2008

Underpricing, Overhang, and the Cost of Going Public to Preexisting Shareholders

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Abstract: IPO underpricing has been extensively studied; however, its impact on the wealth of preexisting shareholders has not been closely examined. We address the question of whether or not periods of high underpricing adversely affect preexisting shareholders. We find that high levels of underpricing are associated with increased share retention, which effectively offsets much of the potential cost. Overall, we find that the percentage of shareholder wealth lost is surprisingly stable over time, unlike underpricing itself. We also find that many factors known to be related to underpricing are not significant determinants of the cost of going public to preexisting owners.

Keywords: IPO, underpricing, share overhang

1. INTRODUCTION

Much research on IPO valuation focuses on underpricing, which is conventionally defined as the percentage difference between the initial offer price and the closing market price on the first day of trading. This measure, typically called the initial or first-day return, is the percentage gain earned by an investor fortunate enough (in most cases) to purchase the stock at the offer price and liquidate at the first-day close. However, while underpricing correctly measures the return to a particular type of investor, it does not accurately reflect, in general, the opportunity cost of going public to the issuing firm.

In a typical IPO, the shares sold constitute only a fraction of the total shares in the issuing firm. Preexisting shareholders who do not sell in the IPO suffer dilution in value as a result of underpricing, but the dilution they experience may be quite small relative to that suggested by the level of the initial return. To give an extreme example, suppose a firm with a large number of shares outstanding goes public by selling a single share. Obviously, any underpricing is economically irrelevant. In a more realistic setting, if the

number of shares sold is small relative to the total, even a large degree of underpricing may translate into a very modest amount of dilution.

In broader terms, the wealth loss experienced by preexisting shareholders in an IPO depends on the 'money left on the table,' which is the underpricing measured in dollars. Underpricing measured as a first-day return is money left on the table divided by the gross proceeds from the offer, which is only indirectly relevant. As shown by Barry (1989), what really matters is the money left on the table relative to preexisting shareholder wealth, which we refer to as the 'opportunity cost of issuance' (OCI). Although existing studies such as Hill (2006), Bradley and Jordan (2002) and Habib and Ljungqvist (2001) explore the relation between underpricing and share retention on a limited basis, they do not directly address the effect of underpricing on the wealth of preexisting firm owners.

Of particular interest in this regard is the recent Internet 'bubble' period. Previous studies document a large increase in underpricing during 1999–2000, posing potential explanations for the increase such as changes in insider ownership structure (Habib and Ljungqvist, 2001) or changes in the desire of issuers to employ underwriters that are able to provide research coverage and other services (Loughran and Ritter, 2004). Although these studies provide some potential reasons for the increase in underpricing, they and other existing studies generally do not explore the effect of this high level of underpricing on the wealth of preexisting owners. Therefore, our contribution is to fill this gap by addressing the question of whether or not high underpricing results in a severe reduction in the wealth of preexisting shareholders.

In our empirical analyses, we focus on two major issues. First, we study the average level of underpricing over time in conjunction with the extent of share retention by preexisting owners. As in previous studies, we measure share retention using 'overhang,' which is the ratio of shares retained to shares offered (or a variation thereof). In addition, we move beyond existing studies by estimating the underlying wealth loss from underpricing as a percentage of the estimated value of shares owned by preexisting shareholders of the firm (i.e., OCI). In our sample, for the periods 1986–1989, 1990–1998, 1999–2000 and 2001–2004 underpricing averages 7.58, 16.29, 65.64 and 10.99 percent, respectively. We find that share overhang is essentially constant in the first two periods, averaging 2.61 and 2.50, respectively; however, in 1999–2000, share overhang rises substantially to 4.40, subsequently falling in the 2001–2004 period to 2.57.

To explore whether the share retention decision effectively reduces the dilutive impact of high underpricing, we also estimate OCI by period. We find that the opportunity cost of issuance has varied within a relatively narrow range. For these same four periods, the opportunity cost of issuance for firms going public averaged 4.79, 5.18, 6.22 and 4.00 percent, respectively. In fact, after controlling for various firm and market characteristics we find no significant change at all. In other words, even though IPO underpricing varied enormously, the opportunity cost of going public to existing shareholders changed by very little, if any.

Second, we examine whether the variables known to be related to IPO underpricing are also related to the opportunity cost of issuance for firms going public. Surprisingly, we find that most of them are not, despite the fact that many are firm and offer specific. Some even have opposite signs as compared to the results of previous studies. This finding is troubling because it suggests that what is often the most important component of the total cost of going public is poorly understood.

Not distinguishing between underpricing and the opportunity cost of issuance is a potentially serious issue in IPO research. The effects on underpricing of phenomena such as informational asymmetry, third-party certification, changing firm composition, increased desire for analyst coverage, and a host of other questions have been previously investigated with somewhat mixed results. However, at least to a degree, some of this research may be missing the point. It is not the rational economic objective of the issuing firm to minimize underpricing (or to maintain it at some equilibrium or other optimal level). As in all things corporate finance-related, the goal of the firm is to maximize the wealth of the existing shareholders. All else the same, doing so in the context of an IPO means focusing on minimizing the opportunity cost of issuance, not necessarily underpricing.

Overall, we conclude that the variation in IPO underpricing through time has generally been accompanied by similar, offsetting movements in overhang. This relation results in an opportunity cost of issuance that is essentially stable through time, particularly after controlling for characteristics of the offer. We further find that many variables thought to 'explain' underpricing are more likely just associated with variation in overhang, but not with the opportunity cost of issuance. We suggest that future theoretical and empirical research on the cost of going public should focus much more closely on the opportunity cost of issuance as opposed to only examining underpricing. Such research should lead to a much richer understanding of the costs of going public.

The rest of the paper proceeds as follows: Section 2 develops the relationship between underpricing, overhang, and the opportunity cost of issuance; Section 3 describes the data; Section 4 provides results; and Section 5 concludes.

2. UNDERPRICING, OVERHANG AND THE OPPORTUNITY COST OF ISSUANCE

(i) Money Left on the Table

The opportunity cost of issuance to a firm in an equity IPO, measured in dollars, is the number of shares offered multiplied by the difference between the market price at the end of the first trading day and the offer price. This quantity is the 'money left on the table,' or MLOT. To understand the relationship between underpricing, overhang, and the opportunity cost of issuance, it is useful to first consider an IPO with no secondary shares offered (as is the case in well over half of all ordinary equity IPOs).

If no secondary shares are offered, then, by definition, MLOT can be written as follows:

$$\text{MLOT} \equiv N_o(P_1 - \text{OP}) \equiv N_B(P_B - P_1) \tag{1}$$

where N_o is the number of (primary) shares offered in the IPO; P_1 is the market price at the end of the first trading day; OP is the offer price; N_B is the number of shares prior to the offer; and P_B is the equity value per share immediately prior to the offering.[1] Note that, also be definition, $P_B - P_1$ is the dilution (per preexisting share) caused by the offer. Thus, equation (1) is an identity stating that money left on the table is equal to the dollar dilution suffered by preexisting shareholders.

1 The assumption that E (i.e., $P_B \times N_B$) is the value immediately prior to the IPO is important in that it assumes that any valuation effects from the IPO are already impounded in E.

If we rearrange equation (1), we have the following, which is equivalent to that provided by Barry (1989):

$$(P_1 - \text{OP}) \equiv \frac{N_B}{N_o}(P_B - P_1). \tag{2}$$

In equation (2), the left-hand side is the underpricing, in dollars, per share offered. The first term on the right-hand side is the ratio of shares retained by non-selling shareholders relative to shares sold in an IPO, and this measure is often referred to as the share 'overhang' (e.g., Bradley and Jordan, 2002; and Loughran and Ritter, 2004). The second term is the dilution per preexisting share, again measured in dollars (note that in an IPO with no secondary shares offered, the number of preexisting shares is the same as the number of shares retained). This very simple expression begins to highlight the critical role played by overhang and makes it clear that the opportunity cost of issuance (per preexisting share) will be much smaller than the underpricing (per share offered) when the overhang is large.[2]

To generalize, when secondary shares are offered, MLOT can be written as:

$$\text{MLOT} \equiv N_o(P_1 - \text{OP}) \equiv N_{o,s}(P_B - \text{OP}) + (N_B - N_{o,s})(P_B - P_1) \tag{3}$$

where $N_{o,s}$ is the number of secondary shares offered, and all other variables are as previously defined. Equation (3) defines MLOT as the sum of two components. The first term is the total opportunity loss to selling shareholders (in dollars) from selling shares at a price below their potential market value. The second is the total dollar dilution suffered by nonselling (i.e., retaining) shareholders. Thus, equation (3) allocates the opportunity cost of issuance between secondary shares sold and retained shares.

Following Barry (1989), we next solve equation (3) for the preissuance equity value, which provides the following:

$$P_B \equiv P_1 + \frac{N_{o,p}(P_1 - \text{OP})}{N_B} \tag{4}$$

where $N_{o,p}$ is the number of primary shares offered, and all other variables are as previously defined. Note that P_B is equal to P_1 if there is zero underpricing; therefore, we also refer to P_B as the 'zero dilution' price.

Defining preexisting share value (i.e., P_B) as the first day closing price plus the per share dilution from MLOT (associated with primary shares sold) follows existing theory and practice; however, this approach ignores the possibility that non-traded shares are typically less valuable due to a lack of liquidity (i.e., a liquidity discount). Thus, in robustness checks, we also examine an alternative definition of preexisting share value that captures industry specific liquidity discounts as identified in Das et al. (2003). We find that our results are robust to this, and other, alternative definitions.

(ii) Opportunity Cost of Issuance

A few existing studies recognize the potentially offsetting effect on issuance costs associated with increasing the number of shares retained. For example, Brennan and

2 Equation (2) is also similar to a decomposition presented in Ritter (2002).

Franks (1997) examine a sample of IPOs in the United Kingdom, detailing that firms that sell only a fraction of existing shares, all else equal, face lower issuance costs. Brennan and Franks attempt to quantify the effect of the share retention decision; however, they do so only for a sample of 69 firms over the years 1986–1989, which is a period characterized by relatively stable prices, making it difficult to gauge the response of issuers to fluctuations in market valuations over time.

More recently, Habib and Ljungqvist (2001) and Bradley and Jordan (2002) suggest that owners who sell fewer shares suffer only marginally from underpricing, both finding that there is a positive relation between share overhang and underpricing. Habib and Ljungqvist imply that more shares retained reduces the incentive to control underpricing, likely because there is reduced dilution associated with underpricing. Unfortunately, neither Habib and Ljungqvist nor Bradley and Jordan quantify the underlying opportunity cost of issuance. Therefore, we attempt to fill this gap by more explicitly deriving a simple formula that can be used to directly calculate the OCI of an issue and by applying this measure to a sample of IPOs over a broad period of time (i.e., 1986–2004).

By definition, OCI is equal to money left on the table relative to preexisting equity value (i.e., the percentage of wealth lost by preexisting owners), which implies:

$$\text{OCI} = \frac{\text{MLOT}}{E} = \frac{N_o(P_1 - \text{OP})}{P_B N_B} \tag{5}$$

where all variables are as previously defined. Substituting for P_B using equation (4) produces the following explicit formula for estimating OCI:

$$\text{OCI} = \frac{N_o(P_1 - \text{OP})}{P_1 N_A - N_{o,p}\text{OP}} \tag{6}$$

where N_A is the total number of shares after the offering (i.e., $N_B + N_{o,p}$), and all other variables are as previously defined. The elimination of the unobservable P_B allows OCI to be directly and simply calculated.[3]

Further, we can decompose OCI into two components:

$$\text{OCI} = \left[\frac{N_o(P_1 - \text{OP})}{N_o\text{OP}}\right] \times \left[\frac{N_o\text{OP}}{P_1 N_A - N_{o,p}\text{OP}}\right]. \tag{7}$$

The first term is underpricing (i.e., money left on the table relative to the gross proceeds of the offer), and the second term is the offering size as a percentage of preexisting shareholder wealth. The reciprocal of this second term is a measure of overhang, which we term economic overhang (*EconOver*).

To interpret *EconOver*, suppose an issue has no underpricing such that $P_1 = P_B = \text{OP}$. In this case, *EconOver* reduces to the ratio of shares outstanding before the offer, N_B, to shares offered, N_o, which is the measure of share overhang in equation (2).

3 Note that our derivation looks strictly at gross proceeds and does not account for the spread paid to the underwriter or any other out of pocket expenses (e.g., legal and administrative fees). Adjusting for direct costs provides the following: $\text{OCI} = \frac{N_o(P_1 - \text{OP}\delta) + \text{DC}}{P_1 N_A - N_{o,p}\text{OP}\delta + \text{DC}}$, where δ is equal to one minus the gross spread percentage, and DC is equal to other direct costs paid. Other indirect costs are still not included.

EconOver can thus be interpreted as a weighted measure of share overhang in which shares sold in the offer are weighted by the offer price, whereas preexisting shares are weighted by the zero dilution price.

Simplifying equation (7) produces the following:

$$\text{OCI} = \textit{Initial} \times \frac{1}{\textit{EconOver}} \tag{8}$$

which clearly illustrates the relation among the variables of interest.[4] Specifically, higher levels of underpricing, all else equal, increase the wealth loss of preexisting shareholders; however, increased share retention offsets this cost.

Rather than managing the number of shares offered, why do owners not attempt to control underpricing, which would also result in a reduced OCI? At least two possible explanations exist. First, underwriters have a great deal of influence in selecting the offer price, which, in effect, determines the level of underpricing.[5] Thus, issuers may lack sufficient influence to adequately control underpricing. Second, Aggarwal et al. (2002) develop a model that suggests managers strategically underprice IPOs to maximize personal wealth from selling shares subsequent to the IPO (i.e., after the lockup period expires). They attribute the potential gain to information momentum associated with higher levels of underpricing, which is also addressed by Zheng et al. (2005), Espenlaub and Tonks (1998) and Demers and Lewellen (2003), who show that increased underpricing leads to increased trading volume and press coverage, which may affect firm sales, as well as the price at which owners may subsequently sell retained shares.

In addition to highlighting the true wealth loss of an IPO, the above decomposition may also help explain a number of puzzling phenomena. For example, it has been widely noted that, in contrast to earlier results in Carter and Manaster (1990), offerings led by high prestige underwriters were more underpriced in the 1990s than offerings led by less prestigious underwriters. However, the proposed certification effect from the use of high prestige underwriters may really be an explanation of OCI, not necessarily underpricing. In fact, as we document in a later section, IPOs led by high prestige underwriters tend to have greater overhang, so the truth concerning the effect of underwriter prestige on the cost of going public may be inadvertently masked. Moreover, in subsequent analyses, we find a negative relationship between OCI and investment bank prestige in the 1990s, which is consistent with a certification effect.

(iii) An Example: The eBay IPO

To illustrate the decomposition of an IPO's initial return, consider eBay's September 24, 1998, offering. The offer price was $18 per share, and the closing market price on

4 Brennan and Franks (1997) provide a formula similar to equation (8); however, they estimate the relation simply by examining the number of shares retained versus the number of shares sold (i.e., share overhang) without considering the value or type of these shares (i.e., economic overhang). Thus, their measure may only approximate the actual opportunity cost of issuance. Further, rather than concentrating on preexisting owners as a whole, they give more emphasis to the separate categories, i.e., selling shareholders versus retaining shareholders.

5 The theories of Benveniste and Spindt (1989) and Rock (1986) suggest that underwriters purposefully select the offer price in order to create sufficient underpricing to reward investors. Further, higher levels of underpricing allow underwriters to better market an issue, thereby reducing the risk of undersubscription.

the first trading day was $47.38 per share. The underpricing was thus 163.22 percent. With 3.5 million shares offered (and ignoring the overallotment option), the total money left on the table by eBay and its investment bankers was ($47.38 − $18) × 3.5 million = $103 million.

Traditional thought suggests that such a high level of underpricing represents an enormous opportunity cost to the preexisting shareholders of the issuing firm. But does it? In eBay's case, there were 36.5 million shares of stock outstanding prior to the IPO (only a negligible 10,725 of which were sold in the IPO). Thus, for every share sold in the IPO, there were more than 10 shares retained. As a result, the true opportunity cost of the underpricing to eBay's preexisting shareholders was vastly lower than that suggested by the 163.22 percent initial return.

First, ignoring the 10,725 secondary shares, the share overhang in the eBay offering was 36.5 million/3.5 million = 10.43. The underpricing in dollars was $47.38 − $18 = $29.38. From equation (2), the dilution (i.e., $P_B - P_1$) was thus $29.38/10.43 = $2.82 per preexisting share, implying a pre-IPO value of $47.38 + $2.82 = $50.20. As a percentage, then, the dilution was $2.82/$50.20 = 5.6 percent, which can also be calculated by plugging directly into equation (6) and solving for OCI.

Thus, we see that the opportunity cost to eBay's preexisting shareholders was only 5.6 percent. Keeping in mind that, in a single day, the IPO created a liquid market where none existed for eBay's preexisting 36.5 million shares with an aggregate value of $1.7 billion (based on the closing stock price), preexisting shareholders might quite rationally have viewed the 5.6 percent opportunity cost as a small price to pay.[6] Also, as we illustrate a little later, an OCI of 5.6 percent is very ordinary for US equity IPOs, particularly in the latter part of the 1990s. Thus, as the case of eBay illustrates, a high percentage initial return does not necessarily imply a large percentage opportunity cost of issuance.

3. DATA

Our main data source is Thomson Financial's SDC New Issues database. SDC captures prospectus information on firm commitment initial public offerings (IPOs); however, SDC only begins reporting data on several important items in 1986. Therefore, the primary period we study begins January 1, 1986, and ends December 31, 2004.

In addition to company and issue information provided by SDC, we rely on the Center for Research in Security Prices (CRSP) database to provide closing market prices and shares outstanding information on the date of issuance. We make numerous corrections to SDC data using information from Jay Ritter on a variety of items such as incorrect file ranges and offer type classifications. Alexander Ljungqvist provided us with information on shares sold as described in Ljungqvist and Wilhelm (2003) for the period 1996–2000.[7] We also use Loughran and Ritter's (2004) updated underwriter

6 Adjusting for a liquidity discount (see Section 4(*iv*)), eBay owners had an opportunity cost of issuance of 8.31%, which is higher than our reported OCI, but still much lower than the actual level of underpricing. This results since even a large liquidity discount has little impact when the number of shares sold is small relative to the total.

7 For correction information, see Ritter's website http://bear.cba.ufl.edu/ritter/SDCCOR.PDF] and Ljungqvist's website [http://pages.stern.nyu.edu/~aljungqv/research.htm]. We thank Jay Ritter and Alexander Ljungqvist for providing us with these data.

reputation variables (i.e., updates to those originally provided by Carter and Manaster (1990)), firm founding dates, and Internet classification.

As is commonly done, we eliminate various types of issues, including closed-end funds, unit issues, American depositary shares, mutual-to-stock conversions, reverse leveraged buyouts, real estate investment trusts, and spin-offs. Unlike many studies, we also eliminate firms with multiple share classes (Smart and Zutter, 2003). The reason is that determination of overhang can be problematic in such cases, particularly in circumstances where, e.g., 1 Class A share can be converted into 10 Class B shares. After elimination of these issues, we are left with a final sample of 4,913 IPOs, consisting of 866 from the 1986–1989 period; 2,884 from the 1990–1998 period; 764 from the 1999–2000 period; and 399 from the 2001 to 2004 period. We group issues into these particular time periods in much of our analysis for comparability with previous studies.

4. RESULTS

(i) Evolution of Initial, OCI, and EconOver Through Time

Given the discussion in our previous sections, we focus primarily on the relation between initial returns (*Initial*), the opportunity cost of issuance (OCI), and economic overhang (*EconOver*). Thus, Table 1 reports means (with medians in parentheses) by year for these three variables in columns (3)–(5), respectively. Share overhang (*ShareOver*), which is defined as shares retained relative to total shares offered, is reported in column (6). Note that equation (8) will not hold, in general, for the averages in this table (i.e., the product of the averages is not equal to the average of the products).

Reviewing the year-by-year results in Table 1, *EconOver*, on average, ranges from a low of 2.82 (in 1994) to a high of 9.01 (in 1999). The medians range from 2.38 (in 1986) to 5.81 (in 1999). Thus, *EconOver* is typically greater than one, and, at times, much greater. As a result, *Initial*, on average, ranges from roughly 1.5 times the average OCI (in 1987) to 10 times as large (in 1999). *ShareOver* ranges from 2.31 (in 2004) to 4.68 (in 2000).

As observed by Loughran and Ritter (2004), among others, underpricing changed over the period examined in Table 1. As shown in Table 2, in our sample, *Initial* averages 7.58 percent during 1986–1989, 16.29 percent during 1990–1998, 65.64 percent during 1999–2000, and 10.99 during 2001–2004. Average OCI displays a similar pattern, but the variation is much less dramatic. For the same four periods, OCI averages 4.79, 5.18, 6.22, and 4.00 percent, respectively.

Like OCI, *EconOver* does not increase significantly over the first two subperiods (the averages are 3.04 and 3.26 for 1986–1989 and 1990–1998, respectively, which are insignificantly different). *ShareOver* actually decreases slightly. However, like *Initial*, *EconOver* jumps substantially in 1999 and 2000, averaging 8.84, which is economically and statistically much larger than in the previous periods. Similarly, *ShareOver* rises from an average of 2.50 in 1990–1998 to 4.40 in 1999–2000. Finally, *Initial*, OCI, *EconOver* and *ShareOver* all decline significantly in the 2001–2004 period, returning to values similar to those observed in the pre-bubble period.

To address this evolution more formally, in unreported results we compare the combined 1986–1998 period (i.e., pre-bubble) to the 2001–2004 period (i.e., post-bubble). As Table 2 suggests, we find that OCI is slightly lower in the post-bubble period; however, the difference between the periods is only marginally significant (*t*-statistic of

Table 1

Descriptive Statistics by Year

	N	*Initial*	*OCI*	*EconOver*	*ShareOver*	*Initial vs. OCI*
1986	397	7.90 (2.60)	5.46 (1.33)	2.88 (2.38)	2.44 (2.00)	2.44
1987	270	6.97 (1.96)	4.65 (0.96)	2.96 (2.46)	2.58 (2.14)	2.10
1988	104	6.73 (2.95)	4.08 (1.29)	3.35 (2.92)	2.94 (2.50)	1.59
1989	95	8.95 (4.76)	3.13 (1.67)	3.61 (2.85)	3.04 (2.30)	6.06
1990	92	12.22 (7.97)	3.60 (3.34)	2.90 (2.66)	2.33 (2.16)	5.89
1991	181	14.52 (10.29)	5.26 (3.54)	3.14 (2.77)	2.47 (2.18)	6.16
1992	260	13.25 (5.52)	4.85 (2.52)	2.98 (2.54)	2.38 (2.12)	7.57
1993	349	15.00 (7.14)	4.86 (2.89)	3.12 (2.64)	2.42 (2.15)	10.56
1994	334	10.61 (5.00)	4.27 (2.36)	2.82 (2.43)	2.33 (2.06)	7.42
1995	407	22.34 (14.29)	6.22 (4.91)	3.47 (2.91)	2.46 (2.20)	13.64
1996	587	18.16 (10.00)	5.55 (3.56)	3.44 (2.65)	2.60 (2.15)	12.24
1997	417	14.07 (8.57)	4.89 (2.88)	3.12 (2.67)	2.48 (2.20)	11.32
1998	257	20.96 (8.33)	5.65 (2.82)	4.02 (2.78)	2.93 (2.42)	4.95
1999	419	72.78 (38.40)	6.96 (6.26)	9.01 (5.81)	4.17 (3.70)	14.40
2000	345	56.98 (27.63)	5.31 (4.98)	8.65 (5.55)	4.68 (4.07)	12.36
2001	59	14.82 (13.00)	3.63 (2.92)	4.08 (3.66)	3.31 (3.20)	6.03
2002	40	11.88 (8.45)	3.14 (3.17)	3.59 (3.17)	2.87 (2.47)	4.14
2003	61	12.71 (9.76)	4.61 (3.28)	3.30 (2.96)	2.67 (2.58)	5.17
2004	239	9.45 (2.00)	4.08 (1.21)	2.84 (2.48)	2.31 (2.25)	4.25

Notes:
The table provides means (with medians in parentheses) for underpricing (*Initial*, percentage change from offer price to market price at end of first trading day), the opportunity cost of issuance (OCI, money left on the table divided by preissuance equity value), economic overhang (*EconOver*, preissuance equity value divided by funds raised), and share overhang (*ShareOver*, shares retained relative to total shares offered). Additionally, the table also provides *t*-statistics from difference of means tests for *Initial* versus OCI in each year. Data are from the SDC New Issues and CRSP databases.

Table 2

Descriptive Statistics by Period

	1986–1989	*1990–1998*	*1999–2000*	*2001–2004*	*Percent Change*			*t-statistics*		
	(1)	*(2)*	*(3)*	*(4)*	*(1) v (2)*	*(2) v (3)*	*(3) v (4)*	*(1) v (2)*	*(2) v (3)*	*(3) v (4)*
Initial	7.58	16.29	65.64	10.99	114.91	302.95	−83.26	−12.61	−15.02	16.33
OCI	4.79	5.18	6.22	4.00	8.14	20.08	−35.69	−0.73	−2.67	3.19
EconOver	3.04	3.26	8.84	3.17	7.24	171.17	−64.14	−1.65	−16.37	13.52
ShareOver	2.61	2.50	4.40	2.57	−4.21	76.00	−41.59	1.00	−20.22	15.57
P_1	10.80	12.99	26.46	15.78	20.28	103.70	−40.36	−9.78	−14.21	10.46
OP	10.01	11.03	14.43	14.11	10.19	30.83	−2.22	−5.71	−15.39	0.83
N_B	4.06	7.99	28.46	22.85	96.80	256.20	−19.71	−13.27	−12.69	2.49
$N_{B,r}$	3.76	7.49	27.91	21.44	99.20	272.63	−23.18	−14.16	−13.36	3.00
N_o	1.84	3.02	6.61	10.79	64.13	118.87	63.24	−8.75	−8.28	−5.71
Proceeds	21.74	36.65	91.38	167.67	68.58	149.33	83.49	−5.78	−7.56	−5.82

Notes:
The table presents summary statistics for four periods [(1) 1986 to 1989, (2) 1990 to 1998, (3) 1999 to 2000 and (4) 2001 to 2004] for underpricing (*Initial*) in percent, the opportunity cost of issuance (OCI) in percent, economic overhang (*EconOver*), and share overhang (*ShareOver*). In addition, the means of the components of each of these variables are also reported. Specifically, P_1 is the market price in dollars at the end of the first trading day; OP is the offer price in dollars; N_B is the number of preexisting shares in millions at the time of the IPO; $N_{B,r}$ is the number of preexisting shares retained in millions; N_o is the total number of shares offered in millions; and *Proceeds* is the gross proceeds of the offering in millions of dollars. The table also provides percentage changes in each variable across time periods and *t*-statistics from difference of means tests between periods. Data are from the SDC New Issues and CRSP databases.

1.72). Further, share overhang is not statistically different in the pre- and post-bubble periods (t-statistic of -0.39). The spike in underpricing in the bubble period appears to be an anomaly that is most likely driven by extremely high market valuations during these years. However, the decision by owners to retain more shares during this period resulted in OCI changing by very little. This stability in OCI suggests that the large level of underpricing had only minimal impact on the wealth of existing firm owners.

Table 2 also provides some insight into why both economic and share overhang changed so dramatically. Comparing the 1986–1989 and 1990–1998 periods, the average number of shares outstanding before the IPO, N_B, and the average number retained, $N_{B,r}$, approximately doubled. Both the aftermarket price (P_1) and offer price (OP) also increased, so the net effect is that average firm size (in terms of market cap) more than doubled. However, offering sizes (*Proceeds*) kept pace, and, as a result, economic overhang was little changed.

Moving from 1990–1998 to 1999–2000, shares outstanding before the offer more than tripled and valuations per share doubled. As a result, average firm size (again referring to market cap) increased by a factor of six or more. The average number of shares offered only doubled, however, so overhang grew. Thus, several forces were at work. Over the 1986–2000 period, firms grew much larger in terms of preexisting shares, and, at the same time, valuations per share increased. Offerings also grew in terms of both shares offered and offer prices. The key difference is that the growth in offer size was similar to the growth in firm size in 1990–1998, but lagged it substantially in 1999–2000, thereby creating the jump in share and economic overhang. Thus, the increase in overhang appears to be attributable to issuers responding to increases in valuations during this period. This relation becomes even more apparent in light of the reversal in valuations and overhang that occurred in the 2001–2004 period.

It is possible that the decision of issuers to retain more shares is a rational response to high expected levels of underpricing. However, an additional, non-exclusive possibility is the wealth effect hypothesis proposed by Ritter (1984). Specifically, Ritter suggests that higher valuations allow issuers to offer fewer shares (relative to the total), while still collecting the same amount of proceeds, which is obviously the case during the bubble period. Both of these factors lead to a higher level of overhang. Thus, the offsetting effect of overhang could be a rational response to expected underpricing, a byproduct of market valuations, or some combination of these two effects.

Table 2 shows that OCI is noticeably higher in the bubble period, even though many issuers retained 100 percent of secondary shares, so the increased share retention did not completely offset the extremely high underpricing during that period. Loughran and Ritter (2004) document that firms going public over the first three periods we examine changed in ways that suggest they became riskier to investors, which may mean that they must leave more money on the table. Loughran and Ritter find that this 'changing risk composition' hypothesis cannot explain the fluctuations in underpricing through time. However, this hypothesis really relates more directly to OCI than underpricing, and it is possible, as we explore subsequently, that the modest changes in OCI can be explained by this phenomenon.

In unreported results, we also examine correlations between the variables of interest. Over the full 1986–2004 period, the correlation between *Initial* and OCI is relatively low, 0.25, whereas the correlation between *Initial* and *EconOver* is 0.79. Thus, empirical studies that focus on variation in underpricing across IPOs may actually be learning

more about the variation in overhang than the opportunity cost of going public. Surprisingly, the correlation between OCI and *EconOver* is only 0.02.

These correlations raise an interesting question. Many factors are known to be associated with IPO initial returns. What is not known is if these same factors also affect OCI. We begin to explore this and related issues in the following section.

(ii) Determinants of OCI and EconOver: Univariate Analyses

To begin to explore potential causes of the variation in *Initial*, *EconOver* and OCI, Table 3 presents descriptive statistics on some selected firm and offer characteristics. The variables in the table are representative of the types commonly examined in IPO research dealing with underpricing, but the list is not intended to be exhaustive. Specifically, we report mean values by period and *t*-tests for differences in means across periods, for the following:

VC = Dummy variable equal to one if the firm is venture capital- (VC-) backed;

Age = Firm age, measured in years;

Integer = Dummy variable equal to one if the IPO offer price is an integer;

Table 3

Descriptive Statistics by Period

	1986–1989	*1990–1998*	*1999–2000*	*2001–2004*	*t-statistics*		
	(1)	*(2)*	*(3)*	*(4)*	*(1) v (2)*	*(2) v (3)*	*(3) v (4)*
VC	0.25	0.42	0.64	0.39	−9.50	−11.14	8.12
Age	18.41	11.02	8.65	16.42	7.85	4.27	−5.96
Integer	0.60	0.76	0.94	0.83	−9.04	−14.74	5.27
HT	0.21	0.33	0.27	0.20	−7.67	3.78	2.54
Internet	na	0.02	0.48	0.05	na	−24.86	20.11
Rank	6.96	6.60	8.01	7.70	4.15	−19.06	2.88
Primary	0.60	0.60	0.85	0.69	−0.17	−15.68	5.89
PartialU	2.25	6.94	21.14	4.30	−16.03	−11.75	13.34
PartialD	−5.86	−7.21	−5.93	−8.20	3.71	−2.72	2.96
Upward	26.56	38.31	60.73	32.83	−6.70	−11.29	9.48
Downward	44.80	38.18	28.14	44.11	3.46	5.39	−5.37
NoAdjust	28.64	23.51	11.13	23.06	2.97	8.97	−4.97

Notes:
The table presents summary statistics (i.e., means and difference tests) for four periods: (1) 1986 to 1989, (2) 1990 to 1998, (3) 1999 to 2000 and (4) 2001 to 2004. VC is a dummy variable equal to one if the IPO is backed by a venture capitalist, zero otherwise. *Age* is the age of the issuing firm in years at the time of the offering. *Integer* is a dummy variable equal to one if the offer price is an integer, zero otherwise. HT is a dummy variable equal to one if the issue is a high technology (but non-Internet) firm, zero otherwise. *Internet* is a dummy variable equal to one if the issue is an Internet firm, zero otherwise. *Rank* is the rank of the lead underwriter as given by Carter and Manaster (1990) and updated by Loughran and Ritter (2004). *Primary* is a dummy variable equal to one if the issue is a pure primary offering, zero otherwise. *PartialU* is the percentage change from the original midfile price to the offer price if the adjustment is positive, zero otherwise; and *PartialD* is the percentage change from the original midfile price to the offer price if the adjustment is negative, zero otherwise. The final three rows report the percentage of issues whose offer prices, relative to the original midfile prices, are adjusted upward (*Upward*), downward (*Downward*), or not at all (*NoAdjust*). Data are from the SDC New Issues and CRSP databases.

HT = Dummy variable equal to one if the firm is in a 'high-tech,' but non-Internet-related, industry;

Internet = Dummy variable equal to one if the firm is Internet-related;

Rank = Carter-Manaster (1990) rank of the lead underwriter, as updated by Loughran and Ritter (2004);

Primary = Dummy variable equal to one if the offering has 100 percent primary shares;

PartialU = The percentage change (from the original midfile) in the final offer price if the change is positive (and zero otherwise);

PartialD = The percentage change (from the original midfile) in the final offer price if the change is negative (and zero otherwise);

Upward = The percentage of firms that have a positively adjusted offer price;

Downward = The percentage of firms that have a negatively adjusted offer price; and;

NoAdjust = The percentage of firms that have no adjustment from the original midfile price to the offer price.

Comparing the four periods in Table 3, the percentage of firms with VC backing more than doubled, going from 25 percent in 1986–1989 to 64 percent in 1999–2000, subsequently falling to 39 percent in the post-bubble period. Average firm age fell significantly from 18.41 to 11.02 years in the first two periods, then to 8.65 years in the bubble period. However, in the 2001–2004 period average firm age rises dramatically to 16.42 years. Bradley et al. (2004) show that IPOs with integer offer prices tend to be more underpriced. They argue that integer prices are, in part, a sign of valuation uncertainty. The percentage of integer offers rises over the first three periods from 60 percent to 94 percent, subsequently falling to 83 percent in the last period.

The percentage of firms in high-tech, but non-Internet-related, industries grows modestly, rising from 21 to 33 over the first two periods then falling to 27 and 23, respectively, over the last two periods. However, in the bubble period, the percentage of offerings that were Internet-related reached 48 percent, so 75 percent of offerings in the 1999–2000 period were either technology- or Internet-related. The average ranking of the lead bank falls from 6.96 to 6.60 as we move from the first period to the second, but rises to 8.01 in the bubble period, subsequently falling to 7.70 in the 2001–2004 period. Interestingly, the percentage of offers that consist entirely of primary shares is relatively constant in all but the bubble period, where 85 percent of the offerings are purely primary shares.

The next two items we examine are *PartialU* and *PartialD*. Conditional on an increase in the offer price relative to the initial midfile price, the average increase grew substantially, both economically and statistically, over the first three periods we study, reaching over 21 percent in 1999–2000, but subsequently falling to 4.3 percent in 2001–2004. The average conditional decrease follows a cyclical pattern over the entire period (falls, rises, then falls), but the changes are economically small.

Table 3 also reports the percentage of issues with positive and negative offer price adjustments. In the first period, about 70 percent of all issues had offer price adjustments. Over 44 percent of all issues had negative price adjustments, compared

to 27 percent with positive adjustments. In the second period, upward and downward adjustments both occur for about 38 percent of firms going public. In the bubble period, however, 61 percent of all issues had a positive adjustment, compared to 28 with a negative adjustment. These adjustments, particularly upward, may be an indication of expected underpricing and serve as a signal to owners to retain more shares.

Taken together, Tables 2 and 3 suggest that much changed in the IPO market over the period we study. The firms going public in the bubble period (which are also those with the highest average level of underpricing and overhang) were (1) more likely to be VC-backed; (2) much younger; (3) more likely to be integer-priced; (4) more concentrated in technology- and Internet-related fields; and (5) more likely to have positive offer price adjustments (and larger price adjustments as well).

The factors identified just above are known to be associated with underpricing; however, it is unclear whether these factors also affect the opportunity cost of issuance. To illustrate this point, we separate all IPOs in our sample into two groups. The first group consists of firms that are: (1) VC-backed; (2) young (age < 8 years); (3) integer-priced; (4) classified as either high-tech or Internet; and (5) have a high-prestige (rank 8 or 9) lead investment bank.[8] We refer to these firms as the 'screened' group. Note that (1) the firms in this group have *all* of these characteristics and (2) neither offer price adjustments nor overhang are considered in forming the groups. The second group contains all the remaining IPOs, and we refer to it as the 'unscreened' group. For the two groups, we tabulate *Initial*, OCI, *EconOver*, *ShareOver*, *PartialU*, and *Upward* by period and by group, and we report the results in Table 4.

Comparing the two groups, several things are apparent. First, firms that meet the screening criteria have much higher share overhang in every period and are much more likely to have a positive offer price adjustment. The screened group's initial returns are almost 50 percent larger in the first period, and they are over 100 percent larger in the later three periods. In each period, the screened group has a significantly larger *PartialU*, and a greater percentage of firms in the screened group have upward adjustments. Finally, the percentage of offerings meeting the screening criteria grows from 5 percent (39 of 866) in the first period to 37 percent (282 of 764) in the bubble period. In the last period, only 6.5 percent of the issues (26 of 399) meet the criteria. In evaluating these results, keep in mind that the members of the screened group have all five of the characteristics we use. As we approach the bubble period, the unscreened group contains a growing percentage of firms that meet some, but not all, of these criteria.

Interestingly, OCI is not different (economically or statistically) between the two groups in any of the three later periods. In the first period, the screened group actually has a lower OCI. Thus, the particular set of screens we employ seems to be useful in identifying factors that lead to differential overhang and underpricing, but not differential OCI, which is consistent with our earlier discussion on correlations. The lack of significance also suggests that OCI is not understood particularly well. In the next section, we attempt to sort out the issues raised by our univariate analyses in a multiple regression framework.

8 Based on univariate analyses of our sample (not reported, but available on request from the authors), these criteria are generally associated with higher degrees of average underpricing (and overhang) over the entire period we study. Similar results have been widely reported in the IPO literature. However, this list is not intended to be exhaustive, and we do not claim that any of these characteristics have a causal relationship with underpricing.

Table 4

Statistics by Category and Time Period

Variable	*Unscreened*	*Screened*	*t-statistic*
Panel A: 1986–1989			
n	827	39	
Initial	7.32	13.19	−2.31
OCI	4.88	2.74	3.13
EconOver	2.96	4.79	−5.28
ShareOver	2.55	3.93	−4.65
PartialU	2.03	6.91	−3.42
Upward	25.15	56.41	−3.82
Panel B: 1990–1998			
n	2,631	253	
Initial	14.76	32.16	−7.55
OCI	5.17	5.29	−0.34
EconOver	3.05	5.46	−9.27
ShareOver	2.39	3.62	−9.83
PartialU	5.71	19.66	−10.04
Upward	35.88	63.64	−8.75
Panel C: 1999–2000			
n	482	282	
Initial	43.19	104.03	−8.38
OCI	5.95	6.67	−1.20
EconOver	6.19	13.38	−9.37
ShareOver	3.74	5.55	−10.02
PartialU	14.92	31.77	−6.46
Upward	52.90	74.11	−6.12
Panel D: 2001–2004			
n	373	26	
Initial	9.68	29.78	−4.33
OCI	3.95	4.78	−0.80
EconOver	2.94	6.53	−4.07
ShareOver	2.42	4.62	−3.64
PartialU	3.45	16.44	−3.74
Upward	30.29	69.23	−4.08

Notes:
The table reports means and difference tests for underpricing (*Initial*) in percent, the opportunity cost of issuance (OCI) in percent, economic overhang (*EconOver*), share overhang (*ShareOver*), partial upward adjustment (*PartialU*) in percent, and the percentage of issues adjusted upward (*Upward*) by time period and segment, where the segment is determined by venture capital backing, the age of issuer, offer price characteristics, high technology or Internet status and underwriter quality level. *Screened* represents issues that are venture capital backed, young (age < 8), priced on an integer, classified as a high technology or Internet firm, and have a highly ranked (Carter-Manaster rank of 8 or 9) underwriter. *Unscreened* represents all other issues. Panel A reports results for the 1986 to 1989 period; Panel B reports results for the 1990 to 1998 period; Panel C reports results for the 1999 to 2000 period; and Panel D reports results for the 2001 to 2004 period. Data are from the SDC New Issues and CRSP databases.

(iii) Determinants of OCI and EconOver: Multivariate Analyses

Motivated by our previous section, we attempt to more specifically determine if the factors known to be related to underpricing are also related to OCI. We base this

multivariate analysis on the following regression:

$$\begin{aligned} Dep_i = {} & \alpha + \beta_1 \mathrm{Ln}Proceeds + \beta_2 \mathrm{VC} + \beta_3 \mathrm{Ln}Age + \beta_4 Integer + \beta_5 \mathrm{HT} + \beta_6 Internet \\ & + \beta_7 Rank + \beta_8 Primary + \beta_9 NasLag + \beta_{10} PartialU + \beta_{11} PartialD \\ & + \beta_{12} Nineties + \beta_{13} Bubble + \beta_{14} PostBubble + \varepsilon_1 \end{aligned} \tag{9}$$

where *Dep* is the dependent variable and is either *Initial*, OCI, *EconOver*, or *ShareOver*. Most of the independent variables have been previously defined. The exceptions are Ln*Proceeds*, which is the natural logarithm of the inflation-adjusted (to 1986 values) proceeds; Ln*Age*, which is the natural logarithm of 1 plus *Age*; and *NasLag*, which is the cumulative return on the Nasdaq composite index for the fifteen trading days prior to the issue date. We also create three time-related dummy variables. *Nineties* takes on a value of one for the years 1990–1998, zero otherwise; *Bubble* takes on a value of one during 1999–2000, zero otherwise; and *PostBubble* takes on a value of one during 2001–2004, zero otherwise. If we are successful in explaining the variation over time in *Initial*, OCI, *EconOver* and *ShareOver*, these dummies should be insignificantly different from zero. We estimate the regression without the dummies for the four subperiods and then include the dummies for the full-period results.

The results of this analysis are reported in Panels A through D in Table 5. In Panel A, *Initial* is the dependent variable. Looking at the four subperiods, there is a noticeable lack of consistency for many of the dependent variables. Only the partial adjustment variables and the *Internet* dummy variable are highly significant in all cases. *NasLag* is relatively consistent, but only marginally significant in the last period. *Integer* and Ln*Age* also maintain the same sign throughout and are significant in the first two periods, but lack significance in the later periods.

Looking at the full sample results in the rightmost column of Panel A, the coefficients and significance levels are, for the most part, what would be expected from the subperiod results and previous studies. The *Nineties* dummy is economically small and statistically insignificant; thus, the model explains the increase in underpricing from the first to the second period. However, the *Bubble* dummy is large (24.91) and highly significant ($t = 10.84$), so the model fails to account for much of the underpricing in this period. Recalling that underpricing during the third period averaged 65.64 percent, a simple interpretation is that about 38 percent (24.91/65.64) of the underpricing remains unexplained or, alternatively, approximately 50 percent of the increase in underpricing from the 1990–1998 period to the 1999–2000 period is not captured by the model. In Panel B, we replace *Initial* with OCI as the dependent variable and rerun the regressions. No independent variables are statistically significant in all four subperiods, and the explanatory power is low. This is troubling because, from a mechanical perspective, the only difference between Panels A and B is that the dependent variable has a different denominator (*Initial* can be calculated as MLOT divided by total offer proceeds; OCI is MLOT divided by pre-offer total equity). The implication is that the determinants of OCI, which is usually the single biggest cost of going public to the issuing firm, are poorly understood.

One very interesting result in Panel B is that *Rank* generally has a negative sign, and it is significant in all but the bubble period, which is contrary to the results in Panel A. Thus, firms that use more prestigious underwriters do, in fact, appear to have a lower

Table 5

Regression Results

	1986–1989		*1990–1998*		*1999–2000*		*2001–2004*		*1986–2004*	
	Coef.	*t-stat*	*Coef.*	*t-stat*	*Coef.*	*t-stat*	*Coef.*	*t-stat*	*Coef.*	*t-stat*
Panel A: Underpricing (*Initial*)										
Intercept	15.27	7.06	15.58	7.03	−52.10	−2.74	14.56	2.28	−0.71	−0.17
Ln*Proceeds*	0.20	0.30	−3.41	−4.64	1.13	0.29	−1.10	−0.90	−2.05	−2.48
VC	−0.41	−0.33	−2.29	−2.39	14.90	2.55	2.15	1.17	0.92	0.80
Ln*Age*	−0.90	−2.21	−1.00	−2.09	−0.76	−0.22	−0.98	−1.03	−0.93	−1.69
Integer	2.37	2.37	4.29	4.23	12.43	1.15	−2.99	−1.38	3.52	2.82
HT	−0.83	−0.66	4.12	4.23	12.29	1.74	2.73	1.37	2.54	2.10
Internet			30.08	10.82	16.44	2.44	7.72	2.26	20.67	9.22
Rank	−1.07	−3.41	0.63	2.22	6.24	3.21	0.96	1.50	0.53	1.57
Primary	−0.46	−0.44	0.46	0.49	6.95	0.97	−3.51	−0.99	7.83	2.47
NasLag	0.49	3.30	0.61	5.61	1.35	3.96	0.31	2.30	0.84	7.82
PartialU	0.76	6.77	0.69	18.60	1.42	16.61	0.61	6.08	1.22	36.65
PartialD	0.30	4.71	0.32	7.85	0.69	2.96	0.25	3.69	0.30	6.15
Nineties									2.01	1.34
Bubble									24.91	10.84
PostBubble									1.85	0.87
n	790		2,738		740		330		4,598	
Adj. R^2	0.1651		0.2552		0.4474		0.2557		0.4565	
Panel B: Opportunity Cost of Issuance (OCI)										
Intercept	2.56	1.17	6.29	6.99	6.00	2.64	3.35	1.47	2.87	2.42
Ln*Proceeds*	3.29	4.90	0.45	1.51	−0.11	−0.23	2.13	3.92	1.26	5.36
VC	−2.24	−1.78	−0.72	−1.85	1.20	1.73	−0.68	−0.83	−0.66	−2.01
Ln*Age*	−0.93	−2.25	−0.34	−1.75	0.79	1.92	−0.82	−1.93	−0.36	−2.28
Integer	0.42	0.41	1.06	2.57	0.91	0.70	−0.70	−0.72	0.89	2.49

HT	−1.36	−1.06	−0.02	−0.04	0.74	0.88	0.41	0.46	−0.16	−0.46
Internet			0.15	0.14	0.51	0.63	0.02	0.01	−0.25	−0.40
Rank	−0.74	−2.35	−0.36	−3.07	−0.26	−1.12	−0.78	−2.64	−0.49	−5.04
Primary	3.66	3.50	0.47	1.22	−1.45	−1.69	1.40	1.76	3.31	3.66
NasLag	0.12	0.80	0.09	2.05	0.14	3.55	0.18	2.89	0.12	3.86
PartialU	0.05	0.48	0.09	5.71	0.04	3.91	0.05	1.18	0.05	5.48
PartialD	0.09	1.38	0.14	8.62	0.13	4.58	0.06	2.04	0.13	9.39
Nineties									−0.38	−0.89
Bubble									−0.72	−1.10
PostBubble									−1.37	−1.26
n	790		2,738		740		330		4,598	
Adj. R^2	0.0519		0.0727		0.1091		0.1104		0.0645	
Panel C: Economic Overhang (*EconOver*)										
Intercept	3.15	6.47	1.78	8.06	−4.25	−2.00	0.66	0.78	0.76	1.61
Ln*Proceeds*	−1.32	−8.83	−0.40	−5.42	0.00	0.01	−0.12	−0.60	−0.57	−6.08
VC	0.29	1.03	−0.26	−2.70	1.64	2.51	0.27	0.91	0.13	1.01
Ln*Age*	0.08	0.84	−0.09	−1.93	−0.50	−1.29	0.08	0.52	−0.08	−1.26
Integer	−0.15	−0.68	0.13	1.32	0.21	0.18	−0.10	−0.27	0.03	0.20

Table 5 (Continued)

	1986–1989		*1990–1998*		*1999–2000*		*2001–2004*		*1986–2004*	
	Coef.	*t-stat*	*Coef.*	*t-stat*	*Coef.*	*t-stat*	*Coef.*	*t-stat*	*Coef.*	*t-stat*
HT	0.06	0.21	0.69	7.13	1.36	1.73	0.30	0.92	0.44	3.25
Internet			2.76	9.97	2.63	3.48	1.63	2.88	2.71	10.67
Rank	0.40	5.62	0.29	10.09	0.96	4.43	0.32	3.03	0.35	9.22
Primary	−0.25	−1.08	0.43	4.57	0.80	0.99	0.55	1.87	1.06	2.93
NasLag	−0.02	−0.53	−0.00	−0.25	0.01	0.27	−0.01	−0.57	−0.00	−0.21
PartialU	0.16	6.26	0.06	16.38	0.14	14.27	0.09	5.20	0.12	30.82
PartialD	0.02	1.32	0.01	2.01	0.01	0.56	0.15	1.34	0.01	1.24
Nineties									−0.07	−0.38
Bubble									2.59	9.95
PostBubble									0.93	3.83
n	790		2,738		740		330		4,598	
Adj. R^2	0.1378		0.2126		0.3677		0.1766		0.3942	
Panel D: Share Overhang (*ShareOver*)										
Intercept	2.46	5.93	1.29	8.78	0.67	1.10	0.53	0.83	0.65	2.85
Ln*Proceeds*	−1.22	−9.57	−0.25	−5.18	−0.20	−1.55	−0.22	−1.46	−0.44	−9.68
VC	0.34	1.42	−0.11	−1.71	0.23	1.24	0.17	0.77	0.02	0.30
Ln*Age*	0.09	1.13	−0.04	−1.29	−0.29	−2.56	0.12	1.00	−0.02	−0.83
Integer	−0.21	−1.11	−0.04	−0.58	−0.10	−0.28	0.03	0.10	−0.06	−0.83
HT	0.10	0.40	0.44	6.81	0.54	2.36	0.16	0.64	0.36	5.41
Internet			0.95	5.12	1.18	5.42	1.02	2.41	1.06	8.57
Rank	0.39	6.44	0.22	11.60	0.42	6.79	0.29	3.68	0.28	15.10

Primary	0.01	0.06	0.56	8.85	0.49	2.11	0.68	3.10	1.14	6.55
NasLag	−0.03	−1.15	−0.02	−2.99	−0.04	−3.27	−0.02	−1.29	−0.03	−5.04
PartialU	0.11	4.91	0.02	8.57	0.02	6.47	0.04	3.48	0.02	11.62
PartialD	0.01	0.55	−0.00	−0.79	−0.01	−1.91	0.01	0.71	0.00	0.44
Nineties									0.06	0.72
Bubble									1.10	8.69
PostBubble									0.71	6.04
n	790		2,738		740		330		4,598	
Adj. R^2	0.1346		0.1249		0.2343		0.1339		0.2149	

Notes:
The table presents results from the following regression:

$$\begin{aligned} Dep_i = {} & \alpha + \beta_1 \mathrm{Ln}\, Proceeds + \beta_2 \mathrm{VC} + \beta_3 \mathrm{Ln}\, Age + \beta_4 Integer + \beta_5 \mathrm{HT} + \beta_6 Internet + \beta_7 Rank \\ & + \beta_8 Primary + \beta_9 NasLag + \beta_{10} PartialU + \beta_{11} PartialD + \beta_{12} Nineties \\ & + \beta_{13} Bubble + \beta_{14} PostBubble + \varepsilon_i \end{aligned}$$

where the dependent variable is underpricing (*Initial*) in percent in Panel A, the opportunity cost of issuance (OCI) in percent in Panel B, economic overhang (*EconOver*) in Panel C, and share overhang (*ShareOver*) in Panel D. Ln*Proceeds* is the natural logarithm of the deal size and is inflation adjusted to 1986 values. VC equals 1 if the IPO is venture capital backed. Ln*Age* is the natural logarithm of one plus the age of the issuing firm. *Integer* is a dummy variable equal to one if the IPO is priced on an integer. HT equals 1 if the issuing firm is a high technology (but non-Internet) firm. *Internet* equals 1 if the issuing firm is an Internet company. *Rank* is the Carter-Manaster prestige ranking for the lead underwriter as updated by Loughran and Ritter (2003). *Primary* is a dummy variable equal to one if the offering has zero secondary shares. *NasLag* is the cumulative return on the Nasdaq composite index for the fifteen trading days prior to the issue date. *PartialU* is the percentage difference between the original midfile price and the offer price if the adjustment is positive, and *PartialD* is the percentage difference between the original midfile price and the offer price if the adjustment is negative. *Nineties* is equal to one if the issue took place in the 1990 to 1998 period; *Bubble* is equal to one if the offer took place in the 1999 to 2000 period; and *PostBubble* is equal to one if the offer took place in the 2001 to 2004 period. Data are from the SDC New Issues and CRSP databases for the 1986 to 2004 time period.

cost of going public, just as suggested by Carter and Manaster (1990). *PartialU* and *PartialD* are highly significant in the second and third subperiods, and the coefficients do not display the pronounced asymmetry shown in Panel A.

In contrast to *Initial* in Panel A, the full period results for OCI show that the time period dummies are not significant. In other words, the model accounts for the variation in OCI over time, including the bubble period. We view this result as lending support to the changing risk composition hypothesis suggested by Loughran and Ritter (2004). Also, based on our decomposition of the OCI in an IPO, the culprit in the model's failure in Panel A must be overhang. We explore this possibility in Panels C and D.

Beginning with economic overhang in Panel C, once again there is a general lack of consistency across the four subperiods. However, a notable exception is *Rank*, which is positive and highly significant in each period. Thus, higher prestige banks are consistently associated with higher economic overhang. From Panel A, the association of underwriter quality to underpricing changes over time, which previous researchers have concluded is inconsistent with a certification effect. However, the combined effect of underwriter prestige on underpricing and overhang results in a consistently negative relation to OCI (Panel B), which is consistent with a certification effect. *PartialU* is also significant in all four subperiods.

The full period results for *EconOver* show that there is little difference between the first two subperiods. The *Nineties* dummy is small and insignificant at conventional levels. In contrast, the *Bubble* dummy is large and highly significant. Thus, the unexplained increase in underpricing in Panel A is associated with a jump in *EconOver*. Since the regressions control for various firm characteristics, the unexplained increase, which is similar to what is observed for underpricing, is most likely a result of issuers responding to market conditions. Compared to OCI in Panel B, the explanatory power is relatively high. As a result, we suspect that underpricing regressions such as those in Panel A probably tell us more about variation in overhang than they do about the cost of going public to the issuing firm. This view is strengthened by the full period results, which show a general consistency when comparing underpricing and overhang.

Because *EconOver* implicitly embeds both the IPO aftermarket price and offer price, we also examine *ShareOver* in Panel D, which embeds neither, allowing us to more explicitly examine the retention choice of preexisting owners. Comparing Panels C and D, the results are similar and in some cases, sharper. *Rank* is again positive and highly significant in all four subperiods, leaving little doubt that higher prestige banks are associated with higher overhang offerings. Another relatively strong and consistent result in Panel D is that greater positive adjustments in offer prices (*PartialU*) are associated with higher share overhang, which is consistent with an earlier univariate result. Not surprisingly, larger offerings are generally associated with lower share overhang (though not strongly so in the last two periods). Finally, Internet firms have much higher share overhang.

Examining the full period results in Panel D, the *Nineties* dummy is not significant; however, the *Bubble* dummy is. From Table 2, the increase in average share overhang from the second to the third period is 1.90. The *Bubble* coefficient is 1.10, so we explain a little less than half of the increase, which approximately matches the proportion of the increase in underpricing we are able to explain in Panel A.

Overall, the results of this section clearly show that variables that are significantly related to underpricing are not strongly related to OCI. Thus, the determinants of

the cost of underpricing to the preexisting owners of firms going public are poorly understood. Future research will be needed to examine this important question.

(iv) Robustness Test: Liquidity Discount and Preexisting Firm Value

As mentioned previously, equation (4) assumes that preexisting firm share value is equivalent to the aftermarket price plus dilution associated with primary shares sold, which implicitly ignores any liquidity discount that may be attached to the firm's shares prior to the offering.[9] Since the 'ink is drying' on the deal when the final offering values are chosen, this issue may have little influence on our results; nonetheless, it does present a potential concern since the liquidity discount would impact the OCI calculation. Specifically, if a liquidity discount exists, we would overstate preexisting firm value and therefore understate OCI. If this difference is substantial, the attributes we ascribe to OCI (such as its stability) may be inaccurate. Thus, for robustness, we explore liquidity discounts and their potential impact on preexisting share value (and OCI).

A common industry practice (see Rogers, 2005) is to apply a standard 20–30 percent liquidity discount to firms whose shares are not traded. This approach is simply a proportional adjustment and has little impact on our overall results. Although common practice, this approach fails to consider the potentially unique industry component of discounts. Thus, for our primary robustness tests, we concentrate on more explicit discount values. Specifically, we follow Das et al. (2003), who develop liquidity discount estimates by industry for the years 1986 to 2000.

We match the estimated discounts reported by Das et al. (2003) to our sample via SIC codes, primarily concentrating on the 1990 to 2000 period, although we find in unreported results that our findings are consistent across the entire sample period. Once we have identified the appropriate liquidity discount, we adjust the calculated preexisting share value, i.e., equation (4), as follows:

$$P_B \equiv \left(P_1 + \frac{N_{o,p}(P_1 - \mathrm{OP})}{N_B} \right) \times (1 - d_i) \tag{10}$$

where d_i is the estimated industry-specific discount for illiquidity. For example, Das et al. (2003) report a relatively high discount of 68.8 percent for semiconductor companies. In contrast, biotechnology firms exhibit a relatively low average discount of 17.4 percent.[10] Applying the discount reduces P_B and, therefore, increases OCI.

For the 1990 to 1998 and 1999 to 2000 time periods, OCI adjusted for the liquidity discount is 8.59 and 9.39 percent, respectively, the difference of which is significant at the 12 percent level. As reported in Table 2, these values compare to our standard OCI estimates for the same periods of 5.18 and 6.22 percent, respectively, the difference of which is significant at the one percent level. Thus, the liquidity adjustment, as expected, increases our average estimate of OCI; however, a few other key results are worth noting.

9 Equation (4) also implicitly assumes that preexisting shareholders possess perfect information about aftermarket behavior. If that were true, then, in absence of any strategic issues such as in Aggarwal et al. (2002), the incentive to underprice would be negligible, which is inconsistent with the high levels observed.

10 Applying the estimated discounts to IPO firms is a conservative approach since the discount percentage would likely be less for a firm that is ready to go public versus one in an earlier stage of financing, thereby adding greater confidence to our results.

First, the average OCI remains relatively small in comparison to the average level of underpricing, especially in the bubble period. Thus, even after accounting for a liquidity discount, it appears that underpricing severely overstates the opportunity cost of issuance for preexisting owners. Second, the average levels of OCI across time, particularly in the bubble, are not as significantly different as our earlier findings, which further strengthens our conclusion that OCI is relatively stable over time. Lastly, we calculate the correlation between our adjusted OCI values and share overhang, finding a negative and significant relation. Thus, at least on a univariate basis, our results appear robust to various measures of preexisting equity value.

To further our examination, we repeat the regression reported in the final column of Panel B in Table 5. We evaluate our existing measure of OCI, as well as our liquidity adjusted measure. As noted above, based on the availability of liquidity discount estimates, we concentrate on the 1990 to 2000 period, which is also the most relevant to our analysis. We find that the majority of the independent variables are relatively consistent in their significance levels. For example, the market return prior to the offering and the partial adjustment variables remain the most significant. Of greatest importance to the robustness test, we find that the bubble dummy variable remains small and insignificant, suggesting that even after controlling for potential valuation discounts, the opportunity cost of issuance to preexisting shareholders remains relatively stable over time.

5. SUMMARY

We examine the evolution of IPO underpricing from 1986 to 2004. Many previous studies attempt to explain the variation in underpricing across firms and through time, but researchers have essentially ignored the broader, and in many ways more important, question of the impact of underpricing on the wealth of preexisting firm shareholders.

To address this question, we build on Barry (1989) and derive a measure of the opportunity cost of issuance (OCI) to firms going public. Our measure, which is simply money left on the table divided by the pre-IPO value of the firm's equity, captures both the effect of underpricing on secondary shares sold and the cost of dilution associated with primary shares issued. We also show explicitly how underpricing and OCI are related. In particular, we find that OCI is the ratio of underpricing to a particular measure of 'overhang' (i.e., shares retained relative to shares offered in the IPO).

In our empirical analysis, we address two issues. First, we examine whether high levels of underpricing translate into large wealth losses to preexisting owners. Second, many factors are known to be related to underpricing, but what is not known is if these same factors are related to the OCI. Therefore, we examine these relations.

For the 1986–1989, 1990–1998, 1999–2000 and 2001–2004 periods, IPO underpricing averages 7.58, 16.29, 65.64 and 10.99 percent, respectively. Across the same periods, economic overhang follows a similar pattern, averaging 3.04, 3.26, 8.84 and 3.17, respectively. The corresponding values for OCI are 4.79, 5.18, 6.22 and 4.00 percent. Thus, OCI and underpricing have a similar pattern over the period we study, but the variation in OCI is much less dramatic. In fact, after controlling for firm and offer characteristics, we find no significant change in OCI, suggesting that owners issue fewer shares during periods of higher underpricing, thereby offsetting the potential cost. We also find that these results are robust to controls for liquidity discounts that may be attached to the value of the firm prior to going public.

Our analyses also show that many variables typically explored in studies of IPO underpricing are not useful in explaining variation in OCI; instead, they are much more strongly related to overhang. The implication is that the determinants of the opportunity cost of going public are poorly understood. We also show how failing to properly distinguish between OCI and underpricing can cause misleading inferences. For example, in the 1990–1998 period, offerings led by high-prestige underwriters are significantly more underpriced, which is contrary to the predictions and findings of Carter and Manaster (1990). However, during this same period, firms with high-prestige banks have a significantly lower OCI, but this fact is obscured because offerings led by such banks tend to have higher overhang.

Two central messages emerge from this paper. The first is that underpricing cannot be properly understood independently of overhang. However, most existing theories are essentially mute on this subject. Second, much of the existing theoretical framework regarding IPO valuation needs to be recast in terms of OCI instead of underpricing. The same is true of the empirical work evaluating that framework. Progress on these two fronts will lead to a much richer understanding of IPO valuation, underpricing, and the opportunity cost of going public.

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