Do Investment Banks' Relationships With Investors Impact Pricing? The Case of Convertible Bond Issues*

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Abstract

This paper examines the role of search frictions in convertible bond pricing. Using a sample of 533 Rule 144-A issues for the years 1997-2007, we examine two channels through which search frictions might impact initial pricing: the ease of attracting initial investors and expected after-market liquidity. We document robust negative relationships between at-issue discounts and both types of frictions. Our findings suggest that search frictions play a meaningful role in pricing and that intermediaries can add value through repeated interactions with investors. This is in contrast to conflict of interest hypotheses, in which banks use underpricing to reward favored clients.

1 Introduction

Why do firms issue convertible bonds at discounts relative to their fundamental values? Despite a vast literature on initial offering discounts, important questions remain about the initial pricing of intermediated securities. We analyze an extensive sample of Rule 144-A convertible bond issues, in which we are able to observe investor-level data across a large number of issuers and their placement agents (investment banks). The data allow us to measure repeated interactions between placement agents and investors and to examine empirically the role of search frictions in initial offering discounts. In particular, we identify two distinct search frictions: the ease of attracting initial investors to the issue and expected secondary-market liquidity. The main results suggest that search frictions play an important role in the determination of the offering discount.

This paper is motivated in part by the substantial body of research investigating the impact of liquidity on asset prices. Particularly relevant in our setting is Duffie, Garleanu, and Pedersen (2005). The authors develop a theoretical model relating search-and-bargaining frictions, bid-ask spreads and prices in over-the-counter markets. Specifically, their model suggests greater liquidity discounts when counterparties are harder to find, sellers have less bargaining power, and there are fewer qualified owners. Following the ideas in Duffie, Garleanu, and Pedersen (2005), the main goal of this paper is to examine the role of search and delay frictions in the initial pricing of convertible bonds. We focus on two such frictions. The first is the ability to find buyers in the secondary market should an initial investor wish to trade the bond. The second measure, the fraction of bond investors that are the investment banks' repeat investors (i.e., they have participated in prior 144-A issues placed by the same investment bank), is intended to capture the ease of attracting investors. The idea is that repeat investors may provide a reduction of the bargaining complexities that can exist in efforts to place initial security issues with unfamiliar investors. Reducing both of these types of search and delay frictions is hypothesized to result in less initial underpricing.

While we posit that repeated interactions between placement agents and investors can impact pricing through a reduction in search costs, it is also important to note that there are two potentially opposing forces: (1) conflict of interest (e.g., Benveniste and Spindt (1989), in which underwriters compensate favored investors with more underpriced issues; or Baron (1982), in which underpricing allows a reduction in distribution effort) and (2) search costs/frictions associated with locating and contracting with an investor willing to trade the bond. The dominant effect of a placement agents use of her "rolodex" on initial bond pricing is therefore an empirical question. To our knowledge, ours is the first study to attempt to identify and disentangle these two potential effects.

Our study relies on data from the 144-A market, which has become an important source of convertible bond financing (see Gomes and Phillips (2008)). The growing importance of the 144-A market, along with the availability of information regarding the identities of the qualified institutional buyers (QIBs) participating in these issues makes this market particularly useful for examining the roles of bank-investor linkages and after-market liquidity in security pricing. Unlike public new issues, corporations choosing to issue bonds in the 144-A market are able to delay or avoid the registration of securities.[1] A major benefit to issuers of Rule 144-A is the increased speed at which transactions are completed. They are also able to save resources that would have been allocated to the registration process in a public offering. The costs to the issuer of Rule 144-A offerings come from the fact that the bonds can be sold only to QIBs who, in turn, can only make secondary market trades in the bonds with other QIBs. All else equal, Rule 144-A bond markets are less liquid than public markets since participation is restricted and transactions take place in over-the-counter markets. However, most 144-A bonds are subsequently registered and may be traded without restriction thereafter.

Ritter and Welch (2002) describe investor allocation, including the question of who receives allocations and how allocations relate to other business provided by the investor as, the most interesting open questions today . . . [u]nfortunately, not only do the answers to these questions depend upon the sample period, but underwriters also usually guard information about the specifics of their share allocations, posing significant challenges to empiricists. (p.1796). Historically, the lack of information on investor allocation has posed a major empirical challenge, even in the voluminous initial public offering (IPO) literature, with the exception of a handful of studies that use proprietary allocation data over short time horizons (e.g., Cornelli and Goldreich (2001); Aggarwal, Prabhala, and Puri (2002) and Aggarwal (2003)). The investor identity data disclosed in registration filings of 144-A bonds provides an opportunity to shed some light on questions regarding the importance of relationships and prior business with the placement agent in initial pricing.

Convertible bonds provide a particularly useful laboratory for examining the determinants of underpricing of intermediated securities, outside of more traditional IPO and SEO settings. This is because many of the explanations for underpricing that have been proposed for other securities are less relevant in the case of convertible bonds, yet convertible bonds are considerably underpriced at issue (we estimate that the bonds in our sample of 533 issues over an 11-year horizon are issued at a discount of 6.99% relative to fundamental value). For example, we expect asymmetric

[1]Bonds issued under SEC Rule 144-A often have registration rights stipulating penalties, often in the form of higher coupon rates, should the issuer fail to exchange the 144-A bonds for otherwise identical registered bonds within an agreed upon time frame.

information and uncertainty about fundamental value to be less severe in these markets, since our sample of issuers already have publicly traded stock. Similarly, the potential impact of the bond issue on monitoring or managerial entrenchment is also less important for convertible bonds than with equity issues (see e.g., Meidan (2006) for an examination of these determinants in the private issue of public equity (PIPE) setting). Convertible bonds have downside protection, decreasing monitoring incentives relative to the case of straight equity. Moreover, equity ownership does not change at issue, so managerial entrenchment is less likely to be altered by a convertible bond issue. These factors make it easier for us to isolate empirically the potential role of search frictions in initial pricing.

This paper provides a number of new results in the literature on the initial pricing of securities and of convertible bonds in particular. The first and most important finding is that convertible bond discounts are related negatively and significantly to the relationship between the underwriter and investors. That is, when investors are the placement agent's repeat customers, convertible bond prices are higher. This result contrasts the hypotheses regarding bankers using underpricing to reward repeat investors but is consistent with findings in Ljungqvist, Jenkinson, and Wilhelm (2003), who find a reduction in underpricing for foreign firms that choose to go public in the United States via the book building method. They estimate that this benefit outweighs the fees charged by U.S. investment banks. We also find that convertible bond discounts are negatively related to proxies for aftermarket liquidity, consistent with prior findings in the literature. The second key finding is that when search costs and contracting frictions are reduced, issuer fees are significantly reduced. Taken together, these findings suggest that the benefits (to the issuer) of the investment bank and investor relationship outweigh potential conflict of interest costs associated with repeated interaction between investors and investment banks.

The balance of the paper is organized as follows: Section 2 provides a brief discussion of related literature; Section 3 presents the data and framework for empirical analysis; Section 4 discusses the empirical results; Section 5 concludes.

2 Related Literature

A substantial empirical literature finds that new issues of equity securities (IPOs, SEOs, and private placements) are priced lower than their fundamental values. Despite extensive tests of theoretical models intended to explain these deviations from fundamental value, the determinants of underpricing are still not well-understood. The most common explanations for underpricing come from the IPO literature and fall into three primary categories: asymmetric information (e.g., asymmetrically informed investors as in Rock (1986) or compensating informed investors in the bookbuilding process as in Benveniste and Spindt (1989)[2]); moral hazard (conflict of interest in which underpricing is a way to reduce distribution effort as in Baron (1982)); and underwriter price support, as in Ellis, Michaely, and O'Hara (2000). Ritter and Welch (2002) and Ljungqvist (2007) provide excellent surveys. We rely on this literature in identifying control variables in our analysis of the role of search frictions and after-market liquidity in the initial pricing of convertible bonds.

The expected relationship between liquidity risk and asset prices has been an important focus of the microstructure and asset pricing literature since Amihud and Mendelson (1986).[3] However, only recently have after-market liquidity and liquidity risk received attention in the IPO underpricing literature. Ellul and Pagano (2006) are the first to develop and test a model in which after-market liquidity and liquidity risk impact IPO underpricing. Our paper complements theirs in that we attempt to capture a previously untested aspect of liquidity - the ease of attracting initial investors - in addition to examining the role of after-market liquidity. Our focus on convertible bonds rather than new equity is also useful because convertible bonds are considerably underpriced at issue (our evidence suggests that they are priced 6.99% lower than fundamental value), yet many of the dominant explanations for equity underpricing are less relevant in the case of convertibles. This improves our ability to empirically isolate and test for evidence of the hypothesized role of liquidity.

Reuter (2006) is the only paper to our knowledge to study the correlation of initial security pricing and business relationships between investment banks and investors. Since it is generally not possible to observe initial allocations of IPOs, Reuter (2006) uses mutual fund holdings during the quarter following the IPO as a proxy for IPO allocations. He links these holdings to fees and trade commissions paid by funds to the IPO underwriters and reports that business relationships with underwriters lead to greater and more favorable IPO allocations. Although Reuter (2006) is closely related to our paper in that it makes use of a relationship measure, a benefit of the 144-A data that we use is that we are able to observe more directly the investor allocations, as well as prior links between investors and investment bankers.[4] Interestingly, our conclusions are different from those

[2]Cornelli and Goldreich (2001) test the bookbuilding hypothesis using the full books in 39 international IPOs, and, consistent with Benveniste and Spindt (1989), they report that favorable allocations and pricing occur when investors are "friends" of investment banks. They define "friends" as investors who often bid large quantities and (alternatively) as those who obtain large allocations. Our study is related to theirs in that we track links between banks and investors; however, our main focus is on the determinants of prices (rather than quantities).

[3]See Amihud, Mendelson, and Pedersen (2005) for a survey of the literature on liquidity and asset pricing.

[4]Stocks are more liquid and trade much more frequently than bonds, making the likelihood that the investors we observe in the Sagient data are initial investors high relative to observing mutual fund holdings in the quarter following new equity issues.

in Reuter (2006) in that we find that links between investors and banks actually improve pricing.

Like IPOs, there is substantial evidence that seasoned equity is also priced at a discount relative to fundamental value (see the survey article by Eckbo, Masulis, and Norli (2007)). Some evidence suggests this underpricing has increased over time. For example, Corwin (2001) reports SEO underpricing of 1.92% in the 1980s and 2.92% in the 1990s. It is important to note that because bonds are traded infrequently, the measure of underpricing that we use differs from both the IPO and SEO underpricing measures.[5] We estimate a theoretical bond price and measure the deviation of the offer price from the model-implied value.

Outside the IPO and SEO setting, the literature documenting discounts of privately negotiated placements of public equity began with Hertzel and Smith (1993), who report discounts of approximately 20 percent. They find evidence that the discounts are compensation for information acquisition by investors. More recently, Brophy, Ouimet, and Sialm (2009) report PIPE discounts of approximately 14 percent for common stock. In a paper that is closely related to ours, Huson, Malatesta, and Parrino (2009), document an important role for capital market conditions in the initial pricing of PIPES. The findings in Huson, Malatesta, and Parrino (2009) complement our analysis, but there are two important differences. First, the primary objective of their paper is to analyze the relationship between aggregate capital market conditions and aggregate issuance. Of particular interest is the relative bargaining power of firms and their investors. We use time fixed effects to control for aggregate conditions and instead focus the analysis on cross-sectional determinants of pricing, in particular the extent of investor-banker relationships at the individual issue level. Second, there are two channels by which a convertible bond issue might impact firm value: at issue discounts as well as fees paid to placement agents. While Huson, Malatesta, and Parrino (2009) study pricing, we explore both of these. Both discounts and fees are potentially important in our context because they provide two channels through search frictions might be value-relevant to issuers.

Despite the size and importance of the convertible bond market, there have been very few studies of the determinants of pricing in these markets.[6] One exception is Chan and Chen (2007), who link convertible bond ratings to initial underpricing. They find initial underpricing of magnitudes similar to ours and report that prices converge to fundamental value within two years with a shorter

[5]IPO underpricing is measured as offer price relative to the closing price on the first day of trading. Similarly, SEO underpricing is typically measured as either the offer price relative to closing price on the first day following the issue or closing price on the first day preceding the issue.

[6]For example, Choi, Getmansky, Henderson, and Tookes (forthcoming) report convertible bond issues in their sample of U.S. publicly traded firms of \$10.7 billion in 1996, \$43.1B in 2001, and \$55.9B in 2007. By comparison, Ritter (2010) reports U.S. initial equity offerings of \$42.2B in 1996, \$34.3B in 2001, and \$35.3B in 2007.

seasoning period for high rated bonds.[7] The main contribution in Chan and Chen (2007) is a test of the hypothesis that covenant renegotiation risk explains underpricing. The proxy that they use for renegotiation risk is bond rating and they find evidence of higher underpricing in low rated bonds.[8] Although our focus is very different from theirs, in light of their results, we include bond rating as a control for expected renegotiation risk in all regression specifications.

3 Empirical Framework

3.1 Variable Construction

The first step in the analysis involves calculating convertible bond at-issue discounts. Unlike the IPO and SEO aftermarkets, bonds trade infrequently, making first-day returns difficult to measure. To quantify pricing in the new issues market, we compute the discount of the offering price relative to the theoretical bond value. This measure is defined as: $Discount_i = 1 - \frac{P_i^{issue}}{P_i^{model}}$, where P_i^{model} is the theoretical bond price (described below) and P_i^{issue} denotes the issue price of the i^{th} bond in the sample. When $1 - \frac{P_i^{issue}}{P_i^{model}}$ is greater than zero, the interpretation is that the bond is underpriced.

The *Discount* measure requires calculation of the theoretical bond price when the bond is issued, P_i^{model}. The convertible bond pricing model used in this paper is a modified version of the binomial pricing model, similar to the procedure in Henderson (2006) and Choi, Getmansky, Henderson, and Tookes (forthcoming). For each new issue i in our sample, we compute the theoretical value of the bond at the time it is issued,$P_{i,0}^{model}$. The first step in this process is construction of the stock price tree. The model assumes that the issuer's stock price follows a geometric Brownian motion process with constant drift and volatility, a constant hazard rate of default, λ, and recovery rate R. The binomial tree is constructed using 50 time steps per year ($dt = \frac{1}{50}$). At each time-step, the stock price S may move up (to $u \times S$) or down (to $d \times S$), where the size of the stock price changes is a function of the stock's return volatility: $u = e\sqrt{(\sigma^2 - \lambda)dt}$, $d = \frac{1}{u}$.

The historical return volatility, σ, for each issuer's stock is the standard deviation of daily historical stock returns during trading days -160 through -20 days prior to issuance.[9] The default

[7]See also Henderson (2006) for convertible bond underpricing estimates. Kang and Lee (1996) examine post-issuance returns of a sample of NYSE listed convertible bond issues and focus on return minus the return on the Merrill Lynch Convertible Bond Index. The interpretation of this measure is somewhat challenging since the stock could outperform the index, causing an excess return in the bond. Instead, we focus on pricing the bond relative to the replicating portfolio as in Chan and Chen (2007).

[8]There is some evidence of underpricing in straight bond markets. Cai, Helwege, and Warga (2007) examine 421 straight bond initial public offerings and report statistically significant underpricing, especially in issues for which information asymmetry is high and rating low. Chen, Lesmond, and Wei (2007) provide evidence of strong links between pricing and liquidity in secondary bond markets.

[9]We use historical volatility rather than option implied volatility since not all issuers have traded options. In

intensity, λ, is inferred from credit spreads at the time of the offering. Specifically, with an implied recovery rate R, the implied default intensity is: $\lambda = \frac{r_c - r_f}{1-R}$, where: r_c is the yield on straight bonds with the same credit rating as the issue; r_f is the risk-free yield; and R is the fraction of par expected to be recovered in the event of default. For convertible bonds that are not rated, we assume each issue is BB rated.[10] We use 40% as the anticipated recovery rate based on historical recovery rates from Moody's.[11]

The probability of the up- and down-steps, p_u and p_d, respectively, are computed as: $p_u = \frac{e^{(r-q)dt} - de^{-\lambda dt}}{u-d}$, $p_d = \frac{ue^{-\lambda dt} - de^{(r-q)dt}}{u-d}$, where the parameter q is the continuously compounded dividend rate, estimated as the trailing 12-month dividend rate on the issuer's stock.

Construction of the convertible bond tree follows from the stock tree. Starting at the terminal node, corresponding to the final maturity date of the bond, the price of the bond is set equal to the maximum of the conversion value (conversion ratio times the stock tree price) or the par value of the bond. Specifically, the expiration date T value of the i^{th} convertible bond in the sample is: $P_{i,t} = MAX[PAR, CR_i \times S_{i,T}]$, where CR_i is the conversion ratio, and $S_{i,T}$ designates the issuers stock price at terminal node T.

The prior nodes on the tree are populated by working backwards. Starting with the time-step immediately prior to expiration, the value of the bond is the maximum of the discounted expected payoff and the conversion value. Specifically,
$P_{i,t} = MAX[e^{-r_f dt}(p_u \times P^u_{t+1} + p_d \times P^d_{t+1} + (1 - p_u - p_d) \times R \times PAR), CR_i \times S_{i,t}]$. We use call and put schedules compiled from SDC and Bloomberg for each bond and assume that these options are exercised optimally.[12]

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addition, most traded options have short maturities. As a robustness check, we recalculate the *Discount* based on the implied volatility and find that it is highly correlated with the *Discount* using the historical volatility input for the sample of firms with traded options. See the Appendix for more details.

[10]The mean rating for the rated bonds in our sample is 5.35, which corresponds to a Moody's rating of Ba or S&P rating of BB. We have repeated all analysis using the rating of BBB, the average rating for convertible bonds in Chan and Chen (2007) and while the implied discount in that case is much higher (14% on average), the results of regression analyses remain qualitatively similar. Note that our empirical tests rely on cross sectional variation, not absolute levels, of the discount.

[11]http://www.moodys.com/cust/content/content.ashx?source=StaticContent/Free%20Pages/Credit%20Policy%20 Research/documents/current/2007400000578875.pdf (Exhibit 16 provides historical recovery of unsecured bonds).

[12]Ingersoll (1977) uses a contingent claims approach to valuing convertibles in which the bond represents contingent claims on the firm as a whole. The benefit of this approach is that it endogenously accounts for default risk. The challenge in our setting is that we would need to model the value of the entire firm, including all liabilities that are senior to the convertible. We therefore choose to value the bond based on the stock price tree.

3.2 Data and Summary Statistics

The initial sample of 144-A convertible bond offerings is based on Sagient's Placement Tracker database for the years 1997 through 2007.[13] These data include placement agent and investor name, the holdings of each individual investor and a description of the investor type (e.g., mutual fund, hedge fund, pension fund, etc). There are 1,176 unique 144-A convertible bond issues in the database. Table 1 provides an example of the $125 million convertible bond offering by Documentum in April 2002. UBS Warbug LLC was the placement agent and charged a 2.96% fee for the transaction. The table shows each investor, investment advisor, and a description of the type of investor, as reported in Sagient. As can be seen from Table 1, some investors are from the same family. For example, Allstate Insurance Company invested $864,263 in the Documentum issue and Allstate Life Insurance invested $463,131. Both investors are advised by Allstate Investments LLC. To reduce potential double-counting of investors, whenever the investor and advisor have common names, we replace the investor name with the advisor's name. In the Allstate case, we treat the two investors as one investor with a total investment of $1,281,534. The Documentum deal has a total of 35 unique investors, of which 48.6 percent have purchased 144-A convertible bonds in a prior UBS deal.

In choosing a relationship measure, we take a very simple approach: we use the Sagient data to calculate the fraction of investors in a particular issue that have purchased a new 144-A issue by the same placement agent in the past 24 months, relative to all investors in the issue. Although in very different settings than ours, Cohen, Frazzini, and Malloy (forthcoming), Davis and Kim (2007) and Mehran and Stulz (2007) also focus on economic implications of investor relationships and construct similar variables to estimate these links.

To obtain issue characteristics, we match the Sagient bonds with convertible bond offerings in the Securities Data Corporation New Issues database (SDC) based on ticker, name, and closing date of the issue. When we are unable to obtain a match in the SDC database, we match with bond issue data from Bloomberg. We exclude from the sample: all exchangeable and mandatory issues; issues with floating conversion prices or coupon rates; and any issues that are missing important terms, such as the coupon rate or conversion ratio.[14] After filtering, we obtain discount estimates

[13]The Placement Tracker data begin in 1995; however, one of the variables of interest is calculated as the number of investors who have participated in an issue by a given placement agent within the last 24 months, requiring a 2-year observation window prior to the earliest cross-sectional observation. We have examined shorter windows for this measure but because we require a placement agent to have a prior deal over which we can measure relationships, shorter windows decrease the number of observations. Longer windows also decrease the number of observations in that more of the first years of the sample become invalid.

[14]Conversion price is the price at which the convertible bond investors may convert their bonds to shares of the issuer's stock.

for 848 bonds. We further require data on all explanatory variables of interest, including the prior relationship measures, leaving a final sample of 533 issues from a broad cross-section of industries.[15] There are 37 unique placement agents and 3,063 unique investor names in the final sample. Note we do not have all of the information required to evaluate every potential way in which investment banker-investor relationships may matter (for example, we do not systematically observe business between bankers and investors outside the 144-A convertible bond market); however, the investor identity information that we use allows us to make significant progress towards capturing the ease of identifying potential investors.

The Placement Tracker data have been used in recent papers of the impact of investor type in private issues of public equity (PIPES). These studies have examined the role of investor type on future equity price performance (Brophy, Ouimet, and Sialm (2009) and on the pricing of PIPES (Meidan (2006). They differ substantially from our paper in their focus on investor type (e.g., hedge funds versus pension funds) rather than investor identity and they also do not include convertible bonds, mainly due to the unobservable nature of the "fundamental prices." We circumvent this problem by estimating a theoretical at-issue price. Huang, Shangguan, and Zhang (2008) also use the Sagient data and, like this paper, measure repeat interactions. They address the question of whether banks with large networks help issuers attract investors in PIPE offerings. Unlike this paper, Huang, Shangguan, and Zhang (2008) do not examine the relationship between networks and pricing or links between fees and networks, questions that are central to our analysis.

Table 2 presents summary statistics for the variables used in the analysis. The first and most important observation from the table is that convertible bonds are issued at substantial discounts. The mean (median) discount relative to fundamental value of the 144-A convertible bonds at issue is sizable, at 6.99% (5.35%). This is similar to the magnitudes reported in prior studies of convertible bond discounts (e.g., Henderson (2006) and Chan and Chen (2007)) and, as might be expected, is less than the magnitude of the discount reported in private placements of equity (e.g., 20 percent, reported in Hertzel and Smith (1993)). While our evidence suggests that convertible bonds are substantially underpriced on average, the variable exhibits significant variation, with an interquartile range of -1.61% to 14.1%. Similar variation is seen in the first day returns of IPOs (see e.g., Ritter (2010)).

Table 2 shows that gross proceeds (issue size) tend to be substantial, with sample mean (median)

[15]When we relax that restriction for non-missing data on fees and instead introduce a dummy variable equal to 1 if fee information is missing in all regressions, the sample size increases to 656, and all results are similar but with greater statistical significance. The coefficient on the missing fee dummy variable is positive and significant in most specifications, suggesting higher discounts when fee data are missing.

of \$274.1 million (\$175 million). The mean (median) fee paid to the placement agent is 2.9% (3.0%) of the total issue, with an interquartile range of 2.5% to 3.2%. Unlike IPOs, in which there is very little variation in gross spreads (see Chen and Ritter (2000)), we observe substantial variation in our sample. This provides an opportunity to analyze the question of what drives fees. There are 55.5 investors in the average issue, and 69.8 percent are related to the placement agent in that they have participated in at least one of the placement agent's issues in the last 24 months.[16] The interquartile range of the number of investors is 29 to 73 and for the fraction of repeat investors measure it is 57.1 percent to 88.5 percent. We use these variables as proxies for after-market liquidity in the bonds and ease of search for investors in placing the issue, respectively.

The median bond in our sample is unrated. Of the rated bonds, the average rating is just below investment grade. The mean rating corresponds to a bond with S&P rating BB. This is expected, given that convertible bonds are a popular source of financing for firms of lower credit worthiness. In regression analysis, we control for bond rating by including five dummy variables: $RateA$ corresponds to S&P Ratings of AAA, AA and A; $RateB$ corresponds to S&P Ratings of BBB, BB and B; $RateC$ corresponds to S&P Ratings of CCC, CC and C; $Junk$ is a dummy that equals one if the bond is below investment grade; $Unrated$ is a dummy equal to one if the bond is unrated.

The sample contains both equity and debt-like issues. The mean conversion premium is 0.33, with a standard deviation of 0.16. Given this variation in nature of the convertible bonds in the sample, it is not surprising that we also observe substantial variation across the types of investors that purchase the issues. Of the investors identified by type in the Sagient database, 53.1% of the proceeds are purchased by hedge funds.[17] The second and third largest purchasers are broker-dealers (22.2% of the proceeds) and mutual funds (18.4% of the proceeds), respectively. The remaining identified investors are insurance/pension funds, corporations, banks, venture capital and private equity funds, charitable/educational investors and family trusts.

The variable $MarketShare$ measures the placement agent's market share of prior 144-A convertible bond issues over the twenty four months preceding the bond offering. The mean (median) $MarketShare$ is 10.98% (7.57%) with a standard deviation of 9.80%, indicating the sample includes

[16] We expect that the marginal investor is an unrelated investor (in all bond issues with less than 100% repeat investors) and that this investor is the one that impacts pricing. In robustness analysis, we introduce an alternative relationship measure intended to capture the intensity of the prior relationships (*Strength*) which has a mean of 0.186, median of 0.183 and interquartile range of 0.145 to 0.220. See the discussion of Table 5, below.

[17] This is somewhat lower than values reported in previous papers (Mitchell, Pedersen, and Pulvino (2007); Choi, Getmansky, and Tookes (2009) and Choi, Getmansky, Henderson, and Tookes (forthcoming)). The difference may be due to the fact that 36 percent of the bonds are purchased by investors with missing investor type information in the Sagient database (these are labeled "Unknown" in the database).

rich variation in the placement agents' deal flow prior to an offering. *PriorInvestorActivity* measures the importance of the investors in bond i in the placement agent's prior deals. The sample average (median) indicates that in the average deal, the investors in a convertible bond offering purchased 22.7% (21.9%) of the placement agent's convertible bond deal flow over the previous twenty four months.

It is important to note that we observe only those investors in 144-A issues that choose to be named. They must do so if they plan to sell the bond to public investors at some point in the future. The mean (median) fraction of issues bought by unnamed investors is 30.9 (19.7) percent in the Sagient sample. We exclude unnamed investors when counting the number of investors to facilitate clearer interpretation of the after-market liquidity proxy since the objective is to construct a measure of investors that may plausibly intend to trade the bond. We do not expect the unnamed investor group to create bias in the estimated relationship between the repeated interaction measure and discounts since we do not have reason to believe that named investors are more or less likely to be related to the placement agent than unidentified ones.

The Sagient data also include announcement dates for 144-A issues during the later years of the sample (2003-2007). There are 294 bonds in the subsample for which we have announcement dates. We calculate cumulative abnormal returns (equity return minus the CRSP value-weighted return) for days -1 to +1 relative to the announcement date and observe a significant negative abnormal return of -3.1%. In extended analysis intended to aid in the interpretation of the *Discount* measure, we test whether discounts are related to the equity price response to the bond issue.

We control for asymmetric information in all regressions by including an analyst following measure, *NumAnalysts*, as a proxy for (low) asymmetric information. We measure analyst following as the log number analysts submitting annual earnings per share forecasts in IBES. The firms in the sample tend to have high analyst coverage, with a mean analyst following of 15.0; however, there is substantial variation, as *NumAnalysts* has a standard deviation of 11.1.

Figure 1 shows the time series of total proceeds and at-issue discounts for each year of the sample. Issuance increases sharply through 2003 and then decreases during the last years of the sample period. Average at-issue discounts have fluctuated over time, ranging between 5 and 15 percent for most years in the sample. Given these patterns, we estimate all regressions with and without with year fixed effects. Figure 2 shows the time series of the number of investors in the average bond issue, as well as three measures of the extent to which bond investors are repeat investors for the placement agent. Except during the first few years of the sample period, the average values of these measures remain fairly stable over time.

Ellis, Michaely, and O'Hara (2000) find that underpricing is significantly related to post-issuance trading activity by underwriters. Due to data limitations, we are unable to test this price support hypothesis directly; however, we were able to obtain market maker trading activity for a small sample of 144-A convertible bond issues by Nasdaq firms (24) during the June 2005 through June 2006 time period. We do find increased market maker trading activity in the stock near issuance. See Figure 3.

3.3 Correlations

Table 3 provides a correlation matrix of the key variables used in the analysis. From the table, observe that at-issue discounts are smaller (i.e., bonds are issued at higher prices relative to fundamental value) when: issues are larger; there are more investors in the issue; the fraction of repeat investors relative to all investors is high; and bonds have longer maturities. Discounts are significantly higher when: placement agent fees are high and when there is more "buyer power" in a given deal (the proxy for buyer power is deal HHI, the sum of squared shares of the issue bought by individual investors). We also observe a significantly negative relationship between at-issue discounts and shareholder wealth effects (CAR_{Market}) at the announcement of a bond issue. The regression analyses given below will shed more concrete light on these univariate relationships.

3.4 Empirical Specification

The main empirical specification is as follows:

$$Discount_{i,t} = \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 RepeatInvestors_{i,t} + \beta_3 X_{i,t} + \epsilon_{i,t}. \quad (1)$$

$Discount$ is the discount of the issue price relative to fundamental value. Recall that when this variable is positive, the interpretation is that the bond is underpriced. Smaller values for the $Discount$ measure indicate that the bond is priced higher relative to fundamental value. The number of investors in the issue, $NumInvestors$, is a proxy for after-market liquidity and is intended to capture the number of potential investors in the secondary market. We expect β_1, the estimated coefficient for $NumInvestors$, to be negative. This hypothesis is consistent with the models of Duffie, Garleanu, and Pedersen (2005) and Duffie, Garleanu, and Pedersen (2007) where more potential investors lead to higher prices. There is some evidence in the literature that liquidity is an important determinant of pricing in the 144-A market for already-issued (rather than new) securities. Chaplinsky and Ramchand (2004) find that the yield on Rule 144-A corporate bonds is 0.49% higher than on unrestricted bonds with similar characteristics. Although this evidence comes from seasoned corporate bonds and includes straight bonds, it highlights the potential importance of after-market liquidity in corporate bond markets and in 144-A bond markets in particular.

$RepeatInvestors$, defined as the fraction of investors that have purchased a new 144-A issue from issue i's placement agent during the past two years, is the proxy for the ease of finding initial investors. If search costs are reduced by attracting familiar investors, then aggressive bond pricing can be avoided and we would expect to observe higher bond prices relative to fundamental value. That is, we would expect $\beta_2 < 0$. If on the other hand, conflict of interest dominates (rewarding repeat customers with more underpriced issues as in Benveniste and Spindt (1989) or underwriter information as in Baron (1982)), then this variable will be positively related to the discount ($\beta_2 > 0$).

Additionally, we include the vector X comprised of the following control variables: bond rating; (log) issue size ($GrossProceeds$); number of equity analysts covering the firm ($NumAnalysts$); and underwriter fees ($Fees$). Bond ratings are represented by four dummy variables: *RateB*, a dummy variable equal to 1 if Moodys or S&P rates the bond as a "B"; *RateC*, a dummy equal to 1 if Moodys or by S&P rate the bond as a "C"; *Junk*, a dummy equal to 1 of the bond Moodys or S&P rate the bond below investment grade; and *Unrated*, a dummy equal to 1 if Moodys and S&P do not assign a debt rating to the bond. The *Junk* dummy is included to capture within-group variation in the *RateB* category, in which some bonds are investment grade and some bonds are not. Relative to A-rated bonds (the intercept), if bond ratings capture renegotiation risk and this risk is reflected in bond discounts as argued by Chan and Chen (2007), we expect all coefficients on the ratings dummies as well as the *Junk* variable to be positive. We also expect the *RateC* coefficient to be greater than *RateB*.

$GrossProceeds$ and $NumAnalysts$ are included to control for information asymmetry at the issue and firm level, respectively. These are included based on prior findings that new issue discounts are positively and significantly related to information asymmetry. *Fees* are included to examine the hypothesis that investment banking fees reflect bankers' efforts to decrease bond discounts. If this is the case, then we would expect lower fees in bonds that have higher discounts.

4 Results

4.1 What Factors Drive Convertible Bond Discounts?

Table 4 shows results of regressions in which *Discount* is the dependent variable. All standard errors are robust to heteroskedasticity (White (1980)). Columns 1 and 4 of Table 4 show the baseline regression in which the bond ratings measures are the only explanatory variables (these variables are a subset of the control variables contained in the vector X in Equation 1). This is based on Chan and Chen (2007), who use credit rating as a proxy for renegotiation risk to examine the hypothesis that convertible bond discounts are due to the possibility of covenant renegotiation. Columns 1 and 4 in Table 4 differ in that the equations are estimated without and with year fixed effects, respectively. Consistent with our expectations, we observe positive estimated coefficients on $RateB$ and $RateC$ dummy variables in both specifications; however, these are significant only for $RateC$ in the regression with year fixed effects. The $Junk$ dummy has a negative and significant estimated coefficient in all specifications. This suggests that investment grade B bonds are more underpriced than non-investment grade B bonds. While somewhat puzzling, this finding is consistent with Chan and Chen (2007) in that they also find higher initial discounts for Baa1, Baa2, Baa3 and Ba1 bonds than they do for Ba2 bonds.[18]

Table 4, Column 2 (without fixed effects) and Column 5 (with year fixed effects) provide the main results of our analysis. The regression specifications include the two search frictions proxies, as well as proxies for information asymmetry and the bond rating controls. The main result is that both of the proposed dimensions of liquidity matter. That is, we observe negative and significant relationships between both the number of investors in the issue (the proxy for after-market liquidity), as well as the fraction of investors who are the placement agent's repeat customers (the proxy for the ease with which the placement agent attracts investors). Recall, the mean convertible bond discount relative to fundamental value is 6.99%. All else equal, a one standard deviation increase in the number of investors from its mean results in a decrease in the at-issue discount of 0.59% (i.e., reduction from 6.99% to 6.40%). A one standard deviation increase in the fraction of repeat investors results in a decrease in the at-issue discount relative to fundamental value of 1.08% (i.e., at its mean, a reduction from 6.99% to 5.91%). Taken together, these findings suggest that search frictions play a meaningful role in bond pricing and that intermediaries can add value through their repeated interactions with investors. This result is in contrast to conflict of interest hypotheses, in which banks use at-issue discounts to reward favored clients.

Consistent with the information asymmetry findings in the IPO literature, the results in Table 4 (Columns 2 and 5) also show a significant role for reduced information asymmetry in bond pricing. That is, the estimated coefficient on $NumAnalyst$ is negative and significant. In addition, we find that high $Fees$ are associated with larger discounts.

[18]See Chan and Chen (2007), Table 1, in which these initial pricing discounts relative to fundamental values are estimated to be -8.78, -8.74, -7.17, -7.47 and -6.25, respectively.

An alternative interpretation for the negative and significant coefficient on the number of investors measure ($NumInvestors$) is that this variable proxies for investor interest in the deal, rather than secondary market liquidity. In extended regressions we add a debt maturity measure ($Maturity$) as an additional proxy for after-market liquidity. The basic idea is that as the maturity of the issue becomes longer, short-horizon investors will be less attracted to the bond due to concerns about the ability to sell the bond in the after-market and is motivated by Amihud and Mendelson (1991), who find that the yields on shorter maturity treasuries are substantially smaller than on less liquid long-maturity treasuries. The results of this regression are in Table 4, Columns 3 and 6. We find that debt maturity is positively and significantly related to *Discount*. That is, longer maturity bonds are priced lower relative to fundamental value. Even if the interpretation of $NumInvestors$ as a proxy for investor interest is valid, the $Maturity$ results suggest a positive role for after-market liquidity in bond pricing. Moreover, the significant and negative coefficient on the related investors measure (*RepeatInvestor*) remains and provides strong evidence that investor base is an important determinant of pricing.

In addition to adding the $Maturity$ measure to the extended analysis presented in Table 4 (Columns 3 and 6), we also include an investor buyer power measure, HHI, and a leverage variable, *DebtRatio*. The HHI measure captures the concentration of investor allocation within an issue. If buyer power matters, we expect that issues in which buyer power is high (high HHI) will be more underpriced. That is, we expect to observe a positive relationship between *Discount* and HHI. We include a *DebtRatio* control variable based on the idea that issuers that already have large amounts of debt outstanding may be forced to issue convertible bonds with less favorable terms. We find that the buyer power measure is insignificant after controlling for prior relationships and the number of investors in the deal (HHI is significantly related to *Discount* in the univariate correlations in Table 3). Not surprisingly, the estimated coefficient on the *DebtRatio* variable is positive, although only marginally significant. This suggests that firms that already have high leverage encounter greater difficulties placing new debt.

4.2 Strength of Placement Agent- Investor Relationships

The baseline analysis in Table 4 uses a very simple measure to define the extent to which placement agents are able to sell bonds to past investors. In order to capture the intensity of the relationship between placement agents and their investors, we examine an alternative definition of placement agent-investor links.

We introduce a new measure, *Strength*, which captures the average participation of investors in issue i in all 144-A convertible bond issues by i's placement agent during the past 24 months.[19] We compute $Strength$ as:

$$Strength = \frac{1}{N}\sum_{i=1}^{N}\frac{NumberOfPriorIssuesByPlacementAgentInWhichInvestorParticipated}{TotalPriorDealsByPlacementAgent} \tag{2}$$

where N is the number of investors in the bond issue. $Strength$ has a mean of 0.186, median of 0.183 and inter-quartile range of 0.15 to 0.22.

In Table 5 we repeat the main analysis (Table 4), but replace $RepeatInvestor$s with the $Strength$ measure. We find that the strength of relationship improves bond pricing. The estimated coefficients range from 0.204 to 0.217 in the four specifications, with even larger economic magnitudes than the coefficients on $RepeatInvestors$ in Table 4. The results in Table 5 suggest that a one standard deviation increase in the average strength of the relationship between investors and the placement agent decreases the at-issue discount by 1.3 to 1.4 percent (at its mean, a reduction in the $Discount$ from 6.99% to approximately 5.64%). Similar to the main results, this is consistent with the hypothesis that when a placement agent attracts important investors from her "rolodex," aggressive discounting becomes less critical for successful placement of the offering.

4.3 Potential Endogeneity of Fees

It is possible that investment banks set fees and determine bond pricing simultaneously. To account for the potential endogeneity of fees, we use the two-stage-least squares procedure to estimate the following system of equations:

$$\begin{aligned} Discount_{i,t} &= \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 RepeatInvestors_{i,t} + \beta_3 GrossProceeds_{i,t} \quad (3)\\ &\quad + \beta_4 Fee_{i,t} + \beta_5 NumAnalysts_{i,t} + \beta_6 Rating_{i,t} + \beta_7 HHI_{i,t} + \beta_8 Maturity_{i,t}\\ &\quad + \beta_9 DebtRatio_{i,t} + \epsilon_{i,t}\\ Fee_{i,t} &= \mu + \gamma_1 RepeatInvestors_{i,t} + \gamma_2 GrossProceeds_{i,t} + \gamma_3 Discount_{i,t} \quad (4)\\ &\quad + \gamma_4 MarketShare_{i,t} + \gamma_5 PriorInvestorActivity_{i,t} + \gamma_6 EquityLike_{i,t}\\ &\quad + \gamma_7 MarketCap_{i,t} + \upsilon_{i,t}. \end{aligned}$$

The specification for the $Discount$ equation is identical to the extended regressions in Table 5,

[19]While in a very different setting from ours, Davis and Kim (2007) also examine relationship intensity measures. Their study examines proxy voting by mutual funds with the goal of understanding whether there is a link between their voting patterns and other links between mutual funds and a firm. They examine both whether a relationship exists and its strength (fees from a given client).

Columns 3 and 6. The additional identifying variables in the *Fee* equation are: *MarketShare*, defined as the placement agent's share of all 144-A convertible bond issues in the Sagient database during the prior two years; *PriorInvestorActivity*, defined as all proceeds bought by issue *i*'s investors from issue *i*'s placement agent, divided by all of the proceeds raised in placement agent's 144-A issues during the prior two years; *EquityLike*, a dummy variable equal to 1 if the bond's conversion premium is less than 20 percent[20]; and *MarketCap*, the (log) market capitalization of the issuer at the end of year t-1. *MarketShare* measures underwriter reputation. In the IPO and SEO literature, researchers find the underwriter's market share to be negatively associated with underwriter fees (see e.g. Eckbo, Masulis, and Norli (2007), Kim, Palia, and Saunders (2008)). The variable *PriorInvestorActivity* captures the importance of the investors in bond *i* in the placement agent's prior deals and captures the extent to which a placement agent's prior customers tend to return to buy bonds from that agent. Since it measures the ease of attracting customers, we expect *PriorInvestorActivity* to be negatively related to fees. Note that *PriorInvestorActivity* does not capture how important related investors are *within* a given issue (this is reflected in the fraction of related investors variable, *RepeatInvestors*).[21] *EquityLike* is included due to the hybrid nature of convertible bonds and the empirical regularity that underwriter fees for equity issues are much higher than for debt issues. For example, Kim, Palia, and Saunders (2008) report median underwriter spreads of 7.0% for IPOs, 5.0% for SEOs and 0.65% for debt offerings. Finally, we include the *MarketCap* of the issuer to capture the potential bargaining power of the issuer.

Results are presented in Table 6. Panel A contains the *Discount* results, which are similar to the main findings in the Table 4 extended regressions. The most important observation from Table 6, Panel A is that all search frictions proxies - *NumInvestors*, *RepeatInvestors*, and *Strength* - remain negatively and significantly related to the *Discount*, with the exception of *RepeatInvestors* in the fixed effects specification. All signs of the other coefficients are consistent with the main analysis in Table 4, although a few coefficients lose or gain significance relative to the Table 4 regressions. In particular: the *RateC* dummy variable becomes positive and significant, consistent with Chan and Chen (2007); *DebtRatio* becomes significant in the fixed effects specifications; both *Fees* and *NumAnalysts* become less significant.

The *Fee* equation results are in Table 6, Panel B. We find that the fees charged by banks are lower when there are more related investors but that the strength of the relationship between the

[20]The conversion premium is a continuous variable about which we have full information; however, the relationship between fees and conversion premium is non-linear in the data.

[21]For example, if 2 of 10 investors in a bond issue *i* purchased 10% of a placement agent's prior bond issues, *PriorInvestorActivity* equals 10% and *RepeatInvestors* equals 20%. If we add 10 new bond investors to bond issue *i*, the *PriorInvestorActivity* value remains 10%, but the *RepeatInvestors* measure decreases to 10%.

placement agent and investment bank does not impact fees, nor does *PriorInvestorActivity*, the importance of the issue's investors in recent deals by the same bank. In other words, the evidence suggests that having a relationship with investors impacts fees, but that the intensity of that relationship is not important. Both issue size (*GrossProceeds*, to account for scale economies) and the proxy for bargaining power of the firms (*MarketCap*) are, as expected, associated with lower fees. After controlling for these variables, we find a significant negative relationship between at-issue discounts and fees. That is, we observe higher percentage fees when bonds are priced favorably. The latter finding is consistent with banks charging higher fees as compensation for obtaining high prices for the bonds; however, the finding that relationships decrease fees is consistent with a reduction of search costs that is transferred to firms. Finally, we find that fees are significantly higher when convertible debt issues are more equity-like. This is consistent with prior findings of higher gross spreads in equity issues than in debt issues (e.g., Kim, Palia, and Saunders (2008)).

Taken together, the results in Tables 4 through 6 provide strong evidence that reducing search frictions improves pricing of an issuer's bonds as well as fees paid to placement agents. The finding that *RepeatInvestors* are associated with higher bond prices is contrary to the conflict of interest hypothesis, but consistent with models of search costs and friction.[22]

4.4 Investor Experience and Contracting Complexity

An alternative interpretation of the relation between repeat investors and deal pricing is that our measure of placement agents' repeat investors may capture investor sophistication as opposed to the relationship between investors and placement agents. Issuing convertible bonds to investors who already have experience purchasing these securities (from any placement agent) may reduce the contracting complexities that would exist for investors that are new to the 144-A convertible bond market. To provide sharper identification of the role of repeated interactions between investors and placement agents versus investor sophistication, we introduce a direct measure of investor experience. The variable *InvestorExperience* is defined as the fraction of issue i's proceeds bought by investors who have invested in a 144-A convertible bond (i.e., investors in the Sagient database) over the preceding 24 months. This measure captures the importance of experienced investors within bond issue i.[23] The mean value of this new measure is 0.97, and the standard

[22] We focus on repeated interaction between the placement agent and the investors. When a given investor is part of a family of investment funds, we aggregate up to to the family lever, as discussed in the description of Table 1. We repeat all analysis using two additional definitions (1) keep all investors separate and (2) aggregate all investors based on their advisors and define relationships with placement agents based on their advisors. All of the main results carry through. These results are not included (for brevity), but are available upon request.

[23] In untabulated robustness analysis, we have also defined *InvestorExperience* as the fraction of all 144-A convertible bond proceeds in the Sagient database that have been purchased by the investors in issue i over the preceding 24

deviation is 0.08, suggesting that 144-A investors tend to be experienced. The correlation between $InvestorExperience$ and $RepeatInvestors$ of 0.28 and is highly statistically significant, which may introduce some multicollinearity; however, as a check, we repeat the regressions shown in Tables 4 through 6, with $InvestorExperience$ as an additional explanatory variable.

Table 7 provides results that are analogous to the extended regressions in Tables 4 and 5. The signs of the estimated coefficients are negative for both investor experience and placement agents' repeat interactions with investors; however, the former effect is statistically insignificant. Importantly, the repeated interactions with the placement agent dominate the impact of investors' prior bond market purchases on pricing. As in the main analysis, we also find that asymmetric information ($NumAnalyst$), placement agent fees, and after market illiquidity as captured by $Maturity$ are all positively and significantly related to the at-issue $Discount$.

In Table 8, we repeat the Table 6 analysis, in which we explicitly account for potential endogeneity of placement agent fees. As in Table 7, we find the effect of placement agent-investor relationships on the $Discount$ to dominate the role of investor sophistication ($InvestorExperience$). Panel B of Table 8 reports results of estimating the Fee equation. Interestingly, the results suggest that the investor sophistication effect dominates the repeat interaction effect on investment banking fees. In all specifications of the Fee equation, estimated coefficients on the $InvestorExperience$ measure are negative and significant and the estimated coefficients on the repeat interaction variables ($RepeatInvestor$ and $Strength$) are insignificant. This suggests that the finding in Table 6 that investment banking fees are reduced when bonds are placed with a placement agent's $RepeatInvestors$ should be interpreted as the reduced contracting complexity associated with placing the 144-A convertible bonds in the hands of experienced investors.

4.5 The Discount Measure and Subsequent Price Convergence

Given the importance of the $Discount$ measure in the main analysis, we next consider the question of whether the $Discount$ actually captures deviations in price relative to fundamental value. The similarity of our estimates with the estimates in Chan and Chen (2007), in which the authors use two alternative pricing models, provides some external validation; however, we provide an additional check using secondary market return data. For all issues in which we were able to obtain quote data in Datastream within one week of 30, 90, and 365 calendar days post issuance, we calculate

months. This measure captures the importance of the investors in the overall 144-A convertible bond market rather than the importance of experienced investors within issue i. The results regarding the importance of $RepeatInvestors$ remain consistent with the main results and are even stronger than those presented in Table 7. The alternative investor sophistication measure is insignificant in all regression.

abnormal bond returns. We then calculate the correlation between this after-market return and the *Discount* proxy. We expect that bonds that are priced lower relative to fundamental value to experience higher subsequent returns (i.e., price convergence).

Abnormal bond returns are defined as the change in price (accounting for coupons paid and accrued interest) from date of issue, minus the benchmark return. We define the benchmark return based on whether the bond is "equity-like" (conversion premium of 20 percent or less) or "debt-like" (conversion premium greater than 20 percent). For equity-like issues, the benchmark consists of 80 percent of the issuer's own-stock and 20 percent of the Lehman Corporate Bond Index. For debt-like issues, the benchmark consists of 40 percent own-stock and 60 percent of the Lehman Corporate Bond Index.[24]

Table 9 shows the correlation between our *Discount* measure and the bonds for which we were able to calculate abnormal returns. Even though the sample is very small relative to the full sample (ranging from 18 bonds to 172, depending on the return window), we observe a significantly positive relationship between price relative to fundamental value and subsequent returns. The correlation over the one year horizon is 0.25 and is statistically significant. That is, bonds that are more underpriced at issue have higher subsequent excess returns and do converge towards fundamental value. This provides market-based validation for the model based pricing measure. The analysis in the next section, in which we link the *Discount* to abnormal returns near the announcement of the issue, provides even stronger interpretation.

4.6 At-Issue Discounts: Costly to Equity-Holders?

As shown in Table 2, the convertible bonds in our sample are priced approximately 6.99% lower than fundamental value. A natural question to ask is whether this is optimal from the perspective of the firm. For example, in the theoretical IPO literature, underpricing can be an optimal solution to an asymmetric information problem (e.g., the winner's curse as in Rock (1986)). The main finding in this paper is that both liquidity and search costs explain bond discounts, even after controlling for asymmetric information and other determinants of underpricing from the literature. Given our findings, should issuers seek to reduce discounts in their bonds by identifying placement agents that can attract large numbers of repeat investors? One way to address this question is to examine the link between discounts and equity market returns near convertible bond announcements.

Using convertible bond announcement dates provided in Sagient for the years 2003 through 2007, we examine the relationship between abnormal equity returns at the time of convertible bond

[24] Cai, Helwege, and Warga (2007) also use the Lehman Corporate Bond Index in their examination of after-market returns of straight bonds.

announcement and convertible bond discounts. The summary statistics in Table 2 show that equity returns decline by more than 3 percent at announcements of convertible bond issues. If discounts are signals of firms' high values, we would expect to see a positive relationship between the *Discount* variable and stock returns at the time of the bond issue (i.e., higher equity price response if bonds are priced lower than fundamental value). If, on the other hand, discounts are due to costly frictions such as illiquidity or search costs in markets, we expect that at-issue discounts of convertible bonds are costly to the firm. That is, we would observe a negative relationship between *Discount* and abnormal returns at announcement.[25]

Table 10 contains results of regressions in which the dependent variable is the day -1 to +1 cumulative above market return at announcement of the bond issue. The explanatory variables are *DilutionPercent* (included to control for the possibility that convertible bonds are "backdoor" equity issues, as in Stein (1992)), *Discount*, and *Fees*. The most important finding in Table 10 is the positive and significant relationship between the *Discount* and equity market returns. For example, the estimated coefficients of 0.076 in the fixed effects specification suggests that a one standard deviation increase in the at-issue discount decreases abnormal equity returns by 1.06% (e.g., at its mean value, a decrease in abnormal returns from -3.12% to -4.18%). This result suggests that initial discounts are, indeed, costly for shareholders. As in Tables 4 through 8, all regression specifications are repeated with and without year fixed effects. Results are similar across both specifications.

5 Conclusions

Our main findings reveal two previously undocumented (to our knowledge) frictions that impact the initial pricing of convertible bonds: search costs and after-market liquidity. We document a robust negative relationship between at-issue discounts of convertible bonds and investors' prior participation in bond issues by the investment bank. We also find a strong negative relationship between bond discounting and proxies for after-market liquidity. Somewhat surprisingly, we do not find evidence consistent with conflict of interest models, in which bankers reward favored investors with more underpriced issues. In extended analysis, we also find that investment banking fees are also lower when search costs are low. Taken together, these findings suggest that search frictions

[25]In unreported analysis, we examined whether investor type plays a role in the equity price response to a bond issue. Meidan (2006) examines this question for a sample of PIPES. Using the share of proceeds bought by investor group i (hedge funds, mutual funds, pension/insurance companies, venture capitalists, education/family trusts, corporations, banks, and broker/dealers) as explanatory variables, we find results that are consistent with Meidan (2006). Investor type does not explain market reaction to the issue. Further, it is unrelated to underpricing.

play a meaningful role in bond pricing and that intermediaries can add value through their repeated interactions with investors. When we examine shareholder wealth effects, we find that equity price responses to Rule 144-A convertible bond issuance announcements are lower when bond are more underpriced. This suggests that efforts to reduce search frictions would be value-enhancing to shareholders.

Appendix A Pricing Model Robustness

The *Discount* variable, based on the theoretical bond pricing model described in Section 3.1, is our central dependent variable. Although variation in this variable across bond issues is of first order importance (i.e., rather than the level), it is reasonable to ask how sensitive the *Discount* measure is to the assumptions regarding volatility, recovery rates, and the rating of unrated bonds. For robustness, we re-estimate the pricing model to compute the offering *Discount* under a range of assumptions. In particular, we: (1) replace the historical volatility input with implied volatility data from Option Metrics;[26] (2) assume that unrated bonds have a BBB rating rather than BB; (3) and assume separate recovery rates for investment grade and non-investment grade issuers rather than a uniform 40 percent.[27]

The correlations of the *Discount* measures, based on model-implied bond values under all combinations of the alternative assumptions (1) to (3) above, are presented in Table A.1. The correlations are high in magnitude, ranging from 0.76 and 0.98, as well as statistically significant. Importantly, almost all correlations are also negatively and significantly related to the search frictions identified in this paper (placement agents' repeat investors and the number of investors in the issue).

Note that each of the alternative assumptions has its own advantages and disadvantages. Using implied volatility rather than historical volatility is potentially attractive since it mitigates potential concerns about changes in volatility near issuance if the implied volatility is a good proxy for forward looking expected volatility; however, we chose not to use implied volatility in the main analysis for two reasons. First, the traded options typically have much shorter maturities than the convertible bonds. Second, not all firms have traded options. In fact, the sample size is reduced by 23% when we rely on implied volatilities. We examine the credit rating assumption of BBB since the median convertible bond in Chan and Chen (2007) is rated BBB. We chose to use BB in the main analysis because the median bond in our sample is rated BB. Varying the recovery rate is potentially the most intuitive assumption; however, we chose to use a 40 percent recovery rate in the main analysis since it is a common assumption in practice. We chose the inputs to the pricing model which we determined to be most appropriate and the high correlation across all of the *Discount* measures in

[26] For each convertible bond issuer in the sample, we identify from the OptionMetrics "vsurfd" file, the implied volatility of the issuer's stock. For each issuer, on the deal closing date, we select the implied volatility for the longest time-to-maturity surface available in Option Metrics for this issuer. We choose the implied volatility on that surface with a strike price most closely matching the conversion price of the convertible bond.

[27] Recovery rate data for "fallen angels" (investment grade issuers that subsequently became non-investment grade) and high yield issues were obtained from Edward Altman's website:
http://pages.stern.nyu.edu/~ealtman/1-%20DefRetIn%20HYBMarket%202004.pdf.

Table A.1 shows that the variation in this measure is robust across a range of reasonable inputs.

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Table 1: Deal Information

This table presents investor-level details for a representative convertible bond from the Sagient Placement Tracker Database. The table presents the bond investor name, the investor's advisor's name, Sagient's classification of the investor type, and the amount each investor purchased of this offering. The following abbreviations are used in the investor type field: Broker Dealer (BD), Corporation (CORP); Hedge Fund Manager (HF); Insurance (INS); Mutual Fund Institutional Advisor (MF); and Unknown (UNKN). The sample deal totals $125 million and was issued by Documentum on April 5, 2002. Documentum paid the placement agent (UBS) fees of 2.96%. UBS's repeat customers (i.e. customers that bought another 144A convertible bond issue from UBS during the past twenty four months) make up 48.6% of the investors in the issue.

Investor Name	**Advisor Name**	**Investor Type**	**Investment Amount**
Ace Tempset Reinsurance Ltd.	Ace Tempset Reinsurance Ltd.	INS	384,418
Akela Capital Master Fund Ltd.	Akela Capital LLC	HF	854,263
Allstate Insurance Company	Allstate Investments LLC	INS	854,263
Allstate Life Insurance Company	Allstate Investments LLC	INS	427,131
Alta Partners Holdings LDC	Creedon Keller & Partners Inc.	UNKN	5,125,577
Arbitex Master Fund L.P.	Arbitex Asset Management L.P.	HF	3,844,182
Argent Classic Convertible Arbitrage Fund L.P.	Argent Financial Group Inc.	HF	1,793,952
Argent Convertible Arbitrage Fund (Bermuda) Ltd.	Argent Financial Group Inc.	HF	1,110,542
Argent LowLev Convertible Arbitrage Fund Ltd.	Argent Financial Group Inc.	HF	2,562,788
Bancroft Fund Ltd. (AMEX: BCV)	Davis-Dinsmore Management Co.	MF	854,263
Calamos Convertible Growth & Income-Investment	Calamos Asset Management Inc.	MF	2,221,083
Canyon Capital Arbitrage Master Fund Ltd.	Canyon Capital Advisors	HF	3,716,043
Canyon MAC 18 LTD (RMF)	Canyon Capital Advisors	HF	619,341
Canyon Value Realization (Cayman) Ltd.	Canyon Capital Advisors	HF	5,574,065
Canyon Value Realization Fund L.P.	Canyon Capital Advisors	HF	2,477,362
Clinton Convertible Managed Trading Account Ltd.	Clinton Group Inc.	HF	1,324,107
Clinton Multistrategy Master Fund Ltd.	Clinton Group Inc.	HF	6,065,266
Clinton Riverside Convertible Portfolio Limited	Clinton Group Inc.	HF	6,065,266
Convertible Securities Fund	Banc of America Capital Mgt. LLC	MF	98,240
Delta Airlines Master Trust	Calamos Asset Management Inc.	MF	324,620
Deutsche Bank Securities Inc.	Deutsche Bank Securities Inc.	BD	27,165,556
Ellsworth Convertible Growth & Income Fund	Ellsworth Cvtbl. Growth & Inc. Fund	UNKN	854,263
Fidelity Financial Trust: Fid Convertibl Secs Fund	Fidelity Mgt. & Research Corp.	MF	2,562,788
Highbridge International LLC	Highbridge International LLC	HF	7,688,365
JMG Capital Partners L.P.	JMG Capital Management LLC	HF	1,281,394
JMG Triton Offshore Fund Ltd.	JMG Capital Management LLC	HF	1,281,394
KBC Financial Products (Cayman Islands) Ltd.	KBC Financial Products USA Inc.	HF	4,869,298
Lincoln National Convertible Securities Fund	Delaware Investments	MF	854,263
Lyxor Master Fund Ref: Argent/LowLev CB	Lyxor Asset Management	MF	1,110,542
Man Convertible Bond Master Fund Ltd.	Marin Capital Partners LP	HF	3,621,220
Microsoft Corporation (NasdaqNM: MSFT)	Microsoft Corporation	CORP	1,362,549
Nations Convertible Securities Fund	Banc of America Capital Mgt. LLC	MF	5,881,599
OCM Convertible Limited Partnership – High Income	Oaktree Capital Management LLC	HF	798,736
Oakwood Assurance Company	Oakwood Healthcare Inc.	CORP	42,713
Oakwood Healthcare Inc.	Oakwood Healthcare Inc.	CORP	277,635
Oakwood Healthcare Inc. Endowment	Oakwood Healthcare Inc.	CORP	8,543
Oakwood Healthcare Inc. Funded Depreciation	Oakwood Healthcare Inc.	CORP	72,612
Oakwood Healthcare Inc. Pension Plan	Oakwood Healthcare Inc.	CORP	140,953
Oakwood Healthcare Inc.-OHP	Oakwood Healthcare Inc.	CORP	12,814
Pacific Life Insurance Company	Pacific Life Insurance Company	INS	427,131
Qwest Occupational Health Trust	Qwest Occupational Health Trust	UNKN	51,256
Renaissance Re Holdings Ltd.	Renaissance Re Holdings Ltd.	INS	375,876
Robertson Stephens	BancBoston Robertson Stephens	BD	4,271,314
San Diego County Employee's Retirement Association	Nicholas Applegate	MF	213,566
St. Thomas Trading Ltd.	Marin Capital Partners LP	HF	6,202,802
Tripar Partnership - HI	Tripar Partnership	UNKN	384,418
UBS Warburg LLC	UBS Capital Americas LLC	BD	5,403,211
Vanguard Convertible Securities Fund Inc.	Oaktree Capital Management LLC	HF	803,007
Zurich Institutional Benchmark Master Fund Limited	Zurich Financial Services	INS	683,410

Table 2: Sample Statistics

This table presents summary statistics for the sample of convertible bonds. The initial sample comprises all convertible bond issues under Rule 144A as identified by Sagient Research's Placement Tracker Database. The sample period begins in 1997 and ends in September 2007. For each variable, Panel A reports the mean, median, minimum, maximum, and standard deviation over the sample period. There are 533 observations in the sample. Panel B reports industries of the issuers in the sample. *Discount* is the percentage discount of the offering price below the fundamental value from the pricing model. The following variables are from Placement Tracker: *GrossProceeds* are the proceeds, inclusive of fees; *Fee* is the fee paid to the placement agent as a fraction of proceeds; *ConversionPremium* is the premium of the conversion price to the issuer's stock price on the issue date; *RepeatInvestors* measures the relationship between the placement agent and investors in the deal and is defined as the fraction of investors that purchased another convertible bond from the same placement agent in the preceding two years; *NumberInvestors* are the number of investors in each deal; *Strength* is the mean fraction of 144A convertible bond issues that investors in bond i purchased from bond i's placement agent during the immediately preceding two years; *PriorInvestorActivity* is defined as all proceeds bought by issue i's investors from issue i's placement agent during the past twenty four months divided by the total deal volume for that placement agent over the same period; *MarketShare* is the placement agent's market share in the 144A convertible bond market over the previous twenty four months; and *HHI* measures buyer power and is defined as the sum of squared fractions of the total proceeds purchased by each investor. *Rating* is based on S&P ratings and takes numeric values from 1 (AAA) to 9 (C). *MarketAdjustedCAR* is the issuer's equity return in excess of the CRSP value-weighted index over the period beginning one day before and ending one day after the announcement of the issue. *MarketCapitalization* comes from CRSP and is the product of shares outstanding and share price. *DebtRatio* is the COMPUSTAT book value of debt from the year preceding the offering divided by *MarketCapitalization*. *NumAnalysts* are the number of stock analysts in IBES producing annual earnings forecasts for the convertible bond issuer. *Maturity* is the time-to-maturity of bond i at the time of its issue. From Mergent FISD, we collect bond ratings. Ratings dummies take the value of unity when bond i fits in that category: B-rating, C-rating, Junk rating, and unrated.

Panel A: Descriptive Statistics

Variable Name	Mean	Median	Minimum	Maximum	Standard Deviation
Discount	0.0699	0.0535	-0.2428	0.6903	0.1410
Gross Proceeds (millions $)	274.1	175.0	30.0	2,821.2	286.2
Fee	0.0293	0.0300	0.0040	0.0830	0.0078
Number Investors	55.5047	45.000	1.0000	272.0000	39.0754
Repeat Investors	0.6979	0.7661	0.0000	1.0000	0.2424
Strength	0.1861	0.1830	0.0000	0.4545	0.0647
Prior Investor Activity	0.2275	0.2194	0.0000	0.6428	0.1092
Market Share	0.1098	0.0757	0.0008	0.3357	0.0980
Bond Rating	5.3452	6.0000	3.0000	7.0000	1.0655
Unrated	0.6304	1.0000	0.0000	1.0000	0.4832
Junk	0.2777	0.0000	0.0000	1.0000	0.4483
Rate A	0.0206	0.0000	0.0000	1.0000	0.1423
Rate B	0.3152	0.0000	0.0000	1.0000	0.4650
Rate C	0.0338	0.0000	0.0000	1.0000	0.1808
Conversion Premium	0.3326	0.3160	0.0020	1.6400	0.1608
HHI	0.1226	0.0836	0.0159	1.0000	0.1224
Market Adjusted CAR	−0.0312	−0.0285	−0.2953	0.1509	0.0668
NumAnalysts	14.8743	12.0000	0.0000	65.0000	11.0953
Debt Ratio	0.6101	0.2103	0.0000	57.3152	2.7957
Maturity	14.4008	19.9397	1.6438	30.4247	8.5509
Market Capitalization (millions $)	3,097.7	861.0	32.0	164,114.5	11,124.0

Panel B: Sample Firms' Industry Representation

Sector	Sample Observations
Basic Materials	9
Communications	85
Consumer Cyclical	59
Consumer Non Cyclical	149
Diversified	4
Energy	31
Financial	44
Industrial	57
Technology	92
Utilities	3

Table 3: Correlation Matrix

This table presents correlations of the variables used in the main analysis. The sample comprises all convertible bond issues under Rule 144A as identified by Sagient Research's Placement Tracker Database with non-missing information on variables of interest. The sample period begins in 1996 and ends in September 2007. Each variable is described in Table 2. Correlations with p-values less than 5% are indicated with † and correlations with p-values less than 1% are indicated with ‡.

Correlation Matrix	**Dis-count**	**Gross Proceeds**	**Fees**	**Rating**	**Repeat Inv.s**	**Strength**	**Prior Inv. Activity**	**Market Share**	**Num. Inv.s**	**HHI**	**CAR Mkt**	**Num-Analysts**	**Debt Ratio**
Discount	1.000												
Gross Proceeds	$-0.141^{\ddagger}$	1.000											
Fees	$0.253^{\ddagger}$	$-0.416^{\ddagger}$	1.000										
Rating	-0.117	$-0.234^{\ddagger}$	$0.411^{\ddagger}$	1.000									
Repeat Investors	$-0.131^{\dagger}$	-0.028	$-0.162^{\ddagger}$	-0.117	1.000								
Strength	-0.034	$-0.231^{\ddagger}$	$0.098^{\dagger}$	$0.163^{\dagger}$	$0.376^{\ddagger}$	1.000							
Prior Investor Activity	$-0.189^{\ddagger}$	$0.516^{\ddagger}$	$-0.273^{\ddagger}$	-0.034	-0.007	0.048	1.000						
Market Share	-0.080	$0.105^{\dagger}$	$-0.252^{\ddagger}$	$-0.205^{\ddagger}$	$0.642^{\ddagger}$	$0.096^{\dagger}$	0.033	1.000					
NumInvestors	$-0.186^{\ddagger}$	$-0.624^{\ddagger}$	$-0.311^{\ddagger}$	$-0.236^{\ddagger}$	-0.009	$-0.328^{\ddagger}$	$0.568^{\ddagger}$	$0.127^{\ddagger}$	1.000				
HHI	$0.150^{\ddagger}$	$-0.089^{\dagger}$	$0.159^{\ddagger}$	-0.047	-0.056	0.043	$-0.444^{\ddagger}$	-0.032	$-0.407^{\ddagger}$	1.000			
CAR_Market	$-0.249^{\ddagger}$	$0.199^{\ddagger}$	$-0.202^{\ddagger}$	-0.173	-0.059	-0.054	0.088	0.039	$0.172^{\ddagger}$	$-0.177^{\dagger}$	1.000		
NumAnalysts	$-0.268^{\ddagger}$	$0.570^{\ddagger}$	$0.381^{\ddagger}$	$-0.263^{\ddagger}$	0.071	$-0.140^{\ddagger}$	$0.315^{\ddagger}$	$0.091^{\dagger}$	$0.408^{\ddagger}$	$-0.135^{\ddagger}$	$0.157^{\ddagger}$	1.000	
Debt Ratio	0.080	-0.007	-0.002	$0.208^{\ddagger}$	-0.074	-0.042	-0.017	-0.053	$0.192^{\ddagger}$	0.025	0.053	-0.068	1.000
Maturity	$-0.176^{\ddagger}$	0.044	$-0.227^{\ddagger}$	$-0.393^{\ddagger}$	$0.175^{\dagger}$	-0.008	-0.083	$0.162^{\ddagger}$	0.050	0.013	-0.078	-0.043	0.018

Table 4: What Drives Convertible Bond Discounts?

This table presents regression results for the following OLS regression:

$$Discount_{i,t} = \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 RepeatInvestors_{i,t} + \beta_3' X_{i,t} + \epsilon_{i,t},$$

where $Discount_{i,t}$ is the percentage discount of the offering price below the fundamental value from the pricing model; $NumInvestors_{i,t}$ is the number of investors in the bond; $RepeatInvestors$ is the fraction of the investors in bond i that also purchased a 144A bond from the placement agent in the preceding twenty four calendar months. The control variables in vector $X_{i,t}$ are: the bond rating, the natural log of gross proceeds, number of equity analysts in IBES producing annual earnings forecasts for firm i during year $t-1$, and the underwriting fees (percentage of gross proceeds). HHI, $Maturity$, and $DebtRatio$ are added to the vector X in extended regressions. Each variable is described in Table 2. The sample contains 533 observations. T-statistics are presented in parentheses and are calculated with heteroskedasticity consistent standard errors.

Regression Results: Determinants of Offering Discount

	No Fixed Effects			**Year Fixed Effects**		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0482	0.3711	0.2260	0.0641	0.4783	0.4259
	(0.89)	(1.48)	(0.88)	(0.85)	(1.84)	(1.68)
Rate B	0.0554	0.0503	0.0683	0.0634	0.0543	0.0711
	(0.92)	(0.82)	(1.12)	(1.17)	(0.98)	(1.33)
Rate C	0.1001	0.0823	0.1088	0.1082	0.0915	0.1301
	(1.45)	(1.21)	(1.60)	(1.65)	(1.41)	(2.08)
Junk	−0.0745	−0.1109	−0.0978	−0.0822	−0.1138	−0.0889
	(−2.61)	(−3.82)	(−3.50)	(−2.97)	(−4.02)	(−3.25)
Unrated	0.0343	−0.0321	−0.0015	0.0384	−0.0258	0.0190
	(0.63)	(−0.57)	(−0.03)	(0.79)	(−0.50)	(0.37)
Gross Proceeds		−0.0067	−0.0056		−0.0128	−0.0181
		(−0.50)	(−0.39)		(−0.93)	(−1.31)
log NumAnalyst		−0.0332	−0.0246		−0.0316	−0.0220
		(−3.80)	(−2.66)		(−3.56)	(−2.34)
Fees		2.5758	3.5994		2.0345	3.3372
		(2.73)	(3.56)		(1.98)	(2.92)
log NumInvestors		−0.0255	−0.0256		−0.0266	−0.0216
		(−1.98)	(−1.57)		(−2.06)	(−1.38)
Repeat Investors		−0.0503	−0.0663		−0.0444	−0.0514
		(−2.09)	(−2.74)		(−1.76)	(−2.07)
HHI			−0.0028			0.0083
			(−0.04)			(0.12)
Maturity			0.0036			0.0048
			(4.82)			(5.71)
Debt Ratio			0.0028			0.0037
			(1.48)			(1.61)
R^2, Adjusted	0.023	0.148	0.190	0.059	0.180	0.246

Table 5: Convertible Bond Discounts at Issue: Strength of Relationship Measure

This table presents regression results for the following OLS regressions:

$$Discount_{i,t} = \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 Strength_{i,t} + \beta_3' X_{i,t} + \epsilon_{i,t},$$

where $Discount_{i,t}$ is the percentage discount of the offering price to the fundamental value from the pricing model, and *Strength* captures mean fraction of 144A convertible bond issues that investors in bond i issue purchased from bond i's placement agent during the immediately preceding twenty four months. The control variables in vector $X_{i,t}$ are: the bond rating, the natural log of gross proceeds, number of equity analysts in IBES producing annual earnings forecasts for firm i during year $t-1$, and the underwriting fees (percentage of gross proceeds). HHI, *Maturity*, and *DebtRatio* are added to the vector X in extended regressions. Each variable is described in Table 2. The sample contains 533 observations. T-statistics are in parentheses and are calculated with heteroskedasticity consistent standard errors.

Determinants of Discount with Relationship Strength

	No Fixed Effects		**Year Fixed Effects**	
	(1)	(2)	(3)	(4)
Intercept	0.3771	0.2069	0.5322	0.4645
	(1.50)	(0.80)	(2.06)	(1.85)
Rate B	0.0495	0.0666	0.0522	0.0692
	(0.80)	(1.08)	(0.94)	(1.29)
Rate C	0.0839	0.1085	0.0920	0.1304
	(1.21)	(1.58)	(1.41)	(2.06)
Junk	−0.1058	−0.0938	−0.1078	−0.0834
	(−3.64)	(−3.33)	(−3.82)	(−3.06)
Unrated	−0.0274	0.0017	−0.0214	0.0231
	(−0.48)	(0.03)	(−0.41)	(0.45)
Gross Proceeds	−0.0062	−0.0032	−0.0131	−0.0169
	(−0.46)	(−0.22)	(−0.96)	(−1.24)
log NumInvestors	−0.0304	−0.0334	−0.0309	−0.0292
	(−2.35)	(−1.97)	(−2.39)	(−1.84)
Fees	2.7846	3.8395	2.2105	3.5684
	(2.98)	(3.85)	(2.19)	(3.20)
log Num Analysts	−0.0344	−0.0269	−0.0326	−0.0234
	(−3.99)	(−2.96)	(−3.72)	(−2.52)
Investor Strength	−0.2146	−0.2172	−0.2043	−0.2132
	(−2.34)	(−2.37)	(−2.28)	(−2.52)
HHI		−0.0215		−0.0118
		(−0.30)		(−0.17)
Maturity		0.0034		0.0048
		(4.52)		(5.69)
Debt Ratio		0.0029		0.0037
		(1.59)		(1.61)
R^2, Adjusted	0.150	0.186	0.183	0.248

Table 6: Potential Endogeneity of Fees

This table presents two stage least squares estimation results for the following simultaneously determined system of equations:

$$\begin{aligned} Discount_{i,t} &= \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 RepeatInvestors_{i,t} + \beta_3 GrossProceeds_{i,t} + \beta_4 Fee_{i,t} \\ &\quad + \beta_5 NumAnalysts_{i,t} + \beta_6 Rating_{i,t} + \beta_7 HHI_{i,t} + \beta_8 Maturity_{i,t} + \beta_9 DebtRatio_{i,t} + \epsilon_{i,t} \\ Fee_{i,t} &= \mu + \gamma_1 RepeatInvestors_{i,t} + \gamma_2 GrossProceeds_{i,t} + \gamma_3 Discount_{i,t} + \gamma_4 MarketShare_{i,t} \\ &\quad + \gamma_5 PriorInvestorActivity_{i,t} + \gamma_6 EquityLike_{i,t} + \gamma_7 MarketCap_{i,t} + \upsilon_{i,t}. \end{aligned}$$

The table presents coefficient estimates with t-statistics in parentheses. Each variable is described in Table 2, with the exception of: *PriorInvestorActivity* which comes from Placement Tracker and is defined as all proceeds bought by issue i's investors from issue i's placement agent, divided by the total deal volume for that placement agent over the previous two years; *MarketShare* is the placement agent's share of the entire 144A convertible bond market during the previous year; *EquityLike* is a dummy variable equal to 1 if the bond's conversion premium is less than 20 percent.

Panel A: Dependent Variable: Offer Discount

	No Fixed Effects		Year Fixed Effects	
Intercept	0.0350	-0.4744	-0.3484	-0.5856
	(0.05)	(-0.73)	(-0.48)	(-0.91)
NumInvestors	-0.0273	-0.0392	-0.0243	-0.0324
	(-1.83)	(-2.53)	(-1.64)	(-2.05)
Repeat Investors	-0.0623		-0.0240	
	(-2.24)		(-0.69)	
Strength		-0.2137		-0.1910
		(-2.30)		(-1.95)
Gross Proceeds	0.0020	0.0241	0.0121	0.0241
	(0.07)	(0.88)	(0.41)	(0.90)
Fees	5.0729	9.1876	10.2438	12.9368
	(0.94)	(1.89)	(1.67)	(2.43)
log NumAnalysts	-0.0226	-0.0189	-0.0110	-0.0072
	(-1.96)	(-1.63)	(-0.83)	(-0.54)
Rate B	0.0694	0.0709	0.0731	0.0728
	(1.58)	(1.56)	(1.63)	(1.55)
Rate C	0.1092	0.1098	0.1366	0.1377
	(2.00)	(1.94)	(2.43)	(2.35)
Junk	-0.1009	-0.1053	-0.1043	-0.1061
	(-3.80)	(-3.90)	(-3.65)	(-3.62)
Unrated	-0.0033	-0.0056	0.0059	0.0033
	(-0.08)	(-0.13)	(0.14)	(0.07)
HHI	-0.0139	-0.0626	-0.0423	-0.0805
	(-0.19)	(-0.83)	(-0.54)	(-1.02)
Maturity	0.0039	0.0043	0.0060	0.0065
	(3.38)	(3.84)	(4.54)	(5.10)
Debt Ratio	0.0029	0.0031	0.0038	0.0037
	(1.43)	(1.51)	(1.87)	(1.74)
R^2 Adjusted	0.169	0.157	0.212	0.198

Panel B: Dependent Variable: Fee

	No Fixed Effects		Year Fixed Effects	
Intercept	0.1227	0.1205	0.1090	0.1088
	(8.86)	(8.42)	(8.00)	(7.62)
Repeat Investors	-0.0040		-0.0051	
	(-2.40)		(-3.04)	
Strength		-0.0037		-0.0033
		(-0.70)		(-0.65)
Gross Proceeds	-0.0039	-0.0039	-0.0034	-0.0034
	(-4.81)	(-4.73)	(-4.30)	(-4.22)
Discount	-0.0224	-0.0207	-0.0193	-0.0183
	(-3.07)	(-2.88)	(-3.17)	(-2.99)
MarketShare	-0.0066	-0.0132	-0.0044	-0.0132
	(-1.30)	(-3.12)	(-0.88)	(-3.22)
PriorInvestorActivity	0.0009	0.0020	-0.0016	-0.0007
	(0.24)	(0.55)	(-0.44)	(-0.21)
Equity-Like	0.0020	0.0021	0.0015	0.0015
	(2.06)	(2.14)	(1.70)	(1.66)
log MarketCap	-0.0020	-0.0019	-0.0023	-0.0022
	(-4.36)	(-4.34)	(-5.00)	(-4.96)
R^2 Adjusted	0.280	0.228	0.323	0.317

Table 7: Convertible Bond Discounts at Issue: Impact of Investor Sophistication

This table presents regression results for the following OLS regression:

$$Discount_{i,t} = \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 RepeatInvestors_{i,t} + \beta_3 InvestorExperience_{i,t} + \beta_4' X_{i,t} + \epsilon_{i,t},$$

where $Discount_{i,t}$ is the percentage discount of the offering price below the fundamental value from the pricing model; $NumInvestors_{i,t}$ is the number of investors in the bond; $RepeatInvestors$ is the fraction of the investors in bond i that also purchased a 144A bond from bond i's placement agent in the preceding twenty four calendar months; $Strength$ is the mean fraction of 144A convertible bond issues that investors in this bond issue purchased from bond i's placement agent during the previous twenty four months; $InvestorExperience$ is the fraction of issue i's proceeds purchased by investors who have invested in a 144A convertible bond over the preceding twenty four months. The control variables in vector $X_{i,t}$ are: the bond rating, the natural log of gross proceeds, number of equity analysts in IBES producing annual earnings forecasts for firm i during year $t-1$, and the underwriting fees (percentage of gross proceeds). HHI, $Maturity$, and $DebtRatio$ are added to the vector X in extended regressions. Each variable is described in Table 2. The sample contains 533 observations. T-statistics are in parentheses and are calculated with heteroskedasticity consistent standard errors.

Regression Results: Determinants of Offering Discount

	No Fixed Effects		**Year Fixed Effects**	
Intercept	0.3579	0.3443	0.5337	0.5588
	(1.36)	(1.31)	(2.02)	(2.13)
Rate B	0.0657	0.0642	0.0692	0.0678
	(1.07)	(1.04)	(1.29)	(1.26)
Rate C	0.1069	0.1067	0.1283	0.1286
	(1.57)	(1.55)	(2.04)	(2.03)
Junk	−0.0951	−0.0918	−0.0863	−0.0819
	(−3.34)	(−3.22)	(−3.12)	(−2.98)
Unrated	−0.0006	0.0019	0.0200	0.0233
	(−0.01)	(0.03)	(0.40)	(0.46)
Gross Proceeds	−0.0071	−0.0053	−0.0192	−0.0182
	(−0.51)	(−0.38)	(−1.41)	(−1.34)
log NumAnalyst	−0.0243	−0.0261	−0.0218	−0.0229
	(−2.65)	(−2.89)	(−2.34)	(−2.48)
Fees	3.4202	3.6072	3.1881	3.3855
	(3.49)	(3.73)	(2.83)	(3.04)
log NumInvestors	−0.0217	−0.0274	−0.0187	−0.0252
	(−1.35)	(−1.65)	(−1.21)	(−1.59)
Repeat Investors	−0.0540		−0.0411	
	(−2.30)		(−1.66)	
Strength		−0.1646		−0.1760
		(−1.88)		(−2.12)
Investor Experience	−0.1249	−0.1302	−0.1003	−0.0935
	(−1.34)	(−1.36)	(−1.18)	(−1.09)
HHI	−0.0055	−0.0195	0.0047	−0.0166
	(−0.08)	(−0.29)	(0.07)	(−0.18)
Maturity	0.0036	0.0034	0.0048	0.0047
	(4.80)	(4.55)	(5.69)	5.68
Debt Ratio	0.0030	0.0031	0.0038	0.0038
	(1.55)	(1.65)	(1.65)	(1.64)
R^2, Adjusted	0.191	0.191	0.248	0.249

Table 8: Investor Sophistication and Potential Endogeneity of Fees

This table presents two stage least squares estimation results for the following simultaneously determined system of equations:

$$\begin{aligned} Discount_{i,t} &= \alpha + \beta_1 NumInvestors_{i,t} + \beta_2 RepeatInvestors_{i,t} + \beta_3 InvestorExperience + \beta_4 GrossProceeds_{i,t} \\ &\quad + \beta_5 Fee_{i,t} + \beta_6 NumAnalysts_{i,t} + \beta_7 Rating_{i,t} + \beta_8 HHI_{i,t} + \beta_9 Maturity_{i,t} + \beta_{10} DebtRatio_{i,t} + \epsilon_{i,t} \\ Fee_{i,t} &= \mu + \gamma_1 RepeatInvestors_{i,t} + \gamma_2 InvestorExperience + \gamma_3 GrossProceeds_{i,t} + \gamma_4 Discount_{i,t} \\ &\quad + \gamma_5 MarketShare_{i,t} + \gamma_6 PriorInvestorActivity_{i,t} + \gamma_7 EquityLike_{i,t} + \gamma_8 MarketCap_{i,t} + \upsilon_{i,t}. \end{aligned}$$

The table presents coefficient estimates with t-statistics in parentheses. Each variable is described in Table 2, with the exception of: $PriorInvestorActivity$ which comes from Placement Tracker and is defined as all proceeds bought by issue i's investors from issue i's placement agent, divided by the total deal volume for that placement agent over the previous two years; $MarketShare$ is the placement agent's share of the entire 144A convertible bond market during the previous year; $EquityLike$ is a dummy variable equal to 1 if the bond's conversion premium is less than 20 percent.

Panel A: Dependent Variable: Offer Discount

	No Fixed Effects		Year Fixed Effects	
Intercept	0.3915	−0.1311	0.0261	−0.2823
	(0.58)	(−0.20)	(0.04)	(−0.47)
NumInvestors	−0.0214	−0.0328	−0.0214	−0.0307
	(−1.41)	(−2.04)	(−1.47)	(−1.96)
Repeat Investors	−0.0545		−0.0279	
	(−2.10)		(−0.93)	
Strength		−0.1768		−0.1896
		(−2.30)		(−1.95)
Investor Experience	−0.1269	−0.0944	−0.0664	−0.0188
	(−1.66)	(−1.16)	(−0.85)	(−0.22)
Gross Proceeds	−0.0084	0.0129	−0.0004	0.0128
	(−0.31)	(0.50)	(−0.02)	(0.53)
Fees	3.1743	7.1065	7.4409	10.3639
	(0.68)	(1.59)	(1.45)	(2.23)
log NumAnalysts	−0.0246	−0.0212	−0.0152	−0.0115
	(−2.29)	(−1.95)	(−1.28)	(−0.97)
Rate B	0.0655	0.0676	0.0711	0.0715
	(1.49)	(1.52)	(1.64)	(1.60)
Rate C	0.1068	0.1080	0.1329	0.1354
	(1.96)	(1.95)	(2.45)	(2.41)
Junk	−0.0945	−0.0998	−0.0965	−0.0996
	(−3.61)	(−3.79)	(−3.54)	(−3.58)
Unrated	−0.0003	−0.0029	0.0117	0.0087
	(−0.01)	(−0.07)	(0.28)	(0.20)
HHI	−0.0037	−0.0465	−0.0249	−0.0618
	(−0.05)	(−0.64)	(−0.34)	(−0.84)
Maturity	0.0035	0.0040	0.0055	0.0061
	(3.37)	(3.80)	(4.73)	(5.126
Debt Ratio	0.0029	0.0032	0.0039	0.0037
	(1.47)	(1.56)	(1.95)	(1.82)
R^2 Adjusted	0.175	0.168	0.228	0.217

Panel B: Dependent Variable: Fee

	No Fixed Effects		Year Fixed Effects	
Intercept	0.1304	0.1278	0.1166	0.1141
	(8.91)	(8.50)	(8.26)	(7.83)
Repeat Investors	−0.0016		−0.0025	
	(−0.85)		(−1.32)	
Strength		0.0014		0.0018
		(0.26)		(0.35)
Investor Experience	−0.0150	−0.0162	−0.0142	−0.0157
	(−3.67)	(−3.98)	(−3.73)	(−4.23)
Gross Proceeds	−0.0036	−0.0034	−0.0030	−0.0029
	(−4.26)	(−4.02)	(−3.79)	(−3.51)
Discount	−0.0252	−0.0248	−0.0214	−0.0208
	(−3.31)	(−3.26)	(−3.42)	(−3.33)
MarketShare	−0.0086	−0.0112	−0.0074	−0.0115
	(−1.91)	(−3.28)	(−1.72)	(−3.56)
PriorInvestorActivity	0.0015	0.0013	−0.0011	−0.0013
	(0.41)	(0.36)	(−0.31)	(−0.38)
Equity-Like	0.0020	0.0020	0.0014	0.0014
	(1.99)	(2.03)	(1.50)	(1.49)
log MarketCap	−0.0022	−0.0022	−0.0025	−0.0025
	(−4.81)	(−4.85)	(−5.40)	(−5.47)
R^2 Adjusted	0.284	0.286	0.331	0.332

Table 9: Offering Discount and Convertible Bond Excess Returns

This table presents correlations between the discount measure (based on the theoretical value at issuance) and secondary market convertible bond excess returns. Secondary market returns come from secondary market prices in Datastream. Bond return computations include price returns, coupons paid, and accrued interest relative to the offer price. Returns are defined over the 30, 90, and 365 day windows following the bond offerings and are benchmarked against portfolios of the issuer's stocks and corporate bonds. For equity-like bonds, which are those bonds with a conversion premium less than or equal to 20 percent, the benchmark consists of 80% issuers' stock and 20% Barclays Corporate Bond Index. The balance of offerings comprise debt-like offerings for which the benchmark consists of 40% issuers' stock and 60% Barclays Corporate Bond Index.

Correlation Coefficients: Discount and Bond Returns

Event Window	**Correlation**	**p-value**	**Number Observations**
30 Day Excess Returns	0.1502	0.552	18
90 Day Excess Returns	0.5353	0.022	18
365 Day Excess Returns	0.2452	0.001	172

Table 10: Shareholder Wealth Effects

This table presents results for the following regression equation:

$$CAR_{i,t} \quad = \quad \alpha + \beta_1 Dilution_{i,t} + \beta_2 Discount_{i,t} + \epsilon_{i,t}$$

where CAR is the cumulative abnormal return to bond issuer i's equity over the three day window surrounding the offering announcement. The sample comprises all observations from 2003 to 2007, consisting of 293 issues. This sample is restricted since announcement dates are missing from the Placement Tracker database prior to 2003. $Dilution$ is the reduction in proportional ownership by equity holders assuming the entire convertible issue is converted to equity at a future date. Additionally, the table presents extended regressions including Fee as an explanatory variable. Fee comes from Placement Tracker and is the fee paid to the placement agent as a fraction of the proceeds. The table presents coefficient estimates and t-statistics calculated with heteroskedasticity consistent standard errors.

Regression Estimates: Shareholder Wealth Effects

Variable	No Fixed Effects		Year Fixed Effects	
Intercept	-0.0070	0.0127	-0.0086	0.0063
	(-0.89)	(0.70)	(-0.81)	(0.30)
Dilution (%)	-0.1122	-0.0996	-0.1090	-0.1004
	(-2.11)	(-1.91)	(-2.02)	(-1.86)
Discount	-0.0840	-0.0721	-0.0755	-0.0678
	(-2.20)	(-1.84)	(-1.97)	(-1.75)
Fees		-0.7702		-0.5365
		(-1.15)		(-0.78)
R^2 Adjusted	0.086	0.090	0.097	0.097

Figure 1: Annual Proceeds and Convertible Bond Issue Discounts

Annual average values for *GrossProceeds* and average annual values for Convertible Bond *Discount* over the sample period. The sample consists of 533 Convertible Bonds issued under Rule 144A and the sample comes from Sagient Research's Placement Tracker database.

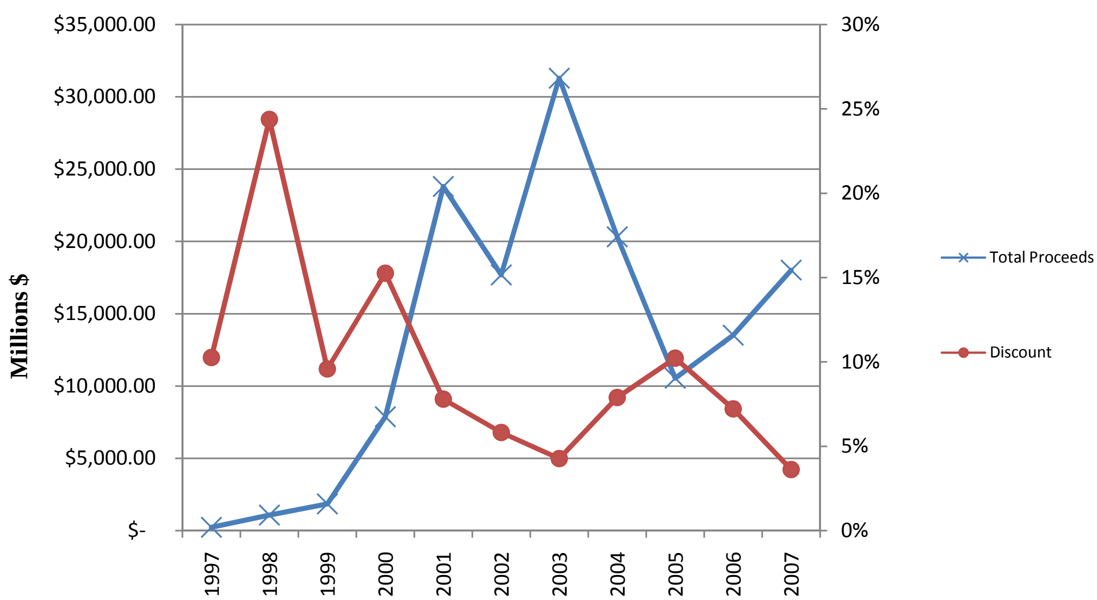

Figure 2: Number of Investors and Relationships

The following chart plots the time series of the annual average number of investors, $NumInvestors$, in Convertible Bonds issued under Rule 144A and three relationship measures. $RepeatInvestors$ is defined as the fraction of investors that participated in another deal by the issuer's placement agent in the past twenty four months. $Strength$ is defined as the average participation of investors in issue i in all 144-A convertible bond issues by bond i's placement agent during the past twenty four months. $PriorInvestorActivity$ is defined as all proceeds bought by issue i's investors from issue i's placement agent, divided by all of the placement agent's 144-A issues during the prior twenty four months.

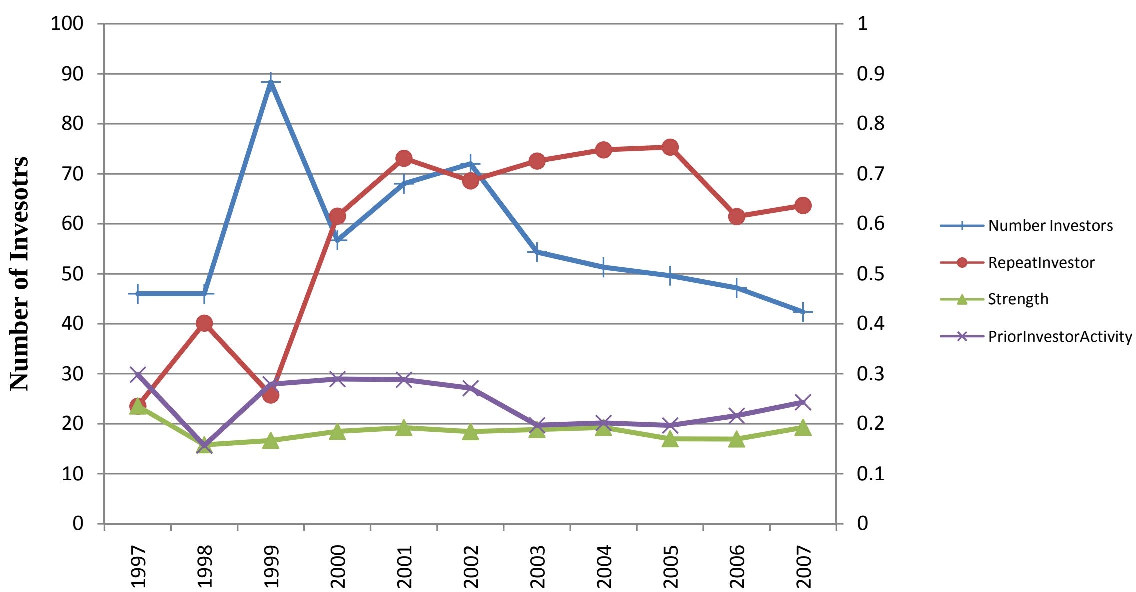

Figure 3: Market Making Activity By Issuer's Placement Agents Near 144A Convertible Bond Issues

This chart shows trading volume relative to average monthly trading volume over the -12 to +12 month period relative to convertible bond issue month for a sample of 24 Rule 144A issues of convertible bonds by Nasdaq listed issuers over the June 2005 through June 2006 period.

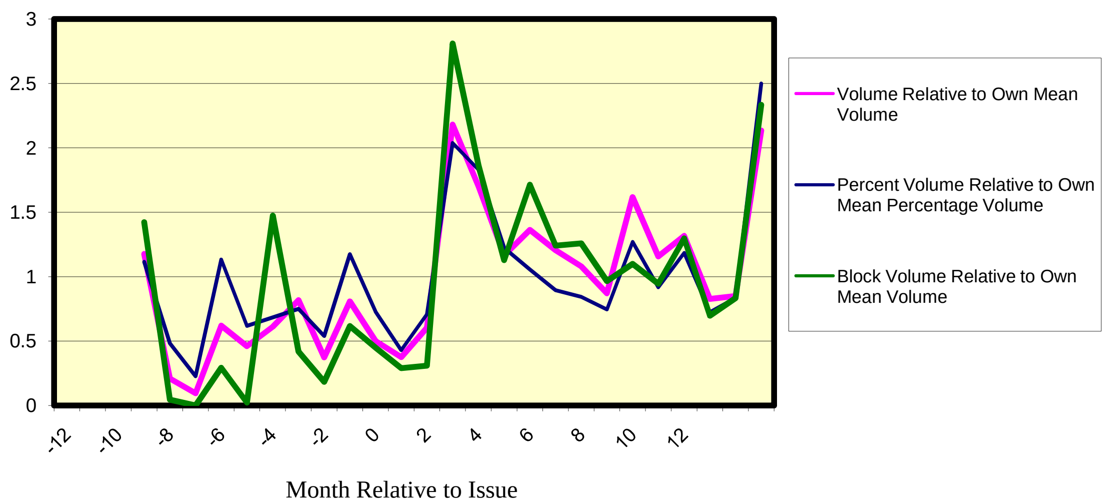

Table A.1: Correlation Matrix

This table presents correlations of the alternative *Discount* measures, based on the theoretical bond prices when we vary three inputs: the volatility measure, the recovery rate, and the assumed credit rating of unrated bonds. The main pricing analysis uses historical volatility measured from daily stock returns (denoted $HVOL$ in the table). The *Discount* measures denoted $IVOL$ use the implied volatility taken from the OptionMetrics vsurfd file for the longest dated volatility surface for the bond issuer. We use the point on the surface corresponding most closely to the conversion price of the bonds. The main analysis assigns credit rating BB to unrated bonds. The *Discount* measures below labeled BBB instead assign BBB rating to unrated bonds. Finally, the main analysis assumes a 40% recovery rate in the event of default. The results labelled $ALTMAN$ below instead assume varying recovery rates for fallen angels versus original high-yield issues, respectively. Correlations with p-values less than 5% are indicated with † and correlations with p-values less than 1% are indicated with ‡.

Correlation Matrix	*Discount* $HVOL$ 40 BB	*Discount* $HVOL$ 40 BBB	*Discount* $HVOL$ $ALTMAN$ BB	*Discount* $HVOL$ $ALTMAN$ BBB	*Discount* $IVOL$ 40 BB	*Discount* $IVOL$ 40 BBB	*Discount* $IVOL$ $ALTMAN$ BB	*Discount* $IVOL$ $ALTMAN$ BBB
$Discount_{HVOL,40,BB}$	1.000							
$Discount_{HVOL,40,BBB}$	$0.924^{\ddagger}$	1.000						
$Discount_{HVOL,ALTMAN,BB}$	$0.915^{\ddagger}$	$0.848^{\ddagger}$	1.000					
$Discount_{HVOL,ALTMAN,BBB}$	$0.865^{\ddagger}$	$0.917^{\ddagger}$	$0.898^{\ddagger}$	1.00				
$Discount_{IVOL,40,BB}$	$0.855^{\ddagger}$	$0.800^{\ddagger}$	$0.864^{\ddagger}$	$0.843^{\ddagger}$	1.000			
$Discount_{IVOL,40,BBB}$	$0.786^{\ddagger}$	$0.837^{\ddagger}$	$0.759^{\ddagger}$	$0.847^{\ddagger}$	$0.939^{\ddagger}$	1.000		
$Discount_{IVOL,ALTMAN,BB}$	$0.877^{\ddagger}$	$0.804^{\ddagger}$	$0.916^{\ddagger}$	$0.854^{\ddagger}$	$0.969^{\ddagger}$	$0.881^{\ddagger}$	1.00	
$Discount_{IVOL,ALTMAN,BBB}$	$0.792^{\ddagger}$	$0.850^{\ddagger}$	$0.776^{\ddagger}$	$0.918^{\ddagger}$	$0.914^{\ddagger}$	$0.983^{\ddagger}$	$0.897^{\ddagger}$	1.00
$NumberInvestors$	$-0.252^{\ddagger}$	$-0.282^{\ddagger}$	$-0.219^{\ddagger}$	$-0.298^{\ddagger}$	$-0.227^{\ddagger}$	$-0.290^{\ddagger}$	$-0.208^{\ddagger}$	$-0.306^{\ddagger}$
$RepeatInvestors$	$-0.131^{\ddagger}$	$-0.140^{\ddagger}$	$-0.110^{\dagger}$	$-0.111^{\dagger}$	-0.085	-0.077	-0.083	-0.073