

IPO underpricing to buy holding

Suman Banerjee^a, Robert S. Hansen^{a*}, Emir Hrnjić^a

^a*A. B. Freeman School of Business
Tulane University, New Orleans, LA, 70118*

Abstract

We present a full information model of underpricing to buy long-term holding of IPO shares and test its empirical implications. In our model the benefits of long-term holding raise firm value. Issuers hire underwriters to use underpricing to pay for institutional holding in two-installments; revenues from flipping initial share allocations and gains from the future sale of remaining shares. IPO holdings are found to be economically significant and more sizeable than flipping. IPOs with more reputable institutional buyers have significantly larger holdings, larger price revisions, and larger underpricing. The same is found for IPOs with more reputable underwriters. Findings confirm a holding explanation for the partial adjustment phenomenon and for several facts that often are coupled with initial share allocations. Overall, the evidence agrees with the theory that underpricing buys holding to raise firm value.

July, 2005

Keywords: Initial public offerings, Going public, Investment banking, Underpricing, Institutional investors, Underwriters

JEL classification: G32, G34

* Corresponding author. Tel.: 504-865-5624; e-mail: rob.hansen@tulane.edu.

1. Introduction

Lead underwriters and issuing firms prefer to allocate IPO shares to long-term holders. For example, Goldman Sachs favors allocating IPO shares to investors who “remain loyal, long-term holders.” Merrill Lynch seeks “institutions that plan to keep IPO shares for the long-run.” In the highly visible Google IPO, which allocated shares by auction rather than lead underwriter founders Page and Brin implored allocation recipients to “invest for the long-term.”¹ In this study we investigate the notion that lead underwriters underprice and allocate IPO shares to secure the benefits of long-term holding. For ease of discussion the benefits are called monitoring and the monitoring owners are called institutions. We present a monitoring theory of underpricing to buy holding under full information that provides several new predictions about holding and pricing IPOs, and entirely new explanations for a number of well-known empirical patterns associated with IPOs. Using a large sample of IPOs, we report findings that agree with many of the theory’s predictions and explanations.

The monitoring theory has a number of distinguishing features. A key contribution is the focus on the role of holdings. Issuers recognize that holding raises firm value and that buyers profit from underpricing. They hire underwriters to buy holding with the underpricing, in two installments. The first installment is buyers’ revenues from flipping an allowed portion of their initial allocation into the secondary market. The second is buyers’ returns from the sale of remaining shares after the monitoring is supplied. Firm value is higher in a two-part arrangement than in a one-part arrangement (e.g., paying solely in flipping revenues or in long-term capital gains). The theory features the lead underwriter in the bookbuilding role of securing long-term owners by setting the

¹ See, respectively, Gasparino, “Goldman IPO Lives Up to Expectations, Posts 33% Gain in First Trading Day,” *Wall Street Journal*, May 5, 1999; Mills, “A Digital Age Rite: The IPO Roadshow,” *The Washington Post*, November 28, 1999; and the Google prospectus of April, 2004.

offer price and allocating underpriced shares to those that promise to monitor.² The promises are enforced with quasi rent rewards to monitoring institutions in future IPOs, and terminating all future business with those that renege on their promise. Institutional buyers are distinguished by their reputation for monitoring efficiency, which is rewarded with quasi rents. Issuers and investors are more certain the firm will be monitored because the underwriter puts on the line its reputation for securing monitoring. The theory has novel predictions about holdings, unlike other underpricing theories which cannot explain holding behavior. The theory is therefore distinct from the other theories that include information gathering, in which lead underwriters use underpricing to buy good information from investors during bookbuilding (Benveniste and Spindt, 1989; Benveniste and Wilhelm, 1990; Spatt and Srivastava, 1991), and the conflict of interest theory in which underpricing is used to expropriate wealth (Loughran and Ritter, 2002; Ljungqvist, Nanda and Singh, 2004). While the theory features monitoring as a distinct benefit of bookbuilding it does not exclude these or other theories of underpricing.

Three new findings confirm the economic importance of institutional holding. First, institutions hold significant long-term stakes in IPOs, averaging over 70% of IPO shares one year later. Evidently, holding is economically more important than flipping. Second, larger holding has a positive impact on the price revision (the offer price as a percent of its file date midpoint level). This shows that more holding increases firm value, in agreement with a fundamental premise of our model. Third, larger institutional holding is associated with larger underpricing. This agrees with a vital point of the monitoring story, that underpricing buys holding. These findings are confirmed for holdings at the end of one, four, and eight quarters after the IPO.

² Bookbuilding is the process before the offer in which lead underwriters meet with potential buyers, to solicit indications of interest in buying and, in our case, holding new shares (Cornelli and Goldreich, 2001; Sherman and Titman, 2002). Other bookbuilding roles for lead underwriters acknowledged in the literature that are distinct from securing monitoring include gathering price information from potential investors (Benveniste and Spindt, 1989; Benveniste and Wilhelm, 1990; Spatt and Srivastava, 1991), and strengthening underwriters' long-term relationships with investors (Sherman, 2000). For surveys of the IPO literature see Ritter and Welch (2002) and Ljungqvist (2004).

New results support three unique predictions that distinguish the monitoring theory from other underpricing theories. Institutions with better reputations for monitoring have larger holdings. Furthermore, they are associated with larger price revisions. Third, underpricing is significantly higher in offerings with more reputable institutional buyers. These results agree with the general implication that buying superior monitoring with more underpricing is associated with better placement. They are confirmed for different holding periods and they are not driven by Internet firms or hi-tech firms, nor are they attributable to systematic omission of variables because fixed effects are used. Moreover, they are confirmed in Fama and MacBeth (1973) tests of mean annual estimates. Thus, the findings are not driven by sub-periods of extraordinary IPO pricing or hot versus cold deal flow. The reputable institution results may seem to agree with information gathering and wealth expropriation. However, information gathering makes no prediction about long-term holding or why long-term institutional investors repeatedly have superior information. Similarly, wealth expropriation makes no prediction about long-term holding or how long-term investors can repeatedly expropriate wealth. Moreover, while the wealth expropriation stories address the extreme underpricing in the bubble period, our Fama and MacBeth (1973) results show that the reputable institution results are not specific to the bubble period.

The monitoring story suggests a new understanding of two well-known IPO pricing phenomena. One phenomenon is the partial rise in offer prices during bookbuilding in response to a rise in stock price, the so-called “partial adjustment phenomenon” (e.g., see Hanley, 1993). Monitoring suggests that more underpricing is used to secure more value as long as the added value exceeds the underpricing. Thus, the offer price rise is less than the rise in market price. The partial adjustment phenomenon is also predicted by the information gathering story and other stories (e.g., Edelen and Kadlec, 2005). Consistent with these stories, we report that a positive correlation remains between the price revision and underpricing after controlling for monitoring. The second phenomenon is the positive impact of underwriter reputation on underpricing (see Beatty and

Welch, 1996; Hansen, 2001). In the monitoring role underwriters have reputation for securing monitoring, independent of any reputation for risk bearing (Carter and Manaster, 1990), certifying the offer price (Booth and Smith, 1986), and overseeing management (Hansen and Torregrosa, 1992), which are not called for in our model (we do not model other rationale for hiring underwriters and focus only on the holding function). More reputable underwriters secure more holding and thus more firm value, requiring more underpricing to pay institutions for more monitoring. We find that more reputable underwriters secure more holding and larger price revisions, and thus are associated with larger underpricing. A positive relationship between reputation and underpricing also agrees with the wealth expropriation stories. However, the wealth expropriation stories focus on explaining extreme underpricing in the bubble period, and our Fama and MacBeth (1973) tests confirm that the reputation results are not specific to the bubble period.

Monitoring adds a new explanation for the initial allocations patterns uncovered in allocations data (Hanley and Wilhelm, 1993; Cornelli and Goldreich, 2001; Aggarwal, Prabhala and Puri, 2002; Jenkinson and Jones, 2002; Ljungvist and Wilhelm, 2003). The studies collectively show three allocation patterns; larger allocations are associated with more reputable underwriters; larger allocations are associated with higher price revisions; and larger allocations to institutions are associated with more underpriced shares. The new monitoring interpretation of these patterns emerges naturally from the fact that long-term holding is a principal component of the initial allocation, since the allocation is chiefly holding plus a lesser amount of flipping. Because monitoring suggests that initial allocations are a good proxy for holdings, the proxy effect predicts that monitoring patterns are reflected in the allocation patterns. Consistent with the proxy effect, the evidence reveals three underlying holding patterns; larger holdings are associated with more reputable underwriters; higher price revisions; and more underpriced shares.

Our robust evidence of positive correlation between underpricing and holding does not appear to be relevant to underpricing theories that make no obvious prediction about holding. Thus, the

correlation sheds no light on the debate over the role of underpricing and ownership structure (Brennan and Franks, 1997; Stoughton and Zechner, 1998), which is not resolved by the findings about correlation between underpricing and ownership structure (Smart and Zutter, 2003; Arugaslan, Cook and Kieschnick, 2005; Field and Sheehan, 2003). Our model differs from these models because holding, the fraction of IPO shares, differs fundamentally from ownership, the fraction of outstanding shares. For example, regardless of the holding of IPO shares, the typical IPO is a mere fraction of outstanding shares that managers control indefinitely. Thus, the ownership theories are not confirmed or rejected by our correlation evidence. However, to the extent that initial allocations are positively correlated with holding as indicated by the proxy effect, and to the extent that flipping is negatively correlated with holding, our correlation evidence seems to agree with theories in which there is positive correlation between underpricing and allocation size, and negative correlation between underpricing and flipping.

It is natural to ask, is there other evidence of value created by institutional holding? Lewellen (2006) finds that IPO allocations to institutions are associated with less need for price stabilization. There is a positive association between institutional ownership and stock price after IPOs (Boehmer, Boehmer, Fische, 2006; Dor, 2004; Field and Lowry, 2005), and after seasoned equity issues (D'Mello, Schlingermann and Subramaniam, 2005). Others show that institutional ownership raises awareness, and thus stock price, among investors (Brennan and Hughes, 1991; Brennan and Subrahmanyam, 1995), venture capitalists (Megginson and Weiss, 1991; Li and Masulis, 2005), and consumers (Demers and Lewellen, 2003). Studies find that institutional ownership is associated with more value due to better governance (Del Guercio and Hawkins, 1999; Gillan, Starks, 2000; Almazan, Hartzell and Starks, 2004), and better firm performance (Jarrell and Poulson, 1987; Brickley, Lease and Smith, 1988; Smith, 1996). Our evidence of greater value from institutional holding agrees with these findings.

The balance of the paper proceeds as follows. Section 2 presents the model of underpricing to buy holding and highlights a number of empirical predictions and implications from the model. The cross section evidence of holding, the offer price revision, and underpricing, drawn from a large sample of IPOs, is reported in Section 3. The paper concludes with Section 4.

2. A theory of underpricing to buy holding

In this section we present a model of IPO underpricing to compensate long-term investors. We develop a simple rational expectation based equilibrium model of long-term holding, in which institutional investors seek to maximize their profit from purchase and resale of new shares, given the exogenously specified benefits and costs of monitoring public firms. We then derive a number of empirical implications from the model.

2.1. The model

Consider an infinite period economy that is divided into a series of identical stages, each having two periods and three dates (zero, one, and two). Without loss of generality we adopt the dynamic repeated game framework of Abrué (1989), so there is no discounting within each stage and payoffs across the stages are discounted at the risk-free interest rate, r . This staged multiperiod setting allows us to incorporate future payoff opportunities for the monitoring institutions in a relatively simple manner and thus, to investigate the role of reputation to discipline agents with diverse objective functions to induce them to work towards the common goal. There are four risk neutral agents; the going public firm, the underwriter, the monitoring institutional investor, and retail investors. For simplicity assume there is one underwriter and one institutional investor.³ We

³ If there is only one institution then it might pursue deviating from the monitoring agreement in the first stage to gain extra rents, only to return in the next stage to renegotiate terms of the next offer with the underwriter. However, the pool of institutional investors is in fact quite large, and our model captures this feature by implicitly assuming a highly elastic supply of similar institutions. While new shares are often allocated to several institutional buyers, the group's collective choice and formation economics is not modeled, nor do we model the manner in which underwriters and institutions may choose each other, or how issuers and underwriters match-up (e.g., see Fernando, Gatchev and Spindt, 2005). Also abstracted from is the real possibility that institutions may be of different types; some may prefer to invest for the long-

focus on underwritten IPOs, with sufficient competition between lead underwriters, institutional investors, and retail investors, and ignore agency problems, information asymmetry, and transaction costs. Within each stage, at date zero a privately held firm will go public, hiring the underwriter to set the offer price and sell the new shares when the secondary market opens. This process is shown in Figure 1.

Figure 1 here

The current value of the firm is V , but the underwriter knows that if monitoring is secured then the current value of the firm is $V(1 + g)$, where Vg is the value added from the monitoring.

Institutional monitoring benefit is featured in the rate of growth of firm value

$$g = \tau\sqrt{\alpha} \tag{1}$$

where τ is the institution's monitoring efficiency and α is the institution's period two holding. Thus, more reputable institutions produce more value growth, for any level of holding. For any given reputation, returns to monitoring are diminishing. This reflects reduced ability and opportunities to improve value as ownership rises. If there is no monitoring then the value of the firm will remain at V .

Lead underwriter reputation for enforcing monitoring is captured with the probability of monitoring failure. Monitoring can fail if the purchasing institution flips all of its shares back into the secondary market at date one, driving holding to zero. It could also fail if the state of nature arises that is beyond the underwriter's supervision. For example, rogue employee behavior within

term; some may prefer to flip most or all of their allocations, perhaps to promote initial share float and market liquidity; and some may receive allocations in exchange for good information.

the lead underwriter's bank or the institution could destroy the monitoring arrangement. The bank's reputation is thus identified with the probability that there is monitoring, β , where the probability of monitoring failure is $1 - \beta$.

The buying institution invests a significant part of its investors' wealth in the firm's stock for the long-term and provides costly monitoring of the firm while invested. The expected cost of monitoring and holding the securities is thus

$$M(\alpha) = b\alpha^2V \quad (2)$$

where b is a positive constant, reflecting variable cost of monitoring. For example, the institution incurs more costs of suboptimal diversification and liquidating its stake as it owns more of the firm. Monitoring costs are thus higher for larger issuers, and increasing with the institution's holding. As noted below, the institution is compensated for supplying its monitoring services with a quasi rent in the underpricing of the offering.

All agents know the institution will choose holding that maximizes the stage I expected profit from shares flipped at price P_1 at date one and the date two sale of the remaining shares at price $P_2(\alpha)$, given the cost of monitoring and the price for the new shares, P_0 . The date two stock price reflects the fundamental value of the asset and is expressed as

$$P_2(\alpha) = V(1 + g(\alpha)) \quad (3)$$

stage I profit is thus

$$\Pi(\alpha) = (\alpha_0 - \alpha)P_1 + \alpha P_2(\alpha) - M(\alpha) - P_0 \quad (4)$$

where α_0 is the fraction of shares allocated to the institutional investor. However, in the model retail investors merely buy and sell shares to satisfy liquidity needs, and thus have no firm-value enhancing feedback effect.⁴ Thus, it is optimal on the part of the underwriter (as well as the issuing firm) to allocate as many shares to institutions as they are willing to absorb in the primary market. For simplicity, we focus on the case in which the institution's initial allocation is 100%, and thus $\alpha_0 = 1$. Eq. (4) can therefore be rewritten as

$$\Pi(\alpha) = (1 - \alpha)P_1 + \alpha P_2(\alpha) - M(\alpha) - P_0 \quad (5)$$

The institutional investor takes date 1 secondary market price, P_1 , as given and maximizes $\Pi(\alpha)$ choosing the proportion of shares to hold until date 2. Thus, differentiating Eq. (5) with respect to α yields

$$\frac{d\Pi}{d\alpha} = -P_1 + P_2(\alpha) + \frac{V}{2}(\beta\tau\sqrt{\alpha} - 4b\alpha) \quad (6)$$

To understand the economic impact of holding, rational expectations are used. Under rational expectations, the date one price is the best guess for its future value. Thus,

$$P_1(\alpha^*) = V(1 + g(\alpha^*)) \quad (7)$$

where α^* is the holding that will maximize Eq. (6). Substituting P_1^* from Eq. (7) into Eq. (6) and

⁴ Allowing allocations to retail investors to have firm-value enhancing benefits may reduce the optimal allocation to the monitoring institution below 100%. This will have no qualitative effects on our results. One case in which it might affect the long-term holding is when the optimal allocation is less than the optimal holding. However, we believe such a scenario is implausible.

solving the first-order condition yields equilibrium holding

$$\alpha^* = \left(\frac{\beta\tau}{4b} \right)^2 \quad (8)$$

The second-order condition required for maximization is met unambiguously.

The optimal holding is thus the same for any offer price, as there is no other equilibrium with a holding other than α^* , except no holding in which case the offer price is simply V . The optimal holding is therefore independent of the offer price. Moreover, because the marginal benefit and cost of holding are independent of underpricing, the optimal holding is independent of underpricing.

The underwriter enforces the monitoring in equilibrium. In the underwriter's absence the institution and issuer would have to contract to assure the supply of monitoring. In our model, however, the issuer alone does not have the ability to discipline the monitoring institution in a single stage because it is not in the market for business with institutional buyers in future stages. Thus, the institutional investor cannot credibly commit to providing the desired monitoring. Because of its unique access to future business with the institutions the underwriter can reward the institutions for providing the promised monitoring, and punish the institutions that renege on their promises by terminating all future business with them. To assure that the promised monitoring is provided, the underwriter must therefore lower the offer price enough to provide the institution with underpricing revenue that covers the monitoring cost plus a quasi rent, QR , that makes it worthwhile for the institution to not deviate from monitoring and flip all shares into the secondary market at date 1. Hence, the offer price must be set to $P_0 = P_1(\alpha^*) - M(\alpha^*) - QR$. In our model, the numerous competitive institutions imply that to maximize the offer price for the issuing firm the underwriter will choose the minimal possible quasi rent that is sufficient to ensure monitoring.

Moreover, non-deviating institutions will earn the present value of quasi rents in every future stage in perpetuity, QR/r . The deviating institution, on the other hand, earns one quasi rent and avoids the monitoring cost outlay only in stage one, $M^* + QR$, and is banned from IPOs by the underwriter thereafter. Given the degree of competition among institutional buyers, equating the two payoff values and solving yields the minimum necessary quasi rent

$$QR(\alpha^*) = \frac{rM(\alpha^*)}{1-r} \quad (9)$$

The offer price that minimizes underpricing while assuring the monitoring, and thus maximizes the proceeds, is therefore found by substitution from Eq. (9) into P_0 and simplifying,

$$P_0(\alpha^*) = P_1(\alpha^*) - M(\alpha^*) - QR(\alpha^*) \quad (10)$$

The optimal offer price is thus the market price achieved with monitoring, less the monitoring cost and quasar rent. Hence, the offer price is determined by the optimal level of holding.

Substituting Eq. (7) into Eq. (10) and solving yields the price revision

$$PR(\alpha^*) = \frac{P_0(\alpha^*) - V}{V} = g(\alpha^*) - c(\alpha^*) \quad (11)$$

where $c(\alpha^*) = M(\alpha^*)/((1-r)V)$. Similarly, optimal underpricing pays for the monitoring cost plus

the quasi rent, and is determined by the optimal level of holding

$$U(\alpha^*) = \frac{P_1(\alpha^*) - P_0(\alpha^*)}{V} = c(\alpha^*) \quad (12)$$

While we define underpricing as a percent of unmonitored value, V , for expositional ease, defining it as a fraction of the offer price or the market price yields qualitatively similar conclusions throughout.

Issuing firms and investors find the underwriter's promise to enforce the monitoring is credible because the underwriter puts on the line its reputation for rewarding monitoring and punishing failure to monitor. Issuers pay for the underwriter's reputation in the underwriting fee that is deducted from the gross proceeds, which we do not model.

The equilibrium is thus characterized by the following. The underwriter allocates 100% of the offer to the institutional investor, which flips $1 - \alpha^*$ on the offer day and holds the remainder α^* for the long-term. This, in turn, determines the market prices at dates 1 and 2, the offer price, and the underpricing. Underwriter enforcement and receipt of sufficient quasi rents in the future make cheating by the institution a bad policy.⁵

⁵ We do not model the related establishment of secondary market making which underwriters acknowledge is an important part of the going public process. Booth and Chua (1996) point out that some shares may be allocated to retail investors precisely to enhance liquidity. It is noteworthy that mechanisms are used in practice that can aid underwriter enforcement. For example, the lead underwriter is virtually always the market maker for the issuer's stock until the stock is sufficiently seasoned (Ellis, Michaely and O'Hara, 1999; Aggarwal and Conway, 2000). Being the market-maker aides the underwriter's ability beyond what detection the model allows to learn if an institutional buyer defaults on the monitoring promise with excess flipping. Moreover, Aggarwal (2003) reports that underwriters and syndicate members keep detailed records of initial allocations and each customer's flipping activity, which are not revealed to institutions or retail investors, nor do they make public who flips shares. This can further aide the ability to discipline the long-term investor. Note also that in our model, in making the market we ignore that the lead underwriter or the institution may engage in short selling.

2.2. *Empirical implications*

The monitoring equilibrium model provides an economic foundation that yields predictions about a number of aspects of IPOs, many of which relate to holdings of institutional buyers. Here we report the implications that are empirically tested. Derivations of these and additional predictions may be found in the Appendix.

2.2.1. *Implications from the model*

Three immediate implications of the monitoring model are empirically verifiable.

- *IPOs are underpriced*

Underpricing is a means to obtain monitoring from long-term owners. A number of other theories also predict positive underpricing.

- *Long-term investors flip part of their initial allocation*

Issuing firms recognize the returns from flipping underpriced shares, and thus recognize that it is a first payment to investors who hold their allocation remainder for the long-term.

- *Long-term investors hold much of their initial allocation for the long-term*

Institutional buyers of IPO shares hold much of their initial allocation for the long-term. Other underpricing theories make no prediction about long-term holding.

2.2.2. *Implications for holding*

The model provides a number of unique predictions about the behavior of holding.

- *Holding rises as institutional monitoring efficiency improves*

More monitoring efficiency increases the marginal benefit from monitoring. Thus, given the relatively modest marginal cost of monitoring, optimal holding increases.

- *Holding rises as underwriter reputation improves*

Underwriter's reputation for enforcing monitoring has two positive effects on holding: The direct effect increases expected benefits from institutional monitoring, since the likelihood of success of any institutional monitoring effort is raised. The indirect effect provides incentive to the institutional investor to not deviate from the promised monitoring.

2.2.3. *Implications for the offer price revision*

The model provides new predictions about the behavior of the offer price.

- *The offer price rises as long-term holding rises*

An increase in long-term holding raises the value of the firm. While underpricing rises, the monitoring is obtained only if the value added is greater. Thus, the offer price rises.

- *The offer price rises as institutional monitoring efficiency rises*

Given that holding rises as monitoring efficiency increases, the surplus value generated by institutional monitoring increases. The higher value raises issuing firm value and is reflected in a higher offer price.

- *The offer price rises as underwriter reputation improves*

A more reputable underwriter increases the marginal benefit from the monitoring, increasing the firm value, and thus the offer price.

2.2.4. *Implications for underpricing*

The model also provides new predictions about the cross section behavior of underpricing.

- *Underpricing goes up as the institutional holding rises*

If institutional holding increases, then the costs of monitoring increases, requiring more underpricing to compensate the institutions.

- *Underpricing goes up as the institutional monitoring efficiency rises*

If the institutional buyer's monitoring efficiency rises, then the optimal institutional holding rises, raising the market price in anticipation of the greater monitoring. Given the diminishing benefits and increasing costs of monitoring, the offer price rises at a slower rate than the market price, to compensate for the additional monitoring costs. Hence, equilibrium underpricing widens as institutional monitoring efficiency rises.

- *Underpricing rises as underwriter reputation improves*

If the underwriter's reputation improves, then optimal institutional holding rises, as do the market price and the offer price, in anticipation of the higher value. But the offer price rises more slowly than the market price, to compensate for the additional holding costs. Hence, equilibrium underpricing rises as the underwriter's reputation improves.

2.2.5. *Underpricing, holding and the price revision*

The model provides a prediction about the general relationship between holding and underpricing.

- *Underpricing and institutional holding are positively correlated*

This prediction is also new. If institutional investors increase the proportion of shares held for the long period then monitoring costs rise and so does stock price. At the same time the proportion of shares flipped falls. The net effect is that revenue from flipping falls, so the institutional investor needs additional compensation in the form of higher underpricing. Note that no causality is being asserted here.

The model also provides a prediction about the general relationship between the price revision and underpricing. However, the model does not suggest any causality between underpricing and the price revision.

- *Underpricing and the price revision are likely positively correlated*

While this prediction does not hold for all values of the parameters, it holds over a wide range of plausible values. It reflects the sharing of increase in firm value as long-term holding rises, in which more underpricing is needed to compensate for the additional monitoring cost, thus firm value must likewise rise by more if the monitoring is to be obtained.

3. Holding, offer price revision, and underpricing

This section first describes the sample and then discusses the empirical evidence.

3.1. Sample

This section describes the large sample of IPOs during the January 1990 through 2000 period, taken from the Securities Data Company Worldwide New Issues Data Base (SDC). SDC provides offer data. Issuers' stock market prices and daily market returns are obtained from the Center for Research in Security Prices files. Underwriter reputation is measured with the Carter and Manaster (1990) ranking of investment banks as updated by Ritter (see <http://bear.cba.ufl.edu/ritter/>). This assumes that monitoring reputation in IPOs is positively correlated with the bank's stature among IPO underwriters. Sample banks identified from SDC that lack a ranking are assigned a reputation of zero. Institutional ownership of common stock is taken from *Disclosure/Spectrum Institutional 13F Common Stock Holdings and Transactions*. *Spectrum* reports quarterly holdings of the stock as reported by institutions with \$100 million under management, on the 13f filings with the SEC. Because of time lag in the reporting of the holdings, the holdings in the first quarter after the offer are sometimes under-reported. To reduce this reporting bias, when the second quarter holdings exceed the first quarter holdings by more than 50%, the first quarter is dropped and the quarterly holdings series are restarted from quarter two. Results are reported as data are available. All monetary variables are expressed in December 2000 dollars using the consumer price index. The

sample focuses on firm-underwritten, syndicated IPOs, and excludes IPOs by regulated firms (SIC in the 4000s and 6000s); reverse leveraged buy-outs; unit IPOs, REITS, and ADRs. Small IPOs are deleted from the sample (those under \$10 million) as are IPOs having an offer price below \$3.

Table 1 here

The monitoring theory suggests a three-equation empirical model in which both the pricing of the offer and the underpricing have separate recursive relationships with holding which, in turn, is explained by a number of exogenous determinants, including institutional monitoring efficiency and underwriter reputation. This section reports empirical results from fitting these relationships.

3.2. *Holding*

A distinct equilibrium feature of the model is that while flipping is a normal activity for long-term investors, they also hold a significant part of the issuer's shares for the long-term. Table 1 reports the sum of quarterly ownership of issuers' common stock following the offering by original institutions (i.e., those with holding on the first reported quarterly date). Panel A reports for all issuers that almost 21 institutions initially own 70% of the new equity at the end of the first quarter after the offer day. Thus, flipping cannot be particularly large relative to long-term holding, particularly if other investors get a nontrivial portion of the initial allocations. This agrees with the flipping evidence of Aggrawal (2003) and Ellis (2005) use elsewhere. The number of institutions and their holding shrink over the next two years, when almost six institutions hold 51.3% of the shares. Throughout, each institution's holding for a firm is the number of the firm's shares owned divided by the number of the shares issued. However, a number of going public firms have a follow-on equity offering after going public. The presence of follow-on offers in the sample impacts holdings to the extent that the institutions participate in the follow-on offer. Panel B

reports similar holding behavior for issuers that have a follow-on offer. While the results show that the subsequent issuance of equity does seem to greatly impact measured holding, in subsequent analyses, results will be reported for all issuers, and for those not having a follow-on offer.

The evidence shows that a substantial part of the initial allocation is long-term holding, which suggests that allocations are a strong proxy for holding. While we do not have access to allocations data to confirm this conjecture, the strength of the proxy relationship can be gauged by first noting that Hanley and Wilhelm (1995) report the correlation between initial allocations and holdings one quarter after the offer exceeds 90%. Pearson correlations between first quarter holdings and quarter Q holdings in our full sample, ρ_Q , are $\rho_{II} = 0.81$, $\rho_{IV} = 0.70$, and $\rho_{VIII} = 0.57$, and for the offers with no follow-on offering, are $\rho_{II} = 0.85$, $\rho_{IV} = 0.73$, and $\rho_{VIII} = 0.56$. Each of the correlations is significantly positive at the $p = 0.0001$ level. These correlations coupled with the Hanley and Wilhelm (1995) initial allocation correlation show there is a strong positive relationship between initial allocations and long-term holding, agreeing with our observation that a major part of the initial allocation is long-term holding.

3.3. *Institutional monitoring*

One distinguishing feature of the monitoring model is that the institutional buyers can have different monitoring efficiencies. To construct a proxy for monitoring efficiency for each institutional buyer, for each IPO we first identify each institution that holds some of the IPO firm's stock as revealed on *Disclosure's* first quarterly report after the offer day. There are 1,595 different institutions in the entire sample period, with 716 participating in more than ten IPOs.

For each IPO_{*j*}, institution *i* is given its $Rank_{i,j}$, which ranges from zero to eight and equals the number of quarters that the institution held issuer *j*'s shares after the IPO, as revealed on *Disclosure*. A rank of eight is assigned for holdings longer than eight quarters. No rank is assigned if the institution did not participate in the IPO. Institution *i*'s average rank for IPO_{*j*}, denoted $Iranks_{i,j}$,

is then computed as its average reputation on all other I-1 IPOs that it participates in, other than IPO_j, as follows

$$Irank_{i,j} = \left(\frac{\sum_{k=1, k \neq j}^I Rank_{i,k}}{I-1} \right) \quad (13)$$

Institution monitoring efficiency for IPO_j, which is a composite measure reflecting the strength of monitoring efficiency among the institutional buyers, denoted *Institution Monitoring_j*, is computed as the average rank for the highest, *top 5*, ranking participating institutions

$$Institution\ Monitoring_j = \left(\frac{\sum_{i=1}^5 Irank_{i,j}^{top5}}{5} \right) \quad (14)$$

Notice that because institution *i*'s rank for IPO_j is purged from the computation of *Irank_{i,j}*, no spurious correlation can arise between *Institution Monitoring_j* and dependent variables that are examined below.

3.4. Cross section analysis of holding

One of the monitoring model's new hypotheses is that more efficient institutional monitoring is associated with greater holding. A second new hypothesis is that IPOs led by more reputable underwriters will have greater holding. To test these two hypotheses we consider an empirical model of holding over various terms ending in the second, fourth, and eighth quarter after the offer day. Using different terms addresses the concern with exactly how to measure the long-term. Since no other published papers examine holding, to identify other control variables to be included in the model we rely on the set of control variables that are used in studies of the price-revision and

underpricing. One control variable is offer size which is the natural logarithm of proceeds at the time of the filing (number of shares filed times the mid-point of the file range) expressed in 2000 real dollars and denoted as $\ln(\text{proceeds})$. A second control is Venture Capital, a zero-one dummy variable that equals one if a venture capital firm is associated with the issuer at the time of the offer, as reported by SDC. Venture Capital is included because venture capitalists are often associated with better placement of new issues (Megginson and Weiss, 1991; Lee and Wahal, 2004; Hellman and Puri, 2002; Li and Masulis, 2005). In addition, fixed effects are used in the estimation that are constructed from the Fama and French (1997) industry definitions, including industry dummy variables for each industry with at least 10 observations. Notice that these dummy variables provide controls for internet firms and for hi-tech firms that have been featured in a number of studies that examine IPO pricing in the 1999-2000 bubble years (Aggarwal, Krigman and Womack, 2002; Ljungqvist and Wilhelm, 2002; Loughran and Ritter, 2002; Lowry and Shu, 2002; Lowry and Schwert, 2003; Cliff and Denis, 2005; Li and Masulis, 2005).

Estimates for the holding regressions for the full sample are reported in the first four columns of Panel A in Table 2, where the dependent variable, holding, is measured over increasingly longer terms, from one quarter, to two quarters, then four quarters, and lastly eight quarters. Proceeds have a significant positive impact on holding, indicating that institutions hold a greater fraction of larger issues for the long-term. Venture capital backing also has a significant positive impact on holding. This agrees with the notion that venture capitalists are effective at promoting holding, and that institutions prefer holding venture capital backed IPOs.

Consider next the monitoring theory hypotheses. More efficient institutional monitoring has a significantly positive impact on holding. Evidently, when there are more efficient institutions among IPO buyers, the issuer receives more monitoring. Furthermore, more reputable lead underwriters secure more holding. This shows that more prestigious underwriters place greater portions of their IPOs with long-term owners, in agreement with the monitoring model. Notice

further that the monitoring evidence is highly significant for holding ranging from the first quarter after the IPO, to holding as of eight quarters after the IPO.

To ascertain whether IPOs with follow-on offerings are adversely impacting the estimation, the holding regressions are estimated again for the sub-sample of firms that do not have a follow-on offering. The estimates are reported in the last three Columns of Table 2. Proceeds and venture capital backing have significantly positive impacts on holding. Moreover, institutional monitoring has a significantly positive impact on holding. Note that the institutional monitoring variable does not suffer from spurious correlation (see Eq. (13) and Eq. (14)). The results also show that lead underwriter reputation has a significantly positive effect on holding. These results are anticipated by the monitoring theory.

To address the concern that the estimated relationships may be influenced by unusual IPO-related events, including pricing associated with hot or cold periods, and IPO pricing in the 1999-2000 bubble period, Panel B reports Fama and MacBeth (1973) estimates of the regressions. Reported are means of the 11 annual estimates of each of the corresponding regression models, with associated p -values. Because the number of years is 11, we report p -values up to 0.20, to reveal the weakly marginally significant estimates, which under a one-tail test will have a p -value of 0.10. In the first four columns, the Fama and MacBeth estimates show that larger offerings tend to have lower holding by institutions, which is a reversal of the estimated size impact in Panel A. The Fama and MacBeth estimates also show that venture capital backed IPOs tend to have longer holding, agreeing with the Panel A findings. In agreement with the predictions of the monitoring theory, holding is significantly larger when more of the offering is placed with more efficient institutions. Moreover, holding is significantly larger for offerings that are placed by more reputable underwriters.

The last three Columns of Panel B report the Fama and MacBeth estimates for the IPOs with a follow-on offering. Those estimates confirm that institutional monitoring has a highly significant

impact on long-term holding. Moreover, holding is also longer for more reputable lead underwriters. These results agree with the monitoring theory.

Table 2 here

Although the fixed effects coefficients are not reported, those industry dummy variables have been included in all of the estimations. This provides control over the concern for omitted variables bias. It also provides control over possible effects on IPO pricing that may be particular to internet and hi-tech companies.

3.5. *Revision of the offer price*

The examination of the price revision provides the opportunity to test the validity of the monitoring theory assumption that more holding raises firm value. Although a number of studies document evidence of benefits from having institutional shareholders, there is no evidence that we are aware of showing that institutional monitoring raises IPO firm value in the bookbuilding period. Following the literature (e.g., Hanley, 1993), the price revision is measured as the ratio of the offer price in the final prospectus, to the mid price reported in the preliminary prospectus at the time the offering is registered with the SEC, as reported by SDC. The monitoring theory implies that larger holding increases firm value and thus the price revision. Moreover, two other influences increase the price revision; greater institutional monitoring efficiency and more reputable underwriters.

To test for the impact of holding on the price revision consider a regression model of the price revision that includes independent control variables that have been identified in the literature. One control used in most studies is proceeds, a proxy for uncertainty, and the findings are quite varied as some authors find a positive impact (Li and Masulis, 2004; Ljungqvist and Wilhelm, 2003),

some find a negative impact (Ljungqvist and Wilhelm, 2002; Benveniste, Ljungqvist, Wilhelm, and Yu, 2003; Lowry and Schwert, 2003), and some report an insignificant impact (Hanley, 1993). Studies also report a mixed impact of venture capital affiliation on the price revision (Ljungqvist and Wilhelm, 2003; Li and Masulis, 2004). A positive impact of the concurrent market return on the price revision is reported by a number of authors (Hanley, 1993; Ljungqvist and Wilhelm, 2003; Lowry and Schwert, 2003; and Li and Masulis, 2004; Edelen and Kadlec, 2005). The estimation uses Fama and French (1997) industry fixed effects for industries with at least 10 observations, and thus controls for internet and hi-tech firms. We also examine Fama and Mac Beth (1973) estimates to moderate the possible influence of unusual periods or trends, such as the bubble period.

Reflecting added value from holding the monitoring theory predicts a positive impact of holding on the price revision. The first estimation of this relationship includes quarter I holdings among the independent variables. Estimates for the model reported in Column (1) of Table 3, show that the price revision is significantly positively related to the amount of capital raised, larger in the presence of venture capitalists, and positively related to the concurrent market return. The test of the monitoring hypothesis shows that quarter I holding has a significantly positive impact on the offer price revision. Columns (2) and (3) of Panel A report estimates of the price revision equation when holding is measured at the end of quarters IV and VIII, respectively, and thus have fewer observations. The estimates show that holding over these longer windows also has a significantly positive impact on the offer price. These new findings agree with the monitoring theory.

Column (4) of Panel A reports estimates of the price revision after replacing holding with institutional monitoring and underwriter reputation. Under the monitoring theory, institutional monitoring and underwriter reputation should each have a positive impact on the price revision. Institutional monitoring efficiency has the predicted significant positive impact on the price revision, consistent with the monitoring theory. Note that by construction (see Eq. (13) and Eq.

(14)) this finding cannot be the result of spurious correlation because institution monitoring is not based on the institution's participation in the current IPO. The estimates show further that higher underwriter reputation has a significantly positive impact on the price revision. This too is in agreement with the monitoring theory.

To check for robustness to the possible influence of follow-on equity offerings the regression models are re-estimated for the sample of IPOs that do not have a follow-on offering and the estimates are reported in Columns (5) – (7) of Panel A. of Table 3. These estimates show that holding has a significantly positive impact on the price revision, when measured one year after the offer, and two years after the offer. Further, the estimates in Column (7), for which the sample is IPO firms without a follow-on equity offer over the first eight months, show that institutional monitoring and underwriter reputation have a highly significant positive impact on the price revision. These results agree with the monitoring rationale for underpricing.

Panel B of Table 3 reports the Fama and MacBeth estimates for the price revision, for all issuers (in Columns (1) – (4)), and for issuers without a follow-on equity offering (in Columns (5) – (7)). The findings show that offer size, venture capital backing, and market return continue to have a significantly positive impact on the price revision. Moreover, greater holding has a highly significant positive impact on the price revision, for both the one-year and two-year holding periods. Moreover, the Column (7) estimates show that the price revision is significantly larger when institutional monitoring efficiency is higher. Finally, more reputable lead banks are associated with greater price revisions.

Table 3 here

An additional worry is that the estimation may be influenced by extreme values in the endogenous variables. To investigate this concern, underpricing and holding are each winsorized at

the 1% and 99% tails. The results using the winsorized values are qualitatively the same (not reported). We note also that to address the concern with omitted variables, the estimation includes fixed effects for sufficiently represented industries using the Fama and French (1997) industry definitions.

3.6. *Underpricing*

The empirical model of underpricing examined here includes the three independent control variables that are most widely used in earlier studies. Proceeds are a proxy for value uncertainty—bigger IPOs have lower uncertainty. Some studies report a negative impact of proceeds on underpricing (Hanley, 1993; Busaba, Benveniste and Guo, 2001; Cliff and Denis, 2005), while others report a positive impact (Li and Masulis, 2003). Also included is the venture capital backing dummy variable. Studies show that venture capital backing is associated with higher underpricing (Loughran and Ritter, 2002; Benveniste, Ljungqvist, Wilhelm and Yu, 2003) and others find a negative impact (Lowry and Shu, 2002; Li and Masulis, 2003; Megginson and Weiss, 1991). The return on the stock market is included because studies suggest that underpricing is positively related to the concurrent return on the market (Hanley, 1993; Hansen, 2001; Li and Masulis, 2003; Edelen and Kadlec, 2005). To reflect recent market trends in underpricing, the model includes mean underpricing for all IPOs measured over the two months prior to the offer month, following Cliff and Denis (2004) and Ljungqvist and Wilhelm (2002). Studies also report various industry effects on underpricing. We use industry fixed effects, whose coefficient estimates are not reported. These dummy variables thus control for internet firms and hi-tech firms.

The monitoring rationale predicts that underpricing is higher when holding is larger. Alternatively, the monitoring theory predicts in the reduced form, that underpricing is higher when the institutional buyer is a more efficient monitor. Moreover, it is higher in IPOs having more reputable lead underwriters. Results of testing these hypotheses are reported in Columns (1) – (3)

of Panel A of Table 4, which include respectively holding as of the first, fourth, and eighth quarters after the offer day. Larger offerings have lower underpricing, consistent with their being less risky. Venture capital backed IPOs have significantly larger underpricing. Moreover, underpricing is higher in rising secondary markets, and when underpricing of other IPOs has been higher. These results are similar to findings reported in other studies. The coefficients for each of the three holding measures are significantly positive. They agree with the monitoring theory prediction that holding is positively associated with underpricing.

In Column (4) holding is replaced with institutional monitoring and underwriter reputation. The estimates show the new finding that institutional monitoring has a highly significant positive impact on underpricing. Once again, by construction this estimate is not the result of spurious correlation. Moreover, underwriter reputation has a positive impact on underpricing.

A number of authors have shown that the price revision has a highly significant impact on underpricing (Hanley, 1993). In our model, the price revision and underpricing are positively correlated, however the model does not indicate any causality between them. To address the concern that the institutional monitoring and underwriter reputation variables may be registering this widely documented empirical relationship, in Column (5) we include the price revision in the estimation. However, to address the concern that the monitoring, reputation, and price revision estimates may be confounded, the price revision residual from the Column (4) estimates in the Table 3 price revision estimation are used in lieu of the price revision. As found in prior studies, the price revision has a highly significant positive impact on underpricing. However, institutional monitoring and underwriter reputation continue to have a highly significant impact on underpricing, independent of the price revision effect. The resulting estimates continue to show that the monitoring efficiency and underwriter reputation variables each have a highly significant impact on underpricing.

The price revision residual impact on underpricing is independent of and thus in addition to, the impact of monitoring and reputation. We interpret this evidence as showing that in addition to the evidence that agrees with the monitoring theory, the findings also register a positive impact beyond what is predicted by the monitoring theory, which agrees with the information gathering story, and with the rent extraction story.

Table 4 here

Column (6) - (8) of Table 4 report underpricing estimates for the sample of issuers that do not have a follow on offering. Those estimates confirm the Column (1) – (3) results that longer holding has a positive impact on underpricing.

Fama and MacBeth (1973) estimates for each regression model in Panel A are reported in Panel B of Table 3. The estimates are qualitatively similar to the estimates for the full sample of offerings, regardless whether there is a follow-on offering. These findings show that the evidence in support of the monitoring theory is not attributable to unusual years in the sample period, including the bubble period.

To investigate the concern that the estimation is influenced by extreme values, all of the estimates in Table 4 are examined when underpricing and holding are each winsorized at their respective 1% and 99% fractile values. The estimates are qualitatively similar to the estimates reported in Table 4 and are thus not reported.

4. Conclusion

We develop the full information theory in which IPO underpricing buys benefits of long-term holding of the IPO shares, and empirically test the theory. Issuers know that holding raises firm value and that investors profit from underpricing. They thus buy holding with underpricing. Payments for holding thus come when long-term investors flip a fraction of their shares and the future sale of their remaining shares after the monitoring is supplied. Institutional buyers are distinguished by their reputation for monitoring which is rewarded with the quasi rents in future IPOs. Underwriters secure monitoring during bookbuilding and enforce promises of monitoring with the quasi rents, and halting future business with those that renege on their promise. We report evidence showing that institutions hold large fractions of IPOs, averaging over 70% one year after the IPO. Thus, holding appears to be quite important vis-à-vis flipping. Moreover, larger holding has a positive impact on both the price revision and underpricing. New evidence shows that more reputable institutions have larger holdings that are associated with larger price revisions and greater underpricing. These findings agree with our model in which institutional holding increases firm value, and underpricing is used to buy the holding.

Widely documented IPO pricing phenomena are consistent with the monitoring theory. The partial adjustment phenomenon is a reflection of more underpricing to secure even greater value via monitoring. A positive impact of underwriter reputation on underpricing agrees with more reputable underwriters securing more holding and thus higher firm value, calling for more underpricing to buy monitoring. More reputable underwriters secure more holding and larger price revisions, and are thus associated with larger underpricing. Monitoring gives a new explanation for patterns in initial allocations of IPO shares because initial allocations are basically a good proxy for holding. Consistent with monitoring, we show that larger holdings are associated with more reputable underwriters and with higher price revisions and larger institutional holding is associated

with more underpriced shares. Given the proxy effect, this suggests patterns in allocations found in the literature; that larger allocations are associated with more reputable underwriters, higher price revisions, and those to institutions are associated with more underpricing. Overall, a large number of findings agree with the monitoring theory of underpricing.

Appendix. Equilibrium comparative static results

This Appendix reports the comparative static results showing how changes in selected exogenous variables impact the holding (part A), the underpricing (part B), the price revision (part C), and the quasi-rents (part D). Part E establishes the positive correlation between equilibrium underpricing and equilibrium holding. Part F shows the correlation between underpricing and the price revision.

A. Impact of exogenous effects on holding.

Following the text, the equilibrium holding is shown to be

$$\alpha^* = \left(\frac{\beta\tau}{4b} \right)^2 \quad (\text{A.1})$$

Holding is larger as institutional reputation rises, for all values of the parameters;

$$\frac{d\alpha^*}{d\beta} = 2 \frac{\alpha^* b}{\beta} > 0 \quad (\text{A.2})$$

Holding rises as underwriter reputation rises, for all values of the parameters;

$$\frac{d\alpha^*}{d\tau} = 2 \frac{\alpha^* b}{\tau} > 0 \quad (\text{A.3})$$

Holding falls as the monitoring cost rises, for all values of the parameters;

$$\frac{d\alpha^*}{db} = -2 \frac{\alpha^*}{b} < 0 \quad (\text{A.4})$$

B. Impact of exogenous effects on underpricing.

As shown in the text, equilibrium underpricing may be expressed as

$$U(\alpha^*) = \frac{P_0(\alpha^*) - P_0(\alpha^*)}{V} = \frac{M(\alpha^*)}{(1-r)V} = \frac{b}{(1-r)} \left(\frac{\beta\tau}{4b} \right)^4 \quad (\text{B.1})$$

More institutional holding has a positive impact on underpricing, for all values of the parameters;

$$\frac{dU(\alpha^*)}{d\alpha^*} = \frac{2b\beta\alpha^*}{(1-r)} > 0 \quad (\text{B.2})$$

More institutional reputation has a positive impact on underpricing, for all parameter values;

$$\frac{dU(\alpha^*)}{d\tau} = \frac{4b\beta}{(1-r)} \left(\frac{\beta\tau}{4b} \right)^3 > 0 \quad (\text{B.3})$$

Greater underwriter reputation has a positive impact on underpricing, for all values of the parameters;

$$\frac{dU(\alpha^*)}{d\beta} = \frac{4b\tau}{(1-r)} \left(\frac{\beta\tau}{4b} \right)^3 > 0 \quad (\text{B.4})$$

Increased monitoring cost has a negative impact on underpricing, for all values of the parameters;

$$\frac{dU(\alpha^*)}{db} = -\frac{3}{b} U(\alpha^*) < 0 \quad (\text{B.5})$$

C. Impact of exogenous effects on the offer price revision.

The price revision expressed as a fraction of initial value, is

$$PR(\alpha^*) = \frac{P_0(\alpha^*)}{V} - 1 = \frac{P_1(\alpha^*)}{V} - \frac{M(\alpha^*)}{(1-r)V} - 1 = b\alpha^* \left(4 - \frac{\alpha^*}{1-r} \right) \quad (C.1)$$

The offer price revision is larger as institutional reputation rises

$$\frac{dPR(\alpha^*)}{d\tau} = \frac{\beta g}{\tau} \left(2 - \frac{\alpha^*}{(1-r)} \right) > 0 \quad (C.2)$$

This requires that $r < 1 - \alpha^*/2$, which is true for all plausible values of r .

The offer price revision is larger as institutional holding rises

$$\frac{dPR(\alpha^*)}{d\alpha^*} = b \left(4 - \frac{2\alpha^*}{(1-r)} \right) > 0 \quad (C.3)$$

This also requires that $r < 1 - \alpha^*/2$, which is true for all plausible values of r .

The offer price revision is larger as the underwriter reputation rises;

$$\frac{dPR(\alpha^*)}{d\beta} = g \left(2 - \frac{\alpha^*}{(1-r)} \right) > 0 \quad (C.4)$$

This also requires that $r < 1 - \alpha^*/2$, which is true for all plausible values of r .

The offer price revision is smaller as the monitoring cost rises;

$$\frac{dPR(\alpha^*)}{db} = -\frac{\beta g}{b} \left(1 - \frac{3\alpha^*}{4(1-r)} \right) < 0 \quad (C.5)$$

This requires that $r < 1 - 3\alpha^*/4$, which is true for all plausible values of r .

D. Impact of exogenous effects on the quasi rent.

The quasi rent, expressed as a percent of initial value is

$$qr(\alpha^*) = \frac{QR(\alpha^*)}{V} = \frac{rM(\alpha^*)}{(1-r)V} \quad (D.1)$$

The quasi rent is larger as institutional reputation rises, for all values of the parameters;

$$\frac{dqr(\alpha^*)}{d\tau} = 4 \frac{qr(\alpha^*)}{\tau} > 0 \quad (D.2)$$

The quasi rent is larger as the underwriter reputation rises, for all values of the parameters;

$$\frac{dqr(\alpha^*)}{d\beta} = 4 \frac{qr(\alpha^*)}{\beta} > 0 \quad (D.3)$$

The quasi rent is smaller as the monitoring cost rises, for all values of the parameters;

$$\frac{dqr(\alpha^*)}{db} = -3 \frac{qr(\alpha^*)}{b} < 0 \quad (D.4)$$

E. Correlation of underpricing with holding.

Using the implicit function rule, in equilibrium, underpricing and institutional holding are positively correlated, for all values of the parameters;

$$\frac{dU(\alpha^*)}{d\alpha^*} = \frac{2b}{(1-r)} \left(\frac{\beta\tau}{4b} \right)^2 > 0 \quad (\text{E.1})$$

F. Correlation of underpricing with the price revision.

Using the implicit function rule, in equilibrium, underpricing and institutional holding are positively correlated, for a wide range of values of the parameters;

$$\frac{dU(\alpha^*)}{dPR(\alpha^*)} = \frac{8b(1-r)}{\sqrt{U(\alpha^*)}} - 1 > 0 \quad (\text{F.1})$$

References

- Abrue, D., 1988. On the theory of infinitely repeated games with discounting. *Econometrica* 56, 383-396.
- Aggarwal, R., 2003. Allocation of initial public offerings and flipping activity. *Journal of Financial Economics* 68, 111-135.
- Aggarwal, R., P. Conway, 2000. Price discovery in initial public offerings and the role of the lead underwriter. *Journal of Finance* 55, 2093-2922.
- Aggarwal, R., N.R. Prabhala, M. Puri, 2002. Institutional allocation in initial public offerings: empirical evidence. *Journal of Finance* 57, 1421-1442.
- Aggarwal, R.K., L. Krigman, K.L. Womack, 2002. Strategic IPO underpricing, information momentum, and lockup expiration selling. *Journal of Financial Economics* 66, 105-137.
- Almazan, A., J.C. Hartzell, L. Starks, 2005. Active institutional shareholders and management compensation. Manuscript, University of Texas.
- Altinkılıç, O., R.S. Hansen, 2002. Discounting and underpricing of seasoned equity offers. *Journal of Financial Economics* 69, 285-323.
- Arugaslan, O., D.O. Cook, R. Kieschnick, 2005. Monitoring as a motivation for IPO underpricing. *Journal of Finance*, forthcoming.
- Beatty, R., Welch, I., 1996. Issuer expenses and legal liability in initial public offerings. *Journal of Law and Economics* 39, 545-602.
- Benveniste, L.M., A. Ljungqvist, W.J. Wilhelm, Jr., X. Yu, 2003. Evidence of information spillovers in the production of investment banking services. *Journal of Finance* 58, 577-608.
- Benveniste, L.M., P. Spindt, 1989. How investment bankers determine the offer price in initial public offerings. *Journal of Financial Economics* 24, 343-361.
- Benveniste, L.M., W.J. Wilhelm, 1990. A comparative analysis of IPO proceeds under alternative regulatory environments. *Journal of Financial Economics* 28, 173-208.

- Bhide, A., 1993. The hidden costs of stock market liquidity. *Journal of Financial Economics* 34, 31-51.
- Boehmer, E., P. Fische, 2004. Who receives IPO allocations? An analysis of “regular” investors. Manuscript, Texas A&M.
- Boehmer, B., E. Boehmer, P. Fische, 2006. Do institutions receive favorable allocations in IPOs with better long run returns? *Journal of Financial and Quantitative Analysis*, forthcoming.
- Booth, J.R., R.L. Smith, 1986. Capital raising, underwriting, and the certification hypothesis. *Journal of Financial Economics* 15, 261-281.
- Brennan, M.J., J. Franks, 1997. Underpricing, ownership and control in initial public offerings of equity securities in the UK. *Journal of Financial Economics* 45, 391-413.
- Brennan, M.J., P.J. Hughes, 1991. Stock prices and the supply of information. *Journal of Finance* 46, 1665-1691.
- Brennan, M.J., A. Subrahmanyam, 1995. Investment analysis and price formation in securities markets. *Journal of Financial Economics* 38, 361-381.
- Brickley, J.A., R.C. Lease, C.W. Smith, 1988. Ownership structure and voting on antitakeover amendments. *Journal of Financial Economics* 20, 267-291.
- Burkart, M., B. Gromb, F. Panunzi, 1997. Large shareholders, monitoring and the value of the firm. *Quarterly Journal of Economics* 112, 693-728.
- Busaba, W., L.M. Benveniste, R. Guo, 2001. The withdrawal of initial public offerings during the pre-market. *Journal of Financial Economics* 60, 73-102.
- Carter, R.B., F.H. Dark, A.K. Singh, 1998, Underwriter reputation, initial returns, and the long-run performance of IPO stocks. *Journal of Finance* 53, 285-311.
- Carter, R.F., S. Manaster, 1990. Initial public offerings and underwriter reputation. *Journal of Finance* 45, 1045-1067.

- Chemmanur, T.J., P. Fulghieri, 1999. A theory of the going-public decision. *Review of Financial Studies* 12, 249-279.
- Cornelli, F., D. Goldreich, 2001. Bookbuilding and strategic allocation. *Journal of Finance* 56, 2337-2369.
- Del Guercio, D., J. Hawkins, 1999. The motivation and impact of pension fund activism. *Journal of Financial Economics* 52, 293-205.
- Demers, E., K. Lewellen, 2003. The marketing role of IPOs: evidence from internet stocks. *Journal of Financial Economics* 68, 413-437.
- D'Mello, R., F Schlingemann, V. Subramaniam, 2005. The monitoring versus information role of institutional investors: evidence from seasoned equity offerings. Manuscript, Tulane University.
- Dor, A.B., 2003. The performance of initial public offerings and the cross section of institutional ownership. Manuscript, Northwestern University.
- Edelen, R.M., Kadlec, G.B, 2005. Comparable-firm returns, issuer surplus, and the pricing and withdrawal of IPOs. *Journal of Financial Economics*, forthcoming.
- Ellis, K., 2005. Who trades IPOs? A close look at the first days of trading. *Journal of Financial Economics*, forthcoming.
- Ellis, K., R. Michaely, M. O'Hara, 2000. When the underwriter is the market maker: An examination of trading in the IPO aftermarket. *Journal of Finance* 55, 1039-1074.
- Fama, E.F., K.R. French, 1997. Industry costs of equity. *Journal of Political Economy* 105, 153-193.
- Fama, E.F., D. MacBeth, 1973. Risk, return, and equilibrium: empirical tests. *Journal of Political Economy* 81, 607-636.
- Fernando, C.S, V.A. Gatchev, P. Spindt, 2005. Wanna dance? How firms and underwriters choose each other. *Journal of Finance*, forthcoming.

- Field, L., D. Sheehan, 2004. IPO underpricing and outside blockholdings. *Journal of Corporate Finance* 10,263-280.
- Field, L., M. Lowry, 2005. Institutional investment in newly public firms? Working Paper, Penn State University.
- Gillan, S.L., L.T. Starks, 2000. Corporate governance proposals and shareholder activism: the role of institutional investors. *Journal of Financial Economics* 57, 275-305.
- Hanley, K.W., 1993. Underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics* 34, 177-197.
- Hanley, K.W., W.J. Wilhelm, 1995. Evidence on the strategic allocation of initial public offerings. *Journal of Financial Economics* 37, 239-257.
- Hansen, R.S., 2001. Do investment banks compete in IPOs?: the advent of the “7% plus contract.” *Journal of Financial Economics* 59, 313-346.
- Hansen, R.S., P. Torregrosa, 1992. Underwriter compensation and corporate monitoring. *Journal of Finance* 47, 1537-1555.
- Hellman, T., M. Puri, 2002. Venture capital and the professionalization of start-up firms: empirical evidence. *Journal of Finance* 57, 169-197.
- Jarrell, G.A., A.B. Poulsen, 1987. Shark repellents and stock prices: the effects of antitakeover amendments since 1980. *Journal of Financial Economics* 19, 127-168.
- Jenkinson, T., H. Jones, 2002. Bids and allocations in European IPOs. *Journal of Finance*, 57, 2,309-2,338.
- Kahn, C., A. Winton, 1998. Ownership structure, speculation and shareholder intervention. *Journal of Finance* 53, 99-129.
- Krigman, L., W.H. Shaw, K.L. Womack, 1999. The persistence of IPO mispricing and predictive power of flipping. *Journal of Finance* 54, 1015-1044.

- Lee, P., S. Wahal, 2004. Grandstanding, certification, and the underpricing of venture capital backed IPOs. *Journal of Financial Economics* 73, 375-407.
- Lewellen, K., 2006. Risk return and IPO price support. *Journal of Finance*, forthcoming.
- Li, X., R.W. Masulis, 2005. Venture capital investments by IPO underwriters: certification or conflict of interest. *Journal of Finance*, forthcoming.
- Ljungqvist, A., 2004. IPO Underpricing. in B.E. Eckbo (ed.), Handbook of Empirical Corporate Finance, North-Holland.
- Ljungqvist, A., V. Nanda, R. Singh. 2005. Hot markets, investor sentiment, and IPO pricing. *Journal of Business*, forthcoming.
- Ljungqvist, A., W.J. Wilhelm, 2002. IPO allocations: discriminatory or discretionary? *Journal of Financial Economics* 65, 167-201.
- Ljungqvist, A., W.J. Wilhelm, 2003. IPO pricing in the dot-com bubble. *Journal of Finance* 58, 723-752.
- Loughran, T., J.R. Ritter, 2002. Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies* 15, 413-443.
- Loughran, T., J.R. Ritter, K. Rydqvist, 1994. Initial public offerings: international insights. *Pacific-Basin Finance Journal* 2, 165-199.
- Lowry, M., W. Schwert, 2004. Is the IPO pricing process efficient? *Journal of Financial Economics* 71.
- Lowry, M., S. Shu, 2002. Litigation risk and IPO underpricing. *Journal of Financial Economics*, 65.
- Maug, E., 1998. Large shareholders as monitors: is there a trade-off between liquidity and control? *Journal of Finance* 51, 65-98.
- Meggison, W.L., K.A. Weiss, 1991. Venture capitalist certification in initial public offerings. *Journal of Finance* 46, 879-903.

- Ritter, J., I. Welch, 2002. A review of IPO activity, pricing, and allocations. *Journal of Finance* 57, 1795-1828.
- Sherman, A., 2005. Global trends in IPO methods: bookbuilding vs. auctions with endogenous entry. *Journal of Financial Economics*, forthcoming.
- Sherman, A., S. Titman, 2002. Building the IPO order book: underpricing and participation limits with costly information. *Journal of Financial Economics* 65, 3-29.
- Sherman, A., 2000. IPO's and long-term relationships: an advantage of bookbuilding. *Review of Financial Studies*. 13, 697-714.
- Smart, S., C. Zutter, 2003. Control as a motivation for underpricing: A comparison of dual- and single-class IPOs. *Journal of Financial Economics* 69, 85-110.
- Smith, M.P., 1996. Shareholder activism by institutional investors: evidence from CalPERS. *Journal of Finance* 51, 227-252.
- Spatt, C.S., S. Srivastava, 1991. Preplay communication, participation restrictions, and efficiency in initial public offerings. *Review of Financial Studies* 4, 709-726.
- Stoughton, N., J. Zechner, 1998. IPO mechanisms, monitoring and ownership structure. *Journal of Financial Economics* 49, 45-77.
- Tinic, S.M., 1988. Anatomy of initial public offerings of common stock. *Journal of Finance* 43, 789-822.
- Townsend, R.M., 1979. Optimal contracts and competitive markets with costly state verification. *Journal of Economic Theory* 21, 265-93.
- Townsend, R.M., 1982. Optimal multiperiod contracts and the gain from enduring relationships under private information. *Journal of Political Economy* 6, 1166-86.

Figure 1. The offering. There is an infinite period economy, broken into an endless series of identical stages (I, II, III, ...), each with two periods and three dates (0, 1, and 2). Within each stage, at date zero a privately held firm will go public and hires the underwriter to conduct the offering. During period one the underwriter arranges the institutional buyer's promise to monitor. At date one offer terms are finalized, the monitoring promise is secured with allocations of underpriced shares, the offer price and market prices are determined, and the institution flips the agreed upon fraction of shares into the market. Monitoring is conducted over the second period. At date 2 the institution liquidates the balance of issuer's shares still held.

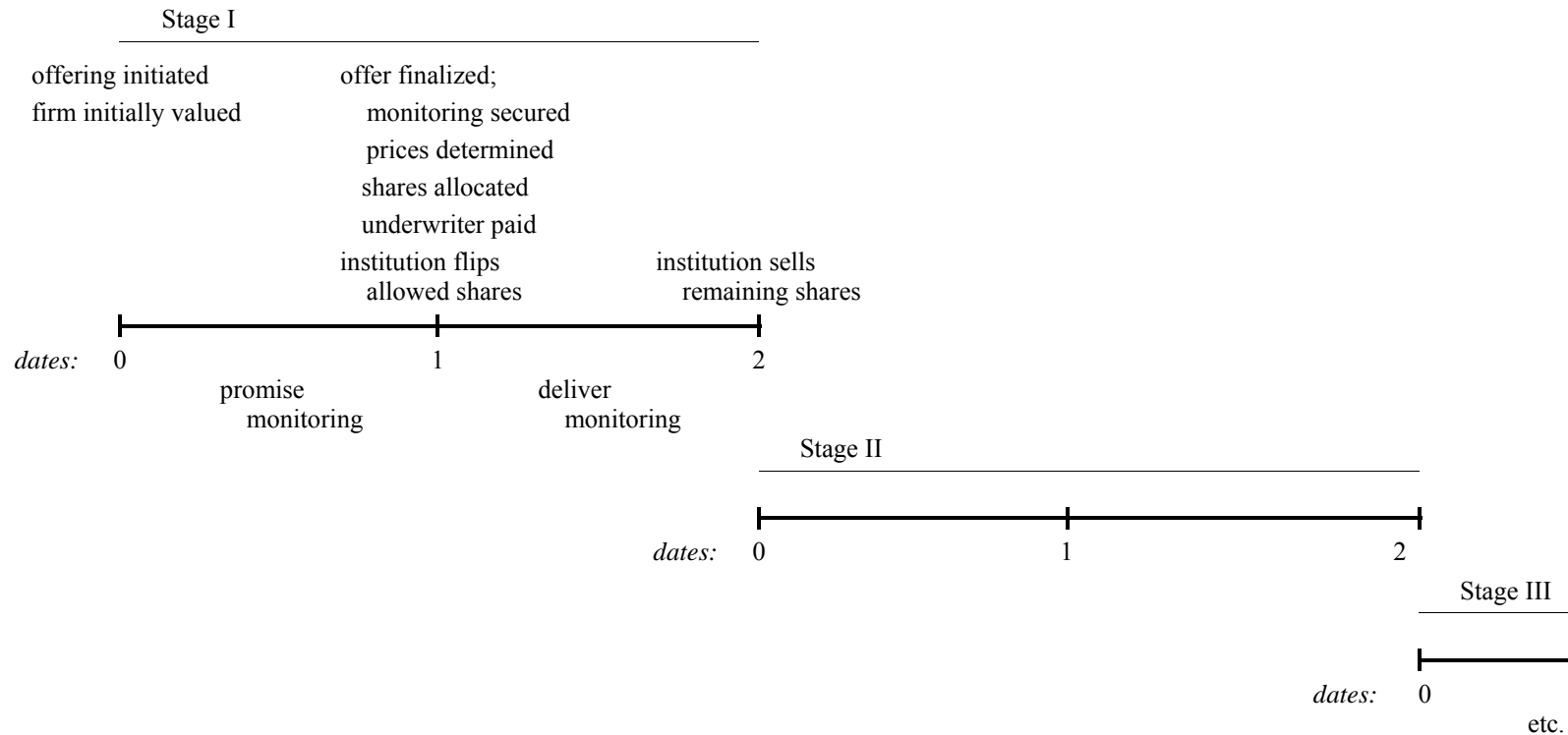


Table 1. Quarterly holding of original institutional holders of IPOs firms. The sample is issuers of IPOs from January 1990 through 2000 as reported on *Securities Data Company Worldwide New Issues Data Base*, excluding financial firms (SIC in the 6000s), reverse leveraged buy-outs, issuers of unit, REITS, and ADRs. Small IPOs are deleted from the sample (those under \$10 million) as are IPOs having an offer price below \$3. No. issuers is the number of issuers in the sample at the end of the quarter; and holding is ownership of the issuer's common stock at the end of the quarter by institutions with holding at quarter I, where all measures are from *Disclosure/Spectrum Institutional 13F Common Stock Holdings and Transactions*. Issuers with no follow-on offer are those issuers as of the end of the holding quarter that have not had a seasoned equity offering following their IPO.

Holding quarter	No. issuers	No. institutions		Holding (%)	
		Mean	Median	Mean	Median
Panel A. All issuers					
0 (offer day)	3,111				
I	3,062	20.7	17.0	70.1	63.7
II	3,008	13.8	11.0	62.9	55.1
III	2,940	10.9	9.0	62.5	50.4
IV	2,845	9.1	7.0	60.9	46.7
V	2,713	7.9	6.0	58.5	43.7
VI	2,591	7.1	5.0	56.0	39.5
VII	2,475	6.6	4.0	54.9	37.1
VIII	2,353	6.2	4.0	53.0	34.7
Panel B. Issuers with no follow-on offer					
0 (offer day)	3,110				
I	2,991	20.7	17.0	70.0	63.7
II	2,708	14.0	11.0	61.1	54.4
III	2,450	11.5	9.0	57.4	47.4
IV	2,228	10.0	8.0	53.7	41.7
V	2,035	9.0	6.0	49.6	36.1
VI	1,863	8.2	6.0	46.3	32.6
VII	1,706	7.7	5.0	44.9	29.8
VIII	1,554	7.3	5.0	42.6	27.1

Table 2. Regressions of holding at selected quarters. The sample is described in Table 1. Reported are ordinary least squares regression coefficients. The dependent variable is institutional ownership of the issuers' common stock at the end of quarters I, II, IV, and VIII. Independent variables include the Logarithm of proceeds at the file date; Venture capital is a zero-one indicator variable equal to one if the offer is associated with a venture capitalist; Institutional monitoring is the ranking of the top five institutional investors in the buying group, based on their historical holding new issue shares for one year; and Underwriter reputation is the lead bank's Carter and Manaster (1988) ranking. Each estimation includes industry fixed effects for Fama-French (1997) industry groups, whose coefficient estimates are not reported. The Panel A estimates are from Ordinary Least Squares estimation using all observations. Panel B reports the means of the Ordinary Least Squares estimates from within each year of the sample period. The mean Adjusted R^2 is the average Adjusted R^2 from the Fama-MacBeth estimates.

Independent variable	All issuers				Issuers with no follow-on offer		
	Q-I	Q-II	Q-IV	Q-VIII	Q-II	Q-IV	Q-VIII
Panel A. OLS estimates over all years							
Intercept	-76.86 ¹	-88.60 ¹	-86.94 ¹	-77.92 ¹	76.77 ¹	-71.33 ¹	-61.13 ¹
Ln(proceeds)	3.54 ²	4.27 ²	5.00 ¹	3.87 ³	4.21 ²	5.27 ¹	1.87
Venture capital	14.35 ¹	16.98 ¹	17.65 ¹	17.10 ¹	15.07 ¹	15.91 ¹	14.31 ¹
Institution monitoring	18.24 ¹	18.77 ¹	18.17 ¹	16.10 ¹	16.42 ¹	14.26 ¹	13.15 ¹
Underwriter reputation	2.86 ¹	2.72 ¹	2.27 ¹	2.12 ¹	2.24 ¹	1.39 ²	1.24 ¹
No.	2,941	2,842	2,687	2,214	2,525	2,106	1,454
Adjusted R^2	0.23	0.18	0.15	0.12	0.16	0.13	0.13
Panel B. Mean of annual OLS estimates within each year							
Intercept	-0.86	-1.07	-0.69	-4.75	2.73	-1.03	-6.11
Ln(proceeds)	-12.70 ¹	-12.74 ¹	-12.34 ¹	-12.02 ¹	-12.74 ¹	-11.48 ¹	-11.65 ¹
Venture capital	4.11 ⁴	4.22 ⁴	4.08 ⁴	5.66 ⁴	3.19 ⁴	2.70	4.89
Institution monitoring	9.05 ¹	9.18 ¹	8.89 ¹	9.10 ¹	8.67 ¹	8.98 ¹	9.76 ¹
Underwriter reputation	2.89 ³	2.84 ²	2.83 ²	2.96 ²	2.61 ²	2.22 ³	2.37 ³
No.	11	11	11	11	11	11	11
Mean Adjusted R^2	0.10 ¹	0.10 ¹	0.10 ¹	0.10 ¹	0.11 ¹	0.11 ¹	0.10 ¹

¹; ²; ³; ⁴ Statistically significant at the 0.01; 0.05; 0.10; 0.20 for two-sided Student t -statistic.

Table 3. Regressions of price revision. The sample is described in Table 1. The dependent variable is price revision, the offer price relative to the filing mid-price, less one. Independent variables are the Logarithm of proceeds at the file date; Venture capital is a zero-one indicator variable equal to one if the offer is associated with a venture capitalist; Market return is the return on the CRSP equal weighted index over the 15 business days before the offer day; Holding Q is institutional ownership of the IPO firms' common stock at the end of quarter Q by institutions with holding at quarter I; Institutional monitoring is the ranking of the top five institutional investors in the buying group, based on their historical holdings of new issue shares for one year; Underwriter reputation is the lead bank's Carter and Manaster (1988) reputation ranking. Each estimation includes industry fixed effects for Fama-French (1997) industry groups, whose coefficient estimates are not reported. The Panel A estimates are from Ordinary Least Squares estimation using all observations. Panel B reports the means of the Ordinary Least Squares estimates from within each year of the sample period. The mean Adjusted R^2 is the average Adjusted R^2 from the Fama-MacBeth estimates.

Independent variable	All issuers				Issuers with no follow-on offer		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. OLS estimates over all years							
Intercept	-15.18 ¹	-15.08 ¹	-13.90 ¹	-35.52 ¹	-15.21 ¹		-41.52 ¹
Ln(proceeds)	1.46 ¹	1.61 ¹	1.84 ¹	-3.94 ¹	1.94 ¹		-3.47 ¹
Venture capital	3.25 ¹	2.66 ¹	3.15 ¹	1.67 ³	2.01 ³		1.20
Market return	1.47 ¹	1.56 ¹	1.59 ¹	1.35 ¹	1.56 ¹		1.35 ¹
Holding I	5.23 ¹						
Holding IV		5.63 ¹			4.73 ¹		
Holding VIII			4.27 ¹			7.44 ¹	
Institution monitoring				7.17 ¹			8.25 ¹
Underwriter reputation				1.07 ¹			1.06 ¹
No.	2,941	2,687	2,214	2,951	2,106	1,454	1,454
Adjusted R^2	0.12	0.14	0.14	0.19	0.12	0.13	0.20

Continued

Table 3 (cont.)

Panel B. Mean of annual OLS estimates within each year

Intercept	2.14	3.59	5.43	-18.67 ¹	2.37	4.66	-27.01 ¹
Ln(proceeds)	-1.80 ²	-1.66 ²	-1.92 ⁴	-7.11 ¹	-1.19	-1.90 ⁴	-7.18 ¹
Venture capital	2.37 ³	1.91 ⁴	2.52 ⁴	0.38	1.81 ⁴	2.57 ⁴	0.95
Market return	1.35 ¹	1.47 ¹	1.49 ¹	1.21 ¹	1.47 ¹	1.34 ¹	1.18 ¹
Holding I	7.07 ¹						
Holding IV		6.14 ¹			5.68 ¹		
Holding VIII			5.20 ¹			8.64 ¹	
Institution monitoring				6.51 ¹			8.01 ¹
Underwriter reputation				1.63 ¹			1.66 ¹
No.	11	11	11	11	11	11	11
Mean Adjusted R^2	0.09 ¹	0.11 ¹	0.10 ¹	0.16 ¹	0.10 ¹	0.11 ¹	0.18 ¹

¹; ²; ³; ⁴ Statistically significant at the 0.01; 0.05; 0.10; 0.15 for two-sided Student t -statistic.

Table 4. Regressions of underpricing. The sample is described in Table 1. The dependent variable is underpricing, the offer day closing stock price relative to the offer price, less one. Independent variables are the Logarithm of proceeds at the file date; Venture capital is a zero-one indicator variable equal to one if the offer is associated with a venture capitalist; Market return is the return on the CRSP equal weighted index over the 15 business days before the offer day; Mean underpricing is the mean underpricing for all unseasoned over the two calendar months before the offer month; Holding Q is institutional ownership of the IPO firms' common stock at the end of quarter Q by institutions with holding at quarter I; Institutional monitoring is the ranking of the top five institutional investors in the buying group, based on their historical holdings of new issue shares for one year; Underwriter reputation is the lead bank's Carter and Manaster (1988) reputation ranking; Price revision is the offer price relative to its file date midpoint; Price revision residual is the residual from the price revision estimation in the corresponding Column in Table 3. Each estimation includes industry fixed effects for Fama-French (1997) industry groups, whose coefficient estimates are not reported. The Panel A estimates are from Ordinary Least Squares estimation using all observations. Panel B reports the means of the Ordinary Least Squares estimates from within each year of the sample period. The mean Adjusted R^2 is the average Adjusted R^2 from the Fama-MacBeth estimates.

Independent variable	All issuers					Issuers with no follow-on offer		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. OLS estimates over all years								
Intercept	-1.46 ¹	-0.69	-3.58 ¹	-29.23 ¹	-35.74 ¹	3.80	-1.10	-40.12 ¹
Ln(proceeds)	-2.66 ¹	-3.02 ¹	-1.68 ¹	-9.12 ¹	-8.03 ¹	-3.51 ¹	-2.33	-7.94 ¹
Venture capital	5.62 ¹	4.89 ¹	6.43 ¹	4.15 ¹	5.11 ¹	3.36 ³	4.69 ²	5.00 ²
Market return	1.84 ¹	2.09 ¹	2.13 ¹	1.71 ¹	1.78 ¹	1.81 ¹	1.89 ¹	0.43
Mean underpricing	0.81 ¹	0.87 ¹	0.90 ¹	0.76 ¹	0.55 ¹	0.83 ¹	0.85 ¹	0.56 ¹
Holding I	11.90 ¹							
Holding IV		13.92 ¹				14.79 ¹		
Holding VIII			8.96 ¹				15.43 ¹	
Institution monitoring				8.55 ¹	9.84 ¹			11.52 ¹
Underwriter reputation				2.29 ¹	2.09 ¹			1.46 ¹
Price revision								
Price revision residual					0.89 ¹			0.94 ¹
No.	2,941	2,687	2,214	2,951	2,951	2,106	1,454	1,454
Adjusted R^2	0.26	0.29	0.28	0.27	0.42	0.29	0.29	0.47

Continued

Table 4 (cont.)

Panel B. Mean of annual OLS estimates within each year

Intercept	21.56 ¹	24.26 ¹	27.00 ¹	-9.53	-5.20	24.17 ¹	29.41 ¹	-3.12
Ln(proceeds)	-4.50 ¹	-4.88 ¹	-4.69 ¹	-11.27 ¹	-10.19 ¹	-5.03 ¹	-5.27 ¹	-10.35 ¹
Venture capital	6.96 ³	6.64 ²	8.20 ⁴	4.10 ⁴	4.54 ⁴	5.23 ³	6.72 ⁴	4.66 ³
Market return	1.79 ¹	1.96 ¹	1.95 ¹	1.71 ¹	1.12 ¹	1.79 ¹	1.78 ¹	0.84 ¹
Mean underpricing	0.29 ²	0.28 ³	0.21	0.24 ³	-0.07	0.26 ⁴	0.11	-0.13
Holding I	8.43 ¹							
Holding IV		9.53 ¹				11.35 ¹		
Holding VIII			8.31 ¹				13.23 ¹	
Institution monitoring				8.19 ¹	8.82 ¹			8.48 ¹
Underwriter reputation				2.91 ²	2.45 ²			1.85 ²
Price revision								
Price revision residual						0.61 ¹		0.65 ¹
No.	11	11	11	11	11	11	11	11
Mean Adjusted R^2	0.12 ¹	0.13 ¹	0.14 ¹	0.15 ¹	0.32 ¹	0.15 ¹	0.18 ¹	0.37 ¹

¹; ²; ³; ⁴ Statistically significant at the 0.01; 0.05; 0.10; 0.15 for two-sided Student t -statistic.