0288	0.0265	0.0261
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rec			0.3310	-0.6813		
			(0.000)	(0.000)		
Rec·$\bar{R}$				0.2278		
				(0.000)		
Rec·$\bar{R}^2$				-0.0103		
				(0.000)		
Split					0.0737	0.1110
					(0.000)	(0.102)
Split $\bar{R}$						-0.0162
						(0.377)
Split $\bar{R}^2$						0.0011
						(0.306)
Rec Split						
Rec Slpit $\bar{R}$						
Rec Split $\bar{R}^2$						
<u>Other issuer features</u>						
Public company	-0.5214	-0.1143	-0.1100	-0.1017	-0.1171	-0.1164
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First issue	0.3036	0.1588	0.1485	0.1512	0.1614	0.1603
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Order of issue	0.0095	0.0208	0.0122	0.0128	0.0243	0.0231
	(0.306)	(0.010)	(0.129)	(0.103)	(0.000)	(0.005)
Time since prev. issue	0.0052	0.0068	0.0053	0.0051	0.6809	0.0068
	(0.391)	(0.185)	(0.296)	(0.304)	(0.182)	(0.183)
<u>Issue design</u>						
Call provision	0.0591	0.0255	0.0258	0.0246	0.0256	0.0257
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Put provision	-0.6817	-0.5393	-0.5360	-0.5364	-.5384	-0.5382
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sinking fund	0.0124	0.0083	0.0097	0.8645	0.0078	0.0075
	(0.005)	(0.038)	(0.014)	(0.029)	(0.051)	(0.061)
Floater	1.8158	1.3371	1.3372	1.3257	1.3375	1.3371
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shelf	-0.3187	-0.1587	-0.1689	-0.1750	-0.1557	-0.1545
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Maturity	0.0847	0.1122	0.1224	0.1264	0.1128	0.1133
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<u>Other controls</u>						
Amount issued	-0.0056	0.0113	0.0119	0.6003	0.0103	0.0103
	(0.424)	(0.062)	(0.046)	(0.315)	(0.089)	(0.090)
Priv. placement	0.3099	0.1767	0.1303	0.1046	0.1760	0.1789
	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)
Log(Time trend)	-0.5284	-0.5891	-0.5318	-0.5346	-0.5856	-0.5849
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
10-Y. Treasury yield	-0.3207	-0.3333	-0.3236	-0.3206	-0.3322	-0.3319
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Yield c. slope	-0.1885	-0.2018	-0.2436	-0.2568	-0.2014	-0.2013
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.7691	0.8144	0.8168	0.8186	0.8147	0.8147
Log likelihood	-13048.9	-11952.3	-11886.8	-11835.6	-11941.9	-11941.9

[a] Continues on the next page.

Table 10 (continued). Bond spreads over Treasury at issue date[b,c]						
Dep. variables	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Constant	5.6663	5.6542	5.6214	5.6118	5.6182	5.6339
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}$	-0.2225	-0.2216	-0.2103	-0.2100	-0.2096	-0.2096
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}^2$	0.0287	0.0287	0.0282	0.0282	0.0281	0.0281
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rec	-0.6769	-0.6998	-0.4952	-0.5030	-0.5014	-0.4991
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rec$\cdot\bar{R}$	0.2273	0.2206	0.1711	0.1727	0.1723	0.1727
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rec$\cdot\bar{R}^2$	-0.0103	-0.0100	-0.0077	-0.0077	-0.0077	-0.0078
	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)
Split	0.0338	0.0172	0.1401	0.1424	0.1453	0.1479
	(0.619)	(0.803)	(0.052)	(0.049)	(0.044)	(0.040)
Split $\bar{R}$	0.0007	-0.0002	-0.0279	-0.0285	-0.0291	-0.0304
	(0.971)	(0.993)	(0.148)	(0.141)	(0.133)	(0.115)
Split $\bar{R}^2$	0.0003	0.0004	0.0017	0.0017	0.0018	0.0018
	(0.761)	(0.705)	(0.128)	(0.124)	(0.118)	(0.101)
Rec Split		0.1204	-0.6697	-0.6635	-0.6665	-0.6632
		(0.023)	(0.002)	(0.002)	(0.002)	(0.002)
Rec Slpit $\bar{R}$			0.1840	0.1833	0.1840	0.1836
			(0.003)	(0.003)	(0.003)	(0.003)
Rec Split $\bar{R}^2$			-0.0089	-0.0089	-0.0089	-0.0089
			(0.024)	(0.024)	(0.023)	(0.024)
<u>Other issuer features</u>						
Public company	-0.1049	-0.1055	-0.1074	-0.1065	-0.1067	-0.1083
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First issue	0.1532	0.1527	0.1534	0.1536	0.1383	0.1198
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Order of issue	0.0154	0.0146	0.0148	0.0141	0.0114	
	(0.051)	(0.065)	(0.061)	(0.074)	(0.133)	
Time since prev. issue	0.0052	0.0054	0.0053	0.0055		
	(0.294)	(0.279)	(0.294)	(0.273)		
<u>Issue design</u>						
Call provision	0.0249	0.0249	0.0249	0.0249	0.0250	0.0251
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Put provision	-0.5363	-0.5371	-0.5349	-0.5346	-0.5352	-0.5354
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sinking fund	0.0078	0.0080	0.0077	0.0077	0.0076	0.0077
	(0.048)	(0.045)	(0.051)	(0.052)	(0.054)	(0.053)
Floater	1.3259	1.3244	1.3237	1.3260	1.3263	1.3274
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shelf	-0.1703	-0.1700	-0.1680	-0.1666	-0.1725	-0.1685
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Maturity	0.1271	0.1274	0.1255	0.1270	0.1276	0.1256
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<u>Other controls</u>						
Amount issued	0.0054	0.0044	0.0049			
	(0.366)	(0.469)	(0.411)			
Priv. placement	0.1069	0.1048	0.1033	0.1065	0.1041	0.1011
	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)
Log(Time trend)	-0.5302	-0.5263	-0.5300	-0.5295	-0.5276	-0.5244
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
10-Y. Treasury yield	-0.3191	-0.3184	-0.3187	-0.3185	-0.3184	-0.3179
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Yield c. slope	-0.2559	-.2551	-0.2566	-0.2564	-0.2565	-0.2553
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.8190	0.8191	0.8192	0.8192	0.8192	0.8192
Log likelihood	-11823.5	-11820.2	-11814.6	-11814.9	-11815.5	-11816.2

[b] Models estimated with OLS. Standard Errors are heteroskedastic-consistent (HCTYPE=2). Total number of observations 10,050. P-values in parenthesis.
[c] The dependent variable is the bond credit spread over the treasury with the same maturity. Spreads are

computed at issue date. $\bar{R}$ is the average of the two numeric ratings given by Moody's and S&P. It is higher for issues with lower ratings (see Table 4). *Rec* dummy that equals 1 if the bond is issued during a recession as defined by NBER (see Table 2). *Split* is a dummy variable that takes the value 1 when Moody's and S&P announce different alpha-numeric ratings (see Table 4) for a new bond issue. *Publiccompany* dummy that equals 1 if the issuer is a public company. *Firstissue* dummy equals 1 if the bond was the company's first bond issue since 1970:1. *Orderofissue* Number of times the firm issued bonds since 1970:1. *Timesinceprev.issue* Number of years since the firm made its latest bond issue. *Callprovision* dummy that equals 1 if the bond is callable. *Putprovision* dummy that equals 1 if bondholders can sell the bond back to the company prior to maturity. *Sinkingfund* dummy that equals 1 if the bond has a sinking fund. *Floater* dummy that equals 1 if the bond is a floater. *Shelf* dummy that equals 1 if the bond is a shelf issue. *Maturity* maturity of the bond in years. *Amountissued* in millions of US dollars. Issues deflated by the Core Urban Consumer CPI with the average of 1982-1984=100. *Priv.placement* dummy that equlas 1 if the bond was privately placed. $Log(Timetrend)$ Log of the time trend. Included in the regressions but not shown in the table are dummy variables for the issuer's sector of activity as defined by SIC one-digit code, and the number of bonds issued in the quarter in each of the nine main credit rating classes as defined by Moody's whole ratings, Aaa, $\cdots$, C. Total number of observations 10,050. P-values in parenthesis.
Source: Author's computations.

Figure 3a. Bond spreads in expansions

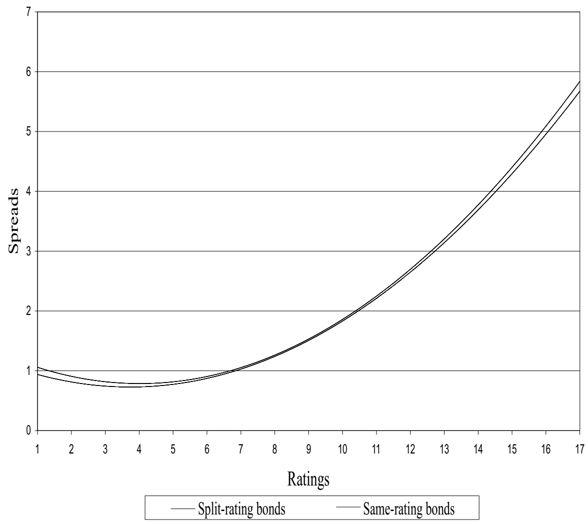

Figure 3b. Bond spreads in recessions

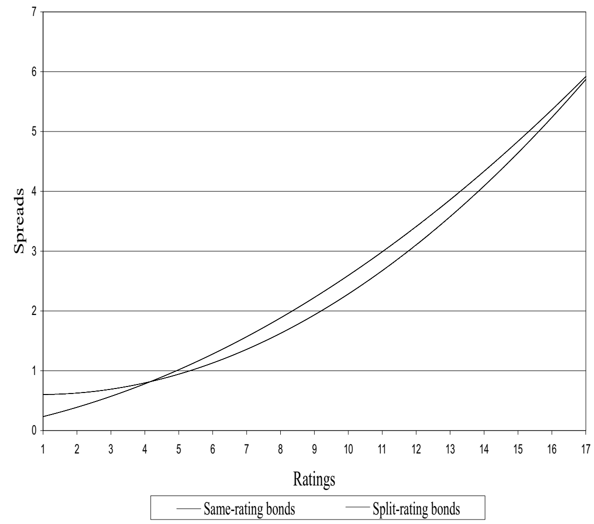

Figure 4a. Cost of split ratings in expansions and recessions

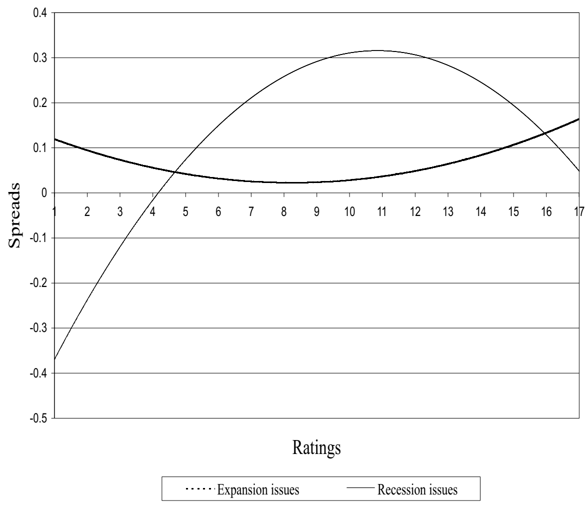

Figure 4b. Additional cost of split ratings for recession issues

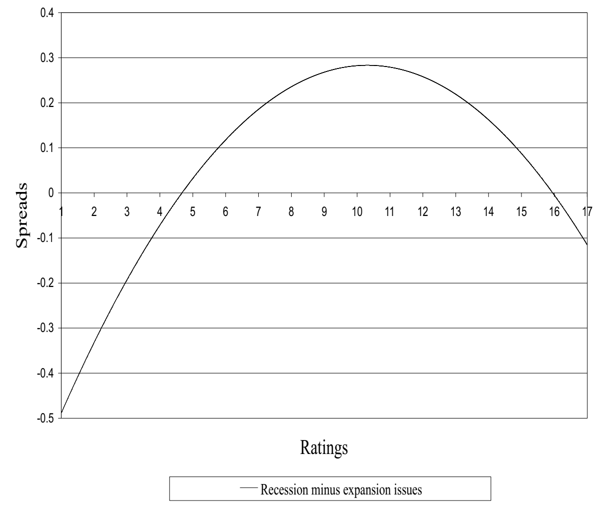

Figure 5 Expected cost of rating splits for recession issues over this cost for expansion issues