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

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Abstract

This paper presents a theory of firm access to the bond market in which information gathering agencies provide a valuable service but alter the relative cost of this funding source across firms of different creditworthiness and over the business cycle. The theory builds on two assumptions. First, the "quality" of the signal produced by the information agencies that firms use to access this market varies with firms' creditworthiness. Second, the mix of bond applicants in recessions is riskier than in expansions. According to this paper's theory, rating agencies affect the cost to access the bond market and recessions increase the impact that these agencies have on the cost of this funding source. Importantly, the impact of recessions 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 assumption. I find that rating agencies are more likely to produce split ratings at issue date, my 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. My 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 do increase the relative cost of this funding source for mid-credit quality issuers in recessions. Furthermore, this 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 do bond credit spreads vary over the business cycle? Evidence from the US bond market shows that recessions increase bond credit spreads over the Treasury at issue date. Importantly, though, the impact of recessions on credit spreads varies across issuers of different creditworthiness.[1] If access conditions to the bond market were independent from the state of the economy, these differences would probably reflect changes in investors' risk preferences over the business cycle.

In this paper, I argue, however, that the cost to access the bond market varies over the business cycle for reasons that are independent from investors' risk preferences. My theory builds on the assumption that the "quality" of the signal produced by the information gathering agencies, which firms use to access the bond market, varies with the firm's creditworthiness. Under these conditions, when the pool of bond applicants becomes riskier, as happens in recessions, the cost of bond financing goes up. Importantly, though, this cost increase due to information agencies does not impact all firms equally. It may, for instance, be largest for mid-credit quality firms. My analysis of the bonds issued in the last two decades by American nonfinancial firms produces evidence in support of both the model's key 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 increases the cost of this funding source in recessions the most for mid-credit quality firms.

The early literature on financial intermediation focused on the conditions under which bank loans dominated public debt.[2] Starting with Diamond (1991) researchers, however, began to expand this literature to explain the coexistence of direct and intermediate lending. A distinct feature of Diamond's (1991) reputation theory is that some firms (younger firms) borrow exclusively from banks while other firms (those with established track records) borrow

[1] Comparing the credit spreads at issue date of bonds issued during the recessions that occurred in the 1982:2-2002:2 period with the spreads of bonds issued during the expansions of this same time period, one finds that recessions affect the bonds in the investment-speculative grade frontier the most. On average, recessions added 78 basis points to Baa Moody's rated bonds and 100 basis points to Ba bonds. The next most affected bonds by recessions were single B and single A rated bonds, with an average increase of 46 and 37 basis points respectively.

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

exclusively from the bond market.[3] Besanko and Kanatas (1993) added to this literature by providing a theory of a firm's simultaneous use of bank loans and public debt. Firms borrow from a bank in order 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.[4]

A striking feature of these theories of public debt is the absence of information gathering agencies, like rating agencies. This is somewhat surprising because virtually all firms use these agencies to access the bond market. The widespread use of credit ratings by bond issuers could, of course, be attributed to institutional factors like regulations.[5] Alternatively, the widespread use of these ratings could be due to a valuable role performed by rating agencies. This is consistent with the theories put forward by Ramakrishnan and Thakor (1984), Millon and Thakor (1984) and Boot and Milbourn (2001), which explain intermediaries whose main function is to produce information to be used by investors. It is also consistent with the evidence unveiled by Liu and Thakor (1984), Ederington, Yawitz, and Roberts (1987), Hand, Holthausen and Leftwich (1992) and others, which shows that rating agencies produce valuable information.

This paper adds to the existing literature on public debt, by providing a theory of firms' access conditions to the bond market which builds on the screening services provided by information gathering agencies, like rating agencies. The theory builds on the assumption that the signal these agencies produce about borrowers' creditworthiness is valuable because entrepreneurs are better informed about their investment projects than investors. Importantly, though, the same asymmetry of information that makes information agencies valuable also leads

[3]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).

[4]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).

[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)).

them to produce incorrect assessments. Under these conditions, as I 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 conditions to market funding, the model that I present makes some simplifying assumptions. I assume that firms' only source of funding is bond financing. In addition, I disregard the potential impact of such things as differences in both investors' risk preferences and firms' investment opportunities over the business cycle. I 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, I assume each firm contracts with two information agencies.[6] 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.

I 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 had access to the same information sources, the information sets they use to screen a firm could still differ. As rating agencies indicate, they use both public and 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.[7] 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.

[6] To simplify the analysis, I do not endogenize 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.

[7] 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.

I make two assumptions about the likelihood of information agencies announcing split ratings. First, I 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 easier for them to "agree" on firms on either tail of the distribution on firm creditworthiness. However, as firms' creditworthiness is further away from these tails, rating agencies are increasingly likely to make incorrect assessments on the firm's creditworthiness. Second, I assume that when firms issue in recessions they are at least as likely to get a rating split than when they do so in expansions. The 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 potentially leading to a higher frequency of different rating assessments.[8]

Building on these assumptions, I show that information gathering agencies, though valuable, influence the cost of accessing the bond market. More specifically, I show that a reduction in the "quality" of the signal they produce increases the cost of this funding source for high and mid-credit quality borrowers and it lowers the cost for low-credit quality borrowers. When I expand the model to consider the impact of the state of the economy on the cost of accessing the bond market, I show that even if the "quality" of the information agencies' signal does not change over the business cycle, provided that the distribution of firm types in expansions exhibits first order stochastic dominance over the corresponding distribution in recessions, then 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 produced by information agencies, then this will further increase the cost of bond financing for high and mid-credit quality firms.

To test my theory I analyze the bonds issued in the last two decades in the United States

[8]Alternatively one could rationalize this assumption following Morgan's (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 firm bonds and argues that this difference arises because banks are more opaque. 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 in the business of judging risk will find it more difficult to perform their jobs during recessions, resulting in a higher frequency of rating splits for bonds issued during recessions.

by American nonfinancial firms. I first try to find support for the model's key assumptions on the "quality" of the signal produced by information gathering agencies. I proxy the quality of this signal by the frequency that Moody's and S&P announce split ratings when they rate bonds at issued date. The results of this analysis confirm the model's assumptions. In particular, I find that, *ceteris paribus*, rating agencies are more likely to announce split ratings on bonds of mid-credit quality issuers. Recessions do not increase the likelihood of all firms getting a rating split, but they do increase this likelihood for mid-credit quality issuers.

I 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. The results of this analysis show that, *ceteris paribus*, rating splits increase the cost of bond financing in recessions. Importantly, though, this impact of recessions on credit spreads is not uniform across firms. Instead, it is largest for mid-credit quality issuers. These results, therefore, lend support to the theory put forward in this paper that information gathering agencies influence the cost of bond financing, and their impact on the cost of this funding source varies across firms and over the business cycle.

My paper is related to various strands of the literature. At the theoretical level, the 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. Even though I do not consider bank lending, my 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.[9] This 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, therefore, does not account for the possibility that access to this funding source is not independent from the state of the economy.[10]

[9] See Diamond (1991), Besanko and Kanatas (1993) and references in footnotes (3) and (4) for models that explain the coexistence of bank and market funding.

[10] Bernanke and Gertler (1989) investigate the role of borrowers' balance sheets on the cost of external funds over the business cycle. Borrowers' net worth tends 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 Townsend's (1979) "costly state verification" model to motivate agency costs of

Lastly, the theory presented in this paper is 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, for example, to the state of the economy.[11] The present model suggests that recessions increase the importance of the bank lending channel, particularly 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, the findings of this paper 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 contrast to this literature, which argues that the widening of spreads in downturns is demand driven, this paper focuses instead on the impact of the "quality" of the signal produced by rating agencies on the cost of accessing the bond market over the business cycle.[13]

Finally, my results add to the literature on bond pricing at issue date. This literature has focused on such determinants of bond pricing as the design of the issue and the characteristics of the issuer, and paid only limited attention to the potential of the "quality" of the

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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.

[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.

signal produced by rating agencies on the cost of this funding source. Cantor, Packer and Cole (1997) and Jewell and Livingston (1998), for example, 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.

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 I 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. Section 5 tests the model's empirical implications on the impact of the "quality" of this signal on the cost of bond financing in expansions and recessions. This section also presents the economic significance of this paper's findings and the results of some robustness tests on this paper's findings. 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, I 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 types 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 $(1-p_i)$. I make the following additional 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, but type-A firms' investment opportunity is safer than that of type-B firms, which in turn is safer than the investment opportunity of type-C firms. Thus we have $p_iX_i > 1$, *for all* $i\in\{A, B, C\}$, *with* $p_A > p_B > p_C$ *and* $X_A \leq X_B \leq X_C$. *In order to simplify the analysis, I will further assume that* $X_A = X_B = X_C = X$.

(ii) The probability of failure of mid-quality firms is at equal distance (in absolute terms) from the probability of failure of the safest firms and that of the riskiest firms. Thus

$p_A - p_B = p_B - p_C$.

Assumption 1(i) rules out moral hazard. It also makes it efficient to fund all investment opportunities in the economy. Assumption 1(ii), in turn, orders the three types of firms according to their riskiness. In the absence of information frictions, this assumption would generate an increasing, but convex relationship between the firm's riskiness and the interest rate it has to pay to borrow funds. It is unclear whether rating agencies adopt a similar ordering when they rate firms because the only information they make available is the ranking of their ratings. Nonetheless, as we will see there exists a similar convex relationship between ratings and credit spreads among bonds that get the same rating from both Moody's and S&P, which are, arguably, the bonds that carry less uncertainty about their creditworthiness.

I assume that 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 in the economy, θ. Let θ_A, θ_B, and θ_C be the portions of firm types A, B, and C, respectively. I 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,* $\theta_B > \theta_C > \theta_A$.

This assumption matches the universe of nonfinancial firms that issued bonds in the United States over the 1982:2–2002:2 period. Of the 10,050 bonds issued by nonfinancial firms during this period, 10% were of high credit quality, in the sense that they had a rating equal to Moody's double A or higher, 32% were of low credit quality in the sense that they had a credit rating equal to Ba or lower, and the remaining 58% were of mid-credit quality in the sense that they had an A or Baa rating.

Finally, I assume that the success of the investment undertaken by each entrepreneur is verifiable at no cost by outsiders, but the investment's return is unverifiable. Consequently, each firm can promise to repay a fixed amount D (its nominal debt) only in case where it succeeds. Because entrepreneurs have no funds, their repayment is zero in case where their investment fails. Under these conditions, investors are repaid with probability $\Gamma(D)$ when they demand a repayment $D \leq X$ where

$$\Gamma(D) = p_A\theta_A + p_B\theta_B + p_C\theta_C.$$

Assuming that the riskless interest rate in the economy is zero, then the equilibrium when firms apply for funding without using the services of information gathering agencies is defined as follows:

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*

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

When the equilibrium exists, that is, the parameters of the model are such that $D^{\star} \leq X$, we have

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

with $\{\frac{1}{p_A}, \frac{1}{p_B}\} < D^{\star} < \frac{1}{p_C}$.[14]

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 low-quality firms.

In what follows I 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 potentially important implications. For example, it may give an incentive to firms, particularly the higher quality firms, to apply for a

[14]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.

second rating, as this may reduce the probability of being assigned the wrong rating and it may improve the "quality" of the signal sent to investors when both information agencies announce the same rating.[15] This choice by high-quality firms, in turn, may "force" low-quality firms to follow suit in order to avoid revealing their own type. Applying for a second rating, however, is costly and it creates the conditions for split ratings, that is, circumstances where the same company gets a different rating from two rating agencies. In what follows, rather than fully modeling which firms seek two ratings and what implications this choice may have on the quality of the screening services provided by rating agencies, I assume that all firms seek two ratings. This is consistent with US evidence where a dual rating is fairly automatic because of Moody's and S&P policy to rate virtually all public corporate bond issuers. Let R_{ij} denote the pair of ratings $\{i, j\}$ that a firm receives from two rating agencies. I 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, A.3(i) implies that 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. Second, A.3(ii) and A.3(iii) together imply that mid-quality firms are more likely to get a split rating than firms on either tail of the distribution of firm credit quality. 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 have that

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

Given that this is an important assumption for the results that follow, in section (4.1) I will present supporting evidence by investigating the likelihood of Moody's and S&P announcing

[15] Hsueh and Kidwell (1988) and Thompson and Vaz (1990), for instance, find that two (or more) equal ratings reduce investors' required yield.

different ratings when they rate bonds at issue date. Lastly, assumption A.2.1 implies that when a firm gets the same rating from the two different agencies its type is fully revealed, that is

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

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

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

These probabilities, in turn, imply that 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} is

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

Under these conditions, the equilibrium when all firms in the economy issue bonds after they receive two ratings is characterized as follows:

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*

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

Therefore, we have in equilibrium that

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

As a result, the expected cost of bond financing for a type-i firm, EC_i, in equilibrium 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 $EC_C^* > D^*$, as long as type-B apply for ratings, type-C are also better off applying for ratings. Otherwise, investors will infer (correctly) their type and charge them $\frac{1}{p_C} > EC_C^*$. Finally, regarding type-B firms, if information agencies were able to produce flawless screening services, these firms would be better off applying for ratings. Under these circumstances $EC_B^* = \frac{1}{p_B}$, thus implying that $EC_B^* < D^*$.[16] Type-B firms will still be better off applying for ratings as long as the "quality" of the signal produced by information agencies' ratings is not too low. Given that when $\mu = \frac{1}{2}$, $EC_B^* \lesseqgtr D^*$ then we will have $EC_B^* < D^*$ as long as $\mu \leq Min\{\frac{1}{2}, \hat{\mu}\}$, where $\hat{\mu}$ is determined by $EC_B^*(\hat{\mu}) = D^*$.

An important feature of the equilibrium when firms use information agencies to access the bond market is that the cost of this funding source 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, it is possible to show that assumption A1(ii), $p_A - p_B = p_B - p_C$, together with assumption A3, $\theta_C > \theta_A$, implies that $CRS_B > 0$. 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 the probability of solvency of both types of firms is at equal distance from that of type-

[16] As I noted in footnote (14), assumptions A.1(ii) and A.2 imply that $D^* > \frac{1}{p_B}$.

B firms (assumption A.1(ii)) and given that type-C firms are more common that type-A firms, (assumption A2), then the cost of getting pooled with lower quality firms is higher than the subsidy of getting pooled 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 $\theta_C > \frac{p_B}{p_B+(p_A-p_C)}(1-\theta_A)$, $CRS_B > CRS_A$, 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. These results are summarized in the following proposition about the equilibrium in the bond market.

Proposition 1 *Provided that 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 I 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. The marginal cost of changes in the "quality" of this signal, however, is a function of the distribution of firm types in the economy. Thus, *ceteris paribus*, systematic changes in this distribution over the business cycle will affect the cost of bond financing. If, in addition, the "quality" of the signal produced by information agencies varies systematically over the business cycle, this will add another link between the cost of bond financing and the state of the economy. In order to analyze the impact of the state of the economy on the cost of accessing the bond market, I make the following assumption:

Assumption 4

(i) The distribution of firm types in expansions exhibits first order stochastic dominance over the corresponding distribution in recessions, 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,

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

Note that changes in the "quality" of the signal produced by rating agencies, μ, affect mid-quality firms the most because of assumption A.2 that rating agencies are more likely to announce split ratings for mid-quality firms than for firms on either tail of the distribution on firm credit worthiness.

Before I investigate the impact of this assumption on the cost of bond financing over the business cycle, I first investigate how changes in the distribution of firm types over the business cycle impact the cost of rating splits. To this end, consider the cost of rating splits, CRS_i, defined above. Taking into account the first order stochastic dominance change assumed in A.4(i) and the condition $d\theta_A + d\theta_B + d\theta_C = 0$, it is possible to write the impact of a recession on the cost of a rating split as

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

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 light-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 $dCRS_B > \{dCRS_A, dCRS_C\}$. Thus, 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.

We are now ready to establish how recessions, by affecting the composition of firm types in the economy and possibly the "quality" of the signal produced by information agencies, can impact the cost of bond financing across firms. To see this, consider the expected cost of market funding in equilibrium defined earlier, EC_i for $i \in \{A, B, C\}$. Given assumption A.4 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, that is, $d\mu = 0$, then $dEC_i^* = \mu dCRS_i$, where $dCRS_i$, is determined as above. In this case, as we just saw, recessions increase the cost of bond financing for mid-quality firms. Under certain conditions, recessions may increase the cost of this funding source to *all* firms in the economy. If, in addition, recessions bring a reduction in the "quality" of the signal produced by information agencies, that is, $d\mu > 0$, then this will add an impact to the expected cost of bond financing which depends on the cost of rating splits, CRS_i, as determined in the previous subsection. Given that $CRS_A > 0$ and $CRS_B > 0$ this impact will further make bond financing more expensive in recessions for high and mid-quality firms. The next proposition summarizes these results.

Proposition 2 *When firms rely on rating agencies to access the bond market:*

(i) If the distribution of firm types in expansions exhibits first order stochastic dominance over the corresponding distribution in recessions, then as a result of firms' use of information agencies, 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 an attempt to test my model's predictions on the influence of information agencies on the relative cost of bond financing across firms and over the business cycle, in the rest of this paper I investigate the cost of bond financing by American nonfinancial firms over the last two decades. Before doing that, however, I test the model's assumptions on the "quality" of information agencies' signal, which I proxy by the likelihood of rating agencies announcing different ratings on the same bond at issue date.

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. The sample of bonds used in this paper includes only bonds issued in the United States in US dollars by American nonfinancial companies between 1982:2 and 2002:2. I 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 that year. I 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.

The sample of bonds that this paper uses includes both shelf and non-shelf issues, and bonds issued in the public market as well as those privately placed. I excluded from the sample asset-backed bonds and convertible bonds. I also excluded bonds for which I do not have the necessary information to compute their credit spreads over the Treasury at issue date, such as bonds for which the yield or maturity information was missing, and bonds with maturities longer than 30 years because the Treasury bonds necessary to compute the spreads for these bonds do not exist. Finally, I excluded bonds that do not have ratings from both Moody's and S&P at issue date. This is not a restrictive criterion because as I noted earlier both Moody's and S&P rate virtually all public corporate bond issues. These criteria left me with a sample of 10,050 bonds.

I use NBER's identification of troughs and peaks to find out if a bond was issued in a recession or in an expansion. I define a recession as the time period between a peak and a trough, and an expansion as the time period between a trough and a peak. Using this definition, I 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. According to this classification there are 70 quarters of expansion and 11 quarters of recession during the period 1982:2-2002:2 (more on the definition of recessions and expansions on the robustness checks subsection below).[17] Still according to this definition, 86% of the 10,050 bonds in the sample were issued in expansions and the remaining 14% were issued in recessions.

Table 1 characterizes the sample of bonds along various dimensions. Among other things, this table shows that bonds issued in recessions have shorter maturities than those issued in expansions. Recession cohorts also have more shelf-registration issues and private placements.[18] Note, though, that 144A issues account for the vast majority of private placements in recessions as well as in expansions.[19] In contrast, recession cohorts have a lower percentage of bonds with call and put provisions, and bonds with a sinking fund than expansion cohorts.[20] Recession cohorts also have a lower percentage of the first bonds issued by corporations than expansion cohorts. I 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.

Finally, note that there is a reduced number of floating bonds in the sample. It is worth noting, though, that this is partly due to my decision to exclude from the sample those bonds in the SDC database that do not have yields, because the vast majority of floating bonds in

[17] According to NBER, 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).

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

[19] 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 bonds that were privately placed.

[20] 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 them back to the issuing firm prior to the maturity date.

that database do not contain this information.

3.2 Methodology

The methodology I use in this paper 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 impact of the "quality" of that signal on the relative cost of accessing the bond market across firms and over the business cycle.

3.2.1 What explains the "quality" of the information agencies' signal?

In the model of firm access to the bond market I presented above, 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 the assumption that when firms apply to two information agencies they always get at least one correct rating. Irrespective of 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. I, therefore, use the frequency of bond-rating splits between Moody's and S&P at issue date as my 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, the ratings of these agencies are comprehensive and thus not likely to introduce sample selection problems. This is because both Moody's and S&P 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, the

[21]Note that my data source includes information on the rating of the issue, not that of the issuer. Even though these two ratings are identical in the model of this paper, the rating that captures best the intuition of the model is that of the firm which captures the issuer's probability of default. I am 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

ratings of these agencies 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 instrument."[23] Both rating agencies, in addition, 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, I assume 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.

Given the assumptions I made in the model of firm access to the bond market that I presented in section 2, I am particularly interested in the relationship between the likelihood of a rating split and the creditworthiness of the issuer, and on the impact of the state of the economy on this relationship. Specifically, I 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. I also want to find out if recessions increase the likelihood of getting a rating split. For these reasons, I estimate the following probit model.

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.

[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 the categorization systems these 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.

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

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. Rating splits are defined based on the alpha-numeric ratings. In order to identify instances where a rating split occurred, I started by converting the long-term debt rating symbols that Moody's and S&P use into a numeric variable. I 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's AAA, 2 to AA+, 3 to AA, $\cdots$, and 17 to CCC+ and any other S&P's rating below CCC+ (see Table 4). I pooled the low ratings 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 applies qualifiers to its CCC rating, Moody's does not use qualifiers with its Caa rating.

In order to find out how the likelihood of getting a rating split varies with the creditworthiness of the borrower, I estimate this probit model controlling for the rating of the bond at the time it is issued. More specifically, I include in the model the average of the two bond ratings given by the agencies at issue date, $\bar{R}$. 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 the ratings attributed by Moody's and S&P. Because I 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 I consider both linear and quadratic functional forms on the issue's rating.

In order 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, I include a dummy variable, *Rec*, that takes the value 1 if the bond is issued during a recession. Lastly, because I want to find out how the impact of recessions on the likelihood of rating splits vary with the creditworthiness of the issuer, I interact this recession dummy with the bond's rating $\bar{R}$.

In addition to these explanatory variables, I include in the probit model of rating splits a set of explanatory variables to control for the design of the bond and a set of variables to control for various aspects of the issuing company. With respect to the bond design, I include dummy variables to control for privately placed bonds, shelf bonds and floating bonds. I also include dummy variables to control for bonds with a call option, a put option, and those with a sinking fund. Finally, I control for the maturity of the bond and for the amount issued.

With respect to the issuing company, I 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. I also control for the first bond issued by the company, the number of times the company has raised funding in the bond market since 1970, and the length of time since the company's last bond issue.

Finally, I include in the probit model a time trend to control for factors such as learning. I also include the number of bonds issued during the quarter in each of the main credit rating classes to control for potential systematic rating differences among these segments.[26] Before analyzing the econometric results of the model introduced here on bond rating splits, I introduce in the next subsection the methodology I use to evaluate the impact of rating agencies on the relative cost of accessing the bond market across firms and over the business cycle.

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

As I noted in the previous subsection, I proxy the "quality" of the signal produced by information gathering agencies by the frequency of rating agencies' split ratings. My premise is that the higher the frequency of split ratings the lower the "quality" of that signal. Accordingly, the model of firm access to the bond market that I presented above 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, I estimate the following model of the bond credit spreads.

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

[26]The ratings used to assign bond issues to each main rating class were those of Moody's. This added nine variables to the regression, each measuring the number of bond issues in the quarter with a rating equal to Aaa, Aa, A, Baa, Ba, B, Caa, Ca and C respectively. It is worth noting that excluding these variables from the model does not change the results reported in the next section in any meaningful way.

where *Spread* is the bond's spread over Treasury at issue date. My bond spreads are, therefore, from the primary market. Despite that, they are market prices because they are based on the price required to place the bonds. Typically the bond will be priced at par, and 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, I 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. I 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]

Because I 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 I consider rating notches.[29] A downside of the approach I 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 finds that the results obtained using the numeric rating variable are virtually identical to those obtained using the full set of rating dummies.

I control for the conditions of the economy at the time the bond is issued by including

[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, I 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 affect bond yields. Pricing models that rely on either rating produce unbiased but highly inefficient estimates. The authors show that 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 I used this alternative approach, I would need to consider 119 dummies because there are 120 Moody's-S&P rating combinations in the sample (see Table 3).

a dummy variable *Rec*, which takes the value 1 if the bond is issued during a recession and zero otherwise. In order to ascertain the impact of split ratings on the cost of accessing the bond market I include the dummy *Split*, which takes the value 1 if rating agencies rate the bond differently at issue date and 0 otherwise. In order to ascertain if the impact of split ratings in recessions is different from the corresponding impact in expansions, I include the interaction dummy *Rec Split*. Because the 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, I interact the three dummies *Rec*, *Split* and $\bar{R}$. Finally, given that the theory put forward in this paper predicts that such an impact can be largest for mid-credit quality issuers I consider both linear and quadratic functional forms on the rating of the issuer (more on this in the robustness checks subsection below).

Based on these definitions, then according to the econometric model of bond spreads specified above, the marginal 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 this paper's theory on the differential conditions of firm access to the bond market over the business cycle due to rating agencies 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 expansions. Given that the econometric model considers a quadratic specification on firm ratings these parameters will also show how this cost difference varies across borrowers of different creditworthiness.

The marginal effects measured by the aforementioned parameters are estimated controlling for the set of factors that other studies of bond pricing have shown, and help explain bond credit spreads.[30] These include the explanatory variables I used in the probit model of rating splits to control for the design of the issue and the features the issuing company, as well as the long-term constant treasury yield and the yield curve premium.[31] I also control for the number of bonds issued in the quarter in each of the main credit rating classes to control for any potential segmentation along these rating classes in the market for corporate bonds.[32]

[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 the treasury yield and the yield curve premium for the pricing of corporate bonds.

[32]This segmentation could arrive because of, for example, regulations which penalize, or even prohibit, some

4 Evidence on the determinants of bond rating splits

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

Table 3 summarizes the ratings attributed by Moody's and S&P to each of the 10,050 bond issues in the sample. These rating agencies attributed the same rating to 5,203 of the sample issues and different alpha-numeric ratings to the remaining 4,847 issues in the sample. When agencies rated bonds differently, Moody's assigned a rating better than S&P 44% of the time. Even though I 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 too different from each other. Note, however, that had I considered whole ratings instead of alpha-numeric ratings I 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 3, 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 I do in the multivariate analysis of the next subsection, the average of the two ratings. This, however, makes it difficult to carry out a discrete analysis. To obviate this problem, in this subsection I assign every bond that gets a split rating to each of the buckets associated with its two ratings. After doing this, I 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 4. They are reported for the overall sample and 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 ratings are more common in recessions, particularly

institutional investors from investing in assets with ratings lower than certain thresholds (see footnote (5) for examples of these regulations). The ratings used to assign bonds to each rating class were those of Moody's. This added nine variables to the econometric model, each measuring the number of issues with a rating equal to Aaa, Aa, A, Baa, Ba, B, Caa, Ca and C respectively. It is worth noting that excluding these variables from the model does not change the results reported in the next section in any meaningful way.

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] These results lend some support to the hypotheses I made in the model of firm access to the bond market on the "quality" of information gathering agencies' signal. They suffer, however, from the usual limitations of a single-variable analysis. To obviate this problem, I estimate the probit model of split ratings introduced in the previous section. I discuss the results of this model next.

4.2 Rating splits across firms and over the business cycle

Table 5 presents the results for the probit model on bond rating splits between Moody's and S&P at issue date. Recall that the key objective of this model is to ascertain how rating splits vary with the credit quality of the borrower, as measured by the credit quality of the bond the borrower issues, and how this relationship varies over the business cycle.

Comparing Models 1 and 2, we immediately see that the quadratic specification explains the likelihood of rating splits better than the linear specification. As the latter model indicates, 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 this paper's 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 firm creditworthiness.

Models 3 and 4 investigate the impact of the state of the economy on this relationship between the borrower's creditworthiness and the likelihood of getting a split rating. Model 3 shows that on average, recessions do not increase the likelihood of split ratings. Model 4, however, show that the impact of recessions on the likelihood of getting a rating split varies significantly with the firm's creditworthiness. While recessions lower this likelihood for firms on either tail of the distribution on firm's creditworthiness, in particular for firms of high-credit

[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.

quality, it increases the chances of getting a rating split for mid-credit quality firms.

Model 5 tests the sensitivity of these results to the explanatory variables included in Model 4 that are not statistically significant by dropping these variables. As the results of the new model show, excluding these variables from the probit model does not affect either the concave relationship between the likelihood of a rating split and the creditworthiness of the issuer, or the result that recessions increase the likelihood of mid-credit quality issuers getting a rating split. As another indication of the robustness of these results, note that all of the parameters defining these relationships are statistically significant at either 1% or 5% confidence level.[34]

The explanatory variables that are statistically significant in Model 5 indicate, as expected, that firms that issue more often and those that issue shelf bonds 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 this variable is statistically significant only at the 10% confidence level. Also, somewhat surprisingly the model predicts 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 correlated with firm size, and larger firms are usually more complex and thus more difficult to rate. Finally, the econometric results show the existence of a negative time trend, indicating 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 the probit model, in Figure 2a I plot 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 I set all of the remaining variables in Model 5 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 a triple-B firm getting a rating split is 52%.

Figure 2b, in turn, shows that recessions add, on average, about 4 percentage points

[34]As another robustness test, following Press and Wilson (1978), who show that the logistic model is more robust than the probit model to departures from normality in the conditioning variables, I re-estimated the split-rating model using a logistic model. The new results are almost identical to those obtained with the probit model.

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 is unlikely to be a statistically significant result, because there is a small number of observations on the tails of that distribution in recessions. 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 bonds.

In sum, the evidence presented in this section lends support to this paper's 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. The evidence on the impact of the state of the economy on rating splits, in turn, lends mixed support to the assumption that a firm is at least as likely to get a rating split if it issues in recessions rather than in expansions. The results show that the state of the economy at the time the bond is issued affects the likelihood of getting a rating split, but they do not indicate that recessions increase this likelihood for all firms. Importantly, though, these results do show 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, I 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. I 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.

I 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.[35] The

[35] I also use this procedure to compute the spreads for the floating rate bonds in the sample because I do not

yield of the issue was obtained from SDC. The yield on the US Treasury bond was based on the Treasury's Constant Maturity Daily Series as reported in the Federal Reserve H15 report.[36]

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 6 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 6 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 recessions. For the former bonds, rating splits increase on average 8 basis points to their credit spreads at issue date. For bonds issued in recessions, on average, split ratings lower their credit spreads by 6 basis points, but this difference is not statistically significant. An obvious limitation of these comparisons is that they do not account for the distribution of credit ratings of the bonds in the cohorts being compared. In order to evaluate how split ratings affect credit spreads over the business cycle across issuers of different creditworthiness, I present in Table 7 the same information included in Table 6 but broken down by the rating of the issue. I account for bonds that get a rating split the same way I did in Table 4, that is, by assigning every bond that gets a split rating to each of the buckets associated with its two ratings.

The results in the left-hand panel of Table 7 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 results also suggest that this effect is more prevalent for mid-credit

have information on the repricing interval of these bonds and thus cannot use the rate of a Treasury bond with the maturity equal to the repricing interval of the floater. These bonds do not drive the results because there are only 50 of them in the sample. Excluding them from the probit analysis on rating splits and from the spread analysis of the next section does not change the results in any meaningful way.

[36]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 interpolated Treasury yield was then read from this function at the exact maturity of the issue, and the bond spread calculated as the difference. For bonds that were callable and deep in the money, the yield and maturity to the date of first call were used.

quality issuers. Note that four of the five differences between the credit spreads of same-rating bonds and those of split-rating bonds are statistically different from zero, thus indicating that split-rating bonds have higher credit spreads. This happens for bonds with ratings equal to Moody's A2, Baa2, Baa3 and B2.[37]

Looking at the difference between the spreads of these bonds based on the expansion and recession cohorts – middle and right-hand side panels of Table 7, respectively, – it is also apparent that first, split-rating bonds tend to have higher credit spreads than same-rating bonds and second, split ratings affect predominantly middle credit quality issuers. Finally, comparing the impact of split ratings in expansions with the corresponding impact in recessions, the results suggest that split ratings have a larger impact on credit spreads in recessions than 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 the theory introduced in this paper 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, I look at these issues more carefully in the next subsection by estimating the model of bond pricing I presented in the previous section.

5.2 Impact of rating splits on bond credit spreads over the business cycle

In order to evaluate the impact of rating splits on the cost of accessing the bond market over the business cycle, I estimate the model of bond pricing presented in section 3 for 10,050 bonds issued in the United States by American nonfinancial firms over the 1982:2-2002:2 time period. The results are presented in Table 8. Model 1 confirms that credit ratings help explain bond credit spreads. In particular, the results show that, as expected, credit spreads increase as the issue's rating decreases. The credit rating of the issue is defined as the average rating attributed

[37]Note that, contrary to what might be expected, the relationship between credit spreads and bond ratings is increasing but not monotone (Table 7). This is because triple-A rated bonds do not always carry lower spreads than double-A rated bonds. Even among those bonds that get the same rating from both Moody's and S&P, regardless of the state of the economy at the time they are issued, on average triple-A rated bonds have a higher spread than double-A rated bonds.

by Moody's and S&P using the correspondence presented in Table 2. Model 2 indicates that this relationship is convex. Therefore, as the rating decreases, credit spreads increase at a faster rate. Note, however, that the relationship between spreads and credit ratings is not monotone. It is decreasing until $\bar{R} = 3$ and increasing afterwards. This is a reflection of the evidence existing in the raw data which show that on average tripe-A rated bonds have higher credit spreads than double-A rated bonds (see footnote (37) for further details). This result is often attributed to a difference in the liquidity of these bonds.

A control missing from models 1 and 2, which according to the theory of firm access to the bond market I presented earlier helps explain the credit spreads, is the state of the economy at the time the bond was issued. To evaluate the impact of the state of the economy on the cost of accessing the bond market, I added to Model 2 the dummy variable *Rec* which takes the value 1 if the bond was issued during a recession. The results of this new model, Model 3, confirm 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, I interact the recession dummy with the credit rating of the issue. The new results are presented in Model 4. They 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 the impact of recessions on the cost of this funding source.

Another important control missing from models 1 and 2, according to this paper's theory of firm access to the bond market, is a measure of the "quality" of the signal produced by rating agencies. As discussed earlier, I proxy the "quality" of this signal by the frequency that rating agencies announce different ratings. For this reason, I added to Model 2 the dummy variable *Split* which takes the value 1 when Moody's and S&P announce different credit ratings on a bond at issue date. 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. Rating agencies, therefore, increase the cost to access the bond market when they announce split ratings. In order to find out if split ratings affect firms differently, I extended Model 5 by including the interaction of the *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.

A limitation of Models 5 and 6 to test this paper's theory is that these models do not distinguish among the bonds that get split ratings those issued in recessions from those issued in expansions. According to the theory of firm access to the bond market that I presented earlier, this difference matters because the distribution of bond issuers varies over the business cycle. This difference may also matter, because the likelihood of rating agencies announcing different ratings on the same bond may vary with the state of the economy. For these reasons, I started by extending Model 6 to include the variables introduced in Model 4 to capture the state of the economy. The new model, Model 7, confirms the results produced by Models 4 and 6. I then extended Model 7 by including a new variable, the interaction of the recession dummy with the split-ratings dummy, *Rec Split*, in order to investigate if the announcement of a split rating during a recession (that is, at the time of the issue and in connection with a bond issued in a recession) has different implications then the same announcement during an expansion.

As the results of Model 8 indicate, effectively rating splits are costlier in recessions than in expansions. On average, a rating split is 12 basis points more expensive in a recession than in an expansion. This model, however, does not account for the potential difference of the impact of rating splits in recessions across firms. Recall that according to the 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 how rating splits impact spreads over the business cycle and across issuers of different creditworthiness, I extended Model 8 and included the interaction of the dummy *Rec Split* with the rating of the issue, $\bar{R}$. Furthermore, in order to find out if split ratings affect mid-credit quality issuers more than high-credit quality issuers, I considered a quadratic specification on the rating of the issuer. The results are presented in Model 9. Given that the coefficients on these new variables are statistically different from zero at 1% or 5% confidence level, the new model confirms that the additional cost of a rating split in recessions does not affect all firms equally.

Before I analyze in detail the insights of the control variables discussed thus far for the theory of firm access to the bond market introduced in this paper, I briefly review the results of the remaining control variables used in the credit spread model. As Model 9 shows, three of these control variables, specifically the size of the issue, the time that elapsed since the firm's last bond issue, and the number of times the firm has issued in this market since 1970, are not statistically significant. The absence of a relationship between the credit spread and the size of the issue is consistent with the findings of other studies of bond spreads.[38] The absence of a link between bond spreads and the frequency that the firm has come to this market or the time since it issued in this market is somewhat unexpected. This, however, may be the result of the way these variables were constructed.[39] As a sensitivity test, I removed these three variables from Model 9. The new results are reported in Model 10. They show that removing these control variables does not affect any of the coefficients on the variables I have discussed thus far.

With respect to the remaining control variables that are statistically significant, as we can see from Model 10, they influence bond credit spreads as expected. The variables that control for the features of the issuer other than its creditworthiness indicate that private companies and first-time issuers pay higher credit spreads than public companies or issuers with a track record in this market.[40] As for the variables that control for the design of the issue, they indicate that callable bonds, floaters, bonds with a sinking fund, and longer maturity bonds pay higher credit spreads.[41] [42] In contrast, bonds with a put provision and shelf issues pay lower spreads.[43] Finally, with respect to the other control variables used in the regression on credit spreads, they indicate that private placements cost more than public issues, and that over time credit spreads have been declining at a decreasing rate.[44] The results of Model 10

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

[39]To construct these variables I used the firm's cusip over time. I relied on information from CRSP to track cusip changes that were due to such things as company name changes. I was unable, however, to track cusip changes that were motivated by other events such as mergers.

[40]Fenn (2000) also finds that investors require a premium for first-time issuers and private companies.

[41]Contrary to my findings, Sarig and Varga (1989) and Fenn (2000) find that longer maturity bonds pay lower credit spreads.

[42]Because the spreads of floaters were computed using a Treasury with the bond maturity rather than a Treasury with a maturity equal to the repricing interval, I re-estimated Model 10 without the 50 floaters in the sample. Excluding these observations from the sample does not change the results of Model 10 in any significant way.

[43]Kidwell, Marr, and Thompson (1984), Kadapakkam and Kon (1989) and Blackwell, Marr and Spivey (1990) also find that bonds sold under shelf registration have lower spreads than nonshelf offerings.

[44]Fenn's (2000) study of 144A bond spreads also finds private placements are costlier, and a secular decline

also show that in periods when the Treasury yield is high or the yield curve is steeper, it is less expensive to access the bond market.[45]

To highlight the results of the analysis of bond pricing that have implications for the theory of firm access to the bond market put forward in this paper, I start by comparing, 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 based on Model 10, are plotted in Figure 3a for each given rating of the issue. All remaining variables of Model 10 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 $Split\ \bar{R}^i$, with $i \in \{1, 2\}$, which measure 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.

In order to illustrate the differential impact of split ratings across firms, Figure 4a plots for the expansion and recession cohorts of bonds the difference between the spreads of split-rating bonds and those of same-rating bonds. The almost flat convex line in the figure represents the cost of a rating split for bonds issued in expansions, and the concave 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. These results, therefore, confirm that the impact which rating agencies have on the access conditions to the bond market is not uniform across firms.

The results of Figure 4a also suggest that, for each firm of a given creditworthiness, the impact of rating agencies varies over the business cycle. This is made clearer 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

in spreads over the 1993-98 period of 13 basis points per year.

[45]Duffee (1996), Collin-Dufresne, Goldstein and Martin (2001) and Harrison (2001) find similar relationships between these variables. Harrison (2001), however, finds a positive relationship between bond credit spreads and the Treasury yield. It is worth noting though that the exclusion of both variables from Model 10 does not alter the results on the impact of rating splits over the business cycle on credit spreads.

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 for firms with ratings above 5 (below Moody's A1 and S&P A+) and below 16 (above Moody's B3 and S&P B-). In contrast, on either tail of the distribution of credit ratings, getting a rating split in recessions is less costly than getting it in an expansion. 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 the reduced number of observations in those areas of the distribution (more on this in the robustness checks subsection).

To fully account for the importance of this differential impact of rating splits, we need to consider the findings of the previous section of firms' likelihood of getting a rating split when they issue bonds. Recall that the results of section 4 showed that mid-credit quality firms are more likely to get a rating split than firms on either tail of the distribution. Combining this result with the results of this section showing that rating splits do not affect credit spreads across firms in expansions, but they do increase these spreads for mid-credit quality firms in recessions, 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. Furthermore, the cost these firms incur to access the bond market in recessions is further amplified by the finding of the previous section that recessions increase the likelihood of mid-credit quality firms getting a rating split.

These findings, therefore, support this paper's 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, by altering the cost to raise funding in this market. It is still unclear from the results presented thus far whether the cost that rating splits impose on mid-credit quality vis-á-vis the cost imposed on other firms on the one hand, and the cost that rating splits impose on those firms when they issue bonds in recessions as opposed to issuing in expansions on the other end, are economically meaningful. The next subsection investigates this issue.

5.3 Economic significance

According to this paper's evidence, 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 a 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.

In contrast, the evidence presented here indicates that rating splits alter the relative cost of bond financing among firms in recessions. Recall that in recessions, as 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. In downturns, however, the cost of a rating split is statistically different across firms. In fact it is largest for mid-credit quality firms. More specifically, in recessions the expected cost of a rating split for a Moody's Baa2 or an S&P BBB-rated firm is 17 basis points, but the expected cost of a rating split for the lowest-rated firms is only 2 basis points. This implies an additional cost of $150,000 for a mid-credit quality firm making an issue of $100 million.

This difference in the impact of rating splits, besides altering the relative cost of bond financing across firms in recessions also alters the access conditions to the bond market over the business cycle. As Figure 4b shows, issuing in recessions rather than in expansions can imply an increase of as much as 30 basis points for mid-credit quality firms. In addition, as Figures 2a and 2b show, the likelihood that these firms will get a rating split is about 50% when they issue during expansions, and it goes up by another 4 percentage points when they issue during recessions. 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).

These results suggest that the cost of rating splits between Moody's and S&P is economically significant for mid-credit quality firms. This assertion, however, raises an important question. Why don't these firms find ways to reduce this cost, such as by getting a rating from a third agency? A possible reason for not doing so is that this is not 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.[46] 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 to get a rating.[47]

5.4 Robustness checks

In this paper I used the NBER's identification of troughs and peaks to identify whether a bond was issued in a recession or in an expansion. I defined a recession as the time period between a peak and a trough, and an expansion as the time period between a trough and a peak. I classified a quarter to be a recession (expansion) if either all months or the majority of months in the quarter were in a recession (expansion) period. As a robustness check to the results presented, I considered a modified version of this definition, whereby I defined a quarter to be a recession (expansion) quarter if either all of its months were in a recession (expansion) period or the trough (peak) occurred in that quarter. As another robustness check, I used instead the Stock-Watson Experimental Coincident Recession Index to define recessions and expansions. Neither of these alternative definitions of recessions changed the key results of the paper in any meaningful way. This was somewhat expected, because both of these alternative definitions of recessions and expansions made only minor changes to the definition I had used.

I used a quadratic specification on the borrower's average rating in order to test for a nonlinear relationships between split ratings and the borrower's creditworthiness on the one hand, and between bond spreads and the borrower's creditworthiness on the other hand.[48] This approach has some advantages, for example it saves on the degrees of freedom, but it also has some potential disadvantages, for example it imposes a quadratic specification on the data. A possible way to obviate this problem would be to code the ratings attributed by Moody's and S&P with dummy variables. However, as I noted earlier it is not feasible to

[46]Some firms also have their bonds rated by Fitch Investor Services and Duff & Phelps Credit Rating Co, the other two rating organizations nationally recognized statistical 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.

[47]Even though Moody's and S&P have the policy of rating all bonds regardless of whether the issuer pays for the rating, according to Kliger and Sarig (2000) nearly all issuers choose to pay to have their bonds rated. Fitch Investor Services and Duff & Phelps Credit Rating Co rate bonds only at the request of the issuer.

[48]I have also considered specifications where I controlled for the creditworthiness of the borrowers by including instead the log of its average rating, but the quadratic specifications always had a higher explanatory power.

adopt this alternative approach in the analysis of bond spreads I conducted because there are 120 rating combinations in the sample (see Table 2). For this reason, I considered a modified version of this approach where the creditworthiness of the borrower is measured through a set of seventeen dummy variables, the number of possible ratings that an agency could attribute to a borrower. The first dummy equals 1 when $\bar{R} = \{1, 1.5\}$, the second dummy equals 1 when $\bar{R} = \{2, 2.5\}$, and so forth. The results of this approach are qualitatively similar to those that I presented in this section.

Lastly, all of the results that I presented are conditional on the firms that issued bonds. This qualification is potentially important. For instance, if the control variables that I used were also to determine whether firms issued bonds or not, then I would have a selection bias. In the context of the analysis developed in this paper, the most likely example of this problem is if high risk firms were priced out of the market in recessions. This is not likely to be a major problem for US firms because of the level of development of the US bond market. Consistent with this assertion, the sample of bond issues I used shows that firms of all risk categories did issue during expansions as well as recessions. Still consistent with this assertion, recall that the analysis of split ratings shows the existence of a concave relationship between the likelihood of a split rating and the borrower's creditworthiness among bonds issued in expansions as well as among those issued in recessions.

6 Final remarks

This paper presents 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 lower 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, my 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-credit quality firms, but not for high and low-credit quality firms. The 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 I account for both the likelihood of rating splits and the cost of rating splits, the 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 I 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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Figure 1 Impact of recessions on the cost of rating splits by firm type

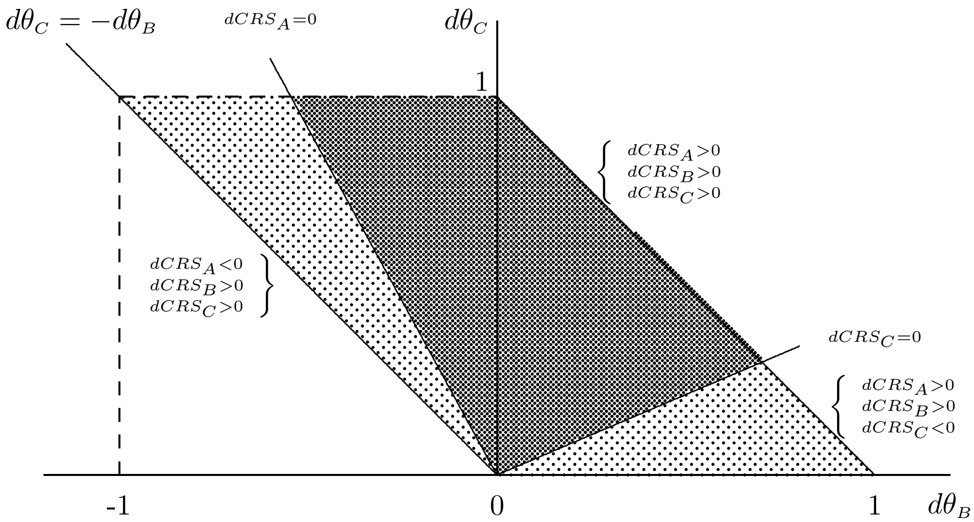

Table 1 Data sample[a]			
Variables	1982:2-2002:2	Expansions	Recessions
Volume and number of issues			
Amount issued[b]	11,653.56	9,605.14	2,048.42
Number of issues	10,050	8,658	1,392
Shares of the number of issues by design of the issue			
Callable bonds	36.856	37.595	32.256
Bonds with a sinking fund	7.602	8.074	4.670
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[c]	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 Moody's and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER definition of peaks and troughs (see footnote (17) for more details).

[b] Millions of US dollars. Issues deflated by the Core Urban Consumer CPI with the average of 1982-1984=100.

[c] Bondholders have the option of selling the bond back to the issuing firm before the maturing date. Source: Author's computations.

Table 2 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 3 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 Moody's and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER definition of peaks and troughs (see footnote (17) for more details).
Source: Author's computations.

Table 4 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 Moody's and S&P. Recessions and expansions defined according to NBER definition of peaks and troughs (see footnote (17) for more details).
Source: Author's computations.

Table 5 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
Constant	0.5920	0.2195	0.2164	0.3050	0.2582
	(0.000)	(0.060)	(0.064)	(0.012)	(0.009)
$\bar{R}$	0.0072	0.1098	0.1100	0.0914	0.0904
	(0.115)	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}^2$		-0.0058	-0.0058	-0.0049	-0.0049
		(0.000)	(0.000)	(0.000)	(0.000)
Rec			-0.0238	-0.4738	-0.4778
			(0.604)	(0.010)	(0.009)
Rec$\cdot\bar{R}$				0.0993	0.1010
				(0.022)	(0.019)
Rec$\cdot\bar{R}^2$				-0.0044	-0.0045
				(0.053)	(0.048)
<u>Other issuer features</u>					
Public company	0.1140	0.0927	0.0926	0.0952	0.0926
	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)
First issue	-0.1190	-0.0886	-0.0889	-0.0873	-0.0824
	(0.015)	(0.072)	(0.071)	(0.077)	(0.065)
Order of issue	-0.1172	-0.1199	-0.1196	-0.1191	-0.1172
	(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)	
<u>Issue design</u>					
Call provision	-0.0762	-0.0003	0.0013	0.0008	
	(0.024)	(0.994)	(0.970)	(0.983)	
Put provision	-0.0008	-0.0378	-0.0395	-0.0384	
	(0.994)	(0.712)	(0.700)	(0.708)	
Sinking fund	0.0361	0.0339	0.0355	0.0312	
	(0.524)	(0.551)	(0.532)	(0.584)	
Shelf	-0.0700	-0.0984	-0.0992	-0.1022	-0.1133
	(0.102)	(0.022)	(0.021)	(0.018)	(0.002)
Maturity	-0.0141	-0.0241	-0.0245	-0.0242	
	(0.549)	(0.306)	(0.299)	(0.304)	
<u>Other controls</u>					
Amount issued	0.0368	0.0351	0.0352	0.0332	0.0316
	(0.001)	(0.002)	(0.002)	(0.003)	(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
	(0.001)	(0.002)	(0.004)	(0.003)	(0.001)
Scalled R^2	0.0328	0.0369	0.0369	0.0376	0.0374
Log likelihood	-6794.45	-6773.45	-6773.32	-6769.78	-6770.67
Expansion argmax	–	–	–	9.33	9.22
Recession argmax	–	–	–	10.28	10.18

[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 3) for a new bond issue. $\bar{R}$ is the average of the two numeric ratings given by Moody's and S&P. $\bar{R}$ is higher for issues with lower ratings (see Table 2). *Rec* dummy that equals 1 if the bond is issued during a recession according to NBER definition of peaks and troughs (see footnote (17) for more details). *Public company* dummy that equals 1 if the issuer is a public company. *First issue* dummy the equals 1 if the bond was the company's first bond issue since 1970:1. *Order of issue* is the number of times the firm issued bonds since 1970:1. *Time since prev. issue* is the number of years since the firm made its latest bond issue. *Call provision* dummy that equals 1 if the bond is callable. *Put provision* dummy that equals 1 if bondholders can sell the bond back to the company prior to maturity. *Sinking fund* dummy that equals 1 if the bond has a sinking fund. *Shelf* dummy that equals 1 if the bond is a shelf issue. *Maturity* maturity of

the bond in years. *Amount issued* in millions of US dollars. Issues deflated by the Core Urban Consumer CPI with the average of 1982-1984=100. *Priv. placement* dummy that equals 1 if the bond was privately placed. *Time trend* 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

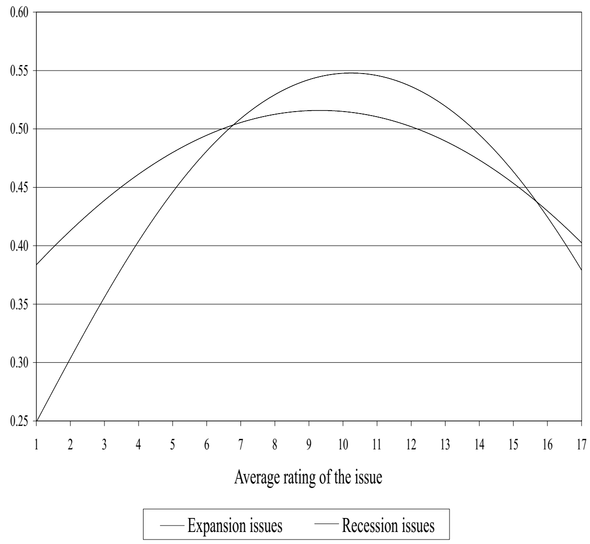

Figure 2b Additional probability of a rating split in recessions given the rating of the issue

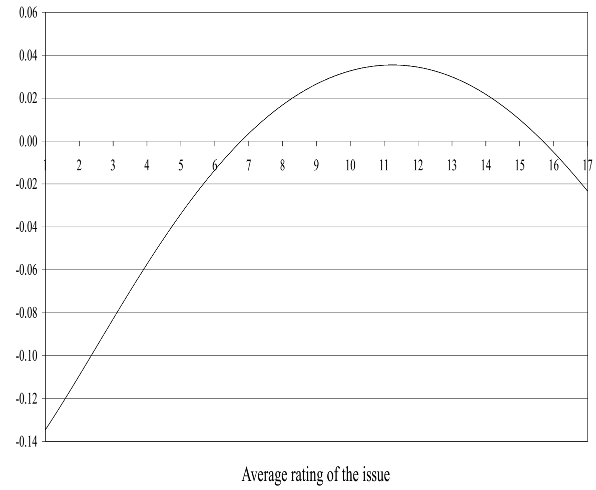

Table 6 Bond spreads over Treasury at issue date[a]			
All bonds			
Expansion issues	Recession issues	Difference	P value
2.0569	2.2924	-0.2355	0.000***
Same rating issues	Split rating issues	Difference	P value
2.0763	2.1623	-0.0860	0.092*
Expansion issues			
Same rating issues	Split rating issues	Difference	P value
2.0400	2.1501	0.1101	0.047*
Recession issues			
Same rating issues	Split rating issues	Difference	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 Moody's and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER definition of peaks and through (see footnote (17) for more details).
Source: Author's computations.

Table 7 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] 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 Moody's and S&P, information on amount issued, maturity and yield to maturity. Recessions and expansions defined according to NBER definition of peaks and through (see footnote (17) for more details). Differences computed as Same Rat. minus Split Rat.
Source: Author's computations.

Table 8 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 $\bar{R}^2$						
Other issuer features						
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)
Issue design						
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)
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)
Other controls						
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 8 (continued). Bond spreads over Treasury at issue date[b,c]				
Dep. variables	Model 7	Model 8	Model 9	Model 10
Constant	5.6663	5.6542	5.6214	5.6339
	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}$	-0.2225	-0.2216	-0.2103	-0.2096
	(0.000)	(0.000)	(0.000)	(0.000)
$\bar{R}^2$	0.0287	0.0287	0.0282	0.0281
	(0.000)	(0.000)	(0.000)	(0.000)
Rec	-0.6769	-0.6998	-0.4952	-0.4991
	(0.000)	(0.000)	(0.000)	(0.000)
Rec$\cdot\bar{R}$	0.2273	0.2206	0.1711	0.1727
	(0.000)	(0.000)	(0.000)	(0.000)
Rec$\cdot\bar{R}^2$	-0.0103	-0.0100	-0.0077	-0.0078
	(0.000)	(0.000)	(0.002)	(0.001)
Split	0.0338	0.0172	0.1401	0.1479
	(0.619)	(0.803)	(0.052)	(0.040)
Split $\bar{R}$	0.0007	-0.0002	-0.0279	-0.0304
	(0.971)	(0.993)	(0.148)	(0.115)
Split $\bar{R}^2$	0.0003	0.0004	0.0017	0.0018
	(0.761)	(0.705)	(0.128)	(0.101)
Rec Split		0.1204	-0.6697	-0.6632
		(0.023)	(0.002)	(0.002)
Rec Slpit $\bar{R}$			0.1840	0.1836
			(0.003)	(0.003)
Rec Split $\bar{R}^2$			-0.0089	-0.0089
			(0.024)	(0.024)
<u>Other issuer features</u>				
Public company	-0.1049	-0.1055	-0.1074	-0.1083
	(0.000)	(0.000)	(0.000)	(0.000)
First issue	0.1532	0.1527	0.1534	0.1198
	(0.000)	(0.000)	(0.000)	(0.000)
Order of issue	0.0154	0.0146	0.0148	
	(0.051)	(0.065)	(0.061)	
Time since prev. issue	0.0052	0.0054	0.0053	
	(0.294)	(0.279)	(0.294)	
<u>Issue design</u>				
Call provision	0.0249	0.0249	0.0249	0.0251
	(0.000)	(0.000)	(0.000)	(0.000)
Put provision	-0.5363	-0.5371	-0.5349	-0.5354
	(0.000)	(0.000)	(0.000)	(0.000)
Sinking fund	0.0078	0.0080	0.0077	0.0077
	(0.048)	(0.045)	(0.051)	(0.053)
Shelf	-0.1703	-0.1700	-0.1680	-0.1685
	(0.000)	(0.000)	(0.000)	(0.000)
Maturity	0.1271	0.1274	0.1255	0.1256
	(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	0.1011
	(0.003)	(0.004)	(0.004)	(0.004)
Log(Time trend)	-0.5302	-0.5263	-0.5300	-0.5244
	(0.000)	(0.000)	(0.000)	(0.000)
10-Y. Treasury yield	-0.3191	-0.3184	-0.3187	-0.3179
	(0.000)	(0.000)	(0.000)	(0.000)
Yield c. slope	-0.2559	-.2551	-0.2566	-0.2553
	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.8190	0.8191	0.8192	0.8192
Log likelihood	-11823.5	-11820.2	-11814.6	-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. $\bar{R}$ is higher for issues with lower ratings (see Table 2). *Rec* dummy that equals 1 if the bond is issued during a recession

according to NBER definition of peaks and troughs (see footnote (17) for more details). *Public company* dummy that equals 1 if the issuer is a public company. *First issue* dummy the equals 1 if the bond was the company's first bond issue since 1970:1. *Order of issue* is the number of times the firm issued bonds since 1970:1. *Time since prev. issue* is the number of years since the firm made its latest bond issue. *Call provision* dummy that equals 1 if the bond is callable. *Put provision* dummy that equals 1 if bondholders can sell the bond back to the company prior to maturity. *Sinking fund* dummy that equals 1 if the bond has a sinking fund. *Shelf* dummy that equals 1 if the bond is a shelf issue. *Maturity* maturity of the bond in years. *Amount issued* in millions of US dollars. Issues deflated by the Core Urban Consumer CPI with the average of 1982-1984=100. *Priv. placement* dummy that equals 1 if the bond was privately placed. *Time trend* 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 3a. Bond spreads in expansions

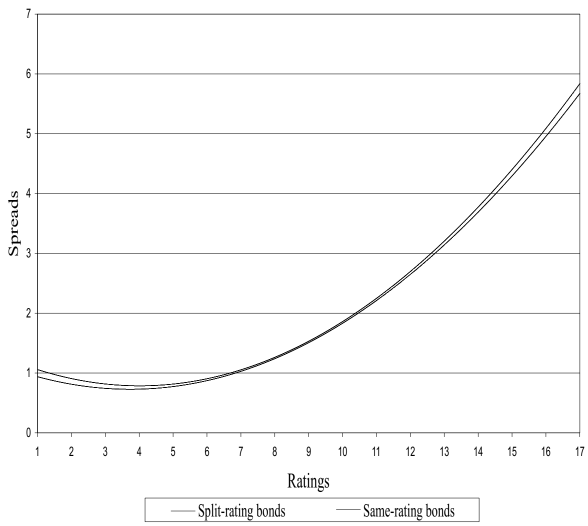

Figure 3b. Bond spreads in recessions

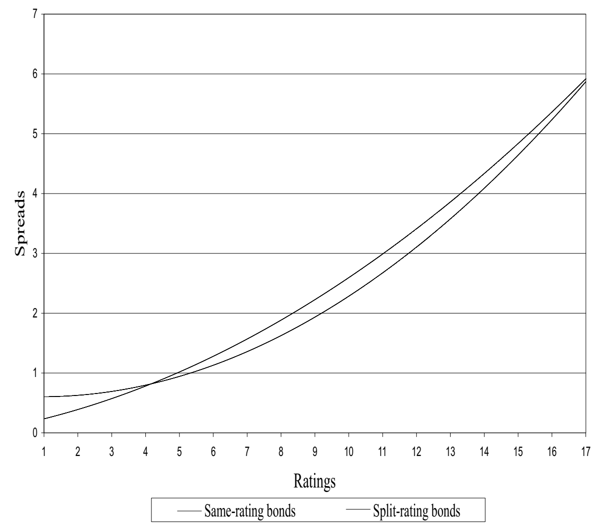

Figure 4a. Cost of split ratings in expansions and recessions

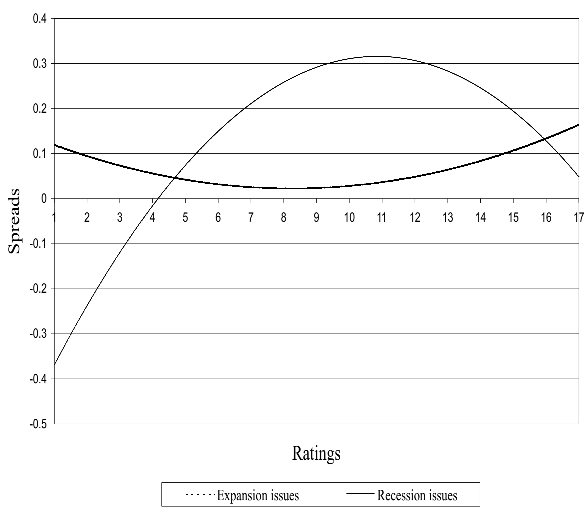

Figure 4b. Additional cost of split ratings for recession issues

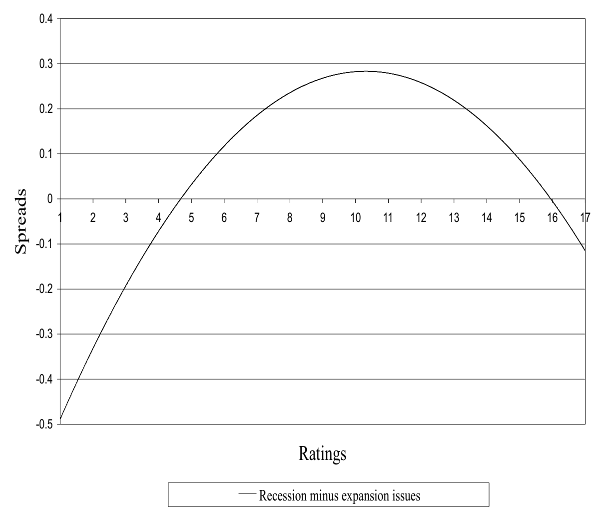

Figure 5 Expected cost of rating splits for recession issues over this cost for expansion issues