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The Underpricing in Corporate Bonds at Issue[★]

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Abstract

New corporate bond issues are underpriced on average by a small, yet significant amount. These excess returns vary nonmonotonically across ratings, decrease in trading frequency, and increase in return volatility. Insurance companies benefit not only by holding larger fractions of underpriced issues but also by waiting to purchase overpriced issues, supporting asymmetric information hypotheses. This conflicts with arguments that underpricing exists to improve liquidity and disperse ownership. Rationing seems to limit insurance companies' ownership of the most underpriced issues. That supports the hypothesis that underpricing exists to compensate uninformed investors for participating rather than to reward investors for becoming informed.

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1. Introduction

Are insurance companies privately informed investors that systematically benefit from the underpricing in new issues of corporate bonds? The evidence presented in this paper shows that new corporate bond issues are significantly underpriced on average and that insurance companies own larger fractions of more underpriced corporate bonds at issue.¹ In addition, not only do insurance companies avoid funding overpriced bonds at issue, but they also wait to purchase more of them in secondary market trading. As with research on initial public offerings (IPOs) of equity issues, this paper supports asymmetric information hypotheses for the existence of underpricing. Interestingly, this paper's evidence on rationing of these new corporate bond issues uniquely distinguishes between two different information stories. Is underpricing a reward for becoming informed or sharing private information? Or is it compensation to ensure that uninformed investors are willing to participate in funding new issues?

Empirical evidence on the underpricing in equity IPOs broadly supports both these asymmetric information hypotheses. Consistent with Rock (1986), issuers apparently underprice stock offerings to ensure that less informed investors are willing to purchase them. Since the winner's curse is larger for riskier issues, Beatty and Ritter (1986) confirm that riskier IPOs are more underpriced than less risky IPOs are. Koh and Walter (1989) show that large orders, which they assume to be a proxy for informed demand, are more sensitive to underpricing than small orders. They also show that the degree of rationing of subscriptions is greater for underpriced issues than overpriced

¹ See Zipf (1996) for a practical guide to the underwriting process for corporate bonds.

issues. Chowdhry and Sherman (1996) demonstrate how allocating favorable rations to small, uninformed investors can reduce the size of the winner's curse problem and hence the amount of underpricing these investors require. In this paper, I examine how the underpricing in new issues of corporate bonds is related to risk, insurance companies' ownership, and rationing.

The evidence from equity IPOs is also generally consistent with asymmetric information between the underwriter and investors, rather than between informed and uninformed investors. Benveniste and Spindt (1989) argue that institutional investors require underpricing to compensate them for sharing their private information with underwriters. This explanation implies that issuers will ration in favor of informed investors to reduce underpricing. Hanley (1993) provides evidence that underwriters do update the offer prices of IPOs in response to information gathered from investors' expressed demand. While data on such pre-issue demand is unavailable for the corporate bond issues in this paper, I am able to analyze whether insurance companies can predict subsequent rating changes and how that information is incorporated in the underpricing at issue.

Kang and Lee (1996) have previously found that convertible corporate bonds are also underpriced at issue. The average underpricing for their sample of convertibles is 1.11%. Despite being able to find a significant relation to rating, they interpret their evidence as general support for the existence of differential information in the initial pricing of convertibles. Yet like the research on equity IPOs, they do not distinguish between information-based explanations.

Other recent research has pointed out why issuers might actually prefer to underprice stock IPOs. Booth and Chua (1996) show that diffuse ownership can increase liquidity which increases the value of the issue in the secondary market. To maximize total proceeds, issuers oversubscribe the issue, trading off the liquidity benefit with the cost for more investors to choose to produce costly information. This paper considers how ownership at issue and trading frequency by the dominant institutional investors in corporate bonds, namely insurance companies, impact the underpricing in corporate bonds.

The underpricing evidence in this paper addresses two additional aspects of research in finance. First, the seasoning process observed in bond prices in the few months following the issue date can be largely explained by that initial underpricing coupled with secondary market purchases by insurance companies as they accumulate holdings. Second, insurance companies discover and benefit from private information, a role often attributed to other financial intermediaries like banks and mutual funds. Insurance companies take advantage of new issues that are underpriced by underwriters and avoid overpriced issues, purchasing these in the secondary market instead. They also distinguish the quality of new issues better than rating agencies.

Early research on the seasoning process of corporate bonds has shown that new issues are underpriced and that their yields converge towards those on existing bonds. Lindvall (1977), among others, argued that because seasoned bonds are infrequently traded, they lag new issues. He suggested that this illiquidity coupled with locked-in institutional ownership causes the market for seasoned bonds to reflect new information more slowly than the market for new issues. Weinstein (1978) refuted this as an artifact

of asynchronous trading in the calculation of index yields. Using holding period returns on new issues over actual returns on bonds, rather than on indices, he showed that new issues season toward existing bonds and that this process is largely completed within one month of the issue date. Sorenson (1982) confirmed this and showed further that those issues which are predicted to be more underpriced season, or fall in yield, more than overpriced issues do. In contrast, Fung and Rudd (1986) measure underpricing from the offer price to the trader-quoted bid price on the day of release from syndication and find no clear evidence in their sample that underpricing or the seasoning process even exists. Wasserfallen and Wydler (1988) do find underpricing among Swiss government bonds, which is related to unexpected changes in interest rates and disappears when secondary market trading begins after about two days. They note that underpricing may be essential to compensate buyers for the allocation risk of oversubscription but lament that empirical data is unavailable to test this. I confirm that corporate bonds are underpriced at issue and that their prices adjust rapidly. Additionally this data set encompasses information on how these issues are allocated to insurance companies.

This paper focuses particularly on the role that insurance companies play in new issues of corporate bonds. As proposed by Leland and Pyle (1977), financial intermediaries may specialize in information gathering. Campbell and Kracaw (1980) argued further that, for credibility, such information institutions will likely serve another intermediation function, including providing liquidity, reducing transactions costs, and pooling risks via insurance. Diamond's (1984) model showed how intermediaries could economize on information discovery costs. Empirical research on information discovery has emphasized the role of banks and mutual funds. Numerous empirical papers

document how bank loans provide a credible reputation to a borrower. Additional research has also been devoted to the ability, or lack thereof, of mutual funds to pick investments. Little evidence exists on whether insurance companies possess abilities to discover information. This paper examines how their ownership at and purchases following the issue date of corporate bonds relates to underpricing.

I begin by describing the data and documenting the underpricing of corporate bonds at issue across ratings. In Section 3, I examine how the underpricing of corporate bond issues varies with corporate bond characteristics that are related to liquidity and risk. That evidence points to information-based explanations for the underpricing, which are contrasted in Section 4. I also test whether insurance companies in aggregate predict underpricing and whether they gain from trading infrequency, uncertainty, or both. The last section summarizes and considers how the evidence reflects on theoretical arguments designed to explain underpricing.

2. Data Description

Actual trades reported by insurance companies provide an unusual opportunity to examine the pricing of new bond issues and how these financial institutions participate in the issuance. In this paper, I utilize the trade prices and amounts that insurance companies report on corporate bonds at and immediately following the issue date.

The data set was collected by CDA Spectrum and includes the fixed income securities trades reported by all domestic insurance companies during 1994 and 1995. Corporate bonds were selected from all the fixed income securities based on whether the issuer was specifically identified as a corporation, supplemented with information on the issuer's reported industry. Based on the issue date, 3,709 new corporate bonds were

issued in 1994 or 1995. Of those, 3,343 were traded by insurance companies during 1994 and 1995. Only 2,041 were owned by insurance companies on the date of issue so that an issue price could be found.² For both consistency and availability, a bond's issue price is taken from the trading prices reported by insurance companies at the issue date. Where available, these coincide with issue prices reported elsewhere.

Using ratings and maturities, 2,014 of these new issues could be matched to corporate bond indices, which are used below to calculate excess returns. Because trading in corporate bonds is infrequent and lumpy, the sample shrank further when the analysis was limited to the period immediately following the issue date. Insurance companies bought or sold only 761 of these within 3 weeks of issue, and those actual trading prices are used to calculate total returns.

Additionally, 31 observations were removed from the sample: 14 had variable rates, 11 were issued under SEC Rule 144A, 15 were convertible, and 1 was reported to have a term to maturity at issue equal to 0. The bonds must have a fixed or zero coupon in order to calculate the total return including accumulated interest following the issue date. Private placements and those bonds issued under SEC Rule 144A are excluded to restrict the analysis to publicly traded corporate bonds. Also the data set includes only fixed-maturity bonds and medium-term notes, and excludes convertible bonds in particular.

Additional bond issue characteristics that were available include the amount issued, term to maturity, security, seniority, and industry. Also, both Moody's and

² Several purchases are recorded by insurance companies during the days immediately prior to the actual issue date. With few slight exceptions, the reported prices on these are identical to the trade prices reported on the actual issue date. I assume that trade dates prior to issue reflect when an insurance company commits to subscribing to a particular issue while the actual transaction occurs on the issue date.

Standard and Poor's ratings are reported at year-end for 1994 and 1995. The average of the two ratings is used throughout, and to construct categories, that average is rounded to the lower rating. For example, a bond rated A3 by one and Baa1 by the other rating agency is categorized among the Baa bonds. The rating at issue is assumed to be the first available rating from the end-of-year 1994 and 1995 data sets of bond characteristics. Numerically, ratings are represented inversely with 1 for an Aaa rating, 2 for Aa1, 3 for Aa2, 4 for Aa3, 5 for A1, and so forth. The lowest rating in this sample is Caa or 17 numerically.

The selected sample comprises 720 publicly traded corporate bonds issued during 1994 and 1995. Table 1 shows the mean cumulative total return on these corporate bonds within three weeks of their issue date across ratings. These total returns include both the price change reported from insurance company trades as well as accumulated interest over the days between the issue date and the date of the last insurance company trade in those three weeks.³ Total returns are predominantly positive as accumulated interest only adds to the total return, while price changes move in either direction.

To eliminate market-wide movements in corporate bonds, I calculate cumulative excess returns over corporate bond indices matched by rating and maturity.⁴ These excess returns are simple returns on a portfolio long a corporate bond and short its rating- and

³ To be consistent with the indices, these reported total returns include accrued interest only up to the trading date. While new issues settle on the issue date, trades in corporate bonds accrue interest up to the settlement date, 3 business days following the trading date. The total returns are slightly biased downwards from what an investor would actually earn, but the investment period would be from 3 to 6 days longer.

⁴ The changes in yield spread over maturity-matched Treasury Bonds were also calculated, assuming semi-annual coupon payments. Throughout the paper, the results shown based on excess returns also hold for the changes in yield spread, but of course they move in opposite directions.

maturity-matched index for the days between the bond's issue date and the last trade by an insurance company within three weeks of issue.⁵

For investment-grade corporate bonds, Salomon Smith Barney reports several maturity-based indices for each of three rating categories: Aaa/Aa, A and Baa. The maturity brackets are 1 to 3 years, 3 to 7 years, 7 to 10 years, and greater than 10 years. However, Salomon Smith Barney did not begin calculating such detailed maturity-based indices on a daily basis until November 1994. For bonds issued before then, the maturity brackets are 1 to 10 years and greater than 10 years.

Daily return indices for junk bonds are available from Merrill Lynch, but they are not categorized by maturity. Merrill Lynch calculates daily return indices for each of Ba, B, and C ratings.⁶ Rather than ignoring market-wide movements in term structure for junk bonds, adjustments for maturity are made based on those in Baa-rated indices. I calculate the excess return on a modified portfolio that incorporates both Salomon Smith Barney's and Merrill Lynch's indices. Excess returns on junk bonds are simple returns on a portfolio long the junk bond, short Salomon Smith Barney's Baa- and maturity-matched index, long Salomon Smith Barney's Baa overall index, and short Merrill Lynch's rating-

⁵ The Salomon Smith Barney and Merrill Lynch daily return indices do not include interest that accrues between the trading and settlement dates. For consistency I calculate total returns following their methods. One potential bias in the excess returns remains if the difference between the new issue's coupon and the index's weighted average coupon do not match. For example, that difference was roughly one-half percent in 1995 for each rating and maturity category because coupons on new issues had dropped from historical levels. That biases the reported excess returns upward, but by roughly only $0.5\%/360 \times 3 = 0.004\%$. Even if that bias were considerable relative to the underpricing, it would not change the convex relation between ratings and underpricing since the difference in coupons was roughly the same for each of the maturity and rating categories.

⁶ Merrill Lynch's high yield indices apparently are not based exclusively on corporate bonds. The results do not change when the Baa indices from Salomon Smith Barney are used to calculate the excess returns on new issues of junk bonds.

matched index. The result matches the rating to Merrill Lynch indices and the maturity to the Baa-maturity based indices from Salomon Smith Barney.⁷

Table 1 also shows these excess returns across average ratings. Unlike the total returns, these market-adjusted excess returns show a systematic nonmonotonic pattern. Market-adjusted excess returns are near zero for A-rated new issues. From there, the excess returns increase steadily for both higher- and lower-rated issues. While the average excess return is a meager 0.10%, it is significantly positive at the 5% level of confidence. The median excess return is 0.06% which is also significantly positive at the 10% level based on the Wilcoxon signed-rank test. The excess returns on all junk bonds are also significantly positive, with mean 0.54% and median 0.25%.

The central tendencies of the underpricing measures exhibit clear patterns across ratings despite the large dispersions among bonds within a given rating category. This pattern is unlikely to show up in small samples. In a sample of 91 convertible bonds, Kang and Lee (1996) report that their underpricing was not significantly related to bond ratings. While their statistics show that the average underpricing increases steadily from A to B ratings, the relation is not statistically significant. Even in the data set I analyze, the large dispersion among excess returns relative to the small, yet positive means also suggests that statistical significance becomes more difficult to obtain in subsamples. While both the mean and median of the excess returns are significantly positive in the total sample, they are statistically significant only in the subsample of junk bonds.

⁷ Fung and Rudd (1986) calculate excess holding period returns over an index lagged one day because the issue offer price is determined before the markets open on the issue date. However that leaves their constructed portfolios exposed over the entire nights both before the issue and prior to subsequent trades. I prefer to synchronize the dates on a bond and its matched index. The results did not demonstrably change when I followed their method.

I measure underpricing as the cumulative excess returns using the last trading price during three weeks following the issue date. The primary reasons for using the last trading price, rather than the initial trading price, relate to the timing of the underwriting process shown in Figure 1. The public offering begins on the issue date, and it can continue for a few days until the issue is completely sold. Because the prices used to calculate returns are taken from trades reported by insurance companies, there is no assurance that these prices are not based on purchases from the underwriters at the issue price rather than based on transactions in the aftermarket. Moreover for firm commitment offerings, the underwriters generally maintain a syndicate bid in the secondary market at or just below the issue price in order to stabilize prices until the issue is sold. That dampens changes in the market price. If market prices start to rise, potential purchasers will prefer to buy directly from the underwriters. If market prices start to fall, the underwriters hold the price at the syndicate bid.

Nonetheless, the initial excess returns within 1, 2, and 3 weeks of the issue date are reported in Table 2. They show the same nonmonotonic pattern of excess returns across ratings and significance of excess returns for the 720 new issues traded by insurance companies within 3 weeks of the issue date. Also regressions using these initial excess returns are reported at the end of the paper to ensure that the results are not affected.

The reasons for using the excess returns over three weeks, rather than a shorter time period, are threefold. First as mentioned above, the underwriting syndicate often maintains a bid for up to two weeks to stabilize prices in the aftermarket. Second, other researchers have repeatedly demonstrated that the seasoning process among new issues of

corporate bonds takes some time. Weinstein (1978) shows that most of the adjustment occurs within the first month. The evidence in Table 2 concurs and shows that even by the *initial* trade after the issue date much of the underpricing is realized and its convex pattern across bond ratings is apparent. Third, since the prices in this dataset are based on actual trades by insurance companies, the sample size is smaller the shorter the time period. The observations in Table 2 grow from 536 trades within the first week to 720 over three weeks. Longer time periods than three weeks add incrementally fewer observations.

Figure 2 shows the patterns of the cumulative and initial excess returns within a month of the issue date. The two measures are volatile within the first few days, as more observations are added and perhaps as hot issues sell out more quickly than those issues that the underwriters must maintain the syndicate bid. The measures also diverge in the first two weeks, but by the end of the third week they both stabilize at above 0.10%.

Because excess returns are calculated over index returns, infrequent trading among bonds in the indices could cause a problem. Weinstein (1978) and Fung and Rudd (1986) noted that seasoned issues are less liquid than new issues and the differential performance between new issues and seasoned indices of corporate bonds may be attributed to asynchronous trading. To ensure that this problem does not have a significant impact, I also calculated changes in yield spreads over maturity-matched U.S. Treasury yields and found that the same results as those reported.⁸ Using excess returns

⁸ While these results are not shown, the significance of regression coefficients is unaffected and their signs switch directions as expected since excess returns and changes in yield spreads are inversely related.

over returns on corporate bond indices ensures that market-wide movements in yield spreads between investment-grade and junk bonds do not impact the findings.

The patterns in Table 1 and Table 2 hint at potential explanations for the underpricing in bonds. From A-rated bonds, excess returns increase steadily as ratings drop. Note also that the standard deviation of the excess returns also increases as ratings fall. Riskier corporate bond issues are generally more underpriced. That is consistent with the existence of asymmetrically informed investors. New issues with larger pricing uncertainty require larger excess returns.

The number of observations in each rating category suggests that alternative explanations related to liquidity might also be valid. New issues rated either higher or lower than A are both fewer in number and more underpriced. If the secondary markets for these are also less actively traded, purchasers of new issues may require compensation for the inability to liquidate quickly.

In the next section, I examine the features of individual corporate bond issues and test which characteristics in addition to ratings impact the amount of underpricing. First, potential control variables including maturity, issue size, security, seniority, and industry are analyzed. Then trading frequency, return volatility and subsequent rating changes are used to examine whether liquidity and private information impact underpricing.

3. Bond Characteristics

Bonds are underpriced by a small, yet significant amount at issue. Their excess returns following issue are positive, and highest for junk-rated issues, even after adjusting for market-wide changes in ratings. This section examines what other bond characteristics are related to this underpricing. I segregate these characteristics into two sets based on

whether they can be observed prior to issue or not. Summary statistics and correlation coefficients are shown in Table 5. Selected data across the average rating categories are provided in Table 6. I conclude this section by examining the cross-sectional variation in excess returns explained by these variables.

3.1 Ex Ante Variables

Investors can observe several bond features at its offering, including term to maturity, issue size, security, seniority and rating.

Term to maturity is calculated simply as the difference between the maturity date and issue date, transformed into years. The average term to maturity among the sample of 1994 and 1995 corporate bonds is over 10 years at issue. Corporations issue bonds with a wide range of maturities from 1 to 100 years.

The amount issued in this sample ranges from \$5 million to \$1.6 billion, with an average of \$215 million and a median issue of \$150 million. Aaa- and Aa-rated issues are typically among the largest.

Among these new issues, 33 are secured by physical assets, 61 by loans and 13 are guaranteed by an outside agency. Additionally over two-thirds of the new issues are senior.

The sample includes 269 new issues by financial firms, 240 by industrials, and 89 by utilities. Not all firms were identified by industry in the data.

3.2 Ex Post Variables

The regressions below show that the underpricing of corporate bonds at issue varies systematically across concurrently measured bond characteristics. While these ex

post variables are not observable to predict excess returns before the issue date, they do offer interpretations of why the underpricing exists. These characteristics include trading frequency, return volatility and rating changes.

One measure of market liquidity is the frequency of trading immediately following issue. As a proxy, I use the number of trades by insurance companies in the three weeks following the issue date. Welch (2000) shows that insurance companies dominate the corporate bond market holding well over 40% of total outstanding par within one year of issue. As shown later in this paper, they hold only 20% at issue. Plus virtually all of the trades in this data set following the issue date are purchases, rather than sales, by insurance companies. These facts indicate that insurance companies may provide liquidity in the corporate bond market, at least during the initial year following issue, as they buy and hold to build up their portfolios.

One potential concern arises in using insurance company trades to measure market liquidity is that they may also be informed investors. As discussed below, insurance companies hold larger fractions at issue of more underpriced bonds. If they trade knowing private information after the issue date, uninformed investors would bear additional liquidity costs in trading against a better informed agent. However I find no reason to suspect that this potential problem varies across bonds unless insurance companies are informed only in one particular category or grouping of bonds. If anything, this concern suggests that the underpricing at issue is underestimated using excess returns from insurance company trades. That is because the secondary market trades are nearly all purchases and investors acting on private information would not buy unless they believe that the issue remains underpriced in the secondary market.

Measuring liquidity using insurance company trades may also pose a problem particularly for junk bonds. Insurance companies are now subject to both laws and regulations that severely restrict their holdings of corporate bonds rated Ba and below. As Welch (2000) shows, mutual funds dominate the ownership of junk bonds. Hence trades by insurance companies are not perfectly comparable across rating categories. That is another reason to analyze data for bonds all together as well as separately in each rating category.

The trading frequency measure must be at least one for the bonds in this sample in order to measure the total return on a bond using prices from insurance company trades. The number of trades ranges up to 50 with an average of 3.5 trades per bond. Among the rating categories, trading in junk bonds is the least frequent, likely reflecting the impact of legal and regulatory restrictions on insurance companies' portfolios.

Volatility of returns is measured as the standard deviation of the weekly close-to-close total returns for the 3 weeks following issue. As an indicator of the uncertainty in pricing, the volatility of returns should be closely related to the benefits from gathering private information. If discovering information is costly, investors will weigh this cost against the benefit of becoming advantageously informed. Consistent with this argument, the volatility of returns do increase as ratings drop.

Several other measures to estimate volatility were analyzed since the bond prices are taken from reported trades by insurance companies and not frequently observed. In particular, I calculated volatility estimates proposed by Parkinson (1980), Garman and Klass (1980) and Kunitomo (1992) that attempt to adjust for infrequent trading. These measures are based on the standard deviation of the natural log of the weekly high

divided by the weekly low trading price including accumulated interest. Since they provided the same implications, those results are not shown.

The number of trades and the volatility of returns might be expected to closely related, but Table 3 shows that they are only slightly positively correlated. In the regressions below they are oppositely related to the underpricing. Moreover I found no difference in the regression results described below when the number of trades and the volatility of weekly total returns were each considered separately.

Because Moody's and Standard and Poor's ratings are available at the end of both 1994 and 1995 for some bonds, the change in rating within roughly a year following issue can be found for this subset. Table 4 categorizes the bond issues based on whether the rating was upgraded or downgraded by Moody's and Standard and Poor's agencies and whether both or only one agency changed ratings.

3.3 Regression Results

With the exceptions of seniority and rating, none of the ex ante characteristics predicts the degree of underpricing among new issues of corporate bonds. The convex relation between excess returns and bond ratings described above is pervasive. The excess returns are significantly related to the ex post variables. Underpricing is linked primarily to trading frequency for new issues rated Aaa/Aa, while both trading frequency and volatility impact the underpricing among Baa-rated and junk bonds. Additionally, the amount of underpricing anticipates subsequent rating changes. Table 5 shows the results of regressions of excess returns across the bond characteristics described above for the sample corporate bonds issued in 1994 and 1995 as well as for each subsample categorized by ratings.

Excess returns following the issue date exhibit no clear pattern across term to maturity. Calculating the excess return over rating- and maturity-matched indices effectively removes the impact of maturity on underpricing.

Surprisingly, excess returns are not larger for the smaller issues. There appears to be no consistent relation between excess returns and issue size. For Baa-rated issues, the relation would appear positive. Yet it turns negative for junk bonds.

While seemingly odd at first glance, the larger underpricing on senior, and possibly on secured, bonds is reasonable. To attain a higher credit rating, riskier issuers need to add collateral or seniority. For example, a senior A-rated bond may be more comparable in risk to a subordinated Baa-rated bond.

Excess returns on corporate bonds following issue are clearly convex in the average rating by Moody's and Standard and Poor's. Together, the coefficients on the average rating terms in the regression for all bonds indicate that the least underpriced bonds are on average in the middle of the A ratings.⁹ Matching this pattern, excess returns are significantly negatively related to ratings for Aaa- and Aa- rated issues, while they are significantly positively related to ratings for junk bond issues.

Corporate bond issues are more underpriced the less frequently they are traded and the greater their return volatility. For the entire sample, the excess returns are significantly negatively related to the number of trades by insurance companies. They are also significantly positively related to the volatility of returns, and both the coefficients and their significance increase as bond ratings fall. Among the subsample of new issues

⁹ The coefficient on the squared term is positive ($a > 0$) indicating a minimum. That occurs at $-b/2a = 6.3$ which corresponds to an A2 rating.

rated Aaa or Aa, the excess returns are related primarily to trading frequency and not significantly to return volatility. The underpricing among Baa- and lower-rated bonds is related to both.

The amount of underpricing anticipates rating changes. Excess returns are significantly lower for those new issues that subsequently receive rating upgrades by either rating agency. This evidence is consistent with arguments that investors may be pricing new issues based on better information than provided by rating agencies. Given that investors require lower total returns on more creditworthy issues, the excess return on a high quality new issue over the return on a mismatched lower rated index would be negative on average. Since laws and regulations make insurance companies especially sensitive to rating changes, these investors in particular have strong incentives to discover information to predict future rating changes. Conversely the rating agencies could be reacting to information revealed by the amount of underpricing. Yet it is difficult to understand why they would upgrade an issue because its price fell after the issue date. The relation between excess returns and rating changes appears one-sided since those that are subsequently downgraded do not earn significantly higher excess returns immediately following issue.

Note also that upgrades from A ratings also have negative rather than positive excess returns on average, and downgrades from Aaa/Aa have higher rather than lower excess returns. That suggests that the larger underpricing of Aaa- and Aa-rated issues relative to A-rated issues is not fundamentally due to the ratings themselves, but rather some underlying reason correlated with ratings.

These observations that infrequent trading, volatility, and subsequent rating changes impact the underpricing of corporate bonds at issue raise the question who benefits. Insurance companies dominate the ownership of outstanding bonds, and nearly all of their trades following the issue dates are purchases as they build up their portfolios. Those ownership and trading facts point to several possibilities. Insurance companies may avoid the initial offerings to potentially gain from providing subsequent liquidity. That strategy oddly suggests that they are willing to miss out on the initial underpricing. They could be rationed at issue by underwriters. If so, what potential reasons could explain why underwriters would want to ration their largest clients? Additionally the positive association between underpricing and risk, measured by either return volatility or by A and lower ratings, raises questions. Investors may require a risk premium on new issues above and beyond the risk premium required on similarly rated bond indices. In the next section, I examine insurance companies' ownership of corporate bonds at issue and their subsequent purchases. They may benefit from underpricing as liquidity providers or as privately informed investors.

4. Ownership and Purchases by Insurance Companies

The previous section showed that the underpricing in new issues of corporate bonds is related to estimates of secondary market liquidity, to credit risk and return volatility, and potentially to information about future rating changes. Each of these has implications for competing theoretical arguments that attempt to explain why underpricing exists. This section examines whether the ownership and purchases of new issues by insurance companies are consistent with these arguments.

In addition to dominating the corporate bond market, insurance companies also play a sizable, although smaller, role in funding new issues. The evidence below shows that they benefit from underpricing, potentially capturing gains from acting on private information at issue and possibly from providing liquidity in the secondary market. This section describes, first, the ownership at issue by insurance companies and, second, their trades in the three weeks immediately following issue. Insurance companies hold larger fractions of bonds that are more underpriced at issue. Following issue, they buy larger fractions of bonds that were more overpriced at issue. Finally, this section examines how the patterns in both ownership and purchases also indicate that insurance companies are rationed in their allocation of underpriced issues.

4.1 Ownership at Issue

Insurance companies funded roughly one fifth of corporate bonds issued in 1994 and 1995. The fraction of the issue amount owned by insurance companies as of the issue date varies strikingly across the bonds' ratings. Further they fund significantly larger fractions of smaller and less frequently traded issues. Intriguingly their ownership suggests that they can predict future rating changes and react to those changes by trading off potential underpricing gains with the impact of regulatory constraints.

Insurance companies face strict constraints on their ownership of corporate bonds. Various state laws passed in the late 1980s and early 1990s preclude them from allocating large fractions of their portfolios to junk bonds. In addition, regulations further discourage their ownership of even Baa-rated bonds. For example, in 1993 the National Association of Insurance Commissioners recommended that life insurance companies be required to hold 0.3% risk-based capital for bonds rated A or better, 1% for Baa, 4% for

Ba, 9% for B, 20% for C and 30% for bonds in default. Welch (2000) shows that as a result insurance companies play only a secondary role to mutual funds in the institutional ownership of junk bonds. The pattern of ownership by insurance companies among new issues of junk bonds reflect these restrictions.

Table 6 summarizes insurance companies' ownership at issue across various bond characteristics. Their ownership at issue increases from 17% on average for Aaa- and Aa-rated bonds to 25% among Baa-rated bonds. It drops precipitously from there across junk ratings. That hump-shaped pattern is pervasive across every other bond characteristic. Insurance companies also own relatively smaller fractions of the shortest maturity bonds at issue. For new issues maturing in less than three years, they fund merely 12% on average.

Their ownership at issue across issue size and trading frequency indicate that insurance companies play a larger role in less liquid issues. For issues of less than \$64 million, they own over one third of the issued amount, whereas they own only 12% of issues larger than \$256 million. Similarly their ownership at issue is negatively related to trading frequency, dropping from 25% for those issues which they trade the least frequently following issue to 15% for those most frequently traded.

Despite its systematic pattern across rating categories, insurance companies' ownership at issue appears invariant to an alternative measure of risk. Across quartiles formed on the volatility of returns, ownership at issue averages within 2% of each other. Similarly there is no obvious variation across these volatility quartiles within any particular rating category. While credit risk impacts insurance companies' ownership of new issues, their holdings are not sensitive to return volatility.

The variation in insurance companies' ownership at issue across subsequent rating changes over the following year depends on the initial rating itself. Among Baa-rated and junk bonds, insurance companies strongly avoid those new issues that will be downgraded, and they hold more of those that will be upgraded. The regulatory and legal constraints imposed on insurance companies' portfolios make them especially sensitive to subsequent rating changes for lower-rated issues. However for higher-rated issues, the relation dissipates and possibly reverses direction. Among new issues rated A, insurance companies hold smaller fractions of those that subsequently receive upgrades. The patterns are unclear for subsequent downgrades from new issues in either the Aaa/Aa- or the A-rating categories. Laws and regulations on insurance companies' portfolios make no distinction among bonds rated A or higher. Accordingly, insurance companies seem much more willing to hold larger fractions of these issues that subsequently receive downgrades.

These patterns are consistent with insurance companies acting on better information at issue than provided by the rating agencies. Due to potential legal and regulatory penalties, insurance companies have incentives to avoid issues that could be downgraded and require either portfolio restructuring or more risk-based capital. They prefer new issues that could be upgraded and allow greater portfolio flexibility or less risk-based capital. Among new issues rated A or higher that do not face legal or regulatory requirements, insurance companies appear to avoid those that are eventually upgraded, possibly because they are less underpriced on average. Both of these explanations support the argument that insurance companies act on private information when they invest in new issues of corporate bonds.

The underpricing of new issues is significantly related to ownership at issue by insurance companies. The regressions in Table 7 include only bond characteristics that are observable at the issue date. Maturity, size, and security are again insignificant, while the excess returns still depend on seniority and rating. On average across all bonds, their excess returns over rating- and maturity-matched bond indices are strongly positively related to the ownership at issue by insurance companies. The significance of this relation diminishes for lower-rated issues. Among these, insurance companies could be less sensitive to underpricing due to the legal and regulatory constraints.

The calculation of returns from prices reported by insurance company trades may potentially create a selection bias. Virtually all of these trades during the weeks following a bond's issue are purchases rather than sales by insurance companies. That fact may push up the realized return on these bonds either if insurance companies buy at the ask price or if the additional demand pushes up the prices in the short-run.

Neither concern affects the results. Table 8 presents the results of the same regressions but using excess returns calculated exclusively from sales by insurance companies within the three weeks following the issue date. Out of the original sample of 720 issues, there are only 46 issues sold by an insurance companies during the three weeks following its issue date. Despite the few observations, the results are surprisingly similar. Underpricing is still higher for senior bonds and convex across ratings while unrelated to the other control variables. Insurance companies do gain from the underpricing especially among the higher-rated issues.

To summarize, ownership at issue by insurance companies does predict underpricing in new issues of corporate bonds. These ownership patterns hint that

insurance companies may indeed be privately informed and capturing gains from underpricing, but that laws and regulations hinder their efforts. Next I examine why they trade following the issue date and then whether their issue ownership and subsequent trading indicate that they are rationed.

4.2 Net Purchases following Issue

The patterns of insurance companies' ownership of newly issued corporate bonds mimics their ownership of outstanding bonds except in one important respect. Insurance companies own much less of corporate bonds at the issue date than they hold within a year. Welch (2000) shows that insurance companies hold 42% on average of outstanding registered corporate bonds. However, as of the issue date, they own only 20% on average. The trades by insurance companies following the issue date support that wide discrepancy since they are virtually all purchases rather than sales.

Two reasons could cause insurance companies to purchase large fractions immediately following the issue. If underwriters ration the distribution of new issues of corporate bonds, insurance companies may increase their holdings simply for portfolio allocation purposes. Alternatively if insurance companies possess private information about the initial pricing of corporate bonds, they will avoid those that are overpriced at issue. They should wait to purchase overpriced bonds at the lower price after issue.

Table 9 shows purchases net of sales by insurance companies in the three weeks following the issue date. On average across all bonds, they purchase an additional 9% of the amount outstanding. These net purchases vary nonmonotonically across ratings, peaking at 11% for bonds rated Baa and dropping to only 3% for junk bonds. They do not consistently vary across term to maturity, but are clearly larger for smaller issues of

bonds. As expected, the number of trades varies with the amount of net purchases because nearly all the trades are purchases. The fraction purchased appears unrelated to volatility of returns. Interestingly, the pattern of net purchases across subsequent rating changes switches direction from that for ownership at issue among bonds rated Aaa, Aa, and A. Insurance companies evidently purchase more of issues with subsequent upgrades than downgrades for highly rated bonds. The relation between purchases and rating changes for Baa-rated and junk bonds is unclear.

The evidence in Table 10 lends credence to both the ‘waiting to buy overpriced issues’ and the ‘rationing of underpriced issues’ explanations. Because insurance company ownership varies systematically across ratings, the quartiles in this table are formed independently for each of the four rating categories. As a result, there are no uniform bounds for the quartiles. For corporate bond issues in the Aaa/Aa rating category, excess returns increase uniformly across quartiles formed on ownership at issue. For those in the A and Baa rating categories, excess returns are negative on average in the lowest quartile of ownership at issue. They increase into the second and third quartiles but fall off by the fourth. That is consistent with rationing of the most underpriced issues. If insurance companies are rationed in their allocation of the most underpriced issues, those issues should not fall into the highest quartile of ownership. For bonds in the junk ratings category, excess returns are on average positive across all four quartiles, with the highest in the second quartile.

Across quartiles formed on net purchases following issue, average excess returns generally decrease across all rating categories. The more overpriced the bond is at issue, the larger fraction that insurance companies buy of it following issue.

The bottom panel of Table 10 examines underpricing across both ownership at issue and net purchases following issue. Without exception among bonds in the lowest quartile of ownership at issue, the excess returns are not only negative on average for those which insurance companies buy high fractions of following issue, but also consistently smaller than for those which insurance companies buy low fractions of following issue. Put simply, for bonds that are least likely to be rationed at issue, insurance companies wait to buy overpriced bonds.

4.3 Rationing

Rationing changes how underpricing is related to ownership at issue and to net purchases following issue. This subsection describes how squaring the issue ownership and net purchases variables capture the impact of rationing. The evidence shows that rationing does impact the significance of these terms in predicting underpricing.

The potential for rationing makes the relation between ownership and underpricing more complex. Yet it can be modeled reasonably simply, as diagrammed in Figure 3. Without rationing, informed investors would hold larger fractions of more underpriced bonds. That predicts a simple linear relation between insurance company ownership at issue and excess returns. Depending on whether the issue is rationed in favor of or against informed investors, that relation can either curve upward or flatten out.

Rationing could occur to reward uninformed investors for participating in the issue when relatively more informed investors are able to capture gains from picking more underpriced issues. If so, the issue should be rationed against informed investors to reduce the total amount of underpricing required by uninformed investors to break even. The ownership at issue by informed investors would be constrained particularly for those

bonds with the largest underpricing. Hence excess returns should increase linearly in ownership at issue until a hypothetical rationing point is reached. At that point, the informed investors are rationed and their ownership at issue will no longer increase with excess returns. Plotting excess returns on the y-axis across ownership at issue on the x-axis, the relationship becomes vertical at the rationing point.

Alternatively, rationing could exist to reward investors for becoming informed or for sharing their private information with the underwriters. If so, the issue should be rationed in favor of informed investors to reduce the total amount of underpricing required to compensate them adequately. The amount of underpricing could be effectively capped by allocating virtually all of the more underpriced issues to the informed investors. Viewed as a function of underpricing with the axes in Figure 3 flipped, the ownership by informed investors would increase at an increasing rate with the underpricing of the issue.

To model the impact of rationing on excess returns, I square the ownership fraction by insurance companies at issue.¹⁰ The exact points where ownership is rationed against informed investors or where the underpricing is capped by rationing toward informed investors are neither defined for any given bond nor even likely to vary consistently across bonds. By squaring ownership at issue, these two competing explanations can be tested. For rationing against informed investors, the graphical

¹⁰ Actually I model this variable equal to minus the square of the natural logarithm of the ratio of amount owned by insurance companies to the amount issued on the bond. I use the natural log of the ratio to reduce the excessive impact of ownership of smaller issues. To compensate, the natural log of the amount issued is always included in regressions. Because the ratio of amount owned to amount issued is bounded between 0 and 1, the natural log of the ratio is always nonpositive. By squaring it, the variable flips direction with higher numbers indicating smaller ownership. I change the direction back by multiplying it by -1.

depiction of excess returns on ownership at issue is predicted to be the right-hand side of a parabola with a minimum at zero ownership. It is essentially a smoothed version of the kinked relation just described. For rationing toward informed investors, that graphical depiction is predicted to be the left-hand side of a parabola with a maximum at 100% ownership.

The regressions in Table 11 demonstrate that modeling the impact of rationing with this squared variable improves the predictive power of insurance company ownership at issue.¹¹ Similar regressions but without squaring the ownership term were presented in Table 8. Using the squared ownership at issue term, the t-statistics are much stronger and significantly positive for the overall regression and for three of the four subsamples based on ratings. The relation between underpricing and ownership in the junk bond subsample is insignificantly negative in either version of the regressions. These results indicate that insurance companies own larger fractions of more underpriced bonds at issue and that they face rationing among the most underpriced bonds.

Rationing also affects the relation between underpricing and net purchases following issue. Without rationing, informed investors wait until after the issue date to buy bonds that are overpriced at issue. This predicts a simple negative and linear relation between excess returns and net purchases following issue. With rationing, the negative relation weakens as the underpricing increases. If insurance companies are unable to obtain issues that are rationed, they should be willing to allocate more of their portfolios to these following issue. By squaring net purchases at issue, the graphical depiction of

¹¹ While the regressions that include both the issue ownership and the issue ownership squared variables are not shown, the coefficients on these are jointly significant at the 1% level.

excess returns on net purchases is predicted to be the left-hand side of a parabola with a minimum at 100% net purchases following issue.

The regressions in Table 12 include both squared ownership at issue and squared net purchases following issue, as well as the ex ante and ex post bond characteristics. There are fewer observations in this table because a few of the net purchases by insurance companies are negative, causing its natural log to be undefined. As predicted, excess returns are negatively related to net purchases by insurance companies following issue, adjusted for the impact of rationing. However this effect is not consistently significant across each of the rating-category subsamples.

These regressions cast some doubt on the argument that underpricing is directly caused by infrequent trading. Comparing the coefficients on the number of trades in Table 12 to those in Table 5, excess returns are no longer significantly related to trading frequency when net purchases by insurance companies are included in the regression. The previously observed relation between excess returns and number of trades may be an artifact of the rationing of privately informed investors. If insurance companies wait to buy overpriced issues or are rationed among underpriced issues, those will be more frequently traded following issue.

The convex relation between excess returns and ratings weakens when issue ownership and net purchases are both included in the regressions. The coefficients on the average Moody's and Standard and Poor's rating variables in Table 12 are no longer jointly significant in the overall regression. Only among the subsample for Aaa- and Aa-rated issues is average rating still significant. Net purchases by insurance companies following issue captures much of the variation in underpricing related to rating.

Ownership and net purchases by insurance companies explains, at least in part, why the underpricing of new issues of corporate bonds is related to rating and trading frequency. However it does not impact the significance of the volatility of returns or subsequent rating upgrades in predicting the amount of underpricing. In the next section, I summarize these findings and their implications for theoretical arguments that attempt to explain why underpricing exists.

5. Summary and Implications

Corporate bonds are significantly underpriced at issue. Their average initial excess returns over rating- and maturity-matched indices are near zero for A-rated bonds, positive for issues in both the Aaa/Aa and Baa rating categories, and largest among junk bonds. Given a particular rating, senior bonds are also significantly more underpriced. The evidence suggests that this variation across ratings is related to both the trading frequency in the secondary market and the pricing uncertainty surrounding new issues. Bonds that are less frequently traded following the issue date have significantly larger excess returns, as do bonds whose returns are more volatile. Additionally, new issues that subsequently receive rating upgrades have significantly smaller excess returns, suggesting that they are priced based on more accurate information than provided by the rating agencies.

Insurance companies clearly capture benefits from underpricing, but they face rationing. Their ownership at issue of corporate bonds generally increases in excess returns, except among those issues that are the most underpriced. Rather than funding overpriced bonds at issue, insurance companies wait to buy these in the secondary market. Their net purchases in the three weeks following the issue date generally decrease

in excess returns. Ownership at issue and net purchases following issue by insurance companies also capture some of the variation in underpricing previously attributed to rating and trading frequency. They cause the convex relation between ratings and excess returns to weaken, and they eliminate the significance of the number of trades in predicting the excess returns. The initial evidence that underpricing is related to infrequent trading may simply be an artifact of informed investors waiting to purchase overpriced bonds in the secondary market. The relation between volatility and the excess returns remains significant.

The evidence on the underpricing of corporate bonds at issue broadly supports the adverse selection hypothesis proposed by Rock (1986). The amount of underpricing increases with risk measures, which is consistent with uninformed investors requiring larger underpricing on issues with greater uncertainty. The facts that insurance companies are consistently able to pick underpriced bonds and wait to purchase overpriced ones suggest that privately informed investors do exist. Also, the effects of rationing among the most underpriced issues are observed in both ownership at issue and net purchases following issue by insurance companies. This rationing is in favor of other investors at the expense of insurance companies. That is consistent with Chowdhry and Sherman's (1995) extension. The winner's curse can be reduced by rationing against informed investors and allocating preference to uninformed investors.

The existence of asymmetric information between issuers and insurance companies receives limited support, consistent with Benveniste and Spindt's (1989) hypothesis and Hanley's (1993) findings for IPOs of stocks. The evidence indicates that insurance companies can predict subsequent upgrades and that this information is

reflected in the initial pricing. Among both Baa-rated and junk bond issues, insurance companies own more at issue of those that are subsequently upgraded than of those subsequently downgraded. However among new issues rated A, insurance companies' ownership at issue varies oppositely to subsequent rating changes. Yet they do purchase, in the three weeks following issue, larger fractions of A-rated issues that are subsequently upgraded than of those downgraded. Since issues that subsequently receive upgrades have significantly lower excess returns, insurance companies may wait to buy A-rated issues that they believe will be upgraded. Among issues rated lower, the impact of legal and regulatory constraints tends to dominate how insurance companies react to anticipated rating changes. They seem willing to accept less underpricing, and possibly overpricing, to free up risk-based capital and allow greater portfolio allocation flexibility.

Regardless of how insurance companies tradeoff underpricing benefits with legal and regulatory constraints, the negative relation between underpricing and subsequent rating upgrades implies that the pricing at issue is based on better information than provided by the rating agencies. Either underwriters can also predict future rating upgrades, or they gather this information from insurance companies during the issuing process.

While the evidence suggests that insurance companies may be better informed than the issuers and their underwriters, it does not follow that issuers design the underpricing as a reward for becoming informed or for revealing private information. Refuting Benveniste and Spindt's (1989) hypothesis, the most underpriced issues are rationed *against* insurance companies.

Another potential explanation suggested by Booth and Chua (1996) argues that issuers underprice their securities to disperse ownership and increase secondary market liquidity. For new issues of corporate bonds, the evidence suggests the reverse. Underpricing increases in the concentration of ownership measured by the fraction held at issue by insurance companies. Plus, excess returns are generally negatively related to trading frequency by insurance companies. However in support of this hypothesis, the most underpriced issues appear to be rationed against insurance companies.

The findings in this paper extend the literature on the seasoning process of corporate bonds. In concurrence with previous research, most of the underpricing in corporate bonds is realized quickly, largely by the initial trade by insurance companies in this sample. The data also indicates a potential cause for the observed differences in liquidity and performance between new issues and seasoned bonds. Insurance companies purchase 9% on average, net of sales, of the issued par amount within the three weeks following issue. Their total ownership of corporate bonds rises, on average, from 20% at issue to 42% by the end of the year. The seasoning, or differential performance between these new issues and existing corporate bonds, fades as insurance companies purchase to accumulate holdings in their portfolios.

Insurance companies fund larger fractions of more underpriced issues of corporate bonds, and they wait to buy more overpriced issues. Their participation in the issuance of corporate bonds indicates that they are privately informed investors who face rationing by underwriters. This informational facet of their role as financial intermediaries has been largely overlooked. Notably, the laws and regulations imposed on the portfolios of

insurance companies since the late 1980s may have an unwanted side effect. Restricting their holdings in the junk bond market may also reduce its informational efficiency.

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Figure 1. Time line for issuing a corporate bond

Usually -20 days	At least -2 days		0		Up to 2 weeks
Registration statement is filed with the SEC	Red herring is distributed	Terms are finalized. Underwriters gather indications of interest	Effective issue date. Public offering begins	Trading begins in aftermarket. Public offering continues	Syndicate maintains a bid (firm commitment offering)

Problems: Insurers often record their trades before the issue date. Also not all bonds are distributed on the issue date (reason why syndicate maintains a bid).

? Redo data with RI from issue date and TR from issue date (no accrued interest before) so that exact return

Figure 2.

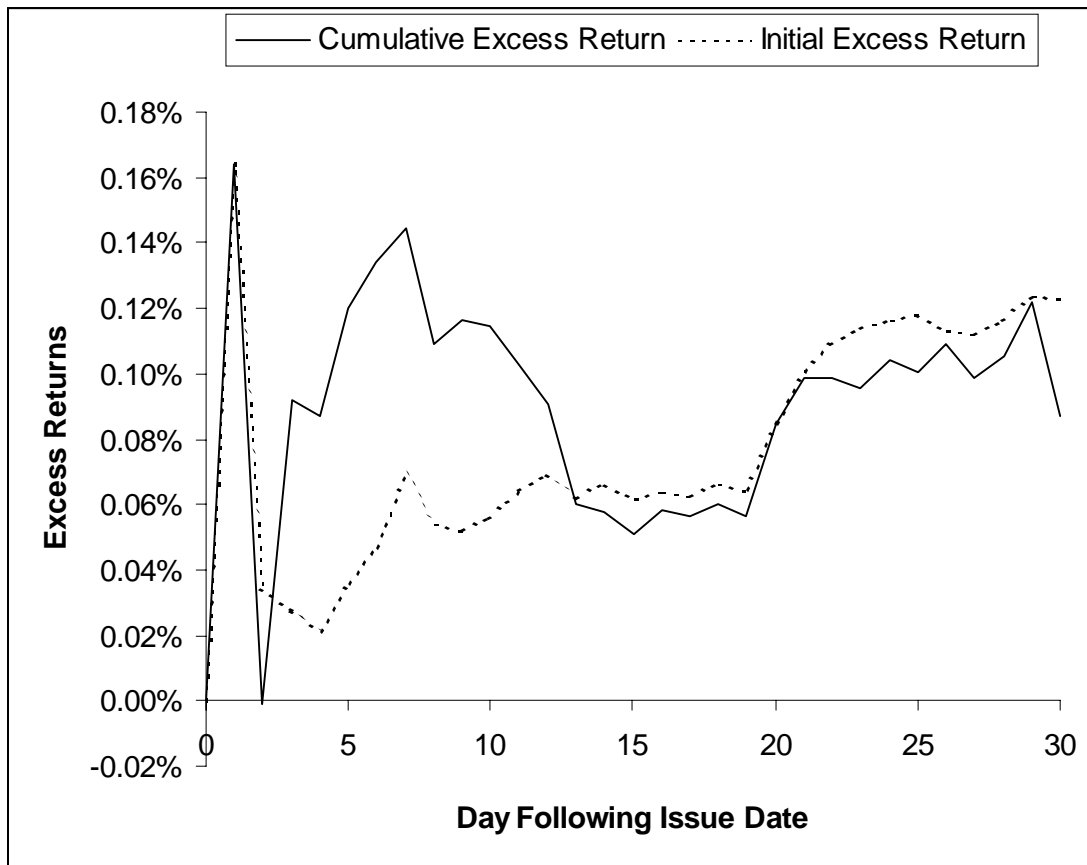


Figure 3. The relationship between ownership by informed investors and the underpricing in new issues of securities predicted by two hypotheses.

Underpricing

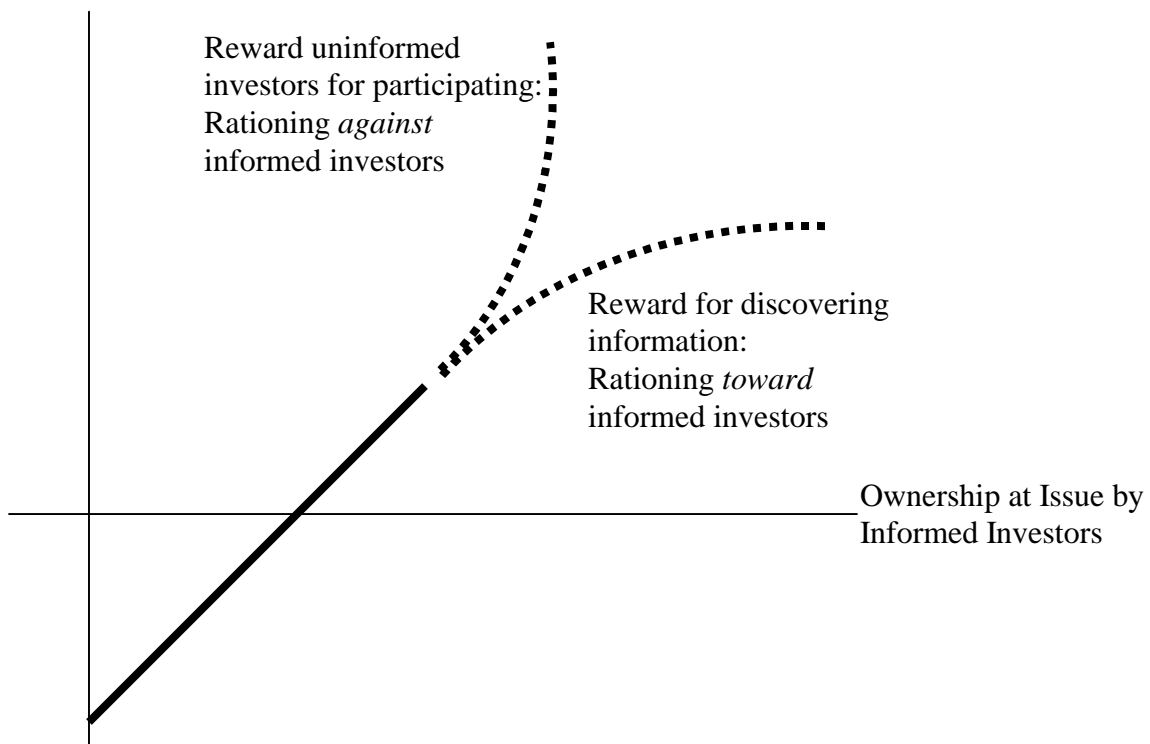


Table 1. Cumulative returns and cumulative excess returns on corporate bonds within 3 weeks of the issue date.

Returns include the price change and accrued interest. Excess returns equal the total returns on each new issue over the returns on corporate bond indices matched by rating and maturity. The average rating is the average of the ratings by Moody's and Standard and Poor's ratings agencies.

Average Rating	Obs.	Total Return Mean (%)	Cumulative Excess Returns (%)					Fraction Positive
			Mean	Standard Deviation	Percentiles			
					25 th	Median	75 th	
Aaa	86	0.27	0.14	0.87	-0.34	0.04	0.58	51%
Aa	78	0.44	0.02	0.98	-0.65	0.08	0.70	55%
A	294	0.42	0.01	1.17	-0.55	-0.03	0.52	49%
Baa	186	0.36	0.08	1.11	-0.50	0.12	0.71	54%
Ba	44	0.64	0.30	1.24	-0.59	0.30*	1.15	66%
B	30	0.60	0.37	1.41	-0.65	0.07	1.51	53%
C	2	9.91	8.58	9.20	2.08	8.58	15.09	100%
Aaa/Aa	164	0.35	0.08	0.92	-0.49	0.06	0.66	53%
Ba/B/C	76	0.87	0.54**	2.13	-0.61	0.25**	1.46	62%
Total	720	0.44	0.10**	1.25	-0.54	0.06*	0.69	53%

** and * indicate significance at the 5% and 10% levels of confidence, respectively, using t-tests for the mean and Wilcoxon signed-rank tests for the median.

Table 2. Initial excess returns on the day of the *first* trade following the issue date. Excess returns equal the total returns on each new issue over the returns on corporate bond indices matched by rating and maturity. The average rating is the average of the ratings by Moody's and Standard and Poor's ratings agencies.

Average Rating	Initial Excess Returns (%)								
	Within First Week			Within Second Week			Within Third Week		
	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median
Aaa	50	0.56	0.14	74	0.46	0.14	86	0.40	0.13
Aa	64	0.03	0.02	73	0.06	0.02	78	0.06	0.03
A	235	0.03	0.03	280	0.03	0.01	294	-0.01	0.00
Baa	135	-0.18	0.01	168	-0.14	0.01	186	-0.05	0.04
Ba	32	0.52 ^{**}	0.31 ^{**}	40	0.27	0.17 [*]	44	0.37 [*]	0.28 ^{**}
B	20	0.41 [*]	0.22 [*]	26	0.34 [*]	0.14	30	0.41 ^{**}	0.14
C	0			0			2	8.58	8.58
Aaa/Aa	114	0.26	0.04	147	0.26	0.04	164	0.24	0.04
Ba/B/C	52	0.48 ^{**}	0.28 ^{**}	66	0.30 ^{**}	0.14 ^{**}	76	0.60	0.25 ^{**}
Total	536	0.07	0.04 [*]	661	0.07	0.03	720	0.10 [*]	0.04 ^{**}

^{**} and ^{*} indicate significance at the 5% and 10% levels of confidence, respectively, using t-tests for the mean and Wilcoxon signed-rank tests for the median.

Table 3. Summary statistics

Excess returns equal the total returns on each new issue over the returns on corporate bond indices matched by rating and maturity. The average rating is the average of the ratings by Moody's and Standard and Poor's ratings agencies. The number of trades is the frequency of insurance company trades within 3 weeks of the issue date. Volatility of returns is measured as the standard deviation of the weekly close-to-close total returns for the 3 weeks following issue. The issue ownership is the fraction of the issue amount owned by insurance companies as of the issue date. Net purchases are the amount purchased less the amount sold by insurance companies in the three weeks following the issue date.

	Obs.	Mean	Std.Dev.	Minimum	Maximum
Excess Return	720	0.10%	1.25%	-5.00%	15.09%
Term to Maturity, years	720	11.2	8.7	1.9	100.0
Amount Issued	720	\$215m	\$193m	\$5m	\$1,636m
Average Rating	720	6.5 (A3)	3.4	1 (Aaa)	17 (Caa)
Number of Trades	720	3.5	4.0	1	50
Volatility of Returns	720	0.621%	1.013%	0.001%	20.486%
Issue Ownership	720	20%	19%	.01%	100%
Net Purchases	720	9%	14%	-100%	90%

Correlation Matrix	ER	lnTerm	lnAI	AR	LnNT	lnVR	lnIO
Excess Return	1.00						
ln(Term to Maturity)	0.02	1.00					
ln(Amount Issued)	-0.02	0.03	1.00				
Average Rating	0.03	0.09	-0.06	1.00			
ln(Number of Trades)	-0.08	0.00	0.30	-0.07	1.00		
ln(Volatility of Returns)	0.13	0.19	0.13	0.10	0.20	1.00	
ln(Issue Ownership)	0.13	0.12	-0.25	0.05	-0.15	0.02	1.00
ln(Net Purchases)	-0.10	-0.01	-0.35	-0.06	0.42	0.01	0.06

Table 4. Characteristics of the sample corporate bonds across ratings

The average rating is the average of the ratings by Moody's and Standard and Poor's ratings agencies. The number of trades is the frequency of insurance company trades within 3 weeks of the issue date. Volatility of returns is measured as the standard deviation of the weekly close-to-close total returns for the 3 weeks following issue. The issue ownership is the fraction of the issue amount owned by insurance companies as of the issue date. Net purchases are the amount purchased less the amount sold by insurance companies in the three weeks following the issue date. Rating changes are the number of corporate bonds issued in 1994 that were upgraded or downgraded by Moody's and Standard and Poor's by the end of 1995.

Frequency or Mean	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Observations	720	164	294	186	76
Term to Maturity (years)	11.2	10.2	11.3	12.4	10.6
Amount Issued (\$ millions)	215	304	178	188	238
Secured (frequency)	107	66	21	13	7
Senior (frequency)	505	75	223	154	55
Financial firms (frequency)	269	49	166	47	7
Industrial firms (frequency)	240	21	81	86	52
Utilities (frequency)	89	12	38	33	6
Number of Trades	3.5	3.7	3.6	4.0	2.1
Volatility of Returns (%)	0.62	0.58	0.56	0.68	0.79
Rating Change (frequency)					
Both Upgraded	18	0	7	5	6
One Upgraded	30	0	10	14	6
No Change	215	66	79	46	24
One Downgraded	24	4	14	4	2
Both Downgraded	14	2	4	7	1

Table 5. Regressions of excess returns on the corporate bond characteristics

Coefficient (t-Statistic)	Dependent Variable: Excess Return				
	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Constant	.761 (1.99)	.773 (1.20)	-.330 (-0.42)	-.727 (-0.70)	-.472 (-0.15)
ln(Term to Maturity)	.005 (0.07)	-.023 (-0.18)	.037 (0.35)	.024 (0.19)	.038 (0.06)
ln(Amount Issued)	-.036 (-0.69)	-.042 (-0.50)	-.030 (-0.39)	.236 (2.11)	-.375 (-1.10)
D(Secured)	.175 (1.08)	-.093 (-0.43)	.340 (1.12)	.508 (1.36)	.438 (0.55)
D(Senior)	.331 (2.70)	.355 (1.47)	.368 (1.93)	.203 (0.81)	.523 (0.93)
Average Rating	-.176 (-3.49)	-.150 (-1.90)	.040 (0.46)	-.016 (-0.17)	.276 (1.93)
(Average Rating) ²	.014 (4.42)				
ln(Number of Trades)	-.137 (-2.30)	-.184 (-1.85)	.043 (0.46)	-.265 (-2.74)	-.726 (-1.93)
ln(Volatility of Returns)	.191 (5.04)	.043 (0.70)	.099 (1.62)	.189 (2.92)	.707 (4.00)
D(Upgrade)	-.504 (-2.73)		-.686 (-2.28)	-.673 (-2.52)	-.156 (-0.25)
D(Downgrade)	.050 (0.25)	.423 (1.07)	-.271 (-0.94)	.154 (0.45)	-.041 (-0.04)
Observations	720	164	294	186	76
Adjusted R-squared	0.078	0.034	0.021	0.067	0.204
Mean Squared Error	1.20	0.91	1.16	1.07	1.90

Table 6. Ownership by insurance companies at the issue date as a percent of amount issued on each bond

Percent of Issue Amount Held by Insurance Companies at Issue	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Mean	20.2	16.6	20.6	25.3	13.9
Median	14.5	12.4	13.4	20.7	9.3
Standard Deviation	19.1	16.1	21.3	18.8	13.0
Observations	720	164	294	186	76
Mean					
by Term to Maturity					
1 to 3 years	11.9	8.0	14.1	9.8	
3 to 7 years	20.4	14.7	21.0	25.6	20.0
7 to 10 years	21.1	18.9	23.9	26.5	12.1
Over 10 years	21.2	19.6	19.3	25.2	17.2
by Amount Issued					
Up to \$64 million	34.6	27.0	36.5	39.0	22.8
\$64 to \$128 million	24.0	25.3	20.8	29.1	17.1
\$128 to \$256 million	18.4	16.1	16.5	24.8	14.3
Over \$256 million	12.2	10.4	13.2	16.0	9.4
by Number of Trades					
1	24.5	21.7	27.0	30.0	13.7
2	18.5	16.6	16.2	24.2	13.5
3 to 5	19.4	13.7	18.6	27.9	14.1
Over 5	15.0	12.6	16.7	14.6	16.6
by Volatility Quartiles					
Lowest Quartile	20.7	19.9	20.6	24.2	14.9
Second Quartile	20.6	11.4	24.2	26.4	13.9
Third Quartile	20.6	18.3	20.3	25.3	12.5
Highest Quartile	18.9	16.7	17.0	25.2	13.9
by Rating Changes					
Both Upgraded	22.6		6.5	49.6	18.7
One Upgraded	20.2		7.7	32.0	13.6
No Change	18.3	16.4	18.7	22.4	14.4
One Downgraded	23.1	11.5	30.4	16.0	9.6
Both Downgraded	12.5	16.1	18.5	9.2	4.2

Table 7. Regressions of excess returns on ownership by insurance companies at the issue date

Coefficient (t-Statistic)	Dependent Variable: Excess Return				
	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Constant	.500 (1.34)	1.047 (1.73)	-.446 (-0.58)	-1.196 (-1.12)	-1.915 (-0.56)
ln(Term to Maturity)	.045 (0.62)	-.057 (-0.48)	.052 (0.51)	.059 (0.45)	.029 (0.04)
ln(Amount Issued)	-.010 (-0.19)	-.023 (-0.29)	.033 (0.46)	.191 (1.67)	-.613 (-1.55)
D(Secured)	.072 (0.43)	-.205 (-0.96)	.290 (0.97)	.390 (1.02)	.543 (0.63)
D(Senior)	.366 (2.95)	.404 (1.74)	.420 (2.22)	.150 (0.58)	.967 (1.61)
Average Rating	-.213 (-4.19)	-.187 (-2.48)	.010 (0.11)	.023 (0.24)	.375 (2.31)
(Average Rating) ²	.017 (5.13)				
ln(Issue Ownership)	.102 (2.82)	.173 (3.09)	.096 (1.85)	.100 (1.47)	-.024 (-0.09)
Observations	720	164	294	186	76
Adjusted R-squared	0.049	0.073	0.014	-0.003	0.032
Mean Squared Error	1.22	0.89	1.16	1.11	2.10

Table 8. Regressions of excess returns, calculated from sales only and not purchases by insurance companies, on ownership by insurance companies at the issue date.

Coefficient (t-Statistic)	Dependent Variable: Excess Return Using Sales Only				
	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Constant	.170 (0.06)	8.626 (1.14)	.593 (0.19)	-.344 (-0.04)	-68.105 (-1.96)
ln(Term to Maturity)	.718 (0.94)	-3.407 (-1.23)	-.877 (-1.24)	.929 (0.61)	3.940 (0.79)
ln(Amount Issued)	.101 (0.22)	.040 (0.08)	.259 (0.99)	.281 (0.32)	3.625 (1.04)
D(Secured)	-.348 (-0.31)	-.426 (-0.66)	3.018 (2.30)	-.459 (-0.18)	-1.086 (-0.18)
D(Senior)	1.400 (1.56)	-1.020 (-0.55)	-.425 (-0.55)	1.627 (0.98)	1.548 (0.40)
Average Rating	-.866 (-2.24)	.556 (0.59)	.063 (0.22)	-.382 (-0.43)	2.710 (2.34)
(Average Rating) ²	.059 (2.90)				
ln(Issue Ownership)	.366 (1.22)	1.410 (1.91)	.271 (1.62)	.360 (0.65)	-.727 (-0.45)
Observations	46	9	15	11	11
Adjusted R-squared	0.175	-0.115	0.314	-0.412	0.039
Mean Squared Error	2.25	0.62	0.83	1.72	4.56

Table 9. Purchases net of sales by insurance companies following the issue date as a percent of amount issued per bond

Percent of Issue Amount Purchased by Insurance Companies following Issue	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Mean	9.1	8.4	9.8	11.0	3.2
Median	4.4	4.1	5.9	4.9	1.5
Standard Deviation	14.0	13.0	15.7	13.9	5.0
Observations	720	164	294	186	76
Mean					
by Term to Maturity					
1 to 3 years	13.3	5.1	18.3	6.0	
3 to 7 years	9.6	9.1	9.6	11.5	4.6
7 to 10 years	7.6	7.5	8.0	11.3	2.8
Over 10 years	9.4	9.9	8.4	10.9	3.9
by Amount Issued					
Up to \$64 million	21.7	20.8	21.5	25.3	1.2
\$64 to \$128 million	9.8	10.6	9.9	12.2	3.1
\$128 to \$256 million	7.2	6.1	6.8	9.9	4.1
Over \$256 million	5.0	5.3	4.6	6.7	2.1
by Number of Trades					
1	5.6	8.6	6.8	3.5	1.6
2	8.2	7.2	8.3	10.6	3.6
3 to 5	10.9	7.3	12.8	12.5	5.1
Over 5	13.8	10.2	11.3	22.3	9.1
by Volatility Quartiles					
Lowest Quartile	10.3	7.6	13.2	11.8	2.8
Second Quartile	7.8	7.3	9.0	8.2	3.0
Third Quartile	10.3	11.2	10.0	11.9	4.3
Highest Quartile	8.0	7.4	7.4	11.8	3.0
by Rating Changes					
Both Upgraded	6.6		12.8	4.9	0.7
One Upgraded	7.2		6.2	8.2	6.5
No Change	8.4	8.1	7.0	14.2	2.7
One Downgraded	5.2	5.9	6.8	0.7	1.3
Both Downgraded	7.2	6.1	2.2	11.1	1.6

Table 10. Excess returns (%) across insurance company ownership at issue and net purchases following issue.

Note: These quartiles do not have fixed bounds across rating categories. Instead quartiles are formed for each rating category because ownership at issue and purchases following issue depend on ratings.

	All Bonds	Average Rating by Moody's and S&P				
		Aaa/Aa	A	Baa	Ba/B/C	
Observations	720	164	294	186	76	
Mean Excess Return	0.10	0.08	0.01	0.08	0.54	
by Issue Ownership						
Lowest Quartile	-0.17	-0.27	-0.29	-0.03	0.22	
Second Quartile	0.22	0.04	0.19	0.00	1.25	
Third Quartile	0.21	0.10	0.09	0.43	0.39	
Highest Quartile	0.14	0.45	0.06	-0.09	0.32	
by Net Purchases						
Lowest Quartile	0.26	0.06	0.09	0.41	1.01	
Second Quartile	0.16	0.18	0.06	0.12	0.60	
Third Quartile	-0.06	-0.04	-0.08	-0.29	0.57	
Highest Quartile	0.02	0.12	-0.05	0.07	-0.01	
by Issue Ownership (Quartiles)		and by Net Purchases (Bitiles)				
Lowest	Low	0.04	-0.15	-0.08	0.22	0.45
	High	-0.39	-0.44	-0.48	-0.28	-0.10
Second	Low	0.36	0.13	0.17	0.06	2.40
	High	0.07	-0.05	0.21	-0.05	0.21
Third	Low	0.25	0.05	0.10	0.55	0.48
	High	0.17	0.15	0.09	0.29	0.23
Highest	Low	0.21	0.61	0.10	0.19	-0.28
	High	0.09	0.35	0.03	-0.40	0.60

Table 11. Regressions of excess returns on insurance company ownership at issue, modified for rationing

Coefficient (t-Statistic)	Dependent Variable: Excess Return				
	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Constant	.418 (1.13)	.938 (1.55)	-.474 (-0.62)	-1.214 (-1.14)	-1.735 (-0.51)
ln(Term to Maturity)	.042 (0.58)	-.048 (-0.41)	.041 (0.40)	.055 (0.42)	.016 (0.02)
ln(Amount Issued)	-.020 (-0.40)	-.052 (-0.66)	.024 (0.35)	.191 (1.68)	-.634 (-1.63)
D(Secured)	.092 (0.56)	-.180 (-0.84)	.306 (1.03)	.427 (1.12)	.553 (0.64)
D(Senior)	.373 (3.01)	.409 (1.75)	.427 (2.27)	.150 (0.58)	.964 (1.60)
Average Rating	-.207 (-4.09)	-.192 (-2.52)	.009 (0.11)	.015 (0.16)	.370 (2.34)
(Average Rating) ²	.016 (5.02)				
- [ln(Issue Ownership)] ²	.017 (3.04)	.022 (2.73)	.018 (2.32)	.018 (1.81)	-.013 (-0.29)
Observations	720	164	294	186	76
Adjusted R-squared	0.060	0.061	0.021	0.004	0.033
Mean Squared Error	1.22	0.89	1.16	1.10	2.10

Table 12. Regressions of excess returns on insurance company ownership at issue and net purchases following issue, modified for rationing

Coefficient (t-Statistic)	Dependent Variable: Excess Return				
	All Bonds	Average Rating by Moody's and S&P			
		Aaa/Aa	A	Baa	Ba/B/C
Constant	.613 (1.72)	.890 (1.36)	-.207 (-0.26)	-.461 (-0.44)	5.648 (2.55)
ln(Term to Maturity)	-.022 (-0.33)	-.056 (-0.45)	.024 (0.23)	-.011 (-0.09)	-.241 (-0.60)
ln(Amount Issued)	-.060 (-1.10)	-.034 (-0.35)	-.081 (-0.93)	.190 (1.44)	-.579 (-2.25)
D(Secured)	.154 (1.04)	-.142 (-0.65)	.298 (0.98)	.383 (1.05)	.257 (0.51)
D(Senior)	.184 (1.63)	.382 (1.57)	.344 (1.77)	.002 (0.01)	-.289 (-0.75)
Average Rating	-.068 (-1.41)	-.163 (-2.08)	.040 (0.46)	-.014 (-0.15)	-.093 (-0.85)
(Average Rating) ²	.005 (1.70)				
ln(Number of Trades)	-.034 (-0.51)	-.116 (-0.99)	.147 (1.35)	-.135 (-1.05)	-.506 (-1.64)
ln(Volatility of Returns)	.135 (3.84)	.023 (0.37)	.075 (1.22)	.179 (2.80)	.410 (3.31)
D(Upgrade)	-.471 (-2.78)		-.642 (-2.13)	-.684 (-2.62)	.190 (0.44)
D(Downgrade)	.073 (0.39)	.380 (0.97)	-.312 (-1.04)	.267 (0.74)	.397 (0.55)
- [ln(Issue Ownership)] ²	.016 (3.25)	.021 (2.51)	.016 (2.03)	.016 (1.70)	-.033 (-1.11)
- [ln(Net Purchases)] ²	-.010 (-2.28)	-.002 (-0.27)	-.013 (-1.74)	-.013 (-1.23)	-.000 (-0.01)
Observations	696	160	288	180	68
Adjusted R-squared	0.055	0.055	0.038	0.089	0.160
Mean Squared Error	1.08	0.90	1.15	1.03	1.20