

# Choice of Underwriters in Initial Public Offerings

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## Abstract

*We examine whether the choice of underwriters is consistent with issuing firms trying to minimize underpricing, or to reap other potential associated benefits. After controlling for selectivity bias, we find firms choosing high-ranked underwriters incur lower underpricing and those choosing low-ranked underwriters incur higher underpricing. This result is robust to sub-samples of firms likely to have discretion on the choice of underwriters. The result suggests that issuing firms weigh the tradeoffs between potential benefits and costs of underpricing in their choice of underwriters. It is also consistent with prestigious underwriters using their reputation capital to certify value and reduce uncertainty about the issue.*

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*Key words: Initial public offerings, underpricing, initial returns, underwriter reputation, certification, marketing benefits.*

## 1. INTRODUCTION

IPO underpricing (positive first day return) is a worldwide phenomenon and has been regarded as money left on the table by the issuers to the investors (see Loughran and Ritter, 2002). While many explanations exist as to why IPOs are generally underpriced, few have examined if issuing firms attempt to minimize underpricing through their choice of underwriters. Since underpricing is costly to the issuing firms, traditional arguments suggest that lowering underpricing is a logical choice as it helps reduce the overall costs of going public. However, recent studies related to the marketing role of IPOs suggest that some issuing firms may choose higher initial

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underpricing in order to reap the associated marketing benefits. For example, Demers and Lewellen (2003) find that media mentions in the month of IPOs are positively related to underpricing, and the upper bound of the cost of underpricing is very similar in dollar value to the direct marketing expenses. Aggarwal, Krigman, and Womack (2002) also argue that extreme underpricing attracts media attention and increase publicity for the issuing firm.

Given that underpricing has potential marketing benefits, we specifically examine whether the choice of underwriters is consistent with issuing firms trying to minimize underpricing, or to reap other potential associated benefits. The tradeoffs between the potential benefits and costs of underpricing could be important to the issuing firms in their selection of underwriters. As the incremental benefit from initial underpricing is expected to be largest for firms that are of low quality and/or less well known, these firms are more likely to incur higher underpricing to reap the marketing benefits. Alternatively, high-quality and/or well-known firms are expected to choose investment bankers who can certify value to lower their initial underpricing. By examining the choice of underwriters and its impact on underpricing, we can also determine if the relation between underwriter reputation and IPO underpricing has changed, as suggested by Ritter and Welch (2002).

Traditionally, prestigious underwriters have been argued to use their reputation capital to certify the value of the firm and reduce investor's uncertainty about the value of the issue, and this consequently lowers the level of underpricing in IPOs (see Smith, 1986, Booth and Smith, 1986, Beatty and Ritter, 1986, Carter and Manaster, 1990, and Chemmanur and Fulghieri, 1994, among others). However, in more recent studies, Beatty and Welch (1996), Cooney, Singh, Carter and Dark (2001), and Loughran and Ritter (2004) document a positive relation between underwriter reputation and underpricing for IPOs in the 1990s. Explanations as to why the relation has flipped are lacking. The positive relation between underwriter reputation and underpricing may suggest that the role of underwriter reputation on underpricing has changed, or that issuing firms are less concerned about underpricing due to the potential associated marketing benefits.

Given the conflicting evidence on the relation between underwriter reputation and underpricing, it is important we explore this topic further. Do issuing firms choose to minimize underpricing through their choice of underwriters? Does the use of prestigious underwriter result in higher or lower underpricing? These questions can be easily answered if we can observe underpricing associated with the use of a prestigious underwriter and underpricing for the same issuer if it had used a less prestigious one. Unfortunately, we only observe one level of underpricing for each IPO. If the selection of underwriter reputation were random, the difference in underpricing associated with these two groups of underwriters would be sufficient for us to draw conclusive inferences. However, previous studies suggest the selection of underwriters represents an endogenous choice made by the issuing firm (see Habib and Ljungqvist, 2001 and Logue, Rogalski, Seward, and Foster-Johnson, 2002). If firms with certain risk and issue characteristics tend to choose one group of investment banks versus another, the

selectivity bias may cause the reversed inferences. This means the positive relation between underwriter reputation and underpricing may derive either from not adequately controlling for issuer related risk characteristics, or from not recognizing the interdependence between underwriter reputation and underpricing.

In this study, we examine underwriter reputation and its impact on IPO underpricing, recognizing the potential simultaneity between the choice and the resulting underpricing. To do this, we explicitly control for the interdependence between underpricing and the use of high-ranked versus low-ranked underwriters using a two-step estimation procedure. The underpricing estimates allow us to determine, 1) whether issuing firms choose high-ranked underwriters who can certify value to lower underpricing, consistent with firms attempting to minimize the overall costs of going public,<sup>1</sup> or 2) whether issuing firms are motivated to incur higher underpricing by using low-ranked underwriters so as to reap potential marketing benefits, even though initial underpricing could have been lower if they use high-ranked underwriters. By examining how underpricing is affected by the use of different ranked underwriters, we gain insight into the role that investment banker's prestige plays in the going public process.

In the two-step procedure, we first examine the factors determining the choice of underwriter reputation in a large sample of IPOs going public from 1988-1998. Specifically, we examine whether the probability of an IPO being underwritten by a high-ranked investment bank is a function of measures of firm and issue characteristics. We next examine the level of underpricing for IPOs underwritten by high-ranked and low-ranked investment banks, using a vector of variables believed to affect underpricing, and controlling for the interdependence between underwriter reputation and underpricing. We then estimate the selectivity-bias-adjusted (unbiased) underpricing for both IPOs with high-ranked and low-ranked underwriters, and also if the alternative choice had been made. These estimates allow us to examine if the use of high-ranked underwriters results in higher or lower underpricing, and whether the choice is consistent with lowering overall costs of going public. Finally, we check the robustness of our results by providing the unbiased estimates of underpricing for sub-samples of IPOs either with lower level of uncertainty, and/or in which the issuing firms are likely to have more discretion on the choice of underwriters. These include larger IPOs, IPOs with positive earnings prior to going public, IPOs whose intended use of proceeds is to repay debt, and non high-tech IPOs.

Consistent with previous studies, we find that size of issue proceeds and the presence of venture capitalists are positively related to the probability that an IPO is underwritten by a prestigious investment bank. The selectivity-bias-adjusted underpricing estimates suggest that, in general, the use of prestigious underwriters is associated with lower level of IPO underpricing, consistent with prestigious underwriters using their reputation capital to certify value and lower the ex-ante uncertainty of the issue. Specifically, we find that issuing firms with high-ranked underwriters have predicted underpricing substantially lower than if they had used a low-ranked

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<sup>1</sup> The direct underwriting spread is not important in the analysis as it is commonly cited as 7% of the gross proceeds (see Chen and Ritter, 2000).

underwriter. Also, issuing firms that use low-ranked underwriters have significantly higher predicted underpricing than if they had used a high-ranked underwriter. The same results prevail in all the sub-samples tested. The results show that certain firms choose high-ranked underwriters to lower underpricing while others choose low-ranked underwriters to reap potential marketing benefits. These results suggest that underwriting business is very complex and lowering the overall costs of going public is not the main consideration for all issuing firms.

Section I describes the relation between the underwriter reputation and IPO underpricing and provides an estimation procedure to correct for the interdependence. Factors affecting the choice of high-ranked versus low-ranked underwriters are also discussed. Sample data and explanatory variables are described in Section II. Empirical results are presented in Section III. A summary and conclusion are presented in Section IV.

## **2. UNDERWRITER REPUTATION AND IPO UNDERPRICING**

### *A. Related Literature*

Underwriter reputation and the role it plays in IPO underpricing has always been a highly debated topic in the IPO literature. The traditional view is that prestigious underwriters use their reputation capital to certify the value of the firm and reduce investor's uncertainty about the value of the issue, and that consequently lowers the level of underpricing in IPOs (see Smith (1986), Booth and Smith (1986), Beatty and Ritter (1986), Carter and Manaster (1990), and Chemmanur and Fulghieri (1994), among others). A less traditional view that may result in the same negative relation between underwriter reputation and underpricing is partial adjustment. Benveniste and Spindt (1989) argue that investment banks only partially adjust IPO offer prices upwards when they receive positive information about the value of the issue. They do that to reward investors who truthfully reveal their information about the issue and threaten access to future deals for those who do not. Since prestigious underwriters are expected to have more future deals to compensate investors, they do not have to pre-commit a large underpricing for each issue. Therefore, prestigious underwriters are associated with lower IPO underpricing.

The negative relation between underwriter reputation and IPO underpricing has been widely documented until recently, where Beatty and Welch (1996), Cooney, Singh, Carter, and Dark (2001), and Loughran and Ritter (2004) document that the relation has been reversed in the 1990s. Beatty and Welch (1996) attribute the positive relation between underwriter reputation and underpricing to the change in economic conditions in the 1990s compared to the 1980s. Cooney, Singh, Carter, and Dark (2001) find that this positive relation exists only for the sample of IPOs with final offer price set above the final file range in the IPOs' preliminary prospectus. The inverse relation still persists for IPOs with final offer price set within the final file range. Loughran and Ritter (2004) argue that the positive relation happens in times when prices rise very quickly, especially during the internet bubble period. Issuers are less concerned about underpricing because their new found wealth is so much higher than what they had

expected. All these arguments suggest that the positive relation between underwriter reputation and underpricing may be time and regime dependent.

In examining the relation between IPO underpricing and litigation risk, Lowry and Shu (2002) argue that underpricing is a cheap form of insurance that will limit potential damages and reduce the plaintiffs' incentives to sue. They find that sued firms have significantly higher ranked underwriters than non-sued firms. Since prestigious underwriters who have "deep pockets" have a higher probability of being sued when prices fall drastically post IPOs, there is an incentive for them to underprice more. This implies that lowering litigation risk could be a reason for the positive relation between underwriter reputation and underpricing.

Bates and Dunbar (2002) simultaneously examine the impact of three measures of underwriter reputation on IPO underpricing. These measures include the Carter-Manaster ranking in which underwriters are ranked based on their relative placements in the Tombstones, underwriter's market share estimate developed by Megginson and Weiss (1991), and an underwriter's industry market share measure. They find that the correlation between Carter-Manaster rank and underpricing is significantly negative for IPOs from 1985 to 2000, while the effect on overall market share is positive. They also find that the relation between Carter-Manaster rank and underpricing remains significantly negative over subperiods in the 1990s after controlling for market share.

In examining promotion cost as a substitute for IPO underpricing, Habib and Ljungqvist (2001) find that the positive relation between underwriter reputation and underpricing is due to the endogenous choice of underwriters, i.e. the choice depends on firm and offering characteristics. Using two-stage least squares (2SLS) allowing for simultaneity in underwriter choice, they find that the relation between underwriter's rank and underpricing is negative but not statistically significant. Though not reported, they mention that the relation becomes significantly negative if they drop risk proxies such as underwriting fees and/or natural log sales from the 2SLS regressions.

Logue, Rogalski, Seward, and Foster-Johnson (2002) also consider the simultaneity problem, but between underwriter reputation and premarket underwriting activities. They use an innovative approach known as path analysis to separate the effect of underwriter reputation from the effect of underwriting activities on the current IPO. They find that prestigious underwriters are more likely to adjust file ranges upward during the bookbuilding process because their reputation capital helps facilitate premarket underwriting activities. Finding no direct relation between underwriter reputation and underpricing, they argue that the principal influence of underwriter reputation on underpricing is through premarket underwriting activities.

It is apparent from the more recent literature that the choice of underwriters is endogenous, and the relation between underwriter reputation and underpricing is inconclusive. Given the endogenous choice of underwriters, we need to explicitly incorporate the potential interdependence between underwriter reputation and the level of underpricing. We recognize that sometimes the choice of high-ranked versus low-ranked

underwriters may not rest in the hands of the issuing firms, i.e. firms of certain risk profile or in certain industries may be forced to use one set of investment bankers rather than another. To mitigate the problem, we do robustness tests on sub-sample of issuing firms that are likely to have the choice of different ranking underwriters. We focus our attention on factors affecting this choice and whether the choice results in higher or lower IPO underpricing. We formalize this in a model in the next sub-section.

### *B. A Model of the Choice Between High-ranked Versus Low-ranked Underwriters*

An issuing firm going public faces two prospective levels of underpricing, depending on whether the underwriting is done by a high-ranked or a low-ranked investment bank. Assume  $U_{hi}$  and  $U_{li}$  are the respective levels of underpricing for issuing firm  $i$  associated with high-ranked and low-ranked underwriters. Depending on the actual choice of underwriters, we only observe underpricing associated with either a high-ranked investment bank or a low-ranked investment bank. This reveals something about the value of the issuing firm's private information about its decision to go with a particular ranked underwriter. The issuing firm is expected to use a low-ranked underwriter if

$$U_{hi} - U_{li} > P_i \quad (1)$$

where  $P_i$  is the reservation price for using the high-ranked investment bank. If an issuing firm chooses to minimize the level of underpricing associated with going public, the reservation price,  $P_i$ , is expected to be 0. The reservation price may not be zero if an issuing firm is concerned with factors other than IPO underpricing. For example, if it expects to benefit from more efficient premarket activities by using prestigious underwriters, as suggested by Logue, Rogalski, Seward, and Forster-Johnson (2002), or if it desires to have better analyst coverage for the stock post-IPO by using a reputable investment banker, as suggested by Krigman, Shaw and Womack (2001), the reservation price,  $P_i$ , is expected to be positive.

Since the reservation price is unobservable, it is estimated on the basis of issue and firm's characteristics. Thus,

$$P_i = \alpha_0 + \alpha_1 I_i + \alpha_2 F_i + \varepsilon_i \quad (2)$$

provides an approximation of the reservation price, where  $I_i$  and  $F_i$  represent vectors of issue and firm's characteristics respectively. The error term,  $\varepsilon_i$ , is assumed to be  $N(0, \sigma^2)$ .

Equations (1) and (2) imply the following Probit model of the choice of a high-ranked versus low-ranked underwriter:

$$C_i = b_0 + b_1(U_{hi} - U_{li}) + b_2 I_i + b_3 F_i + e_i \quad (3)$$

where  $C_i$  is the probability that a high-ranked investment banker will be used. This model specifies complete interactions between the underpricing equations. These are:

$$U_{hi} = \alpha_{h0} + \alpha_{h1}I_i + \alpha_{h2}F_i + \alpha_{h3}M_i + u_{hi} \quad (4)$$

$$U_{li} = \alpha_{l0} + \alpha_{l1}I_i + \alpha_{l2}F_i + \alpha_{l3}M_i + u_{li} \quad (5)$$

where  $U_{hi}$  is the underpricing associated with high-ranked investment bankers and  $U_{li}$  is the underpricing associated with low-ranked investment bankers for issuing firm  $i$ .  $I_i$  and  $F_i$  are the respective vectors of issue and firm's characteristics, and  $M_i$  is the vector of market conditions prior to the offer date. The error terms  $u_{hi}$  and  $u_{li}$  are random residuals assumed to be  $N(0, \sigma_h^2)$  and  $N(0, \sigma_l^2)$ . This model consists of qualitative and limited dependent variables. The underpricing equations cannot be estimated directly because of the interdependence between (3) and (4), and (3) and (5), which causes  $u_{hi}$  and  $u_{li}$  to be correlated with  $e_i$ .

The procedure developed by Heckman (1976) and Lee (1978) is used to obtain the consistent estimation of the underpricing equations. This involves finding the expressions for the means  $E(u_{hi}|C_i = 1)$  and  $E(u_{li}|C_i = 0)$  and adjust the error terms so that they will yield zero means. The estimation procedure is two staged, where the first stage involves estimating the probability of using a high-ranked underwriter estimated by Probit, and the second stage involves estimating the levels of underpricing by ordinary least squares, controlling for the interdependence between the choice of underwriters and the levels of underpricing. The resulting selectivity-bias adjusted (SBA) estimates of underpricing,  $U_{hi}$  and  $U_{li}$ , can be used to estimate the difference in expected underpricing.

The reduced-form probit of the underwriter reputation choice equation is,

$$C_i = \delta_0 + \delta_1I_i + \delta_2F_i + e_i^* \quad (6)$$

where the  $I_i$  and  $F_i$  vectors include all observable characteristics of the issue and the firm. Conditional on the choice of underwriters with different reputations, the underpricing equations can be estimated using the distributional properties of (6). Let  $\psi_i = \delta_0 + \delta_1I_i +$

$$U_{hi} = \alpha_{h0} + \alpha_{h1}I_i + \alpha_{h2}F_i + \alpha_{h3}M_i + \sigma_{1e^*} \left( \frac{-\phi(\psi_i)}{\Phi(\psi_i)} \right) + \eta_{hi} \quad (7)$$

$\delta_2F_i$ .  $\Phi(\psi_i)$  is designated as the cumulative distribution of  $\psi_i$ , and  $\phi(\psi_i)$  is the density function of  $\psi_i$ , a standard normal random variable. Conditional on the choice of high-ranked underwriter, the underpricing equation (4) becomes:

The underpricing associated with a low-ranked underwriter (equation (5)) becomes:

$$U_{li} = \alpha_{l0} + \alpha_{l1}I_i + \alpha_{l2}F_i + \alpha_{l3}M_i + \sigma_{2e^*} \left( \frac{\phi(\psi_i)}{1 - \Phi(\psi_i)} \right) + \eta_{li} \quad (8)$$

where  $\sigma_{ie^*}$  standardizes the selectivity variable to have a variance of 1, and  $\eta_{hi}$  and  $\eta_{li}$ , the selectivity bias adjusted residual errors, are  $E(\eta_{hi}|C_i=1)=0$  and  $E(\eta_{li}|C_i=0)=0$ .

Expressions (7) and (8) are consistently estimated by regressing the observed underpricing on issue and firm's characteristics, market conditions prior to the offer date, and the estimated values of the selectivity variables, which are  $-\phi(\psi_i)/\Phi(\psi_i)$  and  $\phi(\psi_i)/(1-\Phi(\psi_i))$ , respectively. The selectivity variables are also called the "Inverse Mills Ratios". They measure the expected value of the issuing firm's private information about its choice of different ranking underwriters, conditional on their own and their issue's observed characteristics, market conditions, and the underwriter reputation. A significant coefficient for the inversed Mills ratio indicates that the level of underpricing is affected by the choice of underwriter's rank. In the regression associated with high-ranked underwriters, a negative coefficient for the inversed Mills ratio implies that using high-ranked underwriters is associated with higher underpricing in IPOs (that is because the inversed Mills variable for the high-ranked equation carries a negative sign). Analogously, a positive coefficient for the inversed Mills ratio implies that using high-ranked underwriters results in lower level of underpricing. In the regression associated with low-ranked underwriters, a positive coefficient for the inversed Mills ratio implies that using low-ranked underwriters is associated with higher underpricing in IPOs.

Equations (7) and (8) can be used to obtain the unbiased estimates of  $U_{hi}$  and  $U_{li}$  for IPOs that use high-ranked versus low-ranked investment banks. It allows us to predict the expected underpricing if the opposite choice on underwriter's rank had been made.

### C. *Choice of Underwriters and Underpricing*

The model described in sub-section B allows us to determine if the choice of underwriters is consistent with issuing firms (1) attempting to minimize initial underpricing and hence the overall costs of going public or (2) aiming to reap potential marketing benefits associated with underpricing. The results could potentially help resolve the controversies related to the role of underwriter reputation on underpricing.

Underpricing has been regarded as money left on the table by issuers to investors. Loughran and Ritter (2002) report that an average IPO leaves \$9.1 million on the table, an amount that equals to years of operating profit for many IPO firms, and about twice the amount of direct underwriting fees. Hence, it is logical that firms would choose underwriters who are capable of minimizing the level of initial underpricing to take them public if they attempt to minimize the overall costs of initial public offering. If minimizing underpricing is the goal of the issuing firm, we should observe the choice of underwriters corresponding to a *lower* level of underpricing. This means firms that chose high-ranked underwriters would have incurred higher underpricing if they had chosen low-ranked underwriters, and firms that chose low-ranked underwriters would have incurred higher underpricing if they had chosen high-ranked ones. This scenario implies that high-ranked underwriters would underprice lower-quality firms substantially more if they were to take them public, either to protect reputation or to avoid potential lawsuits. Hence, these firms ended up choosing low-ranked underwriters and avoid the



high costs of underpricing. The results would also imply that the relation between underwriter reputation and underpricing is inconclusive (the relation could be either negative or positive), and firms choose to minimize underpricing through their choice of underwriters.

There are various reasons why minimizing underpricing may not be the central concern of issuing firms. Booth and Chua (1996) and Brennan and Franks (1997) argue that issuing firms incur higher underpricing in exchange for wider distribution of ownership, either for promoting secondary market liquidity for their shares and/or for retaining control. Demers and Lewellen (2003) argue that underpricing may play a marketing role because the cost of underpricing is very similar in dollar value to the direct marketing expenses. They find that media mentions in the month of IPOs are positively related to underpricing. Aggarwal, Krigman, and Womack (2002) also argue that extreme underpricing attracts media attention and increase publicity for the issuing firm. If underpricing has its potential marketing benefits, and if issuers think the benefits of underpricing outweigh the costs, we should observe firms' choice of underwriters corresponding to a *higher* level of underpricing. This means empirically, firms that chose high-ranked underwriters would have incurred lower underpricing had they chosen low-ranked underwriters, and firms that chose low-ranked underwriters would have incurred lower underpricing had they chosen high-ranked ones. These results would suggest that the relation between underwriter reputation and underpricing is inconclusive, and firms prefer to incur high underpricing to reap potential associated benefits.

The two scenarios discussed above may not be mutually exclusive. In reality, the business of going public can be very complex. Some firms may choose to lower the level of initial underpricing through their choice of underwriters while others may find it attractive to incur higher underpricing and reap the potential associated benefits. For example, a large and well-known firm may find the incremental benefits derived from underpricing as a marketing tool to be less than the costs of underpricing. Alternatively, a small and unknown firm may find the incremental marketing benefits to be enormous and well worth the higher underpricing costs. If these conditions prevail, we should observe firms choosing high-ranked underwriters to incur lower underpricing compared to if they had chosen the low-ranked ones, since prestigious underwriters have traditionally been argued to provide certification of value and reduce the level of uncertainty associated with new issues. If the role of prestigious underwriters remains unchanged, we should observe firms choosing low-ranked underwriters to incur higher underpricing compared to if they had chosen the high-ranked ones.<sup>2</sup> These firms choose to incur higher underpricing because the potential marketing benefits derived from underpricing outweigh the costs. These results would imply a negative relation between underwriter reputation and underpricing, as argued by Smith (1986), Booth and Smith (1986), and Carter and Manaster (1990), among others. The results also suggest that issuers trade-off potential benefits and costs of underpricing through their choice of underwriters.

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<sup>2</sup> High-ranked underwriters usually try to avoid high underpricing in fear of losing future market share (see Beatty and Ritter, 1986 and Dunbar, 2000).

Empirically, another scenario could possibly be observed from this study. If we observe firms with high-ranked underwriters incurring higher underpricing compared to if they had chosen the low-ranked ones, and firms choosing low-ranked underwriters incurring lower underpricing compared to if they had chosen the high-ranked ones, a positive relationship between underwriter reputation and underpricing is implied. However, this finding is theoretically difficult to justify. Previous studies show that large and well-known firms tend to use prestigious underwriters when going public. Why would they want to engage a high-ranked underwriter to take them public and bear the high costs of underpricing? After all, these firms tend to benefit *less* from the marketing benefits associated with underpricing compared to small and unknown firms. Also, high-ranked underwriters may not want to incur high underpricing in fear of losing future market share. Beatty and Ritter (1986) and Dunbar (2000) argue that investment bankers who deviate in the initial underpricing (too much or too little) lose market share relative to those who underprice by the average amount after controlling for issue characteristics.

### **3. DATA**

#### *A. Sample*

Our sample of IPOs from 1988-1998 is obtained from the Thomson Financial Securities Data new issues database.<sup>3</sup> IPOs with an offer price below \$5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. Our sample does not include best efforts offers because they are typically very small and are not covered by Thomson Financial. The initial sample consists of 3,587 IPOs that have been issued during the 11-year period. We excluded 59 issues where we could not determine whether the price ranges were revised up or down. These are the issues in which the price ranges have been either narrowed or widened. The final sample with complete data is 2,411 IPOs, after adjusting for additional missing data in the variables such as earnings prior to IPO, ratio of retained shares to public float, underpricing, and the intended use of proceeds. Of these 2,411 IPOs, 1,444 were underwritten by high-ranked investment bankers while 967 were underwritten by low-ranked investment bankers.

#### *B. Description of Variables*

The dependent variables used in the two-stage Heckman model are described as follow:

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<sup>3</sup> We start our sample from 1988 because the price range revision data is largely not available in Thomson Financial before that. We stop our sample in 1998 because the internet bubble period is not a normal period for our study. About 80% of the IPOs during the bubble period are underwritten by high-ranked underwriters, which means choice of low-ranked versus high-ranked investment bankers is questionable during that period. Additionally, Loughran and Ritter (2002) report that prestigious underwriters were egregious in leaving huge amounts of money on the table during that period.

**High-ranked** is a binary variable taking on a value of one if the IPO is underwritten by an investment banker with a ranking of 8 or above, and zero if the IPO is underwritten by an investment banker with a ranking below 8. To determine the underwriter's rank, we follow the ranking described in Appendix C of Loughran and Ritter (2004). They started their rankings with rankings from Carter and Manaster (1990) and Carter, Dark, and Singh (1998) and created rankings for 1992-2000 using the same methodology. This measure is based on the investment bankers' relative positions in the Tombstone and it has been widely used in IPOs studies. The resulting rankings are on a scale of 0 to 9, with 9 being the most reputable.<sup>4</sup> In general, a ranking of 8 and above is considered to be high-ranked, prestigious national underwriters.<sup>5</sup> Therefore, we use this criterion to separate high-ranked investment bankers from the low-ranked ones.

**Underpricing** is defined as the percentage change between the offer price and the first day closing market price of the IPO. This percentage change multiplied by the amount of gross IPO proceeds is usually viewed as money left on the table by the issuing firm.

The independent variables that are considered important in determining the choice of high-ranked versus low-ranked underwriters are described below. These variables proxy for issuing firm's characteristics that are known at the time when it is looking for an investment banker to take it public:

**LOSS** is a binary variable taking on a value of 1 if the firm has negative earnings the year prior to the IPO, and a value of 0 if the firm has positive earnings the year prior to the IPO. When a firm has no positive earnings prior to going public, valuation of the firm can be very difficult. In the early 1980s, only about 20% of the IPOs with negative earnings were underwritten by high-ranked investment bankers. However, that figure rose to 80% during 1999 and 2000. Even though early to mid-1980s and 1999-2000 IPOs are not in our sample, this variable can be important to issuing firms when they decide on who to take them public. Because valuation of firms with negative earnings is deemed to be more difficult, **LOSS** is also expected to affect the level of underpricing.

**VC** is a binary variable taking on a value of 1 if the IPO has venture capital backing, and a value of zero if it does not. Previous studies related to certification argue that the presence of venture capitalists should reduce underpricing. Recently, Bradley and Jordan (2002) show that IPOs backed by venture capitalists are associated with higher level of underpricing. However, they find that the difference in underpricing goes away when they control for industries, whether it is NASDAQ-listed, and underwriter's market share. Gao (2002) documents that venture capitalists and investment bankers

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<sup>4</sup> Other measures such as the market share of investment banks have also been used to measure underwriter reputation. However, Carter, Dark, and Singh (1998) find that market share measures provide little additional explanatory power when the ranking based on average placements in Tombstone is used. Therefore, we use the Tombstone measure of underwriter reputation in our study.

<sup>5</sup> Habib and Ljungqvist (2001) classify investment bankers as prestigious if the ranking is above 7. We use that as well and the results are qualitatively very similar and hence not reported here.

have a cozy relationship because there has been an increasing number of venture capitalists receiving generous allotments of IPOs shares. We expect the presence of venture capitalists to be an important determinant of the choice of underwriters.

**TECH** is a binary variable taking on a value of 1 if the firm is a high-tech firm, and a value of 0 if the firm is not a high-tech firm. We classify high-tech firms based on Loughran and Ritter (2004) Appendix D. These firms largely fall under the 2-digit SIC codes equal to 35 (computer hardware), 36 (electronics and communications equipment), 38 (medical instruments and controlling devices), 48 (communications), and 73 (software). We conjecture that high-tech firms tend to choose certain categories of investment banks compared to non high-tech firms. **TECH** is also a variable that has been widely used in previous studies to explain IPO underpricing.

**LN(PROCEEDS)** represents the natural logarithm of the amount of proceeds raised in the IPO. This variable has traditionally been used to proxy for risk of the issue. IPOs with large proceeds are considered to be less risky and hence command a lower level of underpricing. Also, Beatty and Ritter (1986) suggest that safer IPOs tend to be underwritten by more reputable investment banks, leaving the riskier ones for the less reputable investment banks.

**PURPDUMMY** takes on a value of one if the intended use of proceeds is to repay or reduce debt, zero otherwise. In the prospectus, using IPO proceeds for general corporate purposes (56%) and to reduce or payoff debt (33%) are the major reasons cited by firms going public. Other reasons cited include to finance projects or acquisitions, and for working capital or capital investment. If IPO proceeds are intended for repaying or reducing debt, they would not be used to undertake any new projects or expand existing projects that will likely increase or decrease the value of the firm. Hence, some of the uncertainty associated with IPOs will be alleviated. As a result, we expect **PURPDUMMY** to affect the choice of underwriters and underpricing.

Additional variables used to explain underpricing are motivated based on existing research. These are the variables decided upon or occurred after the investment bank has been chosen. They also include some variables proxying for market conditions prior to the IPO offer date:

**OVERHANG** is the ratio of retained shares to the public float at the IPO. Bradley and Jordan (2002) document that share overhang predicts underpricing. One explanation is that when the number of shares issued in the IPO is small relative to the shares retained by pre-issue shareholders, the negatively sloped demand for the shares will push the aftermarket price up, resulting in higher underpricing. The higher aftermarket price can also result from the asymmetric information model argued in Leland and Pyle (1977). By selling a small fraction of the firm in the IPO, the insiders can signal that the firm is of high value and hence push the aftermarket price up. Barry (1989) and Habib and Ljungqvist (2001) suggest that the opportunity cost of underpricing to issuers is less if the share overhang is large. Loughran and Ritter

(2004) argue that when the valuation and share overhang are high, issuers will not bargain as hard for a higher offer price and hence leave more money on the table.

**NASD30days** is the cumulative daily returns of NASDAQ stocks 30 calendar days (approximately 21 to 22 trading days) prior to the IPO date. NASDAQ returns are obtained from CRSP. The cumulative NASDAQ return prior to the IPO has been used in previous studies in explaining IPO underpricing. For example, Bradley and Jordan (2002) and Loughran and Ritter (2004) find that when the cumulative NASDAQ return 15 trading days prior to the IPO is large, underpricing is high.

**IPONUM30DAYS** is the total number of IPOs that went public 30 calendar days before the IPO date. Booth and Chua (1996) argue that when IPOs are clustered, underpricing is expected to be less because spillover effects lower information production costs. However, on an aggregate basis, Lowry and Schwert (2002) find no relation between **Number of IPOs** and average monthly underpricing.

**UNDERPRICING30days** is the average underpricing for the firms going public in the 30 calendar days before the IPO date. This variable is computed by taking the simple average of the IPO underpricing in the sample. Bradley and Jordan (2002) find that when the average underpricing prior to the IPO increases, underpricing for the particular issue increases.

The following independent variables are related to whether the preliminary filing price range of the IPO has been revised. A preliminary price range is set before the investment bank starts the IPO bookbuilding process. During the bookbuilding process, the investment banker is likely to update his price estimates by revising the file price range up (or down) when he determines that the demand of the issue is strong (or weak). **UP** takes on 1 if the file price range is revised up, zero otherwise. **DOWN** takes on 1 if the file price range is revised down, zero otherwise. **REVISION1** is the new mid-price less the original mid-price divided by the original mid-price, where mid-price is the average of the high and low prices of the filing price range. **REVISION2** is the final offer price less the new mid-price divided by the new mid-price. For IPOs that are not revised, the new mid-price is also the original mid-price. Following Bradley and Jordan (2002), we interact **UP** and **DOWN** with **REVISION1** and **REVISION2** to allow for the possibility that there might be asymmetric effects from changes in the file price ranges and changes from the file price to the final offer price.

## 4. EMPIRICAL RESULTS

### A. *Descriptive Statistics*

Table 1 provides descriptive statistics of sample IPOs categorized by high-ranked versus low-ranked investment banks. Consistent with Beatty and Ritter (1986), IPOs underwritten by high-ranked investment banks have significantly larger proceeds and higher offer prices than those underwritten by low-ranked investment banks. They also are more frequently backed by venture capitalists, have higher retained shares to public float, and have a higher percentage with negative earnings. During the

bookbuilding process, high-ranked investment banks are more likely to revise the preliminary file ranges, especially to revise them up, compared to low-ranked investment banks. This is consistent with argument by Logue, Rogalski, Seward, and Foster-Johnson (2002) that investment banks establish their reputation to facilitate the conduct of premarket underwriting activities. When setting the final offer prices, they are also more likely to price them out of the file price ranges, both above and below.

Central to this study is that average underpricing for IPOs underwritten by high-ranked investment banks is significantly higher than that for low-ranked investment banks (15.9% versus 12.09%). This is consistent with evidence by Beatty and Welch (1996), Cooney, Singh, Carter and Dark (2001), and Loughran and Ritter (2004) but inconsistent with evidence by Beatty and Ritter (1986), Carter and Manaster (1990), and Carter, Dark, and Singh (1998), among others, who found a negative relation.

To gain additional insight on the relation between underwriter reputation and IPO underpricing over time, we categorize IPOs by the year they go public in Table 2. During our sample period, only in years 1995, 1997 and 1998 that IPOs underwritten by high-ranked investment banks experience a significantly higher underpricing compared to IPOs underwritten by low-ranked investment banks. IPOs in these years account for about 31% of the total sample size. The difference between underpricing of IPOs underwritten by high-ranked versus low-ranked underwriters is not statistically significant for all the other years. However, it is interesting to note that from 1988-1991, though not statistically significant, IPOs by high-ranked investment banks have lower underpricing, while from 1992-1998, IPOs by low-ranked investment banks have lower underpricing. This may support argument by Beatty and Welch (1996) that the conditions between 1980s and 1990s are fundamentally different. The percentage of IPOs underwritten by high-ranked investment banks does not fluctuate substantially over the years. They range from approximately 50% to 68% during our sample period, with the overall average of about 60%.

## *B. Underwriter Reputation and File Range Revisions*

In Table 3, we examine the underpricing of IPOs that have their file price ranges revised up, down, and not revised. Under each of these categories, we also examine the impact on underpricing when the final offer price is below, within, or above the final file range. Our results for the overall sample are very similar to those found in Bradley

**Table 1**  
**Descriptive statistics of IPOs from 1988-1998 categorized by high-ranked versus low-ranked investment banks.**

Variable	All IPOs (N=2,411)	IPOs by high- ranked investment banks (N=1444)	IPOs by low-ranked investment banks (N=967)	T-statistics
Gross Proceeds (\$m)	50.98	72.30	19.13	11.17***
% with Negative Earnings	34.7	36.8	31.5	2.65***
%VC Backed	41.60	51.2	27.2	12.09***
%Use Proceeds to Reduce Debt Overhang	38.8 4.14	39.8 4.76	37.3 3.19	1.19 6.20***
Offer Price (\$)	11.75	13.60	8.99	29.22***
Original mid-price (\$)	11.80	13.42	9.38	30.42***
Revised mid-price (\$)	11.73	13.44	9.18	30.49***
% Revised Up	14.3	17.9	8.8	6.34***
% Revised Down	17.3	16.8	18.1	-0.81
% Revised	31.6	34.8	26.9	4.09***
% Above Final range	14.7	20.1	6.60	9.31***
% Below Final Range	15.0	16.0	13.4	1.72*
% Out of Final Range	29.7	36.1	20.0	8.56***
Underpricing (%)	14.37	15.90	12.09	4.20***

Notes: The data is from Securities Data Corporation from 1988-1998. IPOs with an offer price below \$5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. Underwriter's rank is obtained from Loughran and Ritter (2004). A ranking of 8 or above is classified as high-ranked and a ranking of below 8 is classified as low-ranked. T-statistics show the significance of mean differences between IPOs underwritten by high-ranked versus low-ranked investment banks.

\*\*\* Statistically significant at .01 level

\*\* Statistically significant at .05 level

\* Statistically significant at .10 level

**Table 2**  
**Underpricing of IPOs from 1988-1998 categorized by year and by high-ranked versus low-ranked investment banks.**

Year	N	% of IPOs with high-ranked investment banks	Underpricing (%)			T-statistics
			All IPOs (N=2,411)	IPOs by high-ranked investment banks (N=1,444)	IPOs by low-ranked investment banks (N=967)	
1988	64	65.6	7.23	5.88	9.81	-1.32
1989	69	56.5	8.54	7.86	9.43	-0.57
1990	61	60.7	11.37	9.24	14.65	-1.25
1991	186	68.3	12.35	12.2	12.69	-0.20
1992	266	60.2	10.62	10.84	10.30	0.25
1993	313	59.7	12.73	13.56	11.48	0.95
1994	244	49.6	9.40	10.29	8.53	0.73
1995	275	60.7	21.62	24.10	17.80	2.04**
1996	457	61.1	17.56	18.54	16.02	1.06
1997	316	56.0	14.03	16.90	10.39	2.98***
1998	160	67.5	19.34	26.00	5.49	3.67***
Overall	2,411	59.5	14.37	15.90	12.09	4.20***

Notes: The data is from Securities Data Corporation from 1988-1998. IPOs with an offer price below \$5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. Underwriter's rank is obtained from Loughran and Ritter (2004). A ranking of 8 or above is classified as high-ranked and a ranking of below 8 is classified as low-ranked. T-statistics show the significance of mean differences between underpricing of IPOs underwritten by high-ranked versus low-ranked investment banks.

\*\*\* Statistically significant at .01 level

\*\* Statistically significant at .05 level



**Table 3**  
**Average underpricing for IPOs that have their preliminary price ranges revised up, down, or not revised.**

	<u>Do Not Revise</u>			<u>Revise Up</u>			<u>Revise Down</u>		
	Below Range	Within Range	Above Range	Below Range	Within Range	Above Range	Below Range	Within Range	Above Range
<b>All IPOs</b>									
Underpricing (%)	2.51	11.56	30.43	7.19	26.33	48.64	2.68	6.52	27.49
N	266	1109	274	23	262	59	72	325	21
<b>IPOs by high-ranked investment banks</b>									
Underpricing (%)	2.64	10.65	30.80	8.77	29.28	49.31	3.72	4.45	29.01
N	170	556	216	13	191	55	48	176	19
<b>IPOs by low-ranked investment banks</b>									
Underpricing (%)	2.28	12.47	29.05	5.13	18.39	39.50	0.61	8.97	13.00
N	96	553	58	10	71	4	24	149	2

Notes: The data is from Securities Data Corporation for the period 1988-1998. IPOs with an offer price below \$5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. Underpricing is defined as the percentage change between the offer price and the first day closing market price of the IPO. A ranking of 8 or above is classified as high-ranked and a ranking of below 8 is classified as low-ranked.

and Jordan (2002), i.e. IPOs priced above (below) the file range has the largest (smallest) underpricing, regardless of whether the file range has been revised. IPOs with file ranges revised up and still priced above the final file ranges experience the largest underpricing (48.64%).<sup>1</sup>

The general pattern of underpricing persists when we subdivide the sample into IPOs underwritten by high-ranked versus low-ranked investment banks. For IPOs that do not have their file range revised, the magnitude of underpricing for the two groups of investments bankers are very similar, whether the final offer price is below, within, or above the file range. However, for IPOs with file range revised up, those underwritten by high-ranked investment banks have substantially higher underpricing than those underwritten by low-ranked investment banks, in the respective categories of below, within, and above range. For IPOs that have their file range revised down, the pattern is not uniform. For these IPOs, high-ranked investment banks tend to underprice more when the final offer price is below or above the file range while low-ranked investment banks underprice more when the final offer price is within the file range. Overall, the evidence in Table 3 suggests that underwriter reputation plays a role in the IPO bookbuilding process, consistent with arguments by Logue, Rogalski, Seward, and Foster-Johnson (2002). High-ranked underwriters tend to underprice more than low-ranked underwriters, especially for IPOs with file ranges revised and with final offer price out of the final file range.

### *C. The Choice of High-ranked versus Low-ranked Underwriters*

A Probit model is used to determine the impact of the factors discussed in Sections I and II on the choice between high-ranked versus low-ranked investment banks. Since the selection of underwriters happens early in the going public process, the determinants of underwriter's choice are limited to size and risk characteristics of the issuing firm known months before the offer date. Hence, factors related to market conditions and file price revisions are not included in the choice equation.

Table 4 provides the estimates of the Probit equation. The estimated coefficients and the marginal effects indicate that several of the independent variables are important in explaining the use of high-ranked underwriters. The positive and statistically significant coefficient for **VC** indicates that venture capital backed IPOs have a higher likelihood of using high-ranked investment banks. The relation between venture capitalists and investment banks has been widely studied. Hsu (2004) argue that entrepreneurs often are willing to accept unfavourable terms from reputable venture capitalists in order to get access to prestigious underwriters when they take their firms public. Recent disclosures by congressional investigators suggest that many venture capitalists receive generous allocations of hot IPOs and that helps them decide as to which investment banks to use when their companies go public (see Smith, Grimes, Zuckerman, and Scannell (2002)). **TECH** and **LOSS**, though with positive coefficients, are statistically insignificant. This could be due to the fact that high-tech firms and firms with negative earnings prior to

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<sup>1</sup> The magnitude of underpricing in our study is smaller than that in Bradley and Jordan (2002) because we exclude year 1999, a year with egregious amount of underpricing, in our study.

**Table 4**  
**Reduced form Probit estimates of the likelihood that an IPO is underwritten by a high-ranked investment banker**

	<u>Overall Sample (N=2,411)</u>			
	Coefficient	Standard Error	Marginal Effect	Standard Error
CONSTANT	-4.49***	0.18	-1.17***	0.07
LOSS	0.06	0.07	0.02	0.03
VC	0.71***	0.07	0.25***	0.02
TECH	0.08	0.07	0.03	0.02
LN(PROCEEDS)	1.36***	0.05	0.50***	0.02
PURPDUMMY	-0.10	0.07	-0.04	0.03
Pseudo R <sup>2</sup>			0.38	
F-stat for the hypothesis that all coefficients (except the constant) equal zero:			144.20	
p-value			0.000	

Notes: The marginal effect for a binary independent variable, say  $d$ , is calculated as  $\text{Prob}[Y=1|x^*, d=1] - \text{Prob}[Y=1|x^*, d=0]$ , where  $Y$  is the binary dependent variable and  $x^*$  denotes the means of all the other independent variables in the model. For the continuous variables, the marginal effects are the partial derivatives of  $E[Y]$  with respect to the vector of characteristics computed at the means of all the other independent variables. The data is from Securities Data Corporation from 1988-1998. IPOs with an offer price below \$5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. The dependent variable is a binary variable that takes on a value of 1 if the underwriter has a ranking equal to or above 8, zero otherwise. Underwriter's rank is obtained from Loughran and Ritter (2004). The independent variables are defined as follow: LOSS a binary variable which takes on a value of 1 if the firm has negative earnings the year prior to the IPO, and a value of 0 if the firm has positive earnings the year prior to the IPO; VC is a binary variable which takes on a value of 1 if the IPO is backed by venture capitalists; TECH takes on a value of 1 if the firm is a high-tech firm, zero otherwise; PROCEEDS is the amount of proceeds raised in the IPO; PURPDUMMY is a binary variable taking on a value of 1 if the intended use of the IPO proceeds is to repay or reduce debt, and a value of 0 if the intended use of proceeds is for other purposes.

\*\*\* Statistically significant at the 0.01 level.

going public tend to be also backed by venture capitalists. **LN(PROCEEDS)** has a positive and statistically significant coefficient, indicating that larger issues tend to be associated with high-ranked underwriters. This is consistent with Beatty and Ritter (1986) that larger and less risky issues tend to be underwritten by high-ranked investment bankers. The Pseudo  $R^2$  for the probit model is 0.38 and we reject the hypothesis that all the coefficients jointly (except constant) equal zero.

#### *D. Determinants of Underpricing*

Table 5 provides estimates of the determinants of underpricing for IPOs underwritten by high-ranked versus low-ranked investment banks, including the inversed Mills ratios derived from the reduced-form Probit model of the choice of underwriter's rank. For both regression equations, the coefficients for **LOSS** are not statistically significant. This suggests that underwriters do not underprice IPOs with negative earnings prior to going public more. The coefficient for **VC** is also not statistically significant for IPOs underwritten by high-ranked investment banks, consistent with evidence from Bradley and Jordan (2002) that VC-backed IPOs are not more or less underpriced than non VC-backed IPOs after controlling for industry, exchange listing, and underwriter market share. However, **VC** is negative and statistically significant for IPOs underwritten by low-ranked underwriters. This is consistent with evidence by Barry, Muscarella, Peavy, and Vetsuypens (1990) and Megginson and Weiss (1991) that venture capitalists are providing a certification role in reducing IPO underpricing. The fact that the negative relation does not exist for IPOs underwritten by high-ranked investment banks may suggest that certification by venture capitalists may not be needed when the investment banks are prestigious and can provide the certification themselves.

The coefficients for **TECH** are positive and statistically significant for both equations, consistent with evidence in previous studies (e.g. Bradley and Jordan (2002)) that high-tech firms are more underpriced than non high-tech firms. The coefficients for **LN(PROCEEDS)** are negative and statistically significant at the 0.01 level for both the regressions, indicating that larger firms are less underpriced, consistent with evidence from previous studies. **PURPDUMMY** has negative coefficients indicating that IPOs with intended proceeds used to repay debt have lower underpricing. These IPOs experience lower level of uncertainty because the proceeds are not used to undertake new investment opportunities that may increase or decrease the value of the firm. However, the negative coefficient is significant only for IPOs underwritten by high-ranked investment banks, suggesting that only the high-ranked investment bankers are providing certification to reduce the underpricing of these less uncertain IPOs. Consistent with Bradley and Jordan (2002), the coefficient for **OVERHANG** is positive for both equations, suggesting that when insiders are selling less of their firms, underpricing is higher. The impact of **OVERHANG** is more prominent for IPOs underwritten by high-ranked investment banks than those underwritten by low-ranked investment banks.

**NASD30DAYS**, **IPONUM30DAYS**, and **UNDERPRICING30DAYS** are variables about stock and IPO market activities shown in previous research to be important in

**Table 5**  
**Selectivity-bias-adjusted estimates of underpricing for IPOs underwritten by high-ranked and low-ranked investment bankers.**

Independent Variable	Dependent Variable: Underpricing (%)	
	High-Ranked Investment Banks (N=1,444)	Low-Ranked Investment Banks (N=967)
Intercept	19.76*** (3.24)	27.89*** (4.73)
LOSS	-1.10 (-0.91)	-0.89 (-0.58)
VC	-0.85 (-0.57)	-9.07*** (-4.92)
TECH	7.17*** (6.33)	2.34** (2.00)
LN(PROCEEDS)	-3.40*** (-3.00)	-10.83*** (-3.76)
PURPDUMMY	-2.41*** (-2.65)	-0.98 (-0.75)
OVERHANG	0.55*** (3.76)	0.40* (1.72)
NASD30DAYS	62.07*** (4.18)	36.50*** (3.03)
IPONUM30DAYS	-0.01 (-0.19)	0.06 (1.52)
UNDERPRICING30DAYS	38.76*** (3.85)	19.37** (2.03)
UP*REVISION1	38.31*** (5.36)	-12.55 (-0.60)
UP*REVISION2	114.36*** (7.18)	85.22*** (3.33)
DOWN*REVISION1	21.24*** (4.73)	7.56 (1.26)
DOWN*REVISION2	26.01*** (3.39)	54.39*** (5.33)
Inverse Mills Ratio	8.49*** (3.26)	16.76*** (4.22)
Adjusted R <sup>2</sup>	0.33	0.10

Notes: The data is from Securities Data Corporation from 1988-1998. IPOs with an offer price below \$5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. Underpricing is defined as the percentage change between the offer price and the first day closing market price of the IPO. T-statistics are in parentheses.

\*\*\* Statistically significant at .01 level.

\*\* Statistically significant at .05 level.

\* Statistically significant at .10 level.

explaining underpricing. **NASD30DAYS** have statistically significant positive coefficient, both for IPOs underwritten by high-ranked and low-ranked investment banks. The results suggest that when the overall stock market return prior to the IPO is high, the initial run-up in price for that IPO is also high. The coefficients for **IPONUM30DAYS** for both equations are not statistically significant, suggesting that the information spillover effect documented in Booth and Chua (1996) diminishes after controlling for file range revisions during the bookbuilding process. **UNDERPRICING30DAYS** are both positive and statistically significant, consistent with Lowry and Schwert (2002) that initial returns are positively autocorrelated.

The coefficients for **UP\*REVISION1** and **DOWN\*REVISION1** are significantly positive for IPOs underwritten by high-ranked investment banks but statistically insignificant for IPOs underwritten by low-ranked investment banks. Bradley and Jordan (2002) argue that file range amendments contain information about the change in valuation by the investment banks during the bookbuilding process, before the final offer price is determined. These results suggest that the information contained in the file range amendment is important in explaining underpricing only when the amendments are done by high-ranked investment banks. The coefficients for **UP\*REVISION2** and **DOWN\*REVISION2** are significantly positive for both equations, suggesting that the final adjustment of the offer price relative to the final file range conveys information important in explaining underpricing regardless of the underwriter's rank.

The bottom of Table 5 reports the coefficients on the inverse Mills ratios, which are  $-f(\psi_i)/F(\psi_i)$  for the high-ranked equations and  $f(\psi_i)/(1-F(\psi_i))$  for the low-ranked equations. The inverse Mills ratio coefficient for IPOs underwritten by high-ranked investment banks is positive and statistically significant at the 0.01 level. This means using high-ranked investment banks reduces IPO underpricing (positive coefficient on  $-f(\psi_i)/F(\psi_i)$  leads to a negative impact). The significance of the inverse Mills ratio suggests that the decision to use a high-ranked investment bank conveys some private information about the unobservable aspects of the firm and issue characteristics. In the OLS model where selectivity bias is not corrected, the cross-sectional variations of this private information are being ignored. The estimated negative truncation also means that we only observe the lower section of the underpricing distributions given firm and issue characteristics. The result stems from the issuing firm's selection of underwriter that will likely result in lower IPO underpricing than the average underwriter. For IPOs underwritten by low-ranked investment banks, the coefficient for the inverse Mills ratio is positive and statistically significant at the 0.01 level. The positive coefficient suggests that for these IPOs, using a low-ranked investment bank is associated with higher underpricing. The results suggest that there is a severe simultaneity problem between the choice of underwriter's rank and IPO underpricing, and this problem has to be corrected for to obtain unbiased predicted values of underpricing.

#### *E. Predicted Underpricing Under the Alternative Choice of Underwriter's Rank*

Results from Table 5 can be used to evaluate whether an issuing firm's choice of high-ranked versus low-ranked underwriters is consistent with minimizing IPO underpricing. To do that, we obtain fitted values of the underpricing using coefficient estimates from the selectivity bias adjusted (SBA) regressions in Table 5. We also compared that to the fitted values of underpricing using coefficient estimates from the simple OLS regressions to illustrate that OLS predictions are erroneous.

Results reported in the first section of Table 6 Panel A indicate that actual underpricing for IPOs with high-ranked underwriters is significantly higher than those with low-ranked underwriters. These results are consistent with those reported in the more recent studies but inconsistent with those reported in earlier studies. The next section of Table 6 Panel A analyzes IPOs that were actually underwritten by high-ranked investment banks. We estimate the expected value of the underpricing if the issuing firm were to choose the alternative choice of underwriter's rank. We compare two different models: 1) the simple OLS model without the inversed Mills ratios (OLS), and 2) the selectivity bias adjusted (SBA) model, i.e. the second stage estimates with the inverse Mills ratios included.  $UP_H$  is the average fitted value of underpricing using the coefficient estimates from the *High-ranked* regressions (OLS or SBA) for the set of IPOs that use high-ranked investment banks, while  $UP_L$  is the average fitted value of underpricing using the coefficient estimates from the *Low-ranked* regressions (OLS or SBA), also for the set of IPOs that use high-ranked investment banks. The OLS estimates indicate that IPOs that actually use high-ranked underwriters will incur significantly lower underpricing if they had chosen low-ranked underwriters. However, we cannot rely on the biased estimates produced by OLS because simultaneity problem between the underwriter's rank and underpricing is ignored. The SBA model specifically corrects for this problem. After adjusting for selectivity bias, the results are quite different. On average, IPOs that actually use high-ranked underwriters are projected to have an underpricing of 15.90%, compared to 16.86% if they had chosen to use low-ranked underwriters. The difference is statistically significant at the 0.05 level.

The third section of Table 6 Panel A concerns only IPOs that actually use low-ranked investment banks.  $UP_H$  is the average fitted value of underpricing using the coefficient estimates from the *High-ranked* regressions (OLS or SBA) for the set of IPOs that use low-ranked underwriters, while  $UP_L$  is the average fitted value of underpricing using the coefficient estimates from the *Low-ranked* regressions (OLS or SBA), also for the set of loans that use low-ranked underwriters. OLS estimates suggest that IPOs that actually use low-ranked underwriters are projected to incur about the same amount of underpricing if they were to use high-ranked underwriters. However, after adjusting for selectivity bias, the estimated underpricing for IPOs with low-ranked underwriters is 12.08%, compared to 8.42% if they had use high-ranked investment banks. The difference is statistically significant at the 0.01 level. The SBA results show that in general, high-ranked underwriters are associated with lower level of underpricing, consistent with prestigious underwriters using their reputation capital to certify value and reduce investor's uncertainty about the issue (see Booth and Smith (1986), Beatty and Ritter (1986), Carter and Manaster (1990), and Chemmanur and Fulghieri (1994), among others).

**Table 6**

**Expected average underpricing (in percent) for IPOs underwritten by high-ranked versus low-ranked investment bankers.**

	Number of IPOs High-Ranked      Low-ranked		Actual Underpricing UP <sub>H</sub> UP <sub>L</sub>		IPOs with High-ranked Underwriters				IPOs with Low-ranked Underwriters			
					Estimates from OLS		Estimates from SBA		Estimates from OLS		Estimates from SBA	
					UP <sub>H</sub> <sup>a</sup>	UP <sub>L</sub> <sup>b</sup>	UP <sub>H</sub> <sup>c</sup>	UP <sub>L</sub> <sup>d</sup>	UP <sub>H</sub> <sup>e</sup>	UP <sub>L</sub> <sup>f</sup>	UP <sub>H</sub> <sup>g</sup>	UP <sub>L</sub> <sup>h</sup>
<i>Panel A: Overall Sample</i>												
All IPOs	1,444	967	15.90 (23.82)	12.09*** (18.53)	15.90 (13.85)	12.33*** (8.14)	15.90 (13.92)	16.86** (10.46)	12.36 (9.31)	12.09 (5.67)	8.42 (10.43)	12.08*** (6.24)
<i>Panel B: Robustness Tests on Sub-sample IPOs</i>												
IPO Proceeds > Mean	511	44	15.88 (22.46)	18.82 (21.53)	16.04 (14.20)	12.90*** (7.75)	16.18 (14.01)	23.65*** (9.91)	12.96 (9.85)	12.33 (5.91)	14.11 (9.81)	18.08** (5.34)
IPO Proceeds > Median	1,033	169	18.46 (25.67)	16.15 (18.45)	17.41 (14.84)	13.22*** (8.48)	17.78 (14.71)	19.80*** (10.23)	14.31 (10.76)	12.93 (6.22)	14.86 (10.71)	15.17 (6.38)
IPOs with +ve Earnings	913	662	15.13 (20.71)	12.05*** (17.59)	15.13 (12.22)	12.31*** (7.39)	15.13 (12.32)	16.70*** (9.78)	12.26 (8.82)	12.05 (5.72)	8.46 (9.94)	12.05*** (6.28)
Purpose to Repay Debt	574	361	11.13 (16.10)	10.19 (17.44)	11.13 (10.95)	10.24* (6.80)	11.13 (10.93)	14.95*** (9.43)	9.82 (9.02)	10.19 (5.50)	6.51 (9.90)	10.19*** (6.02)
Non High-Tech Firms	822	585	10.36 (15.96)	10.79 (17.29)	10.36 (10.01)	10.46 (6.87)	10.36 (10.02)	15.46*** (10.20)	8.79 (8.12)	10.79*** (5.30)	4.55 (9.17)	10.79*** (5.95)

Notes: Standard deviations are in parentheses. OLS estimates are fitted from the equations below and SBA (selectivity bias adjusted) estimates are from Table 5. Mean and median IPO proceeds are \$50.98 million and \$28.8 million respectively. UP<sub>H</sub> and UP<sub>L</sub> are the underpricing for IPOs underwritten by high-ranked and low-ranked investment bankers respectively.



## Table 6 Cont...

a The average fitted values of underpricing for IPOs underwritten by high-ranked investment bankers, using coefficient estimates from the OLS regression for High-ranked underwriters.

b The average fitted values of underpricing for IPOs underwritten by high-ranked investment bankers, using coefficient estimates from the OLS regression for Low-ranked underwriters.

c The average fitted values of underpricing for IPOs underwritten by high-ranked investment bankers, using coefficient estimates from the SBA regression for High-ranked underwriters.

d The average fitted values of underpricing for IPOs underwritten by high-ranked investment bankers, using coefficient estimates from the SBA regression for Low-ranked underwriters.

e The average fitted values of underpricing for IPOs underwritten by low-ranked investment bankers, using coefficient estimates from the OLS regression for High-ranked underwriters.

f The average fitted values of underpricing for IPOs underwritten by low-ranked investment bankers, using coefficient estimates from the OLS regression for Low-ranked underwriters.

g The average fitted values of underpricing for IPOs underwritten by low-ranked investment bankers, using coefficient estimates from the SBA regression for High-ranked underwriters.

h The average fitted values of underpricing for IPOs underwritten by low-ranked investment bankers, using coefficient estimates from the SBA regression for Low-ranked underwriters.

### OLS regressions for High-ranked Underwriters:

$$\hat{UP}_H = 2.89 - 0.87(\text{LOSS}) + 1.47(\text{VC}) + 7.39(\text{TECH}) - 0.25(\text{LNPROCEEDS}) - 2.57(\text{PURPDUMMY}) + 0.55(\text{OVERHANG}) + 63.31(\text{NASD30DAYS}) + 0.00(\text{IPONUM30DAYS}) + 39.05(\text{UNDERPRICING30DAYS}) + 39.41(\text{UP*REVISION1}) + 115.19(\text{UP*REVISION2}) + 24.70(\text{DOWN*REVISION1}) + 27.18(\text{DOWN*REVISION2})$$

### OLS regressions for Low-ranked Underwriters:

$$\hat{UP}_L = 9.03 - 0.04(\text{LOSS}) - 3.49(\text{VC}) + 2.61(\text{TECH}) - 0.58(\text{LNPROCEEDS}) - 1.92(\text{PURPDUMMY}) + 0.38(\text{OVERHANG}) + 40.30(\text{NASD30DAYS}) + 0.05(\text{IPONUM30DAYS}) + 17.96(\text{UNDERPRICING30DAYS}) - 11.00(\text{UP*REVISION1}) + 94.33(\text{UP*REVISION2}) + 11.78(\text{DOWN*REVISION1}) + 56.11(\text{DOWN*REVISION2})$$

\*\*\*, \*\*, and \* denote differences in means between the underpricing for IPOs by high-ranked and low-ranked investment bankers are statistically significant at the 0.01, 0.05 and 0.10 levels respectively.

## *F. Robustness Tests on the Impact of Underwriter's Rank on Underpricing*

In Table 6 Panel B, we conduct robustness tests by estimating the predicted underpricing for IPOs underwritten by high-ranked and low-ranked investment banks for sub-sample of issuing firms that are more likely to have a choice on investment banks. The sub-samples include larger IPOs, i.e. IPOs with proceeds greater than either the mean or the median, IPOs with positive earnings prior to going public, IPOs whose intended use of proceeds is to repay debt, and IPOs of non high-tech firms. These are the IPOs either with lower level of uncertainty, and/or in which the issuing firms have more discretion as to which investment bank to hire to take them public. We find that the general pattern found in Table 6 Panel A persists for larger IPOs, IPOs with positive earnings prior to going public, IPOs intended for repaying debt, and non high-tech IPOs. The SBA results for these sub-samples show that IPOs that actually use high-ranked underwriters would have experienced a significantly higher underpricing had they used low-ranked underwriters, and IPOs that use low-ranked underwriters would have experienced a significantly lower underpricing had they used high-ranked underwriters. The results suggest that some firms choose high ranked underwriters to lower underpricing while others choose low-ranked underwriters and incur higher underpricing to reap potential marketing benefits. Issuing firms weigh the tradeoffs between potential benefits and costs of underpricing in their choice of underwriters and minimizing overall costs of going public is not the main concern for all issuing firms.

Overall, the SBA findings in Table 6 suggest that once the interdependence between underwriter's rank and underpricing is incorporated, high quality investment banks are, on average, associated with lower level of underpricing. The evidence suggests that high quality investment banks continue to provide certification of value in IPOs, even in the 1990s. The positive relation between underwriter reputation and underpricing documented in Beatty and Welch (1996), Cooney, Singh, Carter and Dark (2001), Bradley and Jordan (2002), and Loughran and Ritter (2004) is largely a result of the inadequate treatment of the simultaneity problem between underwriter's rank and underpricing.

## **5. SUMMARY AND CONCLUSIONS**

Traditionally, IPO underpricing is argued to be costly to the issuing firms and lowering it helps reduce the overall costs of going public. However, recent studies suggest that underpricing attracts media attention and can play a significant marketing role for the issuing firm (see Demer and Lewellen, 2003 and Aggarwal, Krigman, and Womack, 2002). Given that underpricing has potential marketing benefits, we specifically examine whether the choice of underwriters is consistent with issuing firms trying to minimize underpricing, or to reap other potential associated benefits. By examining the choice of underwriters and its impact on underpricing, we can also determine if the relation between underwriter reputation and IPO underpricing has changed, as previous studies document mixed results.

Using Heckman (1976) and Lee (1978) two-step procedure to control for the selectivity bias resulting from the interdependence between underwriter reputation and underpricing, we examine the predicted underpricing of IPOs that use a certain group of underwriters and compared that to the predicted underpricing had they used a different group. We first examine whether the choice of underwriters is a function of measures of firm and issue characteristics. Then we examine the underpricing for IPOs underwritten by high-ranked versus low-ranked investment banks, using a vector of variables believed to affect underpricing, and adjusting for the selectivity bias.

After controlling for the interdependence between underwriter reputation and underpricing, we find that IPOs that actually use high-ranked underwriters would have experienced a significantly higher underpricing had they used low-ranked underwriters, and IPOs that use low-ranked underwriters would have experienced a significantly lower underpricing had they used high-ranked underwriters. This result holds true for IPOs either with lower level of uncertainty, and/or in which the issuing firms have more discretion as to which investment bank to hire to take them public. They include larger IPOs, IPOs with positive earnings prior to going public, IPOs whose intended use of proceeds is to repay debt, and IPOs of non high-tech firms.

The results suggest that issuing firms weigh the tradeoffs between potential benefits and costs of underpricing in their choice of underwriters. Some firms choose high ranked underwriters to lower underpricing while others choose low-ranked underwriters and incur higher underpricing to reap potential marketing benefits. Minimizing overall costs of going public is not the main consideration for all issuing firms in their selection of underwriters. As prestigious underwriters are generally associated with lower underpricing, the results also support the traditional view that prestigious underwriters use their reputation capital to certify the value of the firm and reduce investor's uncertainty about the issue. They are also consistent with the partial adjustment theory that prestigious investment bank underprice less because they have more future deals to compensate investors for truthfully revealing information.

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