A Model of the IPO Underwriting Contract

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We provide a reputable intermediaries model of IPO underwriting and pricing. Lead underwriters serve to secure a bargain between the IPO firm and bridge investors who supply the capital. Through a relationship with the IPO firm and bridge investors, the underwriter guarantees the firm's performance, and monitors the firm directly, and indirectly through delegated monitoring by the bridge investors. Issuers pay for monitoring and the cost of holding through IPO underpricing. The model gives new understanding to IPO pricing and allocations and several anomalies reported in the literature.

Keywords: institutional investors, underwriters, going public, initial public offerings, underpricing, investment banking

INTRODUCTION

The going public transaction is complex; on the offer day the firm legally changes from a private firm to a public firm, raises new equity using the firm underwritten initial public offering (IPO) contract, and learns its market value. Before trading starts, firm management and the underwriter sign the contract, fixing the number of shares sold by the firm and selling shareholders, and the offer price, and pledging how much the underwriter pays each party. For example, on the Alibaba IPO offer day, underwriters gave \$11.6B to management and \$13.4B to selling shareholders, and sold 368.1B shares at \$68. Alibaba paid underwriters a fee of \$250M for fulfilling the IPO contract.

One attention grabbing facet of the going public process is the IPO underpricing, the percentage difference between the market price and the offer price, which averages from 10% to 20% in most years. Underpricing's value, the money "left on the table," can be notable. For Alibaba, the offer day closing stock price was \$93.68, so underpricing was 38%, leaving a record \$9.5B on the table. Advanced corporate finance textbooks discuss several uses for underpricing noted by scholars.

However, the going public process has other significant features that also require explanations, many of which lie beyond the purview of the underpricing stories. Perhaps foremost is resolving the IPO underwriting paradox: why do IPO firms use the costly firm-underwritten contract when cheaper options seem to exist? For example, why not use an open auction?[1] Empiricists report other unusual going public facts. Practitioners raise meaningful questions. For example, why do IPO buyers often agree to hold their new shares for some time? This was evident in the Twitter IPO: "The banks aimed to place the bulk of the shares with a relatively small number of long-term investors" (Wall Street Journal, 2013).[2]

We provide a model of the IPO contract that provides understanding of the joint determination of its many contract components. It offers explanations for a range of documented IPO facts. We also report modest new evidence that agrees with key predictions from the model.

To go public and raise its first infusion of public equity firm management must reach agreement on several issues with capital suppliers, or "bridge capitalists" (BCs). Due to their moral hazard managers cannot alone ensure the BCs that their capital will be invested as promised. In turn, due to their free-rider problem, the BCs cannot credibly promise firm management to uphold their commitment to hold their new shares, and thus maintain their big stake in the firm, rather than sell the shares in the secondary market for a quick profit. These and other difficulties make it too costly for managers and investors to complete an effective contract alone.

The IPO contract model features the underwriter as an intermediary with two relationships, each lasting beyond the IPO itself. Firm management seeks Relationship I to get its new equity capital at best terms. It also seeks continued underwriter monitoring of management and the firm after the IPO. This provides managers with the means to bond their performance commitment to buyers. BCs seek Relationship II to obtain assurance that their new capital investment in the young public firm is fairly priced. They also seek the underwriter's promise to monitor their investment stake in the IPO shares, and thus bonding their commitment to monitoring issuing firm management and performance after the IPO.

To assure their monitoring commitment to underwriters to monitor the firm after the IPO, BCs put at risk their record for monitoring, their capital invested in the IPO firm, and their access to future IPOs and their streams of quasi-rents to be received by cooperating with the underwriter. The benefits from cooperation overpower short-run free-rider benefits from selling their holdings and shirking on their monitoring promise. During bookbuilding before the offer the underwriter uses its discretion to allocate IPO shares to the cooperative BCs, arranging the best holding stakes and setting expectations for future quasi-rents.

To secure the IPO contract the underwriter must certify its commitments to monitor the BCs deliver effective monitoring of the issuing firm. At the IPO the underwriter lays on the line its reputation for doing its due diligence to certify the financial reports of the capital raising firms and monitor firm management. Thereafter, to bond its assurance that the BCs will monitor the firm's operating decisions, financial performance, governance, and possible transactions, the underwriter puts at risk its reputation. The issuer pays the underwriter an up-front fee for these uses of its reputation capital.

The model thus draws on the role of bonding to guarantee contract performance (Grossman and Hart, 1980; Klein and Leffler, 1981; Kreps and Wilson, 1982; and Shapiro, 1983) and the role of delegated monitoring to complete contracts (Leland and Pyle, 1977; Diamond, 1984).

By including a number of contract features the model provides new resolutions for a number of established IPO facts. Bookbuilding, which is unique to the firm underwritten contract provides a way to achieve better holding, and thus more proceeds and greater firm value. By attracting a more regular and larger flow of bridge investors, expected underpricing and issuing costs are reduced through bookbuilding (see Binay et al. 2007).

In the model there is no IPO paradox because the firm-underwritten IPO contract raises firm value by more than its costs. Underwriters add value by eliminating the moral hazard and free-riding problems, and delivering monitoring of firm management at and after the IPO. Contract verification has little cost due to the abundance of publicly available post-IPO metrics that are common for publicly traded firms; including financial statements, proxy statements, earnings reports, a stock that is continually evaluated by investors in the secondary market, and the state of investor holdings. Misrepresented financial reports would be revealed in future earnings that exposes the underwriter to SEC actions, and class action lawsuits that threaten damage to the underwriter's reputation and thus future business.

The model sheds light on underwriters' repeated use of buyers who hold large allocations of IPO shares that is often noted by practitioners. The demand for holding the IPO shares is derived from the underwriters' desire to retain buyers who will monitor the firm after it goes public, thus taking a significant long term investment stake in the firm.[3]

The theory provides new insight into facts that have puzzled researchers. One is the reputation anomaly, that underpricing is larger for IPOs led by more reputable underwriters (Beatty and Welch, 1996; Hansen, 2001). This finding is an equilibrium prediction of the holding theory. Underpricing is higher for more reputable underwriters because they increase firm value and secure more proceeds during bookbuilding. The role of underwriter relationships in the model puts new light on Hoberg's (2006) puzzling persistence anomaly; that recent underpricing reliably predicts future underpricing on IPOs led by the same underwriter. The relationships foster recurring holding patterns that contribute to persistence in monitoring costs, and thus in underpricing. Third, the model offers a new explanation for the repeat business between underwriters and large investors. While authors point out a number of dark-side stories from relationships like favoritism (Agarwal, 2002, Reuter, 2006), in the model they arise naturally add value.

The model predicts other documented IPO findings that have been shown to arise during bookbuilding. One is the partial adjustment of the offer price to the market price documented by Hanley (1993). When holding benefit rise during bookbuilding underpricing also rises to reward the buyers who take bigger stakes that raise firm value. This complements the information theory view, that extra underpricing pays investors for better information that pushes up the offer price. Second, the model predicts larger holdings are linked to more reputable underwriters, higher price revisions, and deeper underpricing. The model also predicts some flipping is to be expected in a competitive setting, as it lets investors collect some monitoring quasi-rents soon after the IPO.[4]

The model assumes a competitive market setting, and thus it does include what might occur when the issuing firm, the underwriter, or the buyers possess market power, as a monopolist or an oligopolist. Competitive market setting agrees with the real world-Justice Department etc. Many explanations for underpricing cannot survive under competition.

Perhaps closest to our analyses is the IPO model of Stoughton and Zechner (1998), which also features a monitoring role. In our model the buyer of the IPO shares provides the monitoring. Our model differs from their model in other significant ways. For example, they assume the underwriter intermediary is a monopolist. Thus, there is no role for underwriter reputation in their model. In contrast, our model assumes a high degree of competition and reputable underwriters integral to completing the IPO contract.

The balance of the paper proceeds as follows. Section 2 presents the model of underpricing to buy holding and highlights empirical predictions and implications from the model. Section 3 identifies new empirical implications from the model. The paper concludes with Section 4.

LITERATURE REVIEW

A large collection of findings has influenced the IPO contract model. There is evidence of the importance of underwriter reputation and monitoring in equity financing. IPO underwriters provide monitoring of the issuing firm at the IPO and receive fees for their monitoring and reputation (Booth and Smith, 1986; Hansen and Pinkerton, 1982; Hansen and Torregrossa, 1992). Studies confirm that underwriter reputation can improve firm value after the IPO. Reputable underwriters are associated with less firm failure (Bhattacharya et al. 2014). Lee and Masulis (2010), and Krishnan, et al. (2011) report a positive impact of underwriter reputation on the firm's post IPO performance. Underwriter monitoring that improves firm value is also reported by Sahlman (1990), Holthausen and Larcker (1996), and Wang et al. (2010). Evidence shows that issuing firm's future accounting performance directly affects underwriter reputation (Dunbar, 2000; Fang, 2005). Practitioners also note the demand for institutional holding of IPO shares. Binay et al. (2007) report bridge capitalists hold an average 90% of their IPO allocations as of one year after the IPO.

Further evidence shows the economic importance of underwriter relationships with issuing firm management. Managers bond with underwriters who monitor their incentives to commit fraud and certify firm value (Hansen and Pinkerton, 1982, Megginson and Weiss, 1991, Hellman and Puri, 2002, Krishnan et al., 2010, Lee and Masulis, 2010). Fernando et al. (2012) document the importance of underwriter relationships with client firms during Lehman's demise at the start of the 2008 financial crisis. Kovner (2012) shows that average stock prices of former IPO clients fall 5% at news of the demise of their IPO underwriter in the crisis.

The importance of underwriter relationships with bridge investors has also been documented. Underwriter IPO allocations often go to investors in prior IPOs, especially in large offerings (Cornelli and Goldreich 2001; Binay et al. 2007), and in hotter IPOs (Hanley and Wilhelm (1995). Underwriters allocate more shares to their institutional investors who hold the shares for longer periods, and more so when expected post-IPO demand is weaker (Chemmanur et al. 2010).

Evidence of the importance of bridge investor reputation and monitoring of operating firms is also documented. Kovner (2012) finds that IPO firms with larger institutional holding suffer less damage after the IPO from the loss of their IPO underwriter. Underwriters favor larger, and thus more reputable institutional clients (Aggarwal et al. 2002; Hanley and Wilhelm, 1995; Cornelli and Goldreich, 2001). Institutional ownership is associated with improved monitoring of the firm; higher Tobin's q (McConnell and Servaes 1990), higher post-IPO firm value (Sanders and Boivie 2004), better manager performance (Shivdasani 1993), better alignment of CEO pay with shareholder interest (Hartzell and Starks 2003), and an improved proxy process (Gillan and Starks, 1999, Parrino et al. 2003). Institutions enhance firm monitoring by attracting analysts (Bhushan, 1989, O'Brien and Bhushan, 1990). Cliff and Denis (2004) show greater IPO underpricing when there is more analyst coverage.[5]

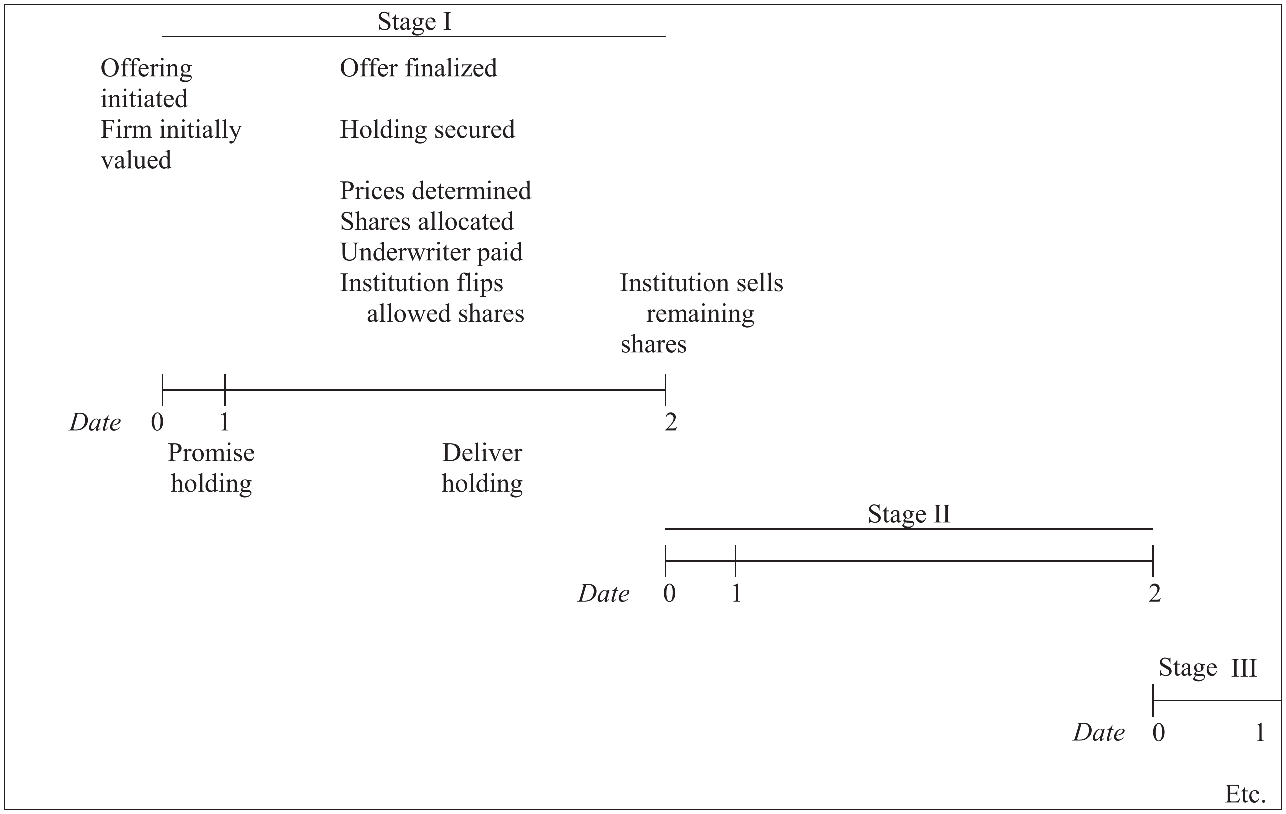
A MODEL OF UNDERPRICING TO BUY HOLDING

This section presents the model in which underwriters underprice IPOs to compensate large institutional investors for holding IPO shares for the long term while monitoring then firm. Institutional investors maximize their profit from the purchase and resale of new shares, given the exogenous benefits and costs of holding public firms. The model is in a competitive setting, so underwriters and investors earn normal profits on their investments, and shareholders of the IPO firm earn all abnormal gains.

The Model

Without loss of generality we adopt the dynamic repeated game framework of Abreu (1988) and focus on underwritten IPOs in an infinite period economy that is divided into a series of identical stages. Each stage has two periods and three dates (0, 1, and 2). No time-value discounting is done within each stage, and payoffs over stages are discounted at the risk-free interest rate, *r*. In each stage, in period 1 a private firm goes public, receiving new capital after its underwriter sets the offer price and sells the new shares. Thus, in our model, period 1 is infinitesimally short. In contrast, period 2 is long, and it is for this period that the issuer seeks holding of the new shares. The stages allow us to incorporate future payoffs to institutions for holding and investigate the role of reputation and monitoring costs in disciplining diverse agents to work toward the common goal. The process is shown in Fig. 1. Throughout we assume rational expectations.

FIGURE 1
THE OFFERING



An infinite period economy is 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 0 a privately held firm goes public and hires the underwriter to conduct the offering. During period one, the underwriter arranges the institutional buyer's promise to monitor. At date 1, offer terms are finalized, the holding 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. Holding extends over the second period. At date 2, the institution liquidates the balance of issuer's shares still held.

The four possible risk-neutral agents are the going public firm, underwriters, possible holding institutional BC investors, and retail investors. For simplicity we assume one underwriter and one institutional investor. The supply of institutional investors is competitive and large, a fact we capture by implicitly assuming an elastic supply of similar institutions. The model abstracts from bargaining issues that could arise in a more complex setting such as the economics of forming IPO buying groups. Nor could a competitive institution successfully deviate from the holding 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. We ignore agency problems, information asymmetry, and transaction costs. Shareholders of the issuing firms are thus the beneficiaries of the net value added from the intermediation, as there is intense competition in underwriting and among institutional investors.

The buying institution could provide costly holding of the firm's IPO shares by investing its investors' wealth in the stock, then monitor the firm over the long term. The costs of such holding include overexposure to idiosyncratic risk stemming from the suboptimal diversification from investing excess funds in one firm (e.g., Stoughton and Zechner, 1998). They include losses from a possible dramatic turn that is more common for young firms that includes economic failure. With limited access to funds, the overexposure could also increase the institution's opportunity losses by limiting its ability to capture unanticipated good investment opportunities. The cost is higher for larger issuers and rises with the fractional holding. Active monitoring, advising, and eventual liquidation generate further costs that rise with the size of the ownership stake.

Without holding the IPO firm value is V. However, the underwriter knows holding benefits increase firm value by $V\beta g$ to $V(1+\beta g)$, by impacting the rate of growth in firm value, g. Growth depends on the size of the institution's holding, α, and its reputation or efficiency for monitoring, α. If N shares are issued and n are held by the active institution, then $\alpha = n/N$ (henceforth, we set $N = 1$). Because holding is a long-term commitment device for active institutional oversight that adds value, allocated shares held only for the first period (shares flipped at date 1) by the institution do not foster growth. Hence,

$$g = g(\alpha, \tau), \tag{1}$$

where α is the institution's active holding for at least two periods.

We assume firm value will not grow without some long-term holding by some reputable buyers. The growth rises with holding at a decreasing rate and reputation adds value in a linear fashion for any holding level; thus, $g = g(\alpha, 0) = g(0, \tau) = 0$, $g_\alpha > 0$, $g_{\alpha\alpha} < 0$, $g_\tau > 0$, and $g_{\tau\tau} = 0$. Throughout subscripts denote partial derivatives (e.g., $g_\alpha = \partial g/\partial\alpha$).

Lead underwriter reputation for enforcing holding is captured with the probability of holding, β, which represents two effects: underwriter reputation and the uncertain states of nature. The probability mass of monitoring success β is a function of the i^{th} underwriter's reputation R_i and is given by $\beta(\omega, R_i)$. We assume the mass function satisfies the following monotone property: For all $\omega_k \in \Omega$, $\beta(\omega_k, R_i) > \beta(\omega_k, R_j)$ if $R_i > R_j$ for all i, j, and $i \neq j$. That is, all else remaining the same, the probability of monitoring success is higher for the i^{th} underwriter if the i^{th} underwriter's reputation is higher than the j^{th} underwriter's reputation. In our model, Ω = (favorable state, unfavorable state). Hence, we assume that β(favorable, R_i) > β(favorable, R_j) if $R_i > R_j$ and β(unfavorable, R_i) > β(unfavorable, R_j) if $R_i > R_j$. Because we have only one underwriter in our model, for simplicity of exposition we denote β(favorable, R_j) by β and β(unfavorable, R_j) by 1-β.

The issuer's cost of raising the new capital consist of the underwriter's fee and the IPO underpricing. We assume the fee is an up-front payment to the underwriter for putting its reputation on the line to certify the offer price and provide direct monitoring of the firm, and is thus deducted from the gross proceeds, which we do not model.[6] In practice, the IPO underwriter fees is often simply 7% (Chen and Ritter, 2000; Hansen, 2001). The model thus focuses on the underpricing cost, and the roles of institutional buyers as post-IPO monitors of the firm and the underwriter who monitors those buyers. The underwriter's scope for conflicts of interest in the determination of underpricing is thus minimized in this setting.

The institution's expected holding cost depends on α, a positive cost parameter, γ, the base firm value, V, and the holding period duration, Δ_2. Because holding takes place in period 2, we simplify the analysis by normalizing holding costs so there are no holding costs in period 1 (thus, $M_1 = M(1, \gamma, V, \Delta_1 \to 0, \Delta_2) = 0$). Hence, costs of holding α shares for two periods is

$$M = M(\alpha, \gamma, V, \Delta_2). \tag{2}$$

We assume expected total monitoring cost is zero when any of its arguments is zero. The cost increases if any of the arguments increase, and increasingly so for holding and more firm value and constant in the cost parameter and holding period duration, so, $M_\alpha > 0, M_{\alpha\alpha} > 0, M_\gamma > 0, M_{\gamma\gamma} = 0, M_V > 0, M_{VV} > 0, M_{\Delta_2} > 0, and\ M_{\Delta_2\Delta_2} = 0$. Monitoring cost does not depend on buyer reputation or on underwriter reputation, given holding.

Optimal Holding

All agents know the institution chooses the holding that maximizes its stage I expected profit, which is earned partly from shares flipped at price P_1 at date 1, and partly from gains at the date 2 sale of the remaining shares at price P_2, less the holding cost and the offer price paid for the new shares, P_0.

The institution's stage I profit is thus

$$\Pi(\bullet) = (\alpha_0 - \alpha)P_1 + \alpha P_2(\alpha, \tau, \gamma, \beta, V, \Delta_2) - M(\alpha, \gamma, V, \Delta_2) - \alpha_0 P_0, \tag{3}$$

where P_2 reflects the fundamental asset value and is expressed as

$$P_2(\alpha, \tau, \gamma, \beta, V, \Delta_2) = V(1 + \beta g(\alpha, \tau, \gamma, \beta, V, \Delta_2), \tag{4}$$

where α is the initial allocation

Optimal holding, α^*, equalizes holding's marginal benefit and cost. Given $\alpha^*$is the optimal holding, the underwriter has three possibilities: Allocate $1 - \alpha^*$ additional shares to the active institution; allocate $1 - \alpha^*$ additional shares to the retail investors; or, with the firm's consent, reduce the intended offer size to α^*, and issue the $1 - \alpha^*$ additional shares in the future, perhaps in an SEO. However, reducing IPO size and conducting an SEO in the near future is a costly option for the firm. Reducing the offer size could also hamper taking on large, lumpy, investment prospects. Also, some scale effects and fixed costs with a follow-on SEO could reduce net proceeds due to paying two underwriter fees (e.g., see Altınkılıç and Hansen, 2000). At the same time, if all new shares are allocated to the active institution, then the holding can increase. Given the normalizing of holding costs, it is straightforward that the firm finds it optimal to allocate additional shares to the active institution.

In the model, retail investors merely buy and sell shares to satisfy liquidity needs and thus have no firm-value enhancing feedback effect. Because the buyer flips any additional shares into the secondary market in period 1, holding only α^* (or less) in period 2, the deadweight holding cost is not affected by the allocation of extra shares to the institution, as it depends only on actual holding; $M(\alpha, \gamma, V, \Delta_2) \leq M(\alpha^*, \gamma, V, \Delta_2)$. The cost also does not depend on the initial allocation, α_0, given that $M_1 = 0$. Also, because all shares must sell at the same offer price, and the offer is underpriced, it is optimal for the shareholders of the issuing firm that the underwriter allocates 100% to the active institution in the primary market.[7]

The institutional investor takes both P_0 and P_1 as given and maximizes $\Pi(\bullet)$ by choosing period 2 holding. Thus, differentiating Eq. (3) with respect to α yields

$$\Pi(\bullet)_\alpha = -P_1 + P_2(\alpha, \tau, \gamma, \beta, V, \Delta_2) + V\beta g_\alpha - M_\alpha. \tag{5}$$

Under rational expectations, the date 1 price is the best guess for its future value. Thus,

$$P_1(\alpha^*, \tau, \gamma, \beta, V, \Delta_2) = P_2(\alpha^*, \tau, \gamma, \beta, V, \Delta_2) = V\big(1 + \beta g(\alpha^*, \tau)\big), \tag{6}$$

where $\alpha^*(\tau, \gamma, \beta, V, \Delta_2)$ is the holding described by Eq. (5). Substituting P_1 from Eq. (6) into Eq. (5) and solving the first-order condition yields equilibrium holding α^*. Hence, equilibrium holding equates the marginal value gain from holding with its marginal cost,

$$V\beta g_\alpha = M_\alpha. \tag{7}$$

Sufficient conditions for an interior α^* to exist are that $g_\alpha(0, \tau) > M_\alpha(0, \gamma, V, \Delta_2)$, and that $g_\alpha(\alpha, \tau) > M_\alpha(\alpha, \gamma, V, \Delta_2)$ for some $\alpha \in (0,1)$. The second-order condition required for maximization is met unambiguously because we assume $g_{\alpha\alpha} < 0$ and $M_{\alpha\alpha} > 0$.

The offer price is then determined once the underpricing is determined, given the total gains from holding. The net proceeds, and thus the offer price, is thus a residual from the profit optimization.

To secure the promised holding the offer price is enough below the market price to provide the institution with anticipated underpricing revenue that covers its holding cost plus a quasi-rent, QR. The quasi-rent makes it worthwhile for the institution to not deviate from holding by flipping all of its shares into the secondary market at date 1. Hence, the offer price must be

$$P_0 = P_1(\alpha^*, \tau, \gamma, \beta, V, \Delta_2) - M(\alpha^*, \gamma, V, \Delta_2) - QR. \tag{8}$$

Competition drives the underwriter to choose the lowest possible quasi-rent that is sufficient to ensure holding, allowing no abnormal profit to buyers. The institution that deviates from the contract, perhaps hoping to capture the underpricing, U, as its own cash flow, will be identified and exposed as a deviator, then banned from all future IPOs by the underwriter. Thus, the seeming short run gains from flipping are overmatched by the long-term quasi-rents gains from not flipping. The non-deviating institution must therefore incur the monitoring cost, earns U, and remains eligible to earn quasi-rents in every future stage in perpetuity, $U - M + QR/r$. Equating the values shows the minimum necessary quasi-rent, as a percent of initial value, is

$$QR = rM(\alpha^*, \gamma, V, \Delta_2). \tag{9}$$

The offer price that minimizes underpricing while assuring the holding, and thus maximizes the proceeds, is therefore found by substitution from Eq. (9) into Eq. (8) and simplifying,

$$P_0 = P_1^*(\alpha^*, \tau, \gamma, \beta, V, \Delta_2) - (1 + r)M(\alpha^*, \gamma, V, \Delta_2). \tag{10}$$

The main IPO pricing components are depicted in Panel A, Fig. 2, where for expositional ease the components are measured as a percent of initial firm value (defining them as a fraction of the offer price or the market price yields qualitatively similar conclusions throughout). The total revision, *TR*, is the total value added to the issuing firm's base value, *V*, as a consequence of the monitoring. Total revision at the optimal holding level is thus the difference between pre-IPO date 1 market price and the market value, measured as follows:

$$TR = \frac{P_1 - V}{V} = \beta g(\alpha^*, \tau). \tag{11}$$

The underpricing, *U*, is payment to investors for their holding cost plus the quasi-rent payment, as determined by the optimal level of holding.

$$U = \frac{P_1 - P_0}{V} = \frac{(1+r)}{V} M(\alpha^*, \gamma, V, \Delta_2). \tag{12}$$

The price revision, *PR*, is the difference between offer price and initial value. It is therefore the gain in net proceeds for the issuing firm to invest, hence, the total revision less the underpricing.

$$PR = \frac{P_0 - V}{V} = \beta g(\alpha^*, \tau) - \frac{(1+r)}{V} M(\alpha^*, \gamma, V, \Delta_2). \tag{13}$$

The total revision may thus be written as the sum of the underpricing paid to secure the holding and the price revision,

$$TR = U + PR. \tag{14}$$

Part of the value added from the intermediation is therefore paid through the underpricing to suppliers of capital for their monitoring. The balance of the value added and is thus included in the gain in net proceeds, under competition is realized by the issuing firm shareholders. If there is no gain in net proceeds, in which case the underpricing costs are too high, then shareholders are better off raising just the base value, V.

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

Because of underwriters' unique access to future business with the active institutions, the lead underwriters can enforce the holding in equilibrium. The underwriters can reward institutions for providing the promised holding by allowing them to participate in future stage offerings, as well as punish those that renege on their promises by canceling all future business with them. The issuer and investors find the promises to enforce the holding to be credible because underwriters put their reputations on the line for rewarding holding and punishing any failure to hold.

The equilibrium must also satisfy the issuing firm's participation constraint, which requires the offer price exceeds the initial firm value. Otherwise, the issuer foregoes the active institutional advice and monitoring and allocates all shares at price V to the market.

A unique feature of the model is that flipping of some new shares is expected in equilibrium under competitive conditions and is thus not a consequence of maverick behavior by parties to the IPO contract. Holding could fail if the buying institution flips all of its allocated shares into the secondary market at date 1, driving holding to zero. It could also fail if an unlucky disaster state of nature arises that is beyond the underwriter's control. For example, an unspotted rogue employee at the underwriter's brokerage or at the buying institution could destroy the holding arrangement.

Because there is competition among buyers and among intermediaries, all excess profits from the IPO are earned by existing shareholders. Of course, the issuer could instead bypass the underwriter and seek to contract directly with the institutional buyers to assure holding. However, in our model the issuer alone has no ability to discipline the institution in a single stage, because it has no future stage business with the institution. Nor can the institution credibly commit to provide the desired holding.

We recognize the model can be adapted with a less powerful enforcement function. For example, punishment for failure to hold could rise at a diminishing rate as underwriter reputation improves. This more complex enforcement results in greater quasi-rents to sustain the holding equilibrium, yet the empirical implications otherwise remain qualitatively the same. Furthermore, certain practices used by underwriters can aid enforcement. For example, the lead underwriter is virtually always the market maker for the issuer's stock until the stock is sufficiently seasoned (Ellis et al., 2000). Acting as the market maker improves the underwriter's ability--beyond what detection the model allows--to learn if an institutional buyer defaults on the holding 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, but they do not reveal this information to institutions or retail investors and they do not make public who flips shares. This record keeping can further aid underwriters in disciplining long-term investors in competitive markets. The brokerage firm analysts may also help detection of deviating behavior from investors. Also, in our model, we ignore that the lead underwriter or the institution could engage in short selling while making the market.

EMPIRICAL IMPLICATIONS

The economic setting in the holding equilibrium offers several new insights into IPO pricing behavior. First predictions from the equilibrium are discussed, many of which agree with findings reported in empirical IPO pricing studies. Then a number of empirical patterns from the model are noted.

Specific Implications from the Model: The Comparative Statics

Predictions for IPO pricing cross-section behavior from the model's comparative statics are grouped into effects from lead underwriter reputation, the reputation of the institutional investors, the underwriter's monitoring costs, and the cost of a longer holding period.

Underwriter Reputation and Buyer Reputation

An increase in the underwriter's reputation for enforcing holding has two positive effects on holding: The direct effect increases the expected benefits from holding because it raises the likelihood of success of any holding effort. The indirect effect is to provide more incentive for the institutional investor to not deviate from the promised holding. So, if optimal holding is constant and reputation rises, then so does the expected marginal benefit of holding. This is seen by differentiating the market value, P_2^*, with respect to β,

$$\frac{dP_2^*(\alpha^*,\tau,V,\beta)}{d\beta} = Vg(\alpha^*,\tau) > 0. \tag{15}$$

Since the marginal cost is unaffected by reputation, optimal holding must increase with greater lead underwriter reputation

$$\frac{d\alpha^*}{d\beta} > 0. \tag{16}$$

How does underwriter reputation impact total value? A rise in reputation increases the marginal value product from holding the new shares, thus contributing to greater firm value,

$$\frac{dTR^*}{d\beta} = \beta g_\alpha \frac{\partial\alpha^*}{\partial\beta} + g > 0, \tag{17}$$

where $g_\alpha > 0$ and $g_\tau > 0$, and Eq. (16) is used.

Next is the underwriter's reputation impact on IPO underpricing. A stronger underwriter reputation is more costly to use and therefore requires more quasi-rent,

$$\frac{dQR^*}{d\beta} = \frac{r}{V} M_\alpha \frac{\partial\alpha^*}{\partial\beta} > 0, \tag{18}$$

by Eq. (16). Thus, when the increase in underwriter reputation expands the optimal holding, quasi-rents also rise, so underpricing rises, Eq. (16),

$$\frac{dU^*}{d\beta} = \frac{(1+r)}{V} M_\alpha \frac{\partial\alpha^*}{\partial\beta} > 0. \tag{19}$$

The higher reputation also results in greater net proceeds received by the firm, and thus the offer price,

$$\frac{dPR^*}{d\beta} = \beta\left(g_\alpha \frac{\partial\alpha^*}{\partial\beta} + g\right) - \frac{(1+r)}{V} M_\alpha \frac{\partial\alpha^*}{\partial\beta} > 0, \tag{20}$$

since α^* is optimal, $V\beta g_\alpha \frac{\partial\alpha^*}{\partial\beta} = M_\alpha \frac{\partial\alpha^*}{\partial\beta}$, and $g > 0$, a sufficient condition for β to increase the price revision is that $r < g/g_\alpha \frac{\partial\alpha^*}{\partial\beta}$. Thus, while issuers must pay a higher quasi-rent in the form of more underpricing for the better reputation, that extra expense is worthwhile because the higher reputation also generates greater net proceeds for the firm.

Notice that these equilibrium predictions from the holding model provide new resolutions of two puzzling empirical findings. First, holding predicts that underpricing is higher when underwriter reputation is higher, which provides a resolution for the *reputation puzzle* reported by Beatty and Welch (1996) and Hansen (2001). In a competitive market, more underpricing is required to compensate more reputable lead underwriters.

The holding model also provides a new explanation for the partial adjustment phenomenon reported first by Hanley (1993). When the lead underwriter reputation increases, the value of the firm rises. To meet the cost of the more valuable underwriter reputation, the underpricing also must increase. Consequently, while the price revision and thus the offer price, rises with the better reputation, the offer price does not rise by as much as the market price due to the added reputation cost.

Next are the predictions for the buyer reputation. More buyer reputation raises the marginal benefit from holding. Thus, given the relatively modest marginal cost of holding, the marginal benefit of buyer reputation rises more than the cost, and optimal holding rises to re-equate the marginal benefit and cost,

$$\frac{d\alpha^*}{d\tau} > 0. \tag{21}$$

An increase in buyer reputation adds value to the firm, increasing the total revision:

$$\frac{dTR^*}{d\tau} = \beta\left(g_\alpha \frac{\partial\alpha^*}{\partial\tau} + g_\tau\right) > 0, \tag{22}$$

where Eq. (21) is used. The increase in market price is in anticipation of the greater holding benefits.

The higher institution reputation receives a higher quasi-rent, from Eq. (21),

$$\frac{dQR^*}{d\tau} = \frac{r}{V} M_\alpha \frac{\partial\alpha^*}{\partial\tau} > 0. \tag{23}$$

Given the diminishing benefits and rising costs of holding, more underpricing is needed to compensate for the holding cost increase,

$$\frac{dU^*}{d\tau} = \frac{(1+r)}{V} M_\alpha \frac{\partial\alpha^*}{\partial\tau} > 0. \tag{24}$$

Thus, the quasi-rent effect again impacts the underpricing, from Eq. (21), and the increase in buyer reputation leads to an increase in underpricing.

In turn, the offer price rises as buyer reputation rises,

$$\frac{dPR^*}{d\tau} = \beta\left(g_\alpha \frac{\partial\alpha^*}{\partial\tau} + g_\tau\right) - \frac{(1+r)}{V} M_\alpha \frac{\partial\alpha^*}{\partial\tau} > 0, \tag{25}$$

where the sufficient condition in this case is that $r < g_\tau / g_\alpha \frac{\partial\alpha^*}{\partial\tau}$.

Thus, in the holding theory, there is a second reputation effect from the buyer reputation: a better buyer reputation is associated with more underpricing and raises shareholders' net proceeds. Thus, a corresponding partial adjustment effect is associated with the reputation of the monitoring institutional shareholders. Because of the additional payment in the quasi-rent, and thus in the underpricing, for higher reputation institutional buyers the offer prices rises less than the rise in the offer price.

Underwriter Monitoring Expense and Holding Period Duration

The holding model also features new predictions about the impact of the cost of intermediary monitoring of IPO pricing. If optimal holding is held constant and the monitoring cost rises, then the marginal cost of holding rises. The marginal benefit of holding is not affected by the cost increase. Thus, to equate the marginal cost of holding to the benefit, optimal holding decreases when monitoring cost rises,

$$\frac{d\alpha^*}{d\gamma} < 0. \tag{26}$$

The total revision also falls if buyer monitoring cost rises

$$\frac{dTR^*}{d\gamma} = \beta g_\alpha \frac{\partial\alpha^*}{\partial\gamma} < 0, \tag{27}$$

as the holding drops in response to the higher cost.

Given eq. (26), the increase in monitoring cost will raise the quasi-rent,

$$\frac{dQR^*}{d\gamma} = \frac{r}{V}\left(M_\alpha \frac{\partial\alpha^*}{\partial\gamma} + M_\gamma\right) > 0. \tag{28}$$

The bracketed term's sign depends on the relative strength of the positive and negative parts. Given α^* is optimal holding, Shephard's lemma and Le Chatelier's principle can be used to argue that the direct effect of γ on the cost of holding has to at least weakly dominate the indirect effect of reduced α^* on cost of holding. That is, $\left|M_\alpha \frac{\partial\alpha^*}{\partial\gamma}\right| \leq |M_\gamma|$. This is because the optimal holding falls only in response to increase in marginal costs at all levels of holding. If costs and α^* both decrease, then α^* cannot be the optimal holding. Hence, the quasi-rent goes up if exogenous cost parameter γ increases.

An increase in the holding period is thus likely to increase underpricing in order to pay the added cost of monitoring,

$$\frac{dU^*}{d\gamma} = \frac{1+r}{(1-r)V}\left(M_\alpha \frac{\partial\alpha^*}{\partial\gamma} + M_\gamma\right) > 0. \tag{29}$$

If monitoring costs increase, the offer price revision is also likely to fall given Eq. (26),

$$\frac{dPR^*}{d\gamma} = \beta g_\alpha \frac{\partial\alpha^*}{\partial\gamma} - \frac{(1+r)}{V}\left(M_\alpha \frac{\partial\alpha^*}{\partial\gamma} + M_\gamma\right). \tag{30}$$

Given α^* is optimal, $V\beta g_\alpha \frac{\partial\alpha^*}{\partial\gamma} = M_\alpha \frac{\partial\alpha^*}{\partial\gamma}$, Eq. (26), and $M_\gamma > 0$, a sufficient condition for γ to increase the price revision is that $r < M_\gamma / [V\beta M_\alpha \frac{\partial\alpha^*}{\partial\gamma} - M_\gamma]$.

Optimal holding is also impacted by the length of the holding period. If optimal holding is held constant and Δ_2 rises, then the marginal cost of holding rises. Since the marginal benefit is not affected, to equate the marginal cost and benefit of holding, optimal holding decreases,

$$\frac{d\alpha^*}{d\Delta_2} < 0. \tag{31}$$

A longer holding period also lowers the total revision,

$$\frac{dTR^*}{d\Delta_2} = \beta g_\alpha \frac{\partial\alpha^*}{\partial\Delta_2} < 0, \tag{32}$$

reflecting the associated fall in holding.

The increase in holding period also raises the quasi-rent,

$$\frac{dQR^*}{d\Delta_2} = \frac{r}{V}\left(M_\alpha \frac{\partial \alpha^*}{\partial \Delta_2} + M_{\Delta_2}\right) > 0. \tag{33}$$

Given α^* is optimal holding, Shephard's lemma and Le Chatelier's principle can again be used to argue that the direct effect of Δ_2 on the cost of holding at least weakly dominate the indirect effect of reduced α^* on cost of holding, hence $\left|M_\alpha \frac{\partial \alpha^*}{\partial \Delta_2}\right| \leq \left|M_{\Delta_2}\right|$, given Eq. (31). Optimal holding falls in response to increase in marginal costs at all levels of holding. If costs and α^* both decrease, then α^* cannot be the optimal holding. Hence, underpricing rises if Δ_2 increases.

The increase in monitoring costs is also likely to increase underpricing in order to pay for the added cost,

$$\frac{dU^*}{d\Delta_2} = \frac{1+r}{(1-r)V}\left(M_\alpha \frac{\partial \alpha^*}{\partial \Delta_2} + M_{\Delta_2}\right) > 0. \tag{34}$$

The holding period increase is thus likely to push down the offer price, given Eq. (31),

$$\frac{dPR^*}{d\Delta_2} = \beta g_\alpha \frac{\partial \alpha^*}{\partial \Delta_2} - \frac{(1+r)}{V}\left(M_\alpha \frac{\partial \alpha^*}{\partial \Delta_2} + M_{\Delta_2}\right). \tag{35}$$

Given α^* is optimal and Eq. (31), $V\beta g_\alpha \frac{\partial \alpha^*}{\partial \Delta_2} = M_\alpha \frac{\partial \alpha^*}{\partial \Delta_2}$, and $M_{\Delta_2} > 0$, a sufficient condition for Δ_2 to increase the price revision is that $r < M_{\Delta_2} / [V\beta M_\alpha \frac{\partial \alpha^*}{\partial \Delta_2} - M_{\Delta_2}]$.

The holding model also predicts there can be an over adjustment phenomenon in the pricing response to changes in monitoring expenses. For example, consider a drop in the monitoring cost, or a reduction in the holding period. The lower cost leads to additional monitoring that pushes up firm value, raising the total revision. At the same time the fall in monitoring cost reduces the underpricing. Consequently, the offer price rises by more than the increase in the market price, over adjusting. A similar effect is predicted by a reduction of the holding period.

One example of an increase in the cost of monitoring is a rise in the rate of interest. In this case, the model reveals the following.

$$\frac{d\alpha^*}{dr} < 0. \tag{36}$$

Higher interest rate reduces the present value of quasi rents, lowering the marginal benefit of monitoring, thus β is reduced.

$$\frac{dTR^*}{dr} = \beta g_\alpha \frac{\partial \alpha^*}{\partial r} < 0. \tag{37}$$

Higher interest rate reduces the holding, reducing the growth and thus the total value from monitoring.

$$\frac{dQR^*}{dr} = M + rM_\alpha \frac{\partial \alpha^*}{\partial r} > 0. \tag{38}$$

Higher interest raises the quasi rent but reduces holding which lowers the quasi rent. Looks like the former should dominate the latter.

$$\frac{dU^*}{dr} = \frac{1}{V}\left((1+r)M_\alpha \frac{\partial \alpha^*}{\partial r} + M\right) > 0. \tag{39}$$

The higher quasi rent due to the higher interest rate (Eq. 7), suggests this should be positive. So higher interest rate raises underpricing.

$$\frac{dPR^*}{dr} = \frac{dTR}{dr} - \frac{dU^*}{dr} = \beta g_\alpha \frac{\partial \alpha^*}{\partial r} - \frac{1}{V}\left((1+r)M_\alpha \frac{\partial \alpha^*}{\partial r} + M\right) < 0. \tag{40}$$

By Eq. (6) and (8), this seems to be unambiguously negative.

We thus see that when the interest rate rises the offer price falls, but the market value falls by even less while underpricing rises. In effect, there is over reaction, the higher interest cost pushes the market price down, but the offer price falls by even more, because the underpricing must increase to cover the higher cost from the higher interest rate.

CONCLUSION

In this paper we provide a new model of the IPO contract in which lead underwriters and two agents play important roles in the pricing and allocating IPOs, by jointly supplying monitoring of mangers that improves firm value. Institutional investors take stakes in the IPO and provide long term monitoring of the firm. To guarantee their performance they put their reputation for monitoring managers of young firms, and thus their access to quasi rents in future IPOs, on the line. In turn, lead underwriters ensure the monitoring by cutting off future quasi rents to any deceiving institution. They bond themselves by putting on the line their underwriting reputation, and thus the value of their future IPO business. In this two-agent model, IPO underpricing embodies the quasi rents for the institutional monitoring. Thus, in this agency theory, IPOs will often display long-term relationships between the IPO firm, the institutional investors, and the lead underwriters.

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ENDNOTES

1. Smith (1977) first poses the paradox for public firms that use the firm underwritten seasoned offering, yet non-underwritten rights cost less. Its resolutions are discussed in Brealey et al. (2013) and Ross et al. (2013). Also see Hansen and Pinkerton (1982), Hansen (1988), Eckbo and Masulis (1992) and Eckbo et al., 2000. Sherman (2000) and De George at al. (2010) discuss IPO auctions.
2. Further limits with the empirical power of extant underpricing stories are discussed in Ritter and Welch (2002), Jenkinson and Jones (2004), and Asquith and Rock (2011).
3. Other examples of large buyers noted in the media include the AIA IPO in which underwriters let investors subscribe to large portions of the "Hong Kong offering in advance in return for agreeing to hold the shares for up to a year." (Wall Street Journal, 2010); the Visa IPO, "J.P. Morgan and Goldman Sachs scrubbed the book of potential buyers to make sure that shares were going into the hands of holders, rather than quick sellers looking to make fast money" (Fortune, 2008). Also, Goldman Sachs sought buyers who "remain loyal, long term holders" (Wall Street Journal, 1999), and Merrill Lynch wanted "institutions that plan to keep IPO shares for the long-run" (Washington Post, 1999).
4. See Hanley and Wilhelm (1995), Krigman et al. (1999), Cornelli and Goldreich (2001), Aggarwal et al. (2002), Ljungqvist and Wilhelm (2003), Aggarwal (2003), Ellis, (2006), Jenkinson and Jones (2004), and Binay et al. (2007).
5. By rewarding analysts' careers it can improve their earnings forecast accuracy, reduce bias in their reports, raise investor awareness of the firm, improve stock price liquidity, and lower capital costs. See Mendelson (1986), Merton (1987), Walther (1997), Hayes (1998), Mikhail et al. (1999), Kothari (2001), Baker et al. (2002), Hong and Kubik (2003), Cowen et al. (2006), Frankel et al. (2006), Ljungqvist et al. (2006), Lehavy and Sloan (2008), Demiroglu and Ryngaert (2010), and Mola et al. (2010).
6. The model has one other pure strategy equilibrium under our rational expectations assumption that we do not take up as it is trivial, having no holding and the stock price equals V, independent of the allocation.
7. In the real world we do observe some retail allocations. Such allocations can be justified by associated liquidity benefits and indirect fringe benefits (allocating to friends and families), which we do not model.

REFERENCES

Abreu, D. (1988). On the theory of infinitely repeated games with discounting. *Econometrica,* 56, 383–396.

Aggarwal, R. (2000). Stabilization activities by underwriters after initial public offerings. *Journal of Finance*, 55, 1075-1103.

Aggarwal, R. (2003). Allocation of initial public offerings and flipping activity. *Journal of Financial Economics*, 68, 111–135.

Aggarwal, R., Prabhala, N. R., & Puri, M. (2002). Institutional allocation in initial public offerings: empirical evidence. *Journal of Finance*, 57, 1421–1442.

Altınkılıç O., & Hansen, R. S. (2000). Are there economies of scale in underwriting fees? Evidence of rising external costs. *Review of Financial Studies*, 13, 191–218.

Asquith, P., & Rock, K. F. (2011). *A test of IPO theories using reverse mergers*. Manuscript. Massachusetts Institute of Technology; National Bureau of Economic Research.

Beatty, R., & Welch, I. (1996). Issuer expenses and legal liability in initial public offerings. *Journal of Law and Economics*, 39, 545–602.

Bhattacharya, U., Borisov, A., & Yu, X. (2014). Firm mortality and natal financial care. *Journal of Financial and Quantitative Analysis*, forthcoming.

Binay, M., Gatchev, V., & Pirinsky, C. (2007). The role of underwriter-investor relationships in the IPO process. *Journal of Financial and Quantitative Analysis*, 42, 785-810.

Booth, J. R., & Smith, R. L. (1986). Capital raising, underwriting, the certification hypothesis. *Journal of Financial Economics*, 15, 261–281.

Brealey, R., Myers, S., & Allen, F. (2013). *Principles of Corporate Finance*. McGraw-Hill.

Chemmanur, T. J., Gang H., & Huang, J. (2010). The role of institutional investors in initial public offerings. *Review of Financial Studies*, 23, 4496-4540.

Chen, H. C., & Ritter, J. R. (2000). The seven-percent solution. *Journal of Finance*, 55, 1105–1132.
Cliff, M., & Denis, D. (2004). Do IPO firms purchase analyst coverage with underpricing? *Journal of Finance*, 59, 2871-2902.
Cornelli, F., & Goldreich, D. (2001). Bookbuilding and strategic allocation. *Journal of Finance*, 56(2), 337–2,369.
Degeorge, F., Derrien, F., & Womack, K. L. (2010). Auctioned IPOs: The U.S. Evidence. *Journal of Financial Economics*, 98, 177-194.
Demiroglu, C., & Ryngaert, M. (2010). The first analyst coverage of neglected stocks. *Financial Management*, 39, 555–584.
Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies*, 51, 393-414.
Dunbar, C. G. (2000). Factors affecting Investment Bank Initial Public Offering Market Share. *Journal of Financial Economics*, 55, 3-41.
Eckbo, E., & Masulis, R. W. (1992). Adverse selection and the rights offer paradox. *Journal of Financial Economics*, 32, 293-332.
Eckbo, E. B., Masulis, R. W., & Norli, Ø. (2000). Seasoned public offerings: Resolution of the new issues puzzle. *Journal of Financial Economics*, 56, 251–91.
Ellis, K. (2006). Who trades IPOs? A close look at the first days of trading. *Journal of Financial Economics*, 79, 339–363.
Ellis, K., Michaely, R., & O'Hara, M. (2000). When the underwriter is the market maker: an examination of trading in the IPO aftermarket. *Journal of Finance*, 55, 1039–1074.
Fang, L. H. (2005). Investment bank reputation and the price and quality of underwriting services. *Journal of Finance*, 60, 2729-2761.
Fernando, C. F., May, A. D., & Megginson, W. L. (2013). The value of investment banking relationships: Evidence from the collapse of Lehman Brothers. *Journal of Finance*, Forthcoming.
Fortune. (2008, March 19). Visa IPO prices at record $17.9B. CNN Money.com.
Gillan, S. L., & Starks, L. T. (1999). Corporate governance proposals and shareholder activism: the role of institutional investors. *Journal of Financial Economics*, 57, 275–305.
Grossman, S., & Hart, O. (1980). Take-over bids, the free rider problem and the theory of the corporation. *Bell Journal of Economics*, 42-64.
Hanley, K. W. (1993). The underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics*, 34, 231-250.
Hanley, K. W., & Wilhelm, W. J., Jr. (1995). Evidence on the strategic allocation of initial public offerings. *Journal of Financial Economics*, 37, 239–257.
Hanley, K. W., Kumar, A., & Seguin, P. J. (1993). Price stabilization in the market for new issues. *Journal of Financial Economics*, 34, 177-198.
Hansen, R. S. (1988). The demise of the rights issue. *Review of Financial Studies*, 1, 289-309.
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., & Pinkerton, J. (1982). Direct equity financing, a resolution of a paradox. *Journal of Finance*, 37, 651-665.
Hansen, R. S., & Torregrosa, P. (1992). Underwriter compensation and corporate monitoring. *Journal of Finance*, 47, 1537–1555.
Hartzell, J. C., & Starks, L. T. (2003). Institutional investors and executive compensation. *Journal of Finance*, 58, 2351-2374.
Hayes, R. M. (1998). The impact of trading commission incentives on analysts' stock coverage decisions and earnings forecasts. *Journal of Accounting Research*, 36, 299–325.
Hellman, T., & Puri, M. (2002). Venture capital and the professionalization of start-up firms: empirical evidence. *Journal of Finance*, 57, 169–197.
Hoberg, G. (2006). The underwriter persistence phenomenon. *Journal of Finance*, 52, 1169–1206.

Jenkinson, T., & Jones, H. (2004). Bids and allocations in European IPOs. *Journal of Finance*, 59, 2309–2338.
Klein, B., & Leffler, K. (1981). The role of market forces in assuring contractual performance. *Journal of Political Economy*, 89, 615-641.
Kovner, A. (2012). Do Underwriters Matter? The Impact of the Near Loss of an Equity Underwriter. *Journal of Financial Intermediation*, 21, 507-5029.
Kreps, D., & Wilson, R. (1982). Reputation and Imperfect Information. *Journal of Economic Theory*, 27, 253-279.
Krigman, L., Shaw, W.H., & Womack, K.L. (1999). The persistence of IPO mispricing and the predictive power of flipping. *Journal of Finance*, 54, 1015-1044.
Krishnan, C. N. V., Ivanov, V. I., Masulis, R. W., & Singh, A. K. (2010). Venture capital reputation, post-IPO performance and corporate governance. *Journal of Financial and Quantitative Analysis*, forthcoming.
Lee, G., & Masulis, R. (2010). *Do underwriters or venture capitalists restrain earnings management by IPO issuers?* Unpublished working paper. University of New South Wales.
Lehavy, R., & Sloan, R.G. (2008). Investor recognition and stock returns. *The Review of Accounting Studies*, 13, 327-361.
Ljungqvist, A., Marston, F., & Wilhelm, W. J. (2006). Competing for securities underwriting mandates: banking relationships and analyst recommendations. *Journal of Finance*, 61, 301–340.
Ljungqvist, A. P., & Wilhelm, W. J. (2002). IPO allocations: Discriminatory or discretionary. *Journal of Financial Economics*, 65, 167–201.
Ljungqvist, A. P., & Wilhelm, W. J., Jr. (2003). IPO pricing in the dot-com bubble. *Journal of Finance*, 58, 723–752.
Loughran, T., & Ritter, J. (2004). Why has IPO underpricing changed over time? *Financial Management*, 33, 5-37.
McConnell, J. J., & Servaes, H. (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial Economics*, 27, 595–612.
Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *Journal of Finance*, 46, 879–903.
Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *Journal of Finance*, 42, 483–510.
O'Brien, P., & Bhushan, R. (1990). Analyst following and institutional ownership. *Journal of Accounting Research*, 28, 55–76.
Parrino, R., Sias, R.W., & Starks, L.T. (2003). Voting with their feet: Institutional ownership changes around forced CEO turnover. *Journal of Financial Economics*, 68, 3–46.
Ritter, J.R., & Welch, I. (2002). A Review of IPO Activity, Pricing, and Allocations. *Journal of Finance*, 57, 1795-1828.
Rock, K. (1986). Why new issues are underpriced. *Journal of Financial Economics*, 15, 187–212
Ross, S., Westerfield, R., & Jaffe, D. (2013). *Corporate Finance.* McGraw-Hill, 10th edition.
Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics*, 27, 472–512.
Shapiro, C. (1983). Premiums for high quality products as returns to reputations. *Quarterly Journal of Economics*, 98, 659-680.
Sherman, A. E. (2000). IPO's and long-term relationships: an advantage of book building. *Review of Financial Studies*, 13, 697–714.
Shivdasani, A. (1993). Board composition, ownership structure, and hostile takeovers. *Journal of Accounting and Economics*, 16, 167-198.
Smith, C. W., Jr. (1977). Alternative methods for raising capital: rights versus underwritten offerings. *Journal of Financial Economics*, 5, 273-307.
Stoughton, N., & Zechner, J. (1998). IPO mechanisms, monitoring, and ownership structure. *Journal of Financial Economics*, 49, 45–77.

Wall Street Journal. (1999). Goldman IPO lives up to expectations, posts 33% gain in first trading day. May 5.
Wall Street Journal. (2010, October 4). AIA IPO seeks $17.1 billion.
Wall Street Journal. (2013, November 7). Twitter's IPO Priced at $26 a Share.
Wall Street Journal. (2013, November 7). Twitter IPO: Relief, Riches and a $25 Billion Finish.
Wang, T., Winton, A., & Wu, X. (2010). Corporate Fraud and Business Conditions: Evidence from IPOs. *Journal of Finance*, 65, 2255-2292.
Washington Post. (1999, December 18). A digital age rite: the IPO roadshow.