The Timing of Debt Issuance and Rating Migration: Theory and Evidence.

Daniel M. Covitz
Paul Harrison

Latest Draft: September 1999
First Draft: January 1999

Federal Reserve Board

20th and C St. NW
Washington DC 20551

This paper reflects the views of the authors only and not necessarily those of the Board of Governors, other members of its staff, or the Federal Reserve System. We thank Bob Avery, Mark Carey, Darrell Duffie, Michael Gordy, Hayne Leland, Mitch Peterson, Calvin Schnure, and Sheridan Titman for helpful discussions. The authors can be contacted at the above address or via email: dcovitz@frb.gov, pharrison@frb.gov.

Please address correspondence to Paul Harrison, Mail Stop 89, Federal Reserve Board, 20th and C Sts. NW, Washington, DC 20551, phone (202)-452-3634, fax (202)-452-3819, email pharrison@frb.gov

The Timing of Debt Issuance and Rating Migration: Theory and Evidence

Abstract:

This paper develops and tests a recursive model of debt issuance and rating migration. We examine a signaling game with firms that have private information about their probability distribution of future rating migration. A key assumption of the model is that rating agencies reveal information over time, creating a recursive information problem, which in turn generates an adverse selection problem in debt issuance similar to that for equity issuance in Myers and Majluf (1984). This adverse selection model predicts that debt issuance provides a negative signal of rating migration, and that the signal strengthens with economic downturns. Another prediction regarding the maturity of debt issuance is that long maturity debt sends a negative signal relative to short maturity debt (Flannery 1986). Using data from 1980 to 1998 on straight bond issuance and Moody's ratings, and controlling for firm and issue specific factors, we find that debt issuance sends a negative signal of a firm's default probability, and that this signal intensifies with a decline in economic activity and with an increase in debt maturity.

JEL Codes: G32, G31.

I. Introduction

In their classic paper on firm capital structure, Myers and Majluf (1984) show that the decision of a large, publicly traded, firm to issue equity conveys a negative signal of firm quality. The result follows from the insight that equity issuance is relatively costly for firms with high unobservable quality because observably equivalent firms relinquish the same equity piece to fund a project. By contrast, in their framework debt issuance is less sensitive to unobservable quality because the cost of the debt depends only on observable quality. Myers and Majluf therefore infer, since debt markets are relatively insensitive to information problems, that the issuance of public debt sends, at worst, a small negative signal about the firm. Subsequent papers on endogenous security design have essentially confirmed this inference, finding that the signal embodied in debt issuance is at worst weakly negative (e.g., Brenan and Kraus (1987), Noe (1988), Constantinides and Grundy (1990), Nachman and Noe (1994), and Rebello (1995)).

Only Flannery (1986) abstracts from equity issuance to focus entirely on the debt issuance process. He models a signaling game in which the interest cost of issuing short term debt and then rolling it over is lower for firms with low unobserved default probabilities than for firms with high unobserved default probabilities. Therefore, his model implies (in some cases) that long term debt signals negative information while short term debt signals positive information to the market.

The empirical literature on signaling and bond issuance follows the equity issuance literature by measuring signals with equity price changes (e.g., Datta, Iskandar-Datta, and Patel, 1998, Shyam-Sunder, 1991, Eckbo, 1984, Mikkelson and Partch, 1986, and Dann and Mikkelson, 1984). If, however, debt issuance sends a signal of migration in a firm's *default probability* -- which is plausible since debt prices and default probabilities are closely linked -- then empirical investigations of equity returns may fail to identify the signals sent by debt issuance. Standard option theory tells us that the relation between changes in a firm's equity value and its default probability is uncertain, and depends on whether the change in default probability is driven by a change in firm asset value or asset variance. This is consistent with the mostly insignificant empirical findings from equity event studies following straight bond issues.

In the spirit of Flannery (1986), this paper breaks from the recent theoretical and empirical literature on capital structure, to focus entirely on understanding the role of asymmetric information in the timing of debt issuance. Our contributions are: (1) to formalize in an intuitive recursive framework how firms with private information may time their bond issuance; and (2) provide new empirical evidence, using changes in credit quality rather than in equity prices, that firms do indeed time issuance. The model does not allow security design to arise endogenously, rather we assume that debt is optimal and that the timing of issuance is endogenous. The model then applies to situations in which a firm is committed to issuing debt, but has discretion over the timing of issuance. We find that debt issuance sends a strong negative signal, and that prior theoretical results on the signal in debt issuance may be confounded by the possibility that private information motivates timing rather than (or, in addition to) security choice.[1]

The information structure in our theoretical model is shaped by the monitoring role of rating agencies. We assume that rating agencies reveal information that is known with certainty by the

[1] A recent paper by Spiess and Affleck-Graves (1999) finds significant long-run equity underperformance following debt offerings. This result is consistent with our model, but not with previous models which do not allow for debt offerings to be important negative signals. However, we would argue that the impact of the debt issuance signal might better be found in bond prices or credit quality measures, than in equity prices (although equity prices seem reasonable for the signal in convertible debt issuance, which is one focus of that paper).

firm. We also assume, as is commonly thought that to be the case, that the degree of asymmetric information between publicly traded firms and the market should be small, given current disclosure rules, accounting standards, and analyst coverage. Consistent with this folk wisdom and the posited role of rating agencies, our model assumes a subtle, recursive, information problem in the debt issuance process of publicly traded firms. In particular, we assume that in each time period a large portion of a firm's solvency probability is public knowledge. Rating agencies observe this portion of the firm's solvency probability and reveal it to the market by assigning the firm a rating. However, in each period the firm has private information about the *distribution* of the unknown innovation to it's solvency probability. If the distribution is positively skewed, we characterize the firm as "optimistic." If the distribution is negatively skewed, we characterize the firm as "pessimistic." Over time, this unknown portion becomes known to the firm, at which point rating agencies also observe the information and reveal it to the market in the form of a refreshed and possibly migrated rating.[2, 3]

The results from the timing model yield unambiguous theoretical predictions about the information embodied in the issuance decision. In particular, the model indicates that issuance never signals positive expected migration. Optimistic firms may have an incentive to delay issuance until migrations are realized, while pessimistic firms clearly have no such incentive because their expected migrations are negative. The results also suggest that issuance more

---

[2] That rating changes contain new information has been established by a large body of literature, see Ederington and Goh (1998) for a summary.

[3] This timing model of debt is similar to the equity timing model in Lucas and McDonald (1990). In their model, firms have private information about unusual earnings that have yet to be revealed to the market. Our predictions about rating migrations after debt issuance are similar to theirs about earnings patterns after equity issuance.

strongly signals negative expected migration during economic downturns as optimistic firms are more likely to delay issuance to avoid the high cost of pooling with pessimistic firms during such periods. These results suggest, ironically, that by limiting the persistence of asymmetric information about firm default probabilities, rating agencies may actually generate an adverse selection problem. If this information was not expected to be revealed, there would be no incentive for optimistic firms to delay issuance.

Consistent with our finding that debt issuance signals changes in default probabilities, the empirical section of this paper measures the signal sent by debt issuance with subsequent rating migrations. Our focus on these migrations allows for straightforward and powerful tests of our theory as well as the theory in Flannery (1986) regarding the signal sent by maturity choice[4]. Ratings are relatively blunt and so should be less sensitive to idiosyncratic, small changes in firm condition. At the same time they are firm specific and so less sensitive to aggregate supply and demand shifts in asset prices. Migrations are also easier to use for examining longer time horizons than just the few days around an announcement. Moreover, to the extent that rating agencies are "backwards looking" and so do not incorporate the information embodied in the issuance decision, migrations following issuance will be more likely to reflect the information in issuance. Therefore, our tests of the debt issuance signal also inform upon the extent to which rating agencies are "backwards" looking.

Using Moody's data on bond issuance and ratings migrations from 1980 to 1998 for non-

[4]To our knowledge, no empirical study has tested Flannery's (1986) prediction regarding the signal sent by the maturity choice of debt. Simkins (1999) tests Titman's (1992) related hypothesis that firms use interest rate swaps together with short-term debt when they anticipate a positive rating migration. Like this paper, Simkins (1999) uses rating changes as the signal of interest; that paper does not, however, observe the issuance of short-maturity bonds.

financial firms, we find that migrations of *investment-grade* firms are consistent with both the theoretical predictions of our timing game and the commonly held notion that rating agencies are backwards looking. The results are economically and statistically significant, and are not the byproduct of firms simply increasing their leverage via issuance. We also find evidence that the negative signal strengthens with a decline in economic activity and strong evidence that the negative signal increases with the debt's maturity, consistent with Flannery (1986).

The migration patterns of *high-yield* firms are consistent with two of three predictions of the timing model. The signal sent by debt issuance during downturns is negative relative to the signal sent during expansions, and the signal sent by long maturity debt is negative relative to the signal sent by short maturity debt. However, the overall high-yield migration pattern does not support the prediction that issuance signals negative migration. During expansions the signal is strongly positive, while during recessions it is strongly negative. We speculate, and provide supporting evidence, that this is due to a screening/disclosure incentive in high-yield issuance that swamps the relatively weak timing incentive during expansions.

II. The Recursive Timing Model

1. The Players

The model contains three types of players: firms, rating agencies, and lenders. Risk neutral firms require a loan of $1 to invest in a new project that guarantees a return of S. The project is small relative to firm size and does not affect the firm's default risk, which equals the firm's probability of insolvency due to operational risk or other ongoing projects.[5] The project has an expiration date T, which implies that the firm can not invest in the project after period T. The pure discounting cost of waiting is reflected in the firm's discount factor δ. Both S, T, and δ are common knowledge. A firm's unobservable probability of solvency over a one period horizon is denoted $\Omega_t \in [0,1]$. We decompose this solvency probability into the sum $X_t + E(\Phi_t)$. X_t is the portion of the firm's solvency probability made public by rating agencies at the beginning of period t. The second parameter, Φ_t, is the unobserved portion of the solvency probability. The distribution of Φ_t, and therefore $E(\Phi_t)$, is learned only by the firm at the beginning of period t. The distribution of Φ_t depends on the firm's type. At the end of the period, Φ_t becomes observable to the rating agency (i.e., the firm's rating migrates), creating a recursive information structure (i.e., $X_t = X_{t-1} + \Phi_{t-1}$).[6]

There are two types of firms, optimistic and pessimistic. At the beginning of each time period, the firm draws its type $k_t \in \{opt,pes\}$ from a population containing O percent optimistic firms and P percent pessimistic firms. The firm then has private information about its probability P_u^k of migrating upward to $X_t + U$ (i.e. $Pr(\Phi_t = U | k_t) = P_{u,}^{k}$), probability P_d^k of migrating downward to

---

[5] This assumption allows us to focus on a pure timing game in which the firm's probability of default does not change with issuance.

[6] Private information about the distribution of the innovation to the firm's solvency probability is equivalent to private information about the firm's actual solvency probability. The advantage of thinking about the firm as privately knowing a distribution of possible migrations is that it provides a natural way of thinking about how rating agencies come to know the firm's private information. Specifically, it reflects the notion that rating agencies learn a firm's private information when that information becomes known to the firm with a high degree of certainty. Another advantage of our set-up is that it allows us to pick distributions of rating migration that are heavily weighted towards no migration, which is consistent with observed migrations, without adding a third type of firm that privately knows it will not migrate.

X_t - D (i.e. $Pr(\Phi_t = -D | k_t) = P_d^k$), and probability $P_0^k = 1 - P_{u,}^k - P_{d,}^k$ of no migration (i.e. $Pr(\Phi_t = 0 | k_t) = P_0^k$). We assume that pessimistic firms are more likely to see their solvency probability fall, while optimistic firms are more likely to see their solvency probability increase (i.e., $P_u^{opt} > P_u^{pes}$ and $P_d^{opt} < P_d^{pes}$). We also assume for simplicity that U = D > 0. These last two assumptions imply negative expected migration for pessimistic firms and positive expected migration for optimistic firms (i.e. $E(\Omega x_t^{pes}) < X_t$ and $E(\Omega x_t^{opt}) > X_t$). To rule out a problematic case in which the firm is pessimistic (optimistic) over the one period horizon, but optimistic (pessimistic) over a longer horizon, we further restrict the migration parameters so that the expected unconditional rating, $E(\Omega x_t) = X_t$. To be parsimonious with notation, we denote $E(\Omega x_t^{pes})$, $E(\Omega x_t^{opt})$, and $E(\Omega x_t)$, respectively, with $E(\Omega_t^{pes})$, $E(\Omega_t^{opt})$, and $E(\Omega_t)$. All migration parameters, M = {O, P, U, D, P_u^{opt}, P_d^{opt}, P_u^{pes}, and P_d^{pes}} are common knowledge.

Information Structure in Period t

Firm: {T, S, δ, X_t, M, k_t}.

Rating Agency: {T, S, δ, X_t, M}

Market: {T, S, δ, X_t, M}

For a firm to issue, it must be assigned a rating, X_t, and the market delegates this task to the rating agencies (the usual arguments for delegated monitoring apply, see Diamond, 1984).[7] We also assume that rating agencies are relatively backwards looking in that they do not form beliefs about which type of firms are issuing and waiting and so fail to capture the information embodied

[7] For simplicity, we do not incorporate a cost of rating into the model.

in issuance. This assumption does not affect the equilibria to the game, because the price of debt is determined by the third player, the market, which forms beliefs about which type of firms are issuing and waiting.

The model contains an infinite supply of "forward-looking" risk neutral lenders, each endowed with $1/n of funds, where n is large. The market's assessment of a firm's default probability in period t, denoted $E(\Omega_t)$, is a function of the firm's rating, the publicly known migration parameters, and the market's beliefs about the types of firm that are issuing debt. We assume a competitive lending market, so the gross interest rate on debt, R, yields lenders in expectation the gross risk free interest rate R_f, set equal to 1 without loss of generality. The debt is zero coupon with a maturity of one period.[8] If the firm enters into bankruptcy, we assume costly bankruptcy and zero recovery -- i.e. the value of the debt is zero in the event of bankruptcy. The gross interest rate on debt, R_t, for a firm with solvency probability $E(\Omega_t)$ is therefore equal to $1/E(\Omega_t)$.

For a firm with a given rating, we assume that the set of possible ratings -- there are $1+2^{T-1}$ possible ratings -- is bounded by [1/S,1]. A solvency probability greater than 1 is clearly impossible. The lower boundary condition is imposed by the return on the investment project, S. If a firm's solvency probability X is low enough in any period t, then the fair interest rate on the debt, 1/X exceeds S, which implies that no firm issues debt. Limiting the set of possible ratings in this way restricts the relevance of the analysis to cases in which the likelihood of reaching the boundary states is small.[9]

---

[8] This assumption simplifies the expressions for the firm's expected return and the market interest rate charged on debt, with no loss of generality.

[9] The empirical work excludes the boundary rating states from the analysis.

2. The Timing of The Recursive Game

Basic Time Line:

|----------------- 1 ----------------|--------------- 2 -------------------|--------- 3 --------------|--> ...

Firm Learns $k_1 \in$ {opt,pes} Firm Issues or Waits	(i) If issues in t=1: Firm Repays or Defaults (ii) If not issued: Firm Learns k_2 Firm Issues or Waits	(i) If issues in t=2: Firm Repays or Defaults (ii) If not issued: Firm Learns k_3 Firm Issues or Waits

---

The game begins in period 1. After observing k_1, a firm decides whether to issue debt or wait. If the firm does not issue in period 1, then Φ_1 is realized, and the game repeats in period 2. This proceeds until the firm defaults or issues debt. The maximum number of periods a firm can wait is T-1, since the project expires after period T. When the firm issues, say at t, the following subgame is played: (1) the rating agency observes X_t, (2) the market determines a competitive price based on $E(\Omega_t)$ given all information available and beliefs about the types of firm that are issuing, (3) the firm issues the debt, (4) the firm invests in the project, (5) the firm either fails or remains solvent, (6a) if the firm is solvent, the project yields S, the firm pays back the loan at the beginning of the period t+1, and the game ends, and (6b) if the firm is not solvent, it defaults, is liquidated in bankruptcy court, and the game ends.[10]

---

[10] The market forms $E(\Omega_t)$ from the distribution of firm types and its belief about which types are issuing in period t. If the market believes that only the optimistic firms issue, then $E(\Omega_t) = E(\Omega_t^{opt}) = X_t + P_u^{opt}(U) + (1 - P_d^{opt})(-D)$. If the market believes that only the pessimistic firms issue, then $E(\Omega_t) = E(\Omega_t^{pes}) = X_t + P_u^{pes}(U) + (1 - P_d^{pes})(-D)$. If the market believes that all firms issue, then $E(\Omega_t) = X_t$.

3. Equilibria

The recursive game is solved by considering the equilibria in period T and working backwards. In period T, given that the project expires at the end of the period, the unique equilibrium involves firms issuing regardless of type (i.e., they pool) and the market prices the debt under the assumption that firms pool. In period T-1, pessimistic firms issue, while optimistic firms may issue (i.e., they pool) or may not issue (i.e., they separate). The decision made by optimistic firms depends on the firm's rating, the migrations parameters, and the market's beliefs about which types of firms issue and which types wait.

The incentive for pessimistic firms to issue at period T-1 derives from the recursive information structure, and is evident upon comparison of the lowest possible expected return to pessimistic firms from issuing and the expected return from waiting. Substituting the highest possible interest rate on debt, $1/E(\Omega_{T-1}^{pes})$ yields the lower bound expected return.

$$(1)\quad [E(\Omega_{T-1}^{pes})]\,[S - (1/E(\Omega_{T-1}^{pes})]$$

The expected return at T-1 for a pessimistic firm that waits and issues in period T is the discounted sum of the three possible period T expected returns, weighted by the likelihood of reaching each final state, conditional upon being pessimistic in period T-1.

$$(2)\quad V^{pes}x_{T-1} =$$

$$\delta\big[P_u^{pes}(X_{T-1} + U)\big[P(E(\Omega^{pes}{}_{T-1}) + U)(S - 1/[X_{T-1} + U]) + O(E(\Omega^{opt}{}_{T-1}) + U)(S - 1/[X_{T-1}+U]\big] +$$

$$P_d^{pes}(X_{T-1} - D)\big[P(E(\Omega^{pes}{}_{T-1}) - D)(S - 1/[X_{T-1} - D]) + O(E(\Omega^{opt}{}_{T-1}) - D)(S - 1/[X_{T-1} - D]\big] +$$

$$P_0^{pes}(X_{T-1})\big[P(E(\Omega^{pes}{}_{T-1}))(S - 1/X_{T-1}) + O(E(\Omega^{opt}{}_{T-1}))(S - 1/X_{T-1}\ )\big]\big]$$

It is straightforward to show (2) is strictly less than (1), which establishes the incentive for pessimistic firms to wait in period T-1.[11]

Given that pessimistic firms issue, a necessary and sufficient condition for a pooling equilibrium in period T-1 is:

Optimistic Firm's Expected Return if Deviate From Pooling

< Optimistic Firm's Expected Return if Conform to Pooling,

$$V^{opt}x_{T-1} < [E(\Omega_{T-1}{}^{opt})]\,[S - (1/E(\Omega_{T-1})],$$

Where V^{opt}, derived analogously to V^{pes}, is the expected profits to the firm from waiting. Rewriting this condition yields the intuitive inequality governing the decision to wait:

Discounting Benefit of Issuing Today > Agency Cost of Issuing Today

$$(3)\quad [E(\Omega_{T-1}{}^{opt})][S-(1/E(\Omega_{T-1}{}^{opt})] - V^{opt}x_{T-1} > [E(\Omega_{T-1}{}^{opt})/E(\Omega_{T-1})] - 1$$

The above inequalities provide us with two scenarios under which a pooling equilibrium exists. If firms heavily discount the future, $V^{opt}x_{T-1}$ --> 0, this inequality holds for any set of migration parameters, and so we have a pooling equilibrium. This pooling equilibrium also exists if the agency cost of pooling with the pessimistic types is small $E(\Omega_{T-1}{}^{opt})/E(\Omega_{T-1})$ --> 1.[12] [13] In other words, a high degree of optimism allows a pooling equilibrium because the agency cost of pooling

[11] Equation (1) reduces to $V^{pes} = \delta\big[P_u{}^{pes}(X_{T-1} + U)[X_{T-1} + U)(S - 1/[X_{T-1} + U]) + P_d{}^{pes}(X_{T-1} - D)[X_{T-1} - D)(S - 1/[X_{T-1} - D])+P_0{}^{pes}\, X_{T-1}{}^2(S - 1/X_{T-1}) < \delta[E(\Omega_{T-1}{}^{pes})]\, S - 1 = \delta[E(\Omega_{T-1}{}^{pes})]\, [S - (1/E(\Omega_{T-1}{}^{pes})]$.

[12] If O is large, the restriction that a firm's rating, X_{T-1}, is equal to the unconditional expected rating $E(\Omega_{T-1})$ (i.e., the rating is correct conditional upon available information) implies that when O is large, $(\Omega_{T-1}{}^{opt})$ must be close to X_{T-1}.

[13] In this case, it is intuitive that the right hand side of (1) approaches zero, while the left hand side may be positive and bounded away from zero -- it is straightforward to show that $[E(\Omega_{T-1}{}^{opt})][S - (1/E(\Omega_{T-1}{}^{opt})] - V^{opt}{}_{T-1} > (1 - \delta)\, [E(\Omega_{T-1}{}^{opt})][S - (1/E(\Omega_{T-1}{}^{opt})]$.

in such an environment is small. The corollary to this statement is that the pooling equilibrium may unravel when the degree of pessimism is high.

Consider now a separating equilibrium, under which optimistic firms choose to delay issuance. A necessary and sufficient condition for optimistic firms to delay issuance is,

Expected Return if Deviate From Separating < Expected Return if Conform to Separation

$$[E(\Omega_{T-1}^{opt})]\,[S - (1/E(\Omega^{pes}_{T-1})] < [V^{opt}x_{T-1}]$$

Using the same transformation as above leads to:

Cost of Signaling Pessimism > Discounting Benefit of Issuing Today

$$(4)\quad [E(\Omega_{T-1}^{opt})/E(\Omega^{pes}_{T-1})] - 1 > [E(\Omega_{T-1}^{opt})][S - (1/E(\Omega_{T-1}^{opt})] - [V^{opt}x_{T-1}]$$

This inequality holds if the firm does not heavily discount the future, or if the cost imposed on an optimistic firm from signaling pessimism, $E(\Omega_{T-1}^{opt})/E(\Omega_{T-1}^{pes})$, is large. The cost of signaling pessimism is always larger than the agency cost of pooling.

In period T-1, depending on the parameters of the model, a pooling equilibrium may be unique, or a separating equilibrium may be unique. If both are possible, then a mixing equilibrium exists.[14, 15] When parameter values are such that all equilibria are possible, we conjecture that the pooling equilibrium is played since it pareto dominates the separating equilibrium (and the mixing equilibrium). When a pooling equilibrium exists, an optimistic firm prefers conforming (i.e., issuing) rather than deviating (i.e., waiting), given market beliefs that a pooling equilibrium is

---

[14] In a mixing equilibrium, pessimistic firms issue in the current period, the market holds beliefs which make optimistic firms indifferent between issuing today and issuing tomorrow, the optimistic firm's probability of issuing today is equal to the market's beliefs.

[15] To see that both equilibria are possible for a given set of migration parameters, simply note that the intersection of (3) and (4) is not empty.

played. At the same time, an optimistic firm is indifferent between deviating (i.e., waiting) under a pooling equilibrium and conforming (i.e., waiting) under a separating equilibrium. Therefore, for a given set of parameters that allow both a pooling and separating equilibrium in period T-1, optimistic firms are necessarily better off under the pooling equilibrium. Pessimistic firms are better off under a pooling equilibrium, since they are pooled with optimistic types, which lowers the interest rate on their debt.[16]

Based on having a unique prediction in period T-1 (either pooling or separating depending on the parameters of the game), we continue to backward induct the game. In period T-2, pessimistic firms issue. The intuition comes naturally from considering the possible T-1 equilibria at X_{T-2}+U, X_{T-2} - D, and X_{T-2}. Clearly, pooling at X_{T-2} + U and X_{T-2} - D, and X_{T-2} does not induce pessimistic firms to wait in period T-2, as it was insufficient to induce waiting in period T-1 with pooling in period T. Separating at these T-1 ratings does not induce pessimistic firms to wait at T-2 because the expected return under a separating equilibrium is less than the expected return under a pooling equilibrium. This follows intuitively from the pareto dominance of a pooling equilibrium, which also implies that a combination of pooling and separating equilibria at T-1 would not induce pessimistic firms to wait at T-2.

Given that pessimistic firms wait at T-2, the existence of a pooling and separating equilibrium are determined, respectively, by the T-2 versions of equation (3) and (4). Clearly, the intuition carries over to all previous periods. Therefore, the solution to the game is established. If

[16] How, given the existence of a pooling equilibrium, can a pareto dominated separating equilibrium also exist? The answer has to do with the market beliefs. Under a separating equilibrium, the market interprets issuance as a signal of pessimism. This belief is rationalized, since given this belief, optimistic firms will not issue.

pessimistic in any period, the firm issues. If optimistic in any period, the decision to issue is governed by,

$$(5) \quad [E(\Omega_t^{opt})][S-(1/E(\Omega_t^{opt})] - V^{opt}x_t > [E(\Omega_t^{opt})/E(\Omega_t)] - 1$$

This inequality is likely to hold when the agency cost of pooling with pessimistic firms is low (i.e., during expansions), and less likely to hold when that cost is high (i.e., during recessions).

4. Empirical Implications

The first prediction of the model, that issuance should be a negative signal of rating migrations, ceteris paribus, follows from the recursive nature of the information problem, which leaves pessimistic firms with no incentive to wait. The second prediction of the model, that the signal sent by debt issuance should be negative in economic downturns relative to the signal sent by debt issuance during an expansion, is predicted by 1) the result that a separating (or signaling) equilibrium is likely to be the unique equilibrium under parameter restrictions that are consistent with economic downturns, and 2) the result that a pooling equilibrium is likely to be the unique or pareto dominant equilibrium during expansions. Our third prediction, that the signal sent by long maturity debt should be negative relative to short term debt, is suggested by Flannery (1986).[17, 18] The set of predictions to be tested is summarized below.

---

[17] An additional prediction of the model is that firms that issue are likely to have migrated upward immediately prior to issuance. We find strong evidence that this is the case. For ease of exposition, we present these results as a robustness check rather than place them in the main text, maintaining the focus of the empirical section on the signal embodied in debt issuance.

[18]To the extent that optimistic firms issue debt with call options rather than wait for optimism to be realized, all three implications will be difficult to observe empirically, and therefore, our tests of these implications may be inherently conservative. This possibility, however, is unlikely given our view that optimism is likely to be revealed within a year of issuance, while call options may typically be exercised only after a number of years have passed since issuance. In any case, our data does not identify call options on debt issues, so we are unable to further explore this

---

1: Issuance signals negative expected rating migration.

2: Debt issuance in a recession sends a negative signal relative to debt issuance in an expansion.

3: Long maturity debt issuance sends a negative signal relative to short term debt issuance.

III. Data Description

Rating migrations and bond issuance are taken from the Moody's Credit Risk Management Services (CRMS) Database, which includes ratings from 1980 to 1998 inclusive. Rating migrations are taken at the firm level[19] using Moody's estimated senior unsecured debt ratings. Moody's typically reports a senior unsecured rating and, in cases where issuers have no such debt outstanding, Moody's derives and reports an estimated senior unsecured rating from the issuers other bonds.[20] To construct our sample of issued bonds, we focus on U.S. issuers and the U.S. bond market. We, therefore exclude non-domestic issuers and issues that are not in U.S. dollars. We also drop issues when there is reason to believe that the issuance price is not directly tied to the credit quality of the issuer. Based on this criterion, we exclude bonds with third-party credit enhancements and limit our sample to issues that are straight debt – excluding medium term notes, anything with specific collateral, anything convertible, and so forth. Further, subsidiaries with the

possibility.

[19] Despite Moody's practice of rating bond *issues*, the fundamental credit quality analysis is typically at the *issuer* level. See Moody's (1999a and 1999b) or Helwege and Liang (1998).

[20] Since we are interested in rating migrations and their direction we only require reliability of changes in the estimated rating, which should be the case even for estimated ratings since the migration will reflect migration in the issuers other bonds.

same rating as their parent are attributed to their parent and those with different ratings are treated as individual entities.[21] Finally, the issuance of multiple bonds on the same day is considered to be a single "issue".

Table 1 shows the history of ratings migrations and bond issuance by year for industrial firms. In the analysis that follows we focus solely on industrial firms, excluding financial firms and public utilities which are subject to regulatory oversight that might affect both issuance and migration patterns. The summary data are strongly cyclical. Economic downturns coincide with an increase in the number of downgrades per upgrade and typically with a decrease in bond issuance.[22] The bottom part of Table 1 provides a cross-sectional break-out by broad rating category.

Table 2 summarizes the characteristics of the issuing firms and issued bonds, using firm-level data from Compustat over the period 1988 to 1998. Thus, our empirical analysis using firm characteristics is restricted to that time period. The typical investment-grade issuer has $5 billion in assets, is 32 percent levered, and has a coverage ratio of 3.9. As expected, high-yield issuers are generally smaller and have weaker balance sheets. Similarly, investment-grade bond issues tend to raise more funds and to have a longer maturity -- typically raising $150 million with a maturity of 10 years.

---

[21] We test the robustness of our results against three alternative treatments of subsidiaries. The qualitative results (not reported) do not differ across treatment. First, following Moody's, subsidiaries are treated as separate issuers from their parent companies. Second, subsidiaries are treated as belonging to the parent company. Third, subsidiaries are eliminated from the analysis.

[22] Our recursive timing model has nothing to say about overall issuance intensity, as it abstracts from interest rates and other cyclical factors which are likely to be the main determinants of whether firms have access to positive net present value projects.

IV. Nonparametric Analysis

1. Methodology

Our primary empirical methodology is nonparametric. This methodology yields intuitive tests for each of the model's predictions regarding the timing of debt issuance. While the tests do not directly identify why firms time their issuance, to the extent that we find evidence of all the timing model's predictions (including the robustness check that expected migrations are positive prior to issuance), the results suggest that the recursive information structure assumed in the model leads firms to time their debt issuance. Consider, for example, the alternative hypothesis that firms issue debt in response to the liquidity demand generated by observable declines in profitability. Such a mechanism might link issuance and negative migrations subsequent to issuance; although, it would not link issuance to positive migrations prior to issuance.

Our nonparametric methodology for testing the model involves two basic steps. First, we calculate an expected rating migration as the observed difference between the frequency of upgrades and downgrades relative to the number of issues, using a 48 week horizon subsequent to bond issuance for a given group of firms (i.e. for all issuing firms, as well as various conditional sub-sets). Second, we test whether this observed net migration differs statistically from a benchmark expected migration which is not conditioned upon issuance. We calculate the benchmark expected migration as the weighted average of the yearly expected migrations for all rated firms that exist at the beginning of each year, where the weights are equal to the number of firms at the beginning of the year relative to the total number of firms in all the years for the sample.

Essentially we are comparing the expected migration conditional upon issuance with the expected migration not conditioned upon issuance -- and asking if they are statistically different. We refer to them as "expected" migrations even though they are calculated ex post because we want to think of the observed upgrades and downgrades as offering a picture of the *ex ante* anticipated net migration for an issuing firm.

The statistical significance of the difference between the post-issuance (conditional) migration expectation and the benchmark (unconditional) expected migration is established in two ways. We use a t-test for the difference in two population averages under the null hypothesis that they are identical. We also provide a Chi-squared test for goodness-of-fit between the observed sample and the null hypothesis that the benchmark sample represents the true population. This Chi-squared test, labeled Q, is intuitively appealing since it provides a measure of how relatively far away the observed expectation subsequent to issuance is from what we would have expected (under the null). We report this deviation (labeled "# off") to provide an idea of the economic significance of issuance – it is the number of observed upgrades that would have to be switched to downgrades (or vice versa) for the sample to match the null.[23]

One potential bias in our difference tests comes from the invariance of the benchmark ratio with respect to time. If benchmark migration probabilities vary over time, the migration ratio subsequent to issuance may differ from the unconditional simply because of when firms issue. We present a second set of results, not prone to this potential bias, based on a Monte Carlo simulation technique. For each group of issuing firms, we randomly draw, with replacement, a group of firms from the entire population with the same number of firms as the issuing group. We then assign

[23]The Q statistic is distributed with 1 degree of freedom and thus the critical values are 2.70, 3.84, and 6.64 for 10%, 5%, and 1% confidence levels, respectively.

each firm a 48 week migration window based on a corresponding firm from the issuing group and then tabulate the expected migration for the randomly drawn group. We repeat the experiment 5,000 times and construct a distribution of these expectations. We then perform t and Q tests using the mean of the Monte Carlo distribution as the benchmark, and also report the 95 percent critical value for rejecting the null that the observed expectation for each issuing group is a draw from its Monte Carlo distribution. This critical value is the most conservative of our tests.

Another potential bias is created by the empirical reality that the highest rated firms can only be downgraded. Therefore, inclusion of AAA firms in the sample may generate a difference (the direction of the bias is not clear since AAA firms not only issue bonds, but also appear in the benchmark) between the benchmark and post-issuance migration expectations, even if no firm is timing issuance. To avoid this problem, we drop AAA rated firms from the sample.[24] The similar issue does not arise for the lowest rated firms (C rated), since we consider them to be in default and exclude them from the sample.[25]

We also consider whether to control for initial rating when constructing our nonparametric benchmarks. Although the results are robust to such controls, it is unclear how rating levels alter the incentive to time issuance. It is also unclear whether the benchmarks, which represent the expected migration at time t not conditioned on issuance, should depend, for example, on whether a firm is BBB or A rated. Therefore, we present results which do not control for the firm's initial rating. However, in order to allow for the possibility that information structure characterizing investment-grade debt issuance differs from the information structure characterizing high-yield

---

[24] The results are qualitatively unchanged if the AAA firms are included.

[25] Again, the presented results are robust to this exclusion.

issuance, we analyze these groups separately.

Following the presentation of the nonparametric results, we consider a number of robustness checks. The primary check is a multivariate logit analysis that links migrations to debt issuance after controlling for public information at the time of issuance.

2. Nonparametric Results

Prediction 1: Issuance signals negative expected migration

Table 3 shows the benchmark expected migrations and the expected migrations subsequent to issuance for the entire sample along with the battery of difference tests. The results for investment-grade firms clearly suggest that issuance signals negative expected migration. All tests indicate that the expected migration subsequent to issuance of -3.79% is significantly lower (at the 95% confidence level) than both the full sample and Monte Carlo benchmarks of -0.52% and -0.51%, respectively. This difference is also economically meaningful, given that the number of migrations that would have to be switched is so high, and since about 15% of issuers migrate within one year of issuance the total dollar value of migrated debt is non-trivial.

In contrast to investment-grade firms, issuance by high-yield firms appears to signal positive expected migration. All tests show that the expected migration subsequent to issuance of -0.11% is significantly higher than the full sample and Monte Carlo benchmarks of -2.06% and -1.06%, respectively, at the 95% confidence level. A possible explanation for this finding is suggested by the timing of high-yield migrations subsequent to issuance, shown in Figure 1. High-yield firms are upgraded soon after issuance, suggesting that information is being revealed at issuance. In other words, high yield firms may have an asymmetric information problem, possibly in addition to the private information about the migration distribution, that may be eliminated through the issuance process. In such an environment, assuming that "other" funding costs are tied to the firm's rating, over-rated high-yield firms have an incentive to refrain from issuing in order to hide their private information. At the same time, for under-rated high-yield firms, the prospect of increasing their ratings through the disclosure/due diligence process may provide an extra incentive for them not to delay issuance.[26] This theory is consistent with the intensive disclosure/due diligence process that characterizes high-yield issuance and is also consistent with the common wisdom that in general (i.e, absent intensive disclosure/due diligence) high-yield ratings may not be very informative.

Additional support for our interpretation of the high-yield results is provided by the fact (not shown) that positive migrations of high-yield firms subsequent to issuance are dominated by large issues -- not the case for investment-grade firms. Large high-yield issues may be subject to more intensive due diligence or market scrutiny, possibly because an underwriting investment bank risks a substantial loss in reputation if a large issue migrates downward.

Returning to the negative migrations for investment-grade firms, there are three compelling reasons why these results are not merely a by-product of the increased leverage of issuing firms.[27] First, the results for high-yield firms offer a counter-example. If the increase in leverage causes the migrations, then one might expect that high-yield firms would also migrate downward.[28]

---

[26] Alternatively, the issue itself might be a positive event. Gilson and Warner (1998) find that high-yield firms that replace bank debt with a new junk bond issue gain greater financial flexibility and can continue to grow rapidly.

[27] To the extent that firms are rolling over existing debt, leverage would remain unchanged by issuance.

[28] The counter example is only suggestive. It may be the case that the leverage effect does in fact push expected migrations downwards subsequent to issuance for high yield firms, but this marginal

Second, the top panel of Table 4 shows that large increases in leverage due to issuance do not drive the overall result for investment-grade firms. Issuance by investment-grade firms that experience a large increase in leverage (greater than the median leverage increase for investment-grade firms, measured as issuance size relative to firm assets) signals positive, not negative migrations. The issuers with small increases in leverage (bottom panel, Table 4) drive the overall result. Third, if leverage were driving the downgrades, we might expect the downgrades to appear soon after issuance, because the increase in leverage occurs and is easily observed at issuance. However, as shown in Figure 1, this is not the post-issuance migration pattern for investment grade firms.[29]

It is also unlikely that the negative signal in investment-grade firm issuance reflects an increase in the heightened screening/disclosure at issuance which is simply revealing an underlying trend towards negative migrations. If this were the case, we would expect that firms with positive information would have an incentive to issue, which would generate the positive migrations subsequent to issuance observed for high-yield firms, not the negative migrations observed for investment-grade firms. Even if we assume that the issuance decision for investment-grade firms is exogenous with respect to screening/disclosure, heightened screening/disclosure would generate migrations only near the issuance date. However, as discussed above, the observed migrations do not occur soon after issuances but rather are spread throughout the subsequent year (Figure 1). Moreover, as shown in Table 5, even if we condition on the occurrence of a rating migration by examining the relative likelihood of upgrades and downgrades, we still find a significant negative

impact of leverage is swamped by the disclosure/due diligence effect which generates positive expected migrations.

[29] The figure also shows that the investment-grade results are robust to the length of the migration window subsequent to issuance.

signal sent by issuance.[30]

Prediction 2: Debt issuance in a recession sends a negative signal relative to debt issuance in an expansion.

Table 6 shows the set of migration probabilities during recessions (top panel) and expansions (bottom panel). Recessions are identified using NBER business cycle dates.[31] The results for the investment-grade firms support the prediction that the signal sent by debt issuance is negative in economic downturns relative to expansions. The expected post-issuance migration of -8.5% for investment-grade firms is significantly lower (under all tests) than the full sample and Monte Carlo benchmarks. For this analysis, the full sample benchmark is conditioned on being in a recession (or expansion). The expected migration of investment-grade firms during expansions of -3.3% is also significantly lower than the expected benchmark migrations of -0.32% and -0.34%. One measure of the signal strength is the difference between the actual migration and the Monte Carlo benchmark, which yields a signal of -6.48% during recessions and -2.96% during expansions. Both t and Q tests (not shown) establish that the issuance signal during a recession is significantly stronger at the 95% confidence level than the issuance signal during an expansion.

The results for the high-yield firms provide additional evidence for the prediction of the timing model that the issuance signal is relatively negative during economic downturns. In fact, the signal sent by high-yield firms during a recession is strikingly negative. The expected migration of high-yield firms that issue during recessions of -33.3% is markedly and significantly lower than the

[30]This metric uses the ratio of probabilities rather than the difference in the probabilities and thus yields an intensity of upgrades relative to downgrades rather than a probability.

[31] The results are robust to alternate definitions, including endogenous ones based on the ratio of upgrades to downgrades.

benchmarks. In contrast, the signal sent by high-yield issuance during an expansion is positive, which suggests that the screening/disclosure incentive may dominate the recursive timing effect for these firms during expansions, and that during recessions the timing motive may dominate.[32]

Prediction #3: The signal sent by long maturity debt issuance is negative relative to the signal sent by short term debt issuance.

Table 7 presents expected migrations subsequent to long term (top panel) and short term (bottom panel) debt issuance. We define long and short term debt relative to the median debt maturity, which is about 10 years. We test an implication of Flannery's (1986) intuition that long term issuance sends a negative signal of firm default probability (rating) while short term issuance sends a positive signal. Specifically, we test whether long term issuance sends a negative signal of firm rating migration relative to short term issuance.

The results for investment-grade and high-yield firms support this implication of Flannery (1986). For investment-grade firms, the results indicate that long term issuance sends a stronger negative signal than short term issuance. The expected migration subsequent to issuance of long term debt of -4.95% is significantly lower than the full sample and Monte Carlo benchmarks of -0.52% and -0.43%, respectively. The expected migration subsequent to issuance of short term debt of -2.48% is significantly lower than the full sample and Monte Carlo benchmarks of -0.52% and -0.64%, respectively. Subtracting the Monte Carlo benchmarks yields a long term signal strength of -4.52% and a short term signal strength of -1.84%. Both t and Q tests (not shown) confirm that the long term signal is significantly stronger in the negative direction than the short

[32]Alternatively, the increase in leverage during recessions may have a strong effect on migrations that does not occur during expansions. Due to limited information on firm characteristics during recessions, we are unable to rule out this possibility.

term signal at the 95% confidence level.

For high-yield firms, long term issuance appears to send a negative signal while short term issuance sends a positive signal. The expected migration subsequent to high-yield issuance of long term debt of -2.99% is significantly lower than the full sample benchmark -2.10% and Monte Carlo (two out of three tests) benchmark -1.83%. In contrast, the expected migration subsequent to the issuance of high-yield short term debt of 1.18% is significantly higher than both benchmarks of -2.1% and -1.3%, respectively. The difference between these two signals, after adjusting for the relevant Monte Carlo benchmarks, is significant at the 95% confidence level.

V. Robustness and Additional Discussion

1. Logit Analysis for Migrations Subsequent to Issuance

The goal of this section is to confirm our interpretation of the nonparametric results as evidence of timing due specifically to asymmetric information. Our strategy is to model migrations using standard latent variable techniques, control for changes and levels of firm characteristics that might generate issuance timing, and then test the hypothesis that issuance within the past year coincides with a greater likelihood of a downgrade.

In our multivariate analysis, all data are quarterly. The model controls for rating class (a higher ratings notch corresponds to a riskier firm), changes in leverage (ratio of debt to assets), changes in coverage (ratio of cash-flow to interest expenses), and whether the quarter is during a recession. The changes in leverage and coverage ratios are calculated as the difference between the respective variable five periods prior to the current quarter to one period prior to the current quarter.[33] Given that 97 percent of firm-quarter observations are non-migrations, the parametric firm-by-firm probability-of-migration approach of these regressions is likely to have much less power than our previous nonparametric approach which examines the probabilities of groups of firms rather than of individual firms. Thus, our significant findings (presented below) are perhaps surprising and bolster our confidence in the non-parametric results.

We model the dependent variable as an unordered multinomial logit. While rating migrations might seem like an obvious case for an ordered model, there are reasons to believe that estimating a single beta coefficient on prior bond issuance, as in the ordered models, is a very restrictive assumption. Comparing the individual gross migration probabilities post-issuance with the unconditional (or Monte Carlo) probabilities shows that bond issuance coincides with a high likelihood of a downgrade and a high likelihood of an upgrade -- with the likelihood of a downgrade being significantly greater. This suggests that imposing a uniform effect from bond issuance on the ordered migrations could tend to weaken the true dichotomous effect.[34] The multinomial logit allows us to capture this directly, albeit with the cost of imposing the assumption

---

[33] We also estimate a probit model, which is essentially the model presented above after switching the migration variable and the issuance indicator variable. The probit tests whether the expectation of future downgrades, assuming that expected downgrades are perfectly correlated with actual downgrades, leads to a high probability that the firm will issue. The results are qualitatively similar to those presented in the text.

[34] Nonetheless, the results from an ordered probit model (with the same right-hand side variables) are completely consistent with those from the multinomial logit model and lend additional confidence to our overall empirical conclusions.

of irrelevant alternatives.[35]

The regression results are displayed in Table 8. Our findings for investment-grade firms -- shown in the first three columns -- are consistent with the nonparametric tests. The estimated marginal effects of prior issuance on the probability of a downgrade, shown in the third column, is positive and statistically significant at the 90% confidence level. The marginal effects of the control variables are mostly as expected. The estimates for the rating class suggest that riskier firms are significantly more likely to migrate in general, upward or downward. In the next row, the marginal effects of increased leverage follow closely the pattern of the rating class marginal effects, with firms recently experiencing large increases in leverage being significantly more likely to migrate in both directions. The effects of a decline in coverage are similar, although less significant. The marginal effects of a recession, as expected, suggest that migrations downward are significantly more likely during a recession.

The regression results for high-yield firms, shown in columns 4 through 6, are also consistent with the nonparametric results. The marginal effects of issuance on upgrades is statistically significant at the 90% confidence level. The marginal effects of the control variables are similar to that for investment-grade firms, except that worse rated junk-firms are more likely to be downgraded and *less* likely to be upgraded.

These results support our interpretation of the nonparametric findings as reflecting issuance timing due to asymmetric information. Even after controlling for changes in leverage (including --

---

[35] The assumption of irrelevant alternatives does not appear particularly binding in this case. Eliminating one of the outcomes and re-estimating the probability of an upgrade or downgrade migration by itself yields almost identical estimates for the effect of bond issuance as from the multinomial logit. Also, estimating the two equations as a bivariate probit model with a correlated error structure, yields estimates little changed from the single equation estimation.

but not exclusively -- those related to a bond issue) and current rating and the state of the economy, a bond issue still sends a negative signal of future quality for an investment-grade firm and a positive signal for a high-yield firm. Additional control variables do not alter these results: using the levels of leverage and coverage, adding the assets of the firm, and adding year dummies. Adding an interaction term between bond issuance and recession (to test our recession hypothesis) proved insignificant. This may be due to the limited number of recessionary quarters since 1988 and the limited bond issuance during those quarters.

Replicating these regressions using SDC issuance data and S&P migrations data, rather than the Moody's data, yields very similar results. These are summarized in the right-hand panel of the same table, but are only available from 1993 to 1998 (limited by our SDC data). Consistent with that comparison, sub-sample regressions on the Moody's database also yield very similar results.

2. Logit Analysis for Migrations Prior to Issuance

While our analysis focuses on negative signals after issuance, the timing model also suggests a positive signal prior to issuance, since according to the theory, optimistic firms wait until their optimism is realized before issuing debt. Table 9 presents results for logit estimations of the probability of issuance. The variable of interest is whether a firm has been upgraded in the previous year. For both investment-grade and high-yield firms, the coefficient on the indicator variable for an upgrade in the previous year is positive and statistically significant. While not shown, we also conducted nonparametric tests for whether expected migrations prior to issuance differed from full sample and Monte Carlo Benchmarks. The results are entirely consistent with the theory that optimistic firms wait to issue. However, the upgrades before issuance -- in particular for high-yield firms -- may be related to information revelation related to the announcement of the bond issue itself. In fact, upgrades for high-yield issuers do occur closer to the issue.

3. First Bond Issue versus Subsequent Issues

We also split the analysis by whether the issued bond was the firm's first issue, or a subsequent issue, we find no qualitative difference in the results. There are (at least) two reasons why one might, ex ante, expect this to matter. First, initial issues could be special because they are the first public debt the firm is raising. On the one hand this might entail greater due diligence or better firm prospects, resulting in subsequent upgrades. However, on the other hand, it might mean that public debt is being substituted for private debt and the firm will be less closely monitored, resulting in subsequent downgrades[36]. Second, one might expect that the firms that survive to issue a second or third bond are proven commodities that will be more likely to be subsequently upgraded. Either because there is no effect, or because of offsetting effects, or because the first Moody's rated bond is not necessarily the firm's first bond, we find that this analysis had no overall impact on the results.

4. Issuance Lemons Premium

While our model predicts that debt issuance negatively signals ratings migration and assumes that the market knows this, the empirical results do not require that the market actually receives the signal. A model which assumes that the market blindly prices bond issues based only on ratings would still predict negative expected migration subsequent to issuance. It is the recursive information structure which drives the negative expected migration. An implication of our model which would not be predicted by a model with a passive debt market is that issuing firms pay a

[36] As suggested by Datta, Iskander-Datta, and Patel (1998).

lemons premium, ceteris paribus. Unfortunately, due to the lack of reliable secondary market bond prices and the difficulty of applying the ceteris paribus assumption by controlling appropriately for credit quality, imbedded options, and the liquidity advantage of new issues over secondary issues, among other factors, testing that prediction is beyond the scope of this paper. Rather we simply re-emphasize that we are assuming in this paper that the market is aware that optimistic firms will want to wait.

5. Further Discussion

The differences that we identify between post-issuance migrations and overall migrations may actually be stronger than we report for a number of reasons. First, we treat migrations as if the upgrade or downgrade is only one notch. In reality it is possible, although much less likely, to migrate multiple notches. Weighting migrations by the magnitude of the change makes the post-issuance downgrades more negative relative to the benchmark, and thus strengthens our findings. Given the similar results, it was easier to work with the simplification of the one-notch migration. Second, market wisdom is that downgrades affect larger price declines than upgrades do price rises. This implies that the substantially greater likelihood of downgrade after issuance may be even economically larger than our migrations measure indicates. Third, our benchmarks are the overall expected migration. One might argue that a more appropriate benchmark could be to use the overall expected migrations conditional upon no issuance. If the post-issuance downgrades are taken away from the benchmark, the no-issuance benchmark is even further away from the post-issuance results, again making the difference more significant. Fourth, another interesting benchmark that strengthens our results is to compare the post-issuance migrations with the pre-issuance migrations. Since the pre-issuance migrations contain more upgrades than the overall unconditional, this again would only make our finding stronger. We chose to report the more conservative results.

VI. Conclusion

This paper models how the endogenous timing of debt issuance might work and then presents empirical evidence consistent with such timing. We construct an intuitive model which shows how an adverse selection problem may arise naturally in public debt markets. We then verify three predictions from the model: Debt issuance provides a negative signal of rating migration; debt issuance during downturns sends a negative signal relative to debt issuance during expansions, and long term debt issuance sends a negative signal relative to short term debt issuance.

References:

Brenan, Michael and Alan Kraus (1987), “Efficient Financing Under Asymmetric Information,” *Journal of Finance* 42, 1225-1243.

Constantinides, M. George, and Bruce D. Grundy (1990), “Optimal Investment with Stock Repurchase and Financing as Signals,” *Review of Financial Studies* 2, 445-466.

Dann, L. and W. Mikkelson (1984), “Convertible Debt Issuance, Capital Structure Change and Finaning-Related Information,” *Journal of Financial Economics* 13, 157-186.

Datta, S., M. Iskandar-Datta, A. Patel (1998), “Some Evidence on the Uniqueness of Initial Public Debt Offerings,” *Journal of Financ*e, forthcoming.

Eckbo, B. E. (1984), “Valuation Effects of Corporate Debt Offerings,” *Journal of Financial Economics* 15, 119-151.

Ederington, Louis H. and Jeremy C. Goh, (1998), “Bond rating agencies and stock analysts: Who knows what when?,” *Journal of Financial and Quantitative Analysis* 33, 569-585

Flannery, Mark J. (1986), “Asymmetric Information and Risky Debt Maturity Choice.” *Journal of Finance* 41, 19-38.

Gilson, C. Stuart, and Jerold B. Warner (1998), “Private versus Public Debt: Evidence from Firms that Replace Bank Loans with Junk Bonds,” working paper, Harvard Business School.

Helwege, Jean and Nellie Liang (1996), “Is there a Pecking Order? Evidence from a Panel of IPO firms,” *Journal of Financial Economics* 40, 429-458.

Lucas, Deborah J. and Robert L. McDonald (1990), “Equity Issues and Stock Price Dynamics,” *Journal of Finance* 45, 1019-1043.

Mikkelson, W. and M. Partch (1986), “Valuation Effects of Security Offerings and the Issuance Process,” *Journal of Financial Economics* 15, 31-60.

Moody’s Investor Service (1999), “Rating Methodology,” August.

Moody’s Investor Service (1999), “Special Comment: Y2K - Potential Impact on Moody’s Ratings and Analysis,” September.

Myers, Stewart C. and Nicholas S. Majluf (1984), “Corporate Financing and Investment Decisions when Firms Have Information that Investors Do Not Have,” *Journal of Financial Economics* 13, 187-221.

Nachman, C David, and Thomas Noe (1994), "Optimal Design of Securities under Asymmetric Information,." *Review of Financial Studies* 7, 1-44.

Noe, Thomas (1988), "Capital Structure and Signaling Game Equilibria," *Review of Financial Studies* 1, 331-356.

Rebello, Michael J. (1995) "Adverse Selection Costs and the Firm's Financing and Insurance Decisions," *Journal of Financial Intermediation* 4, 21-47.

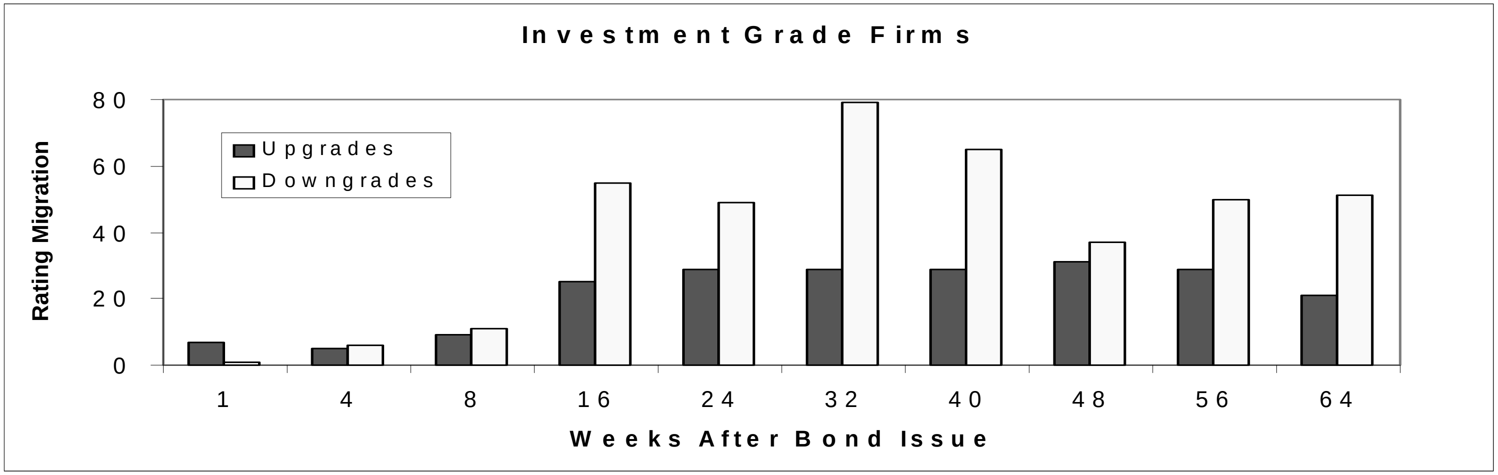
Shyam-Sunder and Betty J, Laksmi (1991), "The Stock Price Effect of Risky versus Safe Debt," *Journal of Financial and Quantitative Analysis* 26, 549-558.

Simkins, Betty J. (1999), "Asymmetric Information, Credit Quality and the Use of Interest Rate Derivatives," working paper, Oklahoma State University.

Spiess, D. Katherine and John Affleck-Graves (1999), "The Long-Run Performance of Stock Returns Following Debt Offerings," *Journal of Financial Economics* 54, 45-73.

Titman, Sheridan (1992), "Interest Rate Swaps and Corporate Financing Choices," *Journal of Finance* 47, 1503-1516.

Figure 1. Upgrades and Downgrades after Issuance



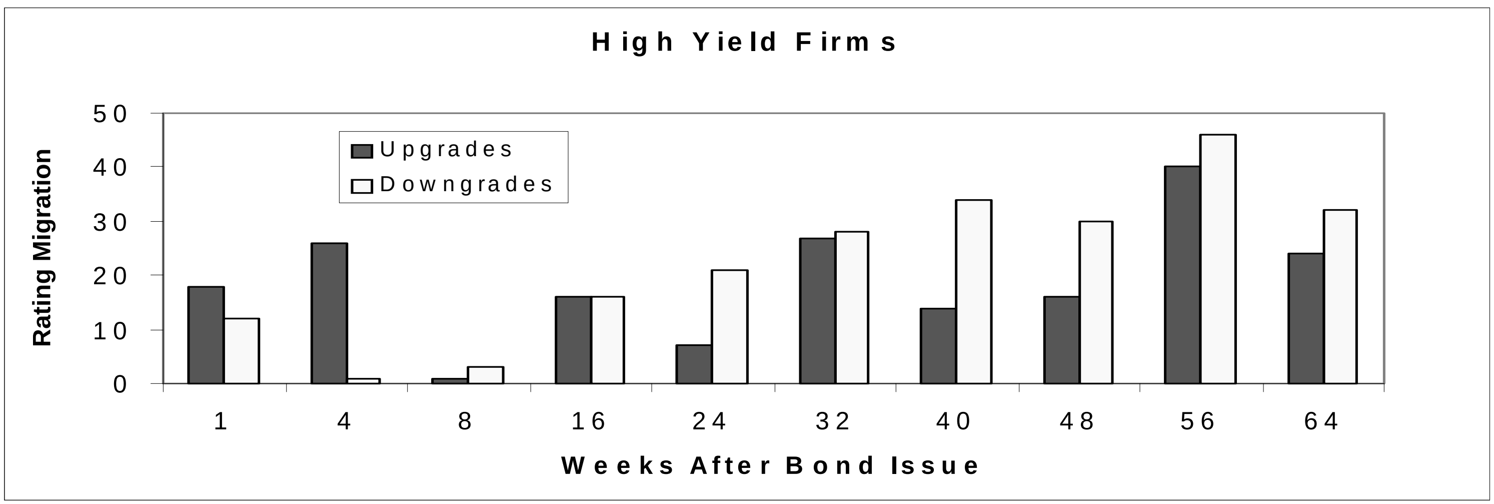


Table 1. Yearly Activity for All Firms.

	Type of Activity:			
Year	Bonds Issued	Total # Upgrades	Total # Downgrades	Ratio of Up/Down
1980	93	6	21	0.29
1981	111	9	26	0.35
1982	167	57	212	0.27
1983	173	33	53	0.62
1984	178	34	62	0.55
1985	372	31	73	0.43
1986	582	22	119	0.19
1987	332	45	75	0.60
1988	265	53	77	0.69
1989	169	53	99	0.54
1990	133	37	144	0.26
1991	268	46	118	0.39
1992	374	53	95	0.56
1993	481	59	56	1.05
1994	255	52	66	0.79
1995	335	63	75	0.84
1996	287	89	72	1.24
1997	373	76	80	0.95
1998	456	79	102	0.78
Total	**5404**	**897**	**1625**	**0.55**
Investment-grade	**3555**	**506**	**684**	**0.74**
High-yield	**1849**	**391**	**941**	**0.42**

Table 2. Description of Issuing Firms and Issued Bonds.

Description of **Issuing Firms**, using Compustat data for firms issuing after 1987:

Description:	Firms Inv Grd	Firms High Yld
Number of issues	3555	1849
Issues after 1987	2360	
Assets:		
Mean	12791	2344
(Std.)	(28028)	(4161)
25th	2334	519
50th	5058	1031
75th	11580	2012
Leverage Ratio:		
Mean	.347	.527
(Std.)	(.174)	(.270)
25th	.243	.341
50th	.324	.468
75th	.410	.686
Coverage Ratio:		
Mean	7.33	1.94
25th	2.31	0.28
50th	3.90	0.96
75th	6.63	2.10

Description of **Bond Issues**, using Moody's data for bonds issued after 1980:

Description:	Bonds Inv Grd	Bonds High Yld
Number of issues	3555	1849
Issues with multiple bonds	429	72
$ Amt. Raised:		
Mean	211	162
(Std.)	(219)	(194)
25th	100	70
50th	150	110
75th	250	175
Maturity:		
Mean	5711	3944
(Std.)	(5089)	(1573)
25th	3605	2933
50th	3658	3656
75th	7307	4385

Notes:
$ Amt is measured in millions,
Maturity is measured in days,
Assets is measured in $ millions,
Leverage is ratio of debt to assets,
Coverage is ratio of cash-flow to interest expenditures.

Table 3. Does Issuance Signal Negative Migration?

	Probability Upgrade minus Probability Downgrade by Group:							1980-1998			
	Expected Migration Benchmark		Actual Migration	Difference Tests vs. Full Sample Benchmark			Difference Tests vs. Monte Carlo Benchmark				
Subsets (# New Issues)	Full Sample	Monte Carlo	within 1 year of Bond Issuance	t	Q	# off	t	Q	# off	Vc
Investment-grade (3506)	-0.52 %	-0.51 %	-3.79 %	-64.93**	691**	114	-18.52**	708**	114	-1.2 %**
High-yield (1849)	-2.06 %	-1.60 %	-0.11 %	+11.66**	8.45**	18	+2.68**	3.03*	9	- 0.7 %**

Note 1: The full sample benchmark is the weighted average of the yearly expected migrations for all rated firms that exist at the beginning of each year, where the weights are equal to the number of firms at the beginning of the year relative to the total number of firms in all the years of the sample.
Note 2: The Monte Carlo benchmark expected migration benchmark is the mean of a distribution obtained by assigning a random firm to each issuance date, calculating the expected migration in the year subsequent to issuance for the random sample of firms, and then repeating the first two steps 5,000 times.
Note 3: The t and Q tests and the # off compare the expected migrations within 1 year of issuance to the full sample and Monte Carlo benchmarks.
Note 4: ** indicates significant at the 95% confidence level, * indicates significant at 90% confidence level.
Note 5: Vc is the critical value for the 95% bound for draws from the benchmark Monte Carlo distribution.

Table 4. Do Increases in Leverage Drive Migrations?

Greater Than Median Contribution to Leverage

Subsets (# New Issues)	Probability Upgrade minus Probability Downgrade by Group:							1988-1998			
	Expected Migration Benchmark		Actual Expected Migration within 1 year of Bond Issuance	Difference Tests vs. Full Sample Benchmark			Difference Tests vs. Monte Carlo Benchmark				
	Full Sample	Monte Carlo		t	Q	# off	t	Q	# off	Vc	
Investment-grade (820)	-0.12 %	-0.02 %	+0.37 %	+22.11**	6.53**	2	+3.13**	39.1**	3	+1.2 %	
High-yield (248)	-1.56 %	-0.90 %	-3.6 %	+11.66**	8.45**	18	-4.02**	20.3**	7	-3.2 %**	

Less Than Median Contribution to Leverage

Subsets (# New Issues)	Probability Upgrade minus Probability Downgrade by Group:							1980-1998			
	Expected Migration Benchmark		Actual Expected Migration within 1 year of Bond Issuance	Difference Tests vs. Full Sample Benchmark			Difference Tests vs. Monte Carlo Benchmark				
	Full Sample	Monte Carlo		t	Q	# off	t	Q	# off	Vc	
Investment-grade (820)	-0.12 %	-0.32 %	-7.3 %	-171**	3281**	58	+3.13**	39.1**	3	-1.4 %**	
High-yield (248)	-1.56 %	-0.90 %	+11.7 %	+97.62**	145**	25	+4.02**	20.3**	7	+1.3 %**	

Note 1: Contribution to Leverage is Defined as Issuance Size relative to Assets.

Table 5. Are results consistent when conditioned upon migration, rather than when looking at the probability of migration?

	Ratio of Upgrades to Downgrades by Group:			1980-1998			
	Benchmark Ratios		Ratios	Difference Tests			
Subsets (# New Issues)	Full Sample	Monte Carlo	Within 1 year of Bond Issuance	t	Q	# off	Monte-Carlo Critical Value
Investment-grade (3506)	0.75	0.79	0.55	-6.05**	10.15**	34	0.58**
High-yield (1849)	0.42	0.47	0.86	14.51**	37.37**	46	0.67**

Note 1: The full sample benchmark ratio is the total number of upgrades to total number of downgrades in the entire sample.
Note 2: The Monte Carlo benchmark ratio is the mean of a distribution obtained by assigning a random firm to each issuance date, calculating the migration ratio 1 year subsequent to issuance for the random sample of firms, and then repeating the first two steps 5,000 times.
Note 3: The t and Q tests and the # off compare the ratios of migrations within 1 year of issuance to the full sample benchmark.

Table 6. Does The Negative Signal Strengthen with Economic Downturns?

Recessions

Subsets (# New Issues)	Expected Migration Benchmark: Full Sample	Expected Migration Benchmark: Monte Carlo	Actual Expected Migration within 1 year of Bond Issuance	Difference Tests vs. Full Sample Benchmark: t	Difference Tests vs. Full Sample Benchmark: Q	Difference Tests vs. Full Sample Benchmark: # off	Difference Tests vs. Monte Carlo Benchmark: t	Difference Tests vs. Monte Carlo Benchmark: Q	Difference Tests vs. Monte Carlo Benchmark: # off	Difference Tests vs. Monte Carlo Benchmark: Vc
Probability Upgrade minus Probability Downgrade by Group: 1980-1998										
Investment-grade (342)	-1.64 %	-2.02 %	-8.50 %	+169.7**	381**	27	-7.34**	17.23**	21	-3.97 %*
High-yield (45)	-3.63 %	-3.77 %	-33.30 %	-267.3**	161**	14	-6.06**	76.9**	13	-8.89 %*

Expansions

Subsets (# New Issues)	Expected Migration Benchmark: Full Sample	Expected Migration Benchmark: Monte Carlo	Actual Expected Migration within 1 year of Bond Issuance	Difference Tests vs. Full Sample Benchmark: t	Difference Tests vs. Full Sample Benchmark: Q	Difference Tests vs. Full Sample Benchmark: # off	Difference Tests vs. Monte Carlo Benchmark: t	Difference Tests vs. Monte Carlo Benchmark: Q	Difference Tests vs. Monte Carlo Benchmark: # off	Difference Tests vs. Monte Carlo Benchmark: Vc
Probability Upgrade minus Probability Downgrade by Group: 1980-1998										
Investment-grade (3164)	-0.32 %	-0.34 %	-3.30 %	-57.39**	447**	87	-16.80**	649**	91	-0.95 %*
High-yield (1804)	-1.78 %	-1.54 %	-0.30 %	+21.69**	27.7**	31	+7.93**	18.65**	23	-0.72 %*

Note 1: Recession and expansion periods are defined according to NBER business-cycle dates. Results are qualitatively similar using other recession definitions.

Table 7. Does The Negative Signal Strengthen with Maturity?

Greater Than Median Maturity

Probability Upgrade minus Probability Downgrade by Group: 1980-1998											
	Expected Migration Benchmark		Actual	Difference Tests vs. Full Sample Benchmark			Difference Tests vs. Monte Carlo Benchmark				
Subsets (# New Issues)	Full Sample	Monte Carlo	Expected Migration within 1 year of Bond Issuance	t	Q	# off	t	Q	# off	Vc
Investment-grade (1737)	-0.52 %	-0.43 %	-4.95 %	-89.8**	620**	77	-16.24**	787**	78	-3.97 %*
High-yield (935)	-2.10 %	-1.83 %	-2.99 %	-10.6**	3.89**	9	-3.12**	6.75**	11	-8.89 %*

Less Than Median Maturity

Probability Upgrade minus Probability Downgrade by Group: 1980-1998										
	Expected Migration Benchmark		Actual	Difference Tests vs. Full Sample Benchmark			Difference Tests vs. Monte Carlo Benchmark			
Subsets (# New Issues)	Full Sample	Monte Carlo	Expected Migration within 1 year of Bond Issuance	t	Q	# off	t	Q	# off	Vc
Investment-grade (1737)	-0.52 %	-0.64 %	-2.48 %	-44.44**	124**	34	-8.63**	93.24**	32	-3.97 %*
High-yield (935)	-2.10 %	-1.30 %	+1.18 %	+39.34**	48.1**	30	+42.4**	44.63**	23	-8.89 %*

Table 8. Multinomial Logit Regression Results

Dependent Variable: No Migration, Upgrade, Downgrade

Independent Variables:	Investment-grade Firms marginal effects [t-stats]			High-yield Firms marginal effects [t-stats]			Investment-grade Firms marginal effects [t-stats]			High-yield Firms marginal effects [t-stats]		
	Moody's Data: 1988-1998						SDC Issuance and S&P Migrations Data: 1993-1998					
	Prob. Same	Prob. Up	Prob. Down	Prob. Same	Prob. Up	Prob. Down	Prob. Same	Prob. Up	Prob. Down	Prob. Same	Prob. Up	Prob. Down
Constant	0.11** [26.0]	-0.50** [17.6]	-0.57** [18.6]	0.10** [9.57]	-0.25** [3.01]	-0.78** [11.0]	0.19** [35.2]	-0.11** [26.4]	-0.87** [21.8]	0.20** [10.9]	0.37* [2.35]	-0.24** [20.8]
Bond Issuance last year	-0.21 [0.94]	-0.59 [0.39]	0.27* [1.63]	-0.53 [1.41]	0.42* [1.73]	0.19 [0.70]	-0.47 [1.28]	-0.34 [1.16]	0.81** [3.51]	-0.95* [0.08]	0.86* [2.25]	0.88 [0.22]
Rating Class	-0.95** [5.38]	0.70** [6.38]	0.25* [1.81]	-0.62 [1.00]	-0.13** [2.69]	0.20** [5.12]	-0.22** [7.79]	0.16** [7.69]	0.61** [3.08]	-0.66 [0.57]	-0.91** [9.23]	0.98** [15.0]
Change in Leverage	-0.13** [4.47]	0.70** [3.75]	0.57** [2.65]	-0.13** [5.23]	0.47** [2.70]	0.84* [4.59]	-0.33* [1.66]	0.12** [7.78]	0.85** [6.24]	-0.27** [5.07]	0.46 [1.14]	0.23** [6.29]
Change in Coverage	0.47* [2.27]	-0.20 [1.47]	-0.23* [1.74]	0.45 [0.45]	0.25 [0.43]	0.20 [0.68]	-0.15 [0.49]	-0.19 [0.09]	-0.17 [0.80]	0.12 [0.35]	-0.37 [0.18]	-0.80 [0.29]
Recession Dummy	-0.17 [.53]	-0.23 [0.97]	0.40* [1.78]	-0.47 [0.32]	-0.45 [1.11]	0.92** [3.94]						

Note 1: * indicates significant at the 10% confidence level.
Note 2: ** indicates significant at the 5% confidence level.

Table 9. Logit Regression Results, for migrations prior to issuance

Dependent Variable: Bond Issuance, No Bond Issuance

Independent Variables:	Investment-grade Firms marginal effects [t-stats]	High-yield Firms marginal effects [t-stats]
	Moody's Data: 1988-1998	
	Prob. Issuance	Prob. Issuance
Constant	-0.22** [35.2]	-0.93** [6.75]
Upgrade previous year	0.22* [2.16]	0.38** [6.98]
Rating Class	0.47** [7.00]	-0.81 [0.95]
Change in Leverage	0.11* [1.65]	0.51 [0.18]
Change in Coverage	-0.47 [1.02]	0.87 [1.36]
Recession Dummy	0.34 [0.57]	-0.45** [4.24]
Firm Assets	0.71** [12.0]	0.15** [3.81]