Liquidity, Divergence of Opinion, and IPO Underpricing

James R. Booth
DePaul University
Department of Finance
College of Commerce
1 E Jackson Blvd.
Chicago, IL 60614
Tel: 312-362-7686
Fax: 312-362-6566
Email: jbooth3@depaul.edu

Lena C. Booth
Thunderbird School of Global Management and DePaul University
Department of Finance
College of Commerce
1 E Jackson Blvd.
Chicago, IL 60614
Tel: 312-362-7685
Fax: 312-362-6566
Email: lbooth@depaul.edu

JEL Classification code: G24; G32

Key words: Initial public offerings, underpricing, initial returns, divergence of opinion, ownership constraint, and liquidity requirements.

Current draft: January 2009

*The authors benefited from discussions with Edward Kane, Jay Ritter, Clifford Smith, and the seminar participants at DePaul University, Thunderbird School of Global Management, University of Hawaii at Manoa, University of Nevada at Las Vegas, Arizona State University, National University of Singapore, Nanyang Business School, and Hong Kong University of Science and Technology for their helpful comments on earlier drafts. We are grateful to Brian Adams for research assistance.

Liquidity, Divergence of Opinion, and IPO Underpricing

Abstract

We explain why initial underpricing of new issue exists globally and is not arbitraged away in an efficient market. We argue that initial underpricing is a natural by-product of liquidity-motivated ownership dispersion requirements and divergence of opinion. In our framework, as shares are widely distributed to achieve exchange listing and related liquidity creation, optimistic investors rationed at the offering will bid up the share price in the secondary market, hence generating initial underpricing. We predict that as the level of divergence of opinion about an issue increases, underpricing will increase. We develop several proxies of divergence of opinion to explain the level of initial underpricing. The empirical results strongly support the model.

Liquidity, Divergence of Opinion, and IPO Underpricing

Schwert (2003) notes that many apparent anomalies in financial markets tend to disappear as research increases market efficiency. However, initial return for new issues remains large in magnitude and highly predictable (Lowry and Schwert, 2004), despite extensive documentation about its existence in virtually all financial markets globally. In this paper, we provide a rationale for IPO initial underpricing that is consistent with efficient markets and rational behavior by all market participants. We argue that initial underpricing is a natural by-product of divergence of opinion about value and ownership dispersion constraints associated with going public. Our argument is consistent with the notion of Ritter and Welch (2002, pg. 1,803): "The solution to the underpricing puzzle has to lie in focusing on the setting of offer price, where the normal interplay of supply and demand is suppressed by the underwriter". Our explanation is not in conflict with existing theories, but can both explain the base level of initial underpricing for any new issue, and answer a number of troubling questions that cast doubt on the existing theories for this anomaly.

Our explanation hinges on a simple consideration frequently ignored in previous studies, i.e. firms go public to create a liquid market for their shares. Capital raising, while important, may be achieved through a number of other means such as using venture capital, bank loans, or private placements. However, liquidity creation can only be achieved through going public and it represents a crucial element in generating initial underpricing. Since stock exchanges directly benefit from listing liquid shares, they specifically require firms to have a minimum numbers of shares and shareholders in the public float to achieve initial and continued listing (see Fama and French, 2004). Similarly, investors require knowledge about where the shares will be traded (e.g. Nasdaq or New York Stock Exchange) so that they can assess potential secondary market liquidity when valuing shares. This means liquidity creation must be instantaneous and cannot be left to develop slowly over time. To achieve this, investment bankers must distribute shares widely in the offering and be cognizant of ownership

dispersion in the secondary market, consistent with their role as market makers (see Ellis, Michaely, and O'Hara, 2002). Divergence of opinion in the presence of ownership dispersion constraints cause the offer price to be determined by the assessed value of the marginal investor, which is below that of the average investor. Setting offer price below the assessed value of the average investor means that price will rise when secondary market trading occurs, due to portfolio shifts between less optimistic and more optimistic investors, resulting in IPO underpicing.

Our framework of initial underpricing shares some aspects of earlier studies examining the role of marginal opinion theory on the pricing of shares. By focusing on the role of the marginal investor, our work is similar to Shliefer (1986), Stulz (1988), and Bagwell (1991, 1992), among others. Applications of marginal opinion theory to IPOs include studies by Miller (1977) and Rock (1986). We differ in crucial ways from both because Rock (1986) focuses only on the offer price while Miller (1977) focuses on the secondary market price. We generalize the information framework in Rock (1986) and consider why the marginal investor at the offering will become inframarginal in the secondary market. At the same time, we show why the marginal investor in the secondary market, as described in Miller (1977), will be inframarginal at the offering. This results in a new rationale that is sufficiently general to explain the global patterns in initial underpricing.

While we cannot claim that our explanation is mutually exclusive of earlier explanations, we are able to address many related questions about the pricing of new issues that provide challenges to previous explanations. Perhaps the most general of these is that we predict initial underpricing regardless of the mechanism used to offer securities in different financial markets globally, since our explanation does not depend on agency costs, winner's curse, signaling, or compensation for other services. We predict that new issue underpricing will occur regardless of issue procedure or type of security. Second, we show that even though initial underpricing is predictable using publicly available information (see Lowry and Schwert, 2002 and Bradley and Jordan, 2002)), it will not be arbitraged away by issuers, investment banks, and/or investors. Third, incorporating divergence of opinion with ownership dispersion constraints also provides insights into why IPOs are occasionally withdrawn. Fourth, we also explain why the level

of initial underpricing changes over time and why it is rational for the number of firms going public to increase during times of large initial underpricing (see Lowry and Schwert, 2002). Finally, we provide a rationale for why the most underpriced issues are likely to be the most overvalued in the longer run. Correspondingly, we argue that practices such as "spinshares" and "laddering agreements" are a logical outgrowth of discretionary allocation procedures that are gaining popularity as bookbuilding expands globally.

Using a large sample of initial public offerings from the U.S., we empirically examine the relation between divergence of opinion and initial underpricing in the presence of ownership dispersion constraints. Since *ex ante* divergence of opinion is not directly observable, we develop both firm-specific and market-wide proxies. Among the firm-specific proxies, we expect that there is a greater divergence of opinion about potential growth options than about assets in place, and higher divergence of opinion is reflected in the difficulty of investment banks in the pricing of shares. Consistent with prediction, we find that those with higher divergence of opinion such as high-tech firms and firms with negative earnings prior to going public have greater initial underpricing. Firms that intend to use their IPO proceeds to repay or reduce debt (low divergence of opinion) experience lower level of underpricing than those that state other purposes as their use of proceeds. IPOs that experience filing price range revision and settle on a final offer price outside the filing price range also have greater underpricing. Similarly, issues with larger price revisions also experience higher underpricing. For proxies of market-wide divergence of opinion, we find that issues with higher cumulative NASDAQ returns 30 days prior, higher average underpricing 30 days prior, and higher mean and median implied market volatilities 30 days prior are each associated with higher underpricing. These results are consistent with the pattern of behavior described in Lowry and Schwert (2002) that initial returns are positively autocorrelated over time. They also strongly support our model prediction that IPO underpricing increases with the increase in the level of divergence of opinion among investors.

In the next section, we discuss the relation between divergence of opinion and uncertainty. This provides a basis for developing the salient features of the aggregate demand curve for shares at the initial

public offering. This is followed by a discussion of the impact of exchange listing requirements on the supply for shares at the IPO. Next, we bring these together and analyze the intersection of supply and demand at the offering and in the secondary market. This illustrates the impact of ownership dispersion constraints in the face of divergence of opinion. In Section III, we describe our data and test our explanation of initial underpricing based on both firm-specific and market-wide measures of divergence of opinion, and present the results. In Section IV, we summarize and conclude.

I. Ownership Dispersion Constraints, Divergence of Opinion, and IPO Underpricing

A. Asymmetric Information, Uncertainty, and Divergence of Opinion

Information plays a critical role in virtually all models of initial underpricing. In existing IPO literature, differences in opinion are assumed to derive from superior private information by one or more groups of participants: issuers, investment banks, and different investors. While we do not dispute that differential information will result in divergence of opinion, we follow treatments by Harris and Raviv (1993), Kandel and Pearson (1995), and Hong and Stein (2003), among others, in which divergence of opinion is derived from disagreement about value based on common information.[1] This view of uncertainty is consistent with Keynes (1937) and Williams (1938). When Keynes (1937) refers to uncertainty in the market, he means disagreement among investors rather than subjective doubt in the mind of an individual investor (see Tobin, 1958).[2]

This framework offers several advantages over the information asymmetry and the uncertainty explanations of IPO initial underpricing. Complications often arise in previous models when one considers the forces necessary to cause price to rise in the secondary market. First, consider the asymmetric information framework of Rock (1986). In his model, both the informed and uninformed

[1] This is also consistent with recent studies on the frictions associated with shorting stocks, especially for recently issued shares. See Duffie et. al. (2002), D'Avolio (2002), Geczy et.al. (2002), Houge et. al. (2001).
[2] We do not dispute that divergence of opinion can be derived from uncertainty about possible return distributions, as argued by Knight (1921). However, divergence of opinion can result in a downward sloping aggregate demand curve for a firm's shares even if individual investors do not have uncertainty about possible return distributions.

investors know their type and the uninformed investors have estimates of share values below those of the informed. The informed investors are assumed to be wealth constrained, and hence offer price is lowered to attract the uninformed investors to purchases shares. This, however, ignores the secondary market forces needed to move prices to equilibrium. Since the more optimistic informed investors in Rock (1986) are wealth constrained, who will purchase shares at a higher price to generate initial underpricing?[3] Our model, alternatively, answers both questions on why offer price has to be lowered and why prices rise in the immediate secondary market. In our framework, we do not assume that investors are wealth constrained since a typical IPO is small and an institutional investor could easily purchase the entire issue. We assume that divergence of opinion causes the aggregate demand curve for the IPO shares to be downward sloping. Since the most optimistic investors must be rationed in the offering to meet listing requirements and to improve secondary market liquidity, offer price has to be set below the market clearing price. When secondary market trading begins, the more optimistic investors will buy shares from the less optimistic ones, causing price to rise, thus generating initial underpricing.

Second, our model does not rely on intertemporal changes in the level of uncertainty to produce price increases in the secondary market. Beatty and Ritter (1986) and Houge, et. al. (2001) argue that underpricing is used to compensate investors for bearing the uncertainty associated with new issues. These studies appear to suggest that uncertainty is resolved in the first day (or typically in the first few minutes) of trading, as investors who buy shares in the immediate secondary market do not appear to require the same premium for uncertainty. In our framework, the duration of the divergence of opinion is not crucial. We only have to assume that divergence of opinion exists at the IPO.

Finally, we offer an explanation for underpricing that is fundamentally different from that of Miller (1977). Miller (1977) asserts that security prices are high when the level of divergence of opinion is high, and they tend to drift down over time as divergence of opinion dissipates. In his framework, divergence of opinion does not automatically imply initial underpricing. Underpricing results from

[3] One possibility is that a third group of investors, either informed or uninformed, step in to bid up prices in the secondary market. However, this raises the question as to why shares were not allocated to these investors initially, thus avoiding underpricing. In this case, the Rock (1986)'s model collapses to the agency model of Baron (1982).

investment bankers incorrectly estimating the level of divergence of opinion as they consistently choose publicly traded firms (with lower divergence of opinion) as pricing comparables. His investment banker incompetence explanation represents a form of repeated pricing error, and it suggests that investment bankers do not learn from their mistakes. Moreover, his explanation is not satisfying in the global IPO context where investment bankers play a limited role in setting the offer price. We, on the other hand, focus on why allocation restrictions cause offer price to deviate from secondary market price, regardless of the role of the investment banker. We argue that even if the investment banker correctly assesses the demand for an issue, initial underpricing will still be present. In our framework, the presence of ownership dispersion constraints in an environment where investors disagree about value is the source for initial underpricing.

B. Ownership Dispersion Constraints and the Aggregate Demand Curve

Having defined the form of disagreement among investors, we can now derive the aggregate demand curve for a particular IPO in the presence of ownership dispersion constraints. For simplicity, we assume that investors are risk neutral in their demand for shares and their opinions about value are drawn from a normal distribution.[4] As in Williams (1938), we assume each investor has a perfectly elastic demand curve at prices below his/her subjective assessed value. However, the market demand curve slopes down because investors have heterogeneous opinions about the asset values. An implicit assumption in previous studies on divergence of opinion is that wealth constraints limit the amount of each security an investor can purchase. For example, Miller (1977) assumes investors can only afford one share in the secondary market (he does not consider the initial offering). He concludes that if $N>1$ shares

[4] With risk neutrality, investors' individual demand curves are perfectly elastic at prices equal to or below their assessed value of the shares. If we allow any form of risk aversion, their demand curves and hence the aggregate demand curves will become more inelastic.

are available, the presence of divergence of opinion means that the secondary market price will be set by the N investors who are the most optimistic about value.[5]

We do not assume that wealth constraints limit investors to purchase a single share in either the initial offering or the secondary market. This is because issue proceeds are sufficiently small that a single large institutional investor could easily afford an entire issue.[6] However, we do impose an ownership dispersion constraint for the IPO shares that is necessary to achieve exchange listing as this constraint is present in virtually every primary market. This means a successful public offering requires that the aggregate demand curve be comprised of sufficient number of individual demand curves (investors) with opinions of value greater than or equal to the minimum price at which the original owners are willing to sell the shares. This constraint influences both supply and demand at the offering and thus causes the intersection to occur below the unconstrained equilibrium.

In Figure 1, the aggregate demand curve for the IPO shares of a given firm is represented by *DD*. Each investor has an individual demand curve representing a different valuation. The aggregate demand curve is downward sloping representing the divergence of opinion among investors. When there is a higher level of divergence of opinion, the aggregate demand curve will be more inelastic.

Insert Figure 1 Here

C. The Liquidity Constrained Supply Curve of New Shares

In developing the supply curve for shares, we need to keep in mind that going public means offering shares in a very specific way, i.e. the ownership allocation is restricted. Even if we assume the issuer does not care about ownership dispersion for retaining control (see Brennan and Franks, 1997), the stock exchanges impose restrictions on both the minimum number of shares and shareholders in the

[5] In traditional auction theory, it is usually assumed that the number of investors exceeds the available supply of the asset being auctioned and that only the highest bidders will receive the asset.
[6] In the U.S., one effectively becomes an insider if his/her ownership exceeds 5% of a firm's shares. Therefore, an investor will typically not seek to purchase more than 5% of a firm's shares unless he/she is seeking control.

public float a firm needs to have in order to qualify for listing.[7] These considerations are generally not addressed in explanations of IPO underpricing. In other words, when firms choose to go public, price is not their only consideration. The decision to go public requires the belief that shares can be sold to a dispersed investor base and still receive the minimum price required by the issuer. For the issuer, this means that the decision to go public shifts from the simple question of "how highly valued are our shares?" to "how highly valued are our shares by at least the minimum number of investors?" This suggests that the supply curve for IPO shares must reflect on the minimum number of shares and the number of investors who receive an allocation. The supply curve where quantity represents the number of investors (N) given a minimum number of shares offered (S_{min}) is in Figure 1, and is determined by the following conditions;

(1) $N|S_{min} >= N_{min}|S_{min}$ *if* $OP>P_{min}$ and $N>=N_{min}$ potential shareholders;

(2) $N|S_{min} = 0$ if $OP>P_{min}$ and $N< N_{min}$ potential shareholders;

(3) $N|S_{min} = 0$ if $OP< P_{min}$ and $N>=N_{min}$ potential shareholders; or

(4) $N|S_{min} = 0$ if $OP< P_{min}$ and $N<N_{min}$ potential shareholders.

The above constraint can be illustrated by the minimums set by exchanges listed in the U.S. The minimum number of public shares required for listing is typically 1.1 million (S_{min}). Thus, the supply of shares will be either 0, or 1.1 million shares or more. Additionally, the public float portion of these shares must be owned by at least 400 investors for NASDAQ NMS listing (2,000 investors for NYSE listing).[8] This means that these 1.1 million shares have to be issued to at least 400 investors (N_{min} investors) in order to be qualified for listing at NASDAQ NMS. If we go beyond the exchange minimums for liquidity purposes, the number of investors will have to be even greater, i.e. $N>N_{min}$.

In Figure 1, we see that the current owners decide to go public only if the demand curve for their shares is such that they can receive an offer price greater than or equal to P_{min} while simultaneously

[7] In the U.S. the securities and exchange commission mandates that the prospectus list the market on which the shares will be traded.

[8] The minimum number of round lot shareholders required for NASDAQ NMS listing under certain standard was 800. As of April 2003, all the standards for NASDAQ NMS have a minimum of 400 shareholders and 300 shareholders for NASDAQ Small-Cap.

distributing the shares to N_{min} investors. If they go beyond the minimum exchange requirements on the number of investors to create additional liquidity (i.e. supply curve $N|\ S_{min}$), they will need additional demand, or alternatively, they will have to lower the offer price (from *OP to OP'*). Issuing shares to more than the minimum number of investors is necessary to ensure continued listing. That is because the minimum number of shareholders needed for continued listing in NASDAQ NMS is also 400. If shares were offered to only 400 investors, and if an existing shareholder sells all his/her shares to another shareholder in the secondary market, the firm would have technically violated the minimum requirement on the number of shareholders.[9] In Figure 1, the maximum offer price is determined when the aggregate demand curve intersects the supply curve with the minimum number of shares and minimum shareholders. With demand at DD, offering to more than the minimum number of investors means the offer price have to be lowered.[10]

The decision to withdraw an offering is also influenced by the same considerations. We illustrate that in Figure 2. We first assume that divergence of opinion is relatively low, as illustrated in the aggregate demand curve DD. At $N|S_{min} > N_{min}|S_{min}$, the current owners of the firm will choose to go public and sell a fraction of the firm because *OP* is above P_{min}. This is possible because there are at least $N>N_{min}$ investors who are willing to pay a price equals to *OP*. If the current owners cannot receive at least P_{min} at the minimum level of liquidity desired, they will choose not to go public, or if they have previously decided to start the going public process, they will withdraw the issue. As illustrated in Figure 2, this may happen when there is a higher level of divergence of opinion, represented by the steeper aggregate demand curve *D'D'*. (As mentioned earlier, $N|S_{min}$ is required to go public to ensure continued listing.) This means there are not enough investors who are willing to pay P_{min} (i.e. $N<N_{min}$ investors) for the

[9] It is not necessary to offer more than the minimum number of shares to ensure continued listing for NASDAQ NMS. In fact, when shares change hands, the number of shares in the public float remains the same. Even if the firm were to buy back some shares later, it will still be complying with the exchange listing requirements as the number of shares needed in the public float to ensure continued listing is only 750,000.

[10] We exclude at this stage the notion in Booth and Chua (1996) that increasing the supply of shares may cause investors to value them more highly due to increased expectations regarding liquidity.

shares, thus the firm will have to withdraw the public issue.[11] The firm can proceed with selling part of the firm to a smaller group of investors who value it more highly in a private transaction. This may explain why the vast majority of firms that withdraw an IPO do not come back to the market at a later date.[12] The above argument implies that as divergence of opinion increases, the likelihood of achieving the necessary conditions for the firm to go public will be reduced.

Insert Figure 2 here

D. Necessary Conditions for a Price Increase in the Secondary Market

To illustrate how restriction on the distribution of shares is crucial to our explanation of initial underpricing, we show that only in the rarest of circumstances will offer price represent the equilibrium price in the secondary market (ignoring price stabilization efforts by investment banks). To illustrate the relation between the ownership-constrained offer price and the secondary market price, we consider a simple example of a firm seeking to go public and selling two shares (public float). Two investors A and B value the shares as V_A and V_B. The relation between offer price (*OP*) and the secondary market price (*MP*), and thus underpricing or initial returns (*IR*) will depend on several conditions:

(1) If $V_A = V_B$, then *OP=MP, IR=0;*

(2) If $V_A > V_B$, and there is a wealth constraint (i.e. each investor can only afford one share) at the initial offering and in the secondary market, then $OP=V_B=MP$, *IR=0;*

(3) If $V_A > V_B$, there is no wealth constraint, and the ownership dispersion constraints are not binding at the offering, i.e. the investor who values the issue the most is allowed to purchase both shares at the offering, then $OP=V_A=MP$, *IR=0;*

[11] If the investment banker decides to go ahead with the issue by offering the shares at P_{min} and absorbing the unwanted shares, price will drop in the secondary market and results in overpricing. This is done only if the investment banker estimates that the loss from absorbing the unwanted shares is less than the forgone underwriter spread had the issue been withdrawn, ignoring any reputation effects.

[12] Evidence by Dunbar and Foerster (2002) shows that only 9% of firms that are withdrawn attempt second public offerings at a later date. It is likely that many of these firms were subsequently sold in private transactions.

(4) If $V_A > V_B$, there is no wealth constraint, and ownership dispersion constraints are binding at the offering but are relaxed in the secondary market, then $OP=V_B<MP$ *and* $IR>0$.

In the first case, there is no divergence of opinion among the investors. Even if demand exceeds supply (due to ownership restrictions or other reasons), the issue will be fairly priced (the demand curve is perfectly elastic and OP=MP).[13] This is the standard finance model. In case (2), because of the wealth constraints in both the initial offering and the secondary market, each investor can only afford one share. There is divergence of opinion as $V_A > V_B$. The offer price will be set at V_B to clear the market. Each investor will be allocated one share. The investor who values the share higher (investor A) cannot drive up the price in the secondary market because of the wealth constraint. Therefore, $OP=MP$ and $IR=0$.[14] In case (3), wealth constraint is not binding and each investor (*A or B*) can afford to buy both shares. The offer price will be set at V_A, the market clearing price, and investor A will buy both shares. Therefore, $OP=MP$ *and* $IR=0$.

Case (4) accounts for both divergence of opinion and ownership dispersion constraints. The wealth constraint is not binding but ownership constraints at the offering will result in rationing, causing the shares not to be held by only the most optimistic investor. In this case, investor A is willing to buy both shares at V_A, but is rationed to buy only one. To comply with this constraint, i.e. to sell shares to both investors *A* and *B,* offer price has to be set at V_B or below in order to entice investor *B* to participate in the offering. At V_B or lower, both investor *A* and *B* would like to buy 2 shares. Because they are rationed to only one share each, investor *A* will bid up the price in the secondary market when the ownership dispersion constraint is relaxed, thus resulting in initial underpricing ($OP<MP$ *and* $IR>0$). In our framework, investors A and B have different estimates of value because they have heterogeneous opinions. Unlike the asymmetric information models such as Rock (1986) and others, we do not assume

[13] We ignore the case described in Benveniste and Spindt (1989) that investors withhold information useful for pricing. Including this behavior will only add to initial underpricing.

[14] In a discriminatory price auction, investor *A* will buy at V_A and investor *B* will buy at V_B. Because of wealth constraint, they cannot drive up the price in the secondary market either.

that *B* is less informed than *A* (or visa versa) and thus adverse selection in allocations does not affect behavior.

We argue that case (4) represents the most realistic scenario of the IPO market. Evidence from IPO distributions suggests that even institutional investors disagree about the value of IPOs.[15] Wealth constraint is usually not binding as one or a few institutional investors can easily buy up the entire issue. As we previously noted, going public is as much a liquidity event as a capital-raising event. Thus, secondary market trading is important to the issuer, investment banker, and the exchange chosen for listing. This explains why exchanges set their own limits on both the minimum number of shares and shareholders. Because of ownership dispersion constraint, offer price has to be set at or below the market clearing price, resulting in an oversubscription for the shares. With secondary market trading, the price will be bid up, which results in positive initial underpricing. This suggests that initial underpricing is unintentional and is a natural by-product of divergence of opinion and ownership dispersion constraints. It cannot be arbitraged away by issuers, investment banks, and/or investors even when the level of divergence of opinion can be predicted.

In summary, to achieve zero initial underpricing (i.e. offer price equal to the secondary market price), one or more of the following conditions must hold. First, no divergence of opinion exists among investors. Second, a wealth constraint is binding, both at the offering and in the secondary market. This would also mean there is no trading in the secondary market until either new information arrives or some investors holding the shares receive a liquidity shock. The notion of lack of divergence of opinion about value (which results in a perfectly elastic aggregate demand curve) or a binding wealth constraint is unrealistic for IPOs. Third, there is no restriction on the concentration of ownership such that the single most optimistic investor gets the entire offering. If this occurs, the firm does not go public but simply sell the ownership stake to the highest bidder in a private transaction.

[15] See Lipman (1994)'s discussion of the Microsoft IPO pricing.

E. Why Higher Divergence of Opinion Results in Greater Underpricing?

As we have illustrated how underpricing occurs in our framework, we next consider the relation between the level of divergence of opinion and the amount of underpricing. In Figure 3, we illustrate this by examining the impact of different levels of divergence of opinion about value. The aggregate demand curve for high level of divergence of opinion is *D'D'* and that for low level of divergence of opinion is *DD*. The offering is successful under both levels since the constrained market clearing offer prices are above P_{min}. We also assume that the ownership dispersion is beyond the exchange's mandated minimum requirement, i.e. the supply curve is $N|S_{min}$. At this supply curve, the offer price will be *OP*. When the ownership constraint is relaxed, less optimistic shareholders may sell shares to the more optimistic shareholders who receive only partial allocations at the IPO. In this case, trading price will rise to where aggregate demand intersects supply at $N_{min}|S_{min}$.[16] In the case of low divergence of opinion, the price run-up will be less (from *OP to* MP_D) than in the case of high divergence of opinion (from *OP to* $MP_{D'}$). This suggests that in successful offerings, initial underpricing increases with the level of divergence of opinion.

Insert Figure 3 Here

Besides divergence of opinion, the variation in initial underpricing can also result from how the shares are being rationed at the offering. If more shares are allocated to investors with higher valuation (typically in an auction framework), initial underpricing will be less compared to if all investors receive the same number of shares or if more shares are allocated to investors with lower valuation (possibly in the lottery or bookbuilding framework). Because levels of divergence of opinion vary over time, our model is also capable of explaining the time-series differences in IPO underpricing.

The explanation thus far (and many previously developed explanations) seems to treat initial underpricing as a direct cost to the issuer at the time the shares are sold. This, of course, is not always the

[16] Price may rise under two other scenarios with constant ownership dispersion. First is that investors who are completely rationed in the IPO purchase in the secondary market. Second, if existing shareholders who are less optimistic sell part of the allocations received at the offering to other more optimistic shareholders.

case. In Miller (1977)'s model, higher level of divergence of opinion leads to a higher secondary market price. His argument is due to the assumption that the marginal investor holds an opinion of value above the average of all possible investors for these shares. Here we have illustrated that higher divergence of opinion leads to larger initial underpricing. As long as $\partial D'D'/\partial P > \partial DD/\partial P$, initial underpricing will be a positive function of divergence of opinion.

F. Relation between Initial Underpricing and Issue Proceeds

Our result suggests a more complex relation between initial underpricing and issue proceeds than that discussed in earlier studies. Previous studies have defined initial underpricing as money left on the table (see Loughran and Ritter (2002)), i.e. the issue proceeds could have been larger if the issue was not underpriced. Our analysis suggests that at least part, if not all, of this initial underpricing is a natural consequence of divergence of opinion. This is illustrated in Figure 3. Given the supply curve $SB|S_{min}$, the firm issues the minimum number of shares. Hence, the offer prices and issue proceeds are the same under both levels of divergence of opinion. However, initial underpricing is much larger when the level of divergence of opinion is high (aggregate demand curve *D'D'*) than when the level of divergence of opinion is low (aggregate demand curve *DD*). This suggests that higher initial underpricing may not be costly to the issuing firm in terms of proceeds forgone. Figure 3 illustrates only one possible scenario where the offer price is the same for both levels of divergence of opinion. However, depending on the positions of the aggregate demand curves, higher level of divergence of opinion may lead to higher offer prices and larger amount of issue proceeds, and result in higher initial underpricing.[17] This relation between level of divergence of opinion and issue proceeds represents an alternative rationale to the irrational issuer explanation suggested by Brealey and Myers (1996 page 389). It also provides a rationale for why many firms choose to go public during times of large initial underpricing (see Lowry and Schwert, 2002).

[17] If the demand curves are positioned in such a way that the intersections with supply curve occur to the right of the crossover point of the two demand curves, higher level of divergence of opinion will lead to lower offer price and lower issue proceeds, but higher initial underpricing.

We next consider how divergence of opinion impact initial underpricing under alternative security issuance and share allocation mechanisms. This also provides a basis for discussing the changing nature of initial underpicing across different time periods and markets with varying liquidity constraints.

II. The Impact of Divergence of Opinion Under Alternative Security Issuance and Allocation Mechanisms

Many explanations of IPO underpricing are specific to the share allocation method used. This means that most explanations of underpricing are derived from the characteristics of the issuing procedure and the institutional features of the IPO market. The important question remained unanswered in previous studies is that why underpricing exists under all allocation schemes and across all time periods. Our model suggests a rationale for a baseline level of underpricing in any primary market at any time, and it also makes predictions about differences in initial underpricing across time and issuing procedures. In fact, our explanation suggests that when holding ownership dispersion constraints constant, periods that have a large number of IPOs with high level of divergence of opinion are associated with large initial underpricing, and *vice versa*. Holding divergence of opinion constant, markets where liquidity is less of a concern are expected to experience less initial underpricing.

A. Evidence from the Primary Market for U.S. Treasuries

To gain additional insight into why firms going public experience initial underpricing, we provide evidence that virtually all other primary issues of securities are underpriced initially. To illustrate this, we first consider evidence from the U.S. Treasury auction market. Studies of this market suggest that divergence of opinion and ownership dispersion constraints play an important role in generating initial underpricing in the new issues of Treasuries.

In considering the Treasury auction market, we note that it has some similarities to the IPO market. First, there are 38 primary dealers who are permitted to submit competitive bids for securities.

There are also retail customers who will submit non-competitive bids (with limits on the size of each of these bids). Competitive bids submitted include price and quantity demanded. This demand schedule will be filled from high price (low yield) to low price (high yield). Non-competitive bidders receive their quantity demanded at the filled weighted average price of successful competitive bids. Thus, in this market, the competitive bids determine the auction clearing price for the non-competitive bid investors. Studies of T-bill auctions by Cammack (1991) and Spindt and Stolz (1992) show two interesting pricing features in this market. First is that competitive bids are dispersed, reflecting divergence of opinion about the value of these securities. Second, the auction clearing price rises on average in the secondary market, i.e. the auction clearing price is underpriced. Thus, we have a security that, for all practical purposes, is risk free, i.e. its cash flows are certain. Yet investors disagree about its value. Divergence of opinion plays a role in underpricing only when the most optimistic bidder is not awarded the entire issue. In the Treasury auction market, no single bidder is awarded the entire issue. Treasury rules influence the initial ownership dispersion by limiting the size of the winning competitive and non-competitive bids in the auction.[18] The constraints imposed on competitive and non-competitive bidders suggest that the Treasury is concerned about the secondary market liquidity of their debt. Since rationed bidders can fulfil their excess demand in the secondary market, this will have the effect of raising secondary market prices. While a Treasury auction is technically an auction of new bills (primary securities), virtually identical instruments are already trading in the secondary market. These instruments take the form of previously issued bills, notes, and bonds with identical maturities, and securities offered through a when issued market before the auction. Not surprisingly, the amount of underpricing for Treasury bill is low compared to the uncertain world of the IPO market. A more surprising finding is that underpricing exists in the Treasury bill market at all.[19]

[18] See U.S. Treasury 356.22 Limitations on Auction Awards. Non-competitive bidders are limited to $1 million for bills and $5 million for notes and bonds. Competitive bidders are limited to purchase not more than 35 % of the public offering less their net long positions as reported under 356.13, which is basically their positions in similar instruments in the secondary market.

[19] The presence of initial underpricing for new T-bills in a market with perfect substitutes appears to contradict the notion of lack of market spanning as a reason for initial underpricing (see Mauer and Senbet (1992)).

From this comparison with the Treasury auction market, one can only conclude that underpricing should be more severe in the issuance of securities with less certain cash flows, especially in light of more rigid stock exchange restrictions on initial ownership dispersion. While the focus here has been on Treasury securities, virtually every study of the pricing process of corporate debt finds the same conclusions about initial underpricing.[20]

B. Evidence from Alternative Issuing Methods

The IPO markets most closely related to the auction framework discussed above are those in Taiwan and Japan. As described in Liaw, Liu and Wei (2000), new issues offered in Taiwan are in a discriminatory price auction similar to the U.S. Treasury securities. Ownership dispersion is maintained in this market by restricting individuals to no more than 3% of available shares. Another restriction is that usually only 50% of the available shares are distributed through the auction. The remaining available shares are offered to the public about 4 weeks after the results of the auction are published. In this market, the investment banker plays virtually no role in setting the offer price. However, because of divergence of opinion among investors and the ownership dispersion constraints, prices paid by an average wining bidder rise 7.83% in the post market.

Similar underpricing evidence for IPO markets with discriminatory price auctions also exists in Japan. Kutsuna and Smith (2003) document that Japanese regulations significantly limit the maximum number of shares each bidder is allowed to purchase in the discriminatory auction. This ownership dispersion constraint means that shares have to be allocated to bidders with lower bid prices, until the entire allocation is distributed or the floor bid value is reached. The combination of divergence of opinion (as evidenced from the divergence of bids) and the imposed ownership dispersion constraints explains why IPO underpricing exists during the discriminatory auction regime in Japan. In September 1997,

[20] See, for example, Ederington (1974), Weinstein (1978), Booth and Smith (1986) Datta *et. al.* (1997), among others.

Japan introduced the bookbuilding method as an alternative to the auction method in the IPO market.[21] Kaneko and Pettway (2002) and Kutsuna and Smith (2003) find that IPO underpricing continues to exist, even though its magnitude is significantly larger under the bookbuilding method than under the discriminatory auction method. The differences in average underpricing under both methods are also consistent with our model prediction. We argue that in the presence of divergence of opinion and ownership restriction, underpricing will be lower if more shares are allocated to bidders with higher valuation, compared to if all investors receive the same number of shares or if more shares are allocated to investors with lower valuation. In a discriminatory auction, shares are allocated to the highest bidders first, hence it is not surprising that we observe lower underpricing for these IPOs.

Similar evidence exists for IPOs in France offered through different selling mechanisms. Derrien and Womack (2003) examine three IPO share allocation mechanisms that are the most common in France: the fixed-price offer, the uniform price auction, and the bookbuilding.[22] In the fixed price offer, the issuer and the underwriter jointly determine the offer price and investors place orders for shares at this fixed offer price. In the uniform price auction, investors submit price/quantity bids. These bids are used to compute a cumulative demand curve that is subsequently used to determine the offer price and the maximum price.[23] Shares are then allocated, on a pro rata basis, to all the investors who place bids between these two prices. Derrien and Womack (2003) find that underpricing exists for IPOs using all allocation mechanisms, with the pure uniform price auction exhibits the lowest average underpricing. Their evidence is again, consistent with our model prediction.

Uniform price auction similar to that used in France is also used in Israel. Amihud, Hauser and Kirsh (2003) document that 86% of their sample IPOs in the Tel Aviv Stock Exchange use sealed-bid uniform-price auction with specified minimum and maximum prices. During their sample period from

[21] Even though the auction method is not formally abandoned, virtually all IPOs after that period use the bookbuilding method to determine their offer prices.
[22] Fixed-price offer has lost its popularity in recent years. The uniform price auction and the bookbuilding are now the dominant mechanisms used in French IPOs.
[23] Maximum price is chosen so that "unrealistic bids" (bids well over the clearing price) can be eliminated. This is done to prevent investors from placing very high bids to ensure they get share allocation.

November 1989 to November 1993, 77% of the auctioned IPOs had the maximum price as the offer price. This suggests that the offer price of Israel IPOs is constrained, and it is inevitable that initial underpricing exists. The initial returns of IPOs average about 12% in Israel.

The presence of divergence of opinion about value in IPOs is clearly illustrated in the auction allocation mechanism, whether discriminatory or uniform price. However, evidence about disagreement in value also exists in IPOs that use the bookbuilding method. Cornelli and Goldreich (2003) analyze the order book of a major European investment bank that underwrites 63 international equity issues. This order book contains information on each bid submitted, the identity of the bidder, the number of shares (or dollar amount) requested, and any limit price. After bids are collected from institutional investors, the investment banker aggregates them into a demand curve, and chooses the final offer price. The demand curve is downward sloping, indicating divergence of opinion about the value of shares. Cornelli and Goldreich (2003) also note that the offer price is not set at the point where aggregate demand equals supply, but at below the market-clearing price. This suggests that offer price is constrained to ensure wide distribution of the shares, to both institutional and retail investors. The average first day returns that are benchmarked to the domestic stock market indices average 7.57% for IPOs and 3.27% for the seasoned equity offerings. Their results strongly support our model that underpricing arises from the interaction of divergence of opinion and ownership dispersion constraints.

Given that divergence of opinion exists in IPOs, we can also illustrate how ownership dispersion constraints result in IPO underpricing in the German Neuer Markt, a market segment of the Frankfurt Stock Exchange. The Neuer Markt is similar to the Nasdaq in the U.S. in types of firms listed, and most companies go public using the bookbuilding method. The difference is that an active market for when-issued trading of IPO shares, also known as the "grey market", exists in Germany. Grey market trading starts after the filing price range is set, and ends right before the pricing of the IPO shares. Since this market is fairly active and liquid, the last market price before the close of this market should be reflective of what investors are willing to pay for the IPO shares. However, according to Aussenegg, Pichler and Stomper (2003), the final offer price set by underwriters is on average about 22% lower than the last grey

market price. We argue that this is necessary to ensure that the IPO shares are widely distributed. In the grey market, there is no ownership restriction on shares because the market is not regulated. Therefore, the grey market price reflects the assessed value of an average investor. To satisfy ownership dispersion constraints for going public, shares have to be priced at the assessed value of the marginal investor, which is lower than that of an average investor. Hence, we observe the phenomenon of investment banker setting the offer price significantly below the last grey market price in Germany. Aussenegg, Pichler and Stomper (2003) also report that the average underpricing (from offer price to first day close) is about 45% on average. This is consistent with our model prediction that IPO share price rises in the secondary market when the ownership dispersion constraints are relaxed.

In summary, the findings from different issuing procedures and types of securities provide striking evidence consistent with our model. While we do not dispute that other explanations may contribute to initial underpricing, our model provides the baseline underpricing that exists in all issuing procedures and securities. In the next section, we empirically examine the role that divergence of opinion plays in the initial underpricing of IPOs in the U.S. market. This market uses bookbuilding method of initial underpricing virtually exclusively. Thus our findings related to divergence of opinion are expected to transcend this type of market structure and apply to IPOs globally.

III. Empirical Analysis

A. Sample and Data Description

Our sample of IPOs from 1988-2000 is obtained from the Thomson Financial Securities Data new issues database. IPOs with an offer price below $5.00 per share, unit offers, REITs, closed-end funds, banks and S&Ls, ADRs, and partnerships are excluded. Our sample does not include best efforts offers because they are typically very small and are not covered by Thomson Financial. The initial sample consists of 4,385 IPOs that have been issued during the 13-year period.[24] We excluded 63 issues where

[24] We start our sample from 1988 because the price range revision data is largely not available in Thomson Financial before that.

we could not determine whether the price ranges were revised up or down. These are the issues in which the price ranges have been either narrowed or widened. This reduced the sample to 4,322. The sample is further reduced to 3,406 due to missing data in the variable firm's earnings prior to IPO. The final sample with complete data is 3,010 IPOs, after adjusting for additional missing data in the variables such as ratio of retained shares to public float, underpricing, and the intended use of proceeds.

Underpricing is defined as the percentage change between the offer price and the first day closing market price of the IPO. Average underpricing is the equal weighted average of the individual IPO underpricing each month. In the cross-sectional analysis, we use variables shown in previous studies to be important in explaining IPO underpricing as control variables. **Year Trend** is a variable taking on values of 1 to 13 for years 1988 to 2000. As there is a wide variation in underpricing each year, especially in the mid to late 1990s, we control for the trend in the cross-sectional regressions.[25]

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

Ln(Proceeds) represents the natural logarithm of the amount of proceeds raised in the IPO. This variable has traditionally been used to proxy for risk of the issue. IPOs with large proceeds are considered to be less risky and hence command a lower level of underpricing. We also use **Offer Price** as a control variable in the multiple regressions. Previous studies have shown that issues with higher offer price tend to have higher underpricing.

For the underwriter's rank, we follow the ranking described in Appendix 3 of Loughran and Ritter (2003). They started their rankings with rankings from Carter and Manaster (1990) and Carter,

[25] To check for robustness, we also use a dummy variable for each year. The results are very similar.

Dark, and Singh (1998) and created rankings for 1992-2000 using the same methodology. The resulting rankings are on a scale of 0 to 9, with a higher number denotes a higher ranking. In general, a ranking of 8 and above is considered to be high-ranked, prestigious national underwriters. We use this criterion to separate high-ranked investment bankers from the low-ranked ones. In the multiple regressions we use **High-ranked** as a control variable to denote high-ranked underwriters. Starting from the underwriter certification hypothesis by Booth and Smith (1986), underwriter's rank has been widely documented to reduce underpricing in IPOs. However, studies by Beatty and Welch (1996), Cooney, Singh, Carter, and Dark (2001), and Loughran and Ritter (2003) have seen the negative relation reversed in the 1990s.

Overhang is the ratio of retained shares to the public float at the IPO. Bradley and Jordan (2002) document that share overhang predicts underpricing. One explanation is that when the number of shares issued in the IPO is small relative to the shares retained by pre-issue shareholders, the negatively sloped demand for the shares will push the aftermarket price up, resulting in higher underpricing. The higher aftermarket price can also result from the asymmetric information model argued in Leland and Pyle (1977). By selling a small fraction of the firm in the IPO, the insiders can signal that the firm is of high value and hence push the aftermarket price up. Barry (1989) and Habib and Ljungqvist (2001) suggest that the opportunity cost of underpricing to issuers is less if the share overhang is large. Loughran and Ritter (2003) argue that when the valuation and share overhang are high, issuers will not bargain as hard for a higher offer price and hence leave more money on the table.

We use several firm-specific variables to proxy for the level of divergence of opinion. The first proxy is **Firms with Loss. Firms with Loss** is a binary variable taking on a value of 1 if the firm has negative earnings the year prior to the IPO, and a value of 0 if the firm has positive earnings the year prior to the IPO. In previous studies, little attention has been devoted to whether firm goes public has positive or negative earnings. We believe that when a firm has no positive earnings prior to going public, the valuation of the firm is more difficult and there will be a higher level of divergence of opinion about its value. This is consistent with D'Avoli (2002)'s notion of using cash flow as a proxy for differences in opinion.

Tech Firms is a binary variable taking on a value of 1 if the firm is a high-tech firm, and a value of 0 if the firm is not a high-tech firm. We classify high-tech stocks based on Loughran and Ritter (2003) Appendix 4. These stocks largely fall under the 2-digit SIC codes equal to 35 (computer hardware), 36 (electronics and communications equipment), 38 (medical instruments and controlling devices), 48 (communications), and 73 (software). **Tech-Firms** is a variable that has been widely used in previous studies to explain IPO underpricing. However, none of those studies associates it with the level of divergence of opinion. In general, high-tech firms have more growth opportunities compared to non high-tech firms. Growth options are harder to value and are likely to result in greater divergence of opinion among the investors.

The third proxy for divergence of opinion is related to how the proceeds from IPO will be used. Using IPO proceeds for general corporate purposes (56%) and to reduce or payoff debt (33%) are the major reasons cited by firms going public. Other reasons cited include to finance projects or acquisitions, and for working capital or capital investment. We argue that if the proceeds are for repayment of debt (**Repay Debt Purpose**), divergence of opinion is likely to be less. This is because the issuing firm is not using the proceeds to undertake any new projects or expand existing projects that will likely increase or decrease the value of the firm. Thus, investors will have less divergence of opinion about the values of these firms.

The following proxies for divergence of opinion apply to IPOs under the bookbuliding method. The first is related to whether the preliminary filing price range of the IPO has been revised (**Revised**). **Revised** takes on a value of one if the price range is amended, and a value of zero otherwise. A preliminary price range is set before the investment bank starts the IPO bookbuilding process. During the bookbuilding process, the investment banker is likely to update his price estimates by revising the filing price range up (or down) when he determines that the demand of the issue is strong (or weak). The likelihood of a preliminary price range being revised up or down depends on the characteristics of the issue and the market conditions. We conjecture that when there is a high level of divergence of opinion, there is a higher tendency that the price range will be revised during the book building process.

A related variable used to proxy for divergence of opinion is whether the final offer price is out of the filing price range (**Out-of-range**). **Out-of-range** is a binary variable that takes on a value of 1 if the final offer price is out of the filing price range, and zero if the final offer price is in the range. For issues where the file price ranges have been revised, **Out-of-range** takes on a value of 1 if the final offer price is out of the last revised filing price range. When divergence of opinion is high, investment banker has to constantly update his estimate of value, hence there is a higher tendency that the final offer price will be out of the filing price range.

Besides the price range adjustment and weather the final offer price is outside the filing price range, we also look at the magnitude of the price revisions from the original mid-price to the final offer price. **Revision-Magnitude** is the absolute value of the final offer price less the original mid-price divide by the original mid-price. Original mid-price is the average of the high and low prices of the original filing price range. **Revision-Magnitude** is zero when the final offer price is equal to the original mid-price. **Revision-Magnitude** is expected to be high when divergence of opinion among the investors is high.

We use three variables to proxy for the market-wide divergence of opinion. First, we use the volatility index VIX, a daily index obtained from the CBOE websites. VIX is calculated by taking a weighted average of the implied volatility from eight calls and puts on the S&P 100 index, with thirty calendar days to expiration. We use **VIX-30days**, the median VIX 30 calendar days prior to the IPO date as a proxy for divergence of opinion.[26] We use the cumulative daily returns of NASDAQ stocks 30 calendar days (approximately 21 to 22 trading days) prior to the IPO date as another market-wide proxy of divergence of opinion (**NASDAQ-30days**). NASDAQ returns are obtained from CRSP. The cumulative NASDAQ return prior to the IPO has been used in previous studies in explaining IPO underpricing. For example, Bradley and Jordan (2002) and Loughran and Ritter (2003) find that when the

[26] For robustness check, we also use mean of VIX 30 days prior to the IPO date, VIX on the IPO date, mean and median of VXN 30 days prior to the IPO date. VXN is calculated using the same methodology as VIX, but based on the implied volatility of Nasdaq-100 Index (NDX) options. Since VXN is available only from 1995, forecast values based on a simple regression are used for 1988-1994. The coefficient estimates of the regression are obtained from regressing VXN on constant and VIX for the period 1995-2000. The results for all these measures are very similar.

cumulative NASDAQ return 15 trading days prior to the IPO is large, underpricing is high. We conjecture that when expected returns in the market are high, divergence of opinion is likely to be high. Another variable we use to proxy for market-wide divergence of opinion is the average underpricing for the firms going public in the 30 calendar days before the IPO date (**Underpricing-30days**). This variable is computed using the underpricing of IPOs in the sample. Bradley and Jordan (2002) find that when the average underpricing prior to the IPO increases, initial underpricing increases. We conjecture that if the average underpricing 30 calendar days prior to the IPO is high, the divergence of opinion in the market is likely to be high.

B. Empirical Results

Table I presents summary statistics of firm characteristics and underpricing each year during the sample period. The average IPO proceed is $71.42 million, with the last 3 years averaged over $110 million a year. The average offer price stays fairly stable from 1988-1998 but it jumps to over $14.50 in 1999 and 2000. The same pattern prevails in average underwriter rank. About 45% of the sample IPOs are backed by venture capital, with higher percentages in the early 1990s and in 1999 and 2000. While about 44% of the IPO firms report a loss in the year prior to going public, this percentage jumps to about 80% in 1999 and 2000. On average, 46% of the IPOs in the sample period are high-tech firms and about 33% of the firms intend to use the IPO proceeds to repay or reduce debt. Bradley and Jordan (2002) report that about 36% of their sample IPOs have their filing price ranges amended while we have a very similar percentage of 34%. On average, 32% of the IPOs have final offer prices either above or below the filing price range. As for average underpricing each year, our results are very similar to Loughran and Ritter (2003). They report an average underpricing of 18.9% from 1980-2000 while the average underpricing is 24.4% in our sample from 1988-2000.

In Table II, we compare issue characteristics and presents tests of mean differences between those with high versus low divergence of opinion. Using various measures of divergence of opinion, we find that issues with high divergence of opinion are more likely to be backed by venture capitalists than those

with low divergence of opinion. The differences are statistically significant at the 0.01 level for all the firm-specific measures. The results for issue gross proceeds are mixed. Issue proceeds are not statistically significantly different for firms with positive versus negative earnings prior to going public, for firms that use proceeds for debt repayment versus for other purposes, and for firms with or without preliminary filing price ranges revised. However, non high-tech firms and issues with final offer price out of filing price range have significantly larger proceeds. As for offer price, those issues with filing price ranges revised or with final offer price out of filing price ranges have significantly higher offer prices. Issues with proceeds used to repay debt also have a higher offer price on average compared to issues with proceeds used for other purposes. As for underwriter rank, issues exhibit a higher level of divergence of opinion have significantly higher ranking and have higher proportions of high-ranked underwriters in all but one measure. Issues with proceeds used to repay debt (low divergence of opinion) have a significantly higher average underwriter ranking than issues with proceeds used for other purposes. As for overhang (retained shares divide by public float), all measures of divergence of opinion show that a significantly higher overhang is associated with issues exhibiting higher divergence of opinion. Since high divergence of opinion issues have higher overhang and are more likely to be VC-backed, our findings are consistent with Bradley and Jordan (2002)'s finding that VC-backed IPOs have significantly higher overhang.

In Table III, we present the tests of mean differences in underpricing for IPOs with high versus low divergence of opinion. During the sample period 1988-2000, firms with negative earnings (**Firms with loss**) a year prior to their IPOs have an average underpricing of 38% compared to 16% for firms with positive earnings. The difference is statistically significant at the 0.01 level. These results are very similar to those reported in Ritter and Welch (2002) for sample period 1980-2001. Panel B shows that hig-tech firms (**Tech firms**) also have significantly higher underpricing than non high-tech firms. High-tech firms are underpriced 37% on average compared to 14% for non high-tech firms. Panel C shows that IPOs with proceeds used to repay debt are significantly less underpriced than those with proceeds used for other purposes (12% versus 30%). This result is consistent with low divergence of opinion leads to

lower underpricing. In Panel D, we show that IPOs with a revised filing price ranges are underpriced 38% compared to 18% for those without a revised price range. The difference is statistically significant at the 0.01 level. Similar pattern persists for IPOs that are priced out of the filing price range, i.e. those priced out of ranged are significantly more underpriced than those priced in range. These results are consistent with our model prediction that IPOs with high divergence of opinion have significantly higher underpricing than IPOs with low divergence of opinion. For robustness, we also divide the sample into sub periods 1988-1998 and 1999-2000. The results for the whole sample persist in the sub-samples. All the t-tests of mean differences are statistically significant at the conventional level.

In Table IV, we present results of OLS regressions of underpricing on different proxies of divergence of opinion. Our model predicts that underpricing increases as divergence of opinion increases. Tests of mean differences in underpricing between groups of IPOs with high versus low divergence of opinion in Table III confirm this prediction. In Table IV, we show that this relationship remains strong after controlling for issue characteristics and time trend. Regression (1) in Table IV shows the results for the control variables. IPOs that are VC-backed, have higher offer prices and higher **Overhang** have higher underpricing. These results are consistent with those found in Loughran and Ritter (2003) and Bradley and Jordan (2002). In Regression (2), we added various proxies of divergence of opinion related to issue characteristics. **Firms with Loss** and **Tech-Firms** have positive and statistically significant coefficients, suggesting that issues with higher divergence of opinion results in greater underpricing. Consistent with prediction, the coefficient for **Repay Debt Purpose** is negative and statistically significant at the 0.01 level. This suggests that when the IPO proceeds will be used for repayment of debt, there is less divergence of opinions about the value of the shares, and hence underpricing is less. Binary variables indicating whether the preliminary filing price range is revised or not revised **(Revised)**, and whether the final offer price is out of or in the filing price range (**Out-of-Range)** have positive and statistically significant coefficients, suggesting that issues with higher level of divergence of opinion are more underpriced. The coefficient for the interactive variable, **Revised*Out-of-Range**, is also positive and statistically significant. This suggests that issues that have their preliminary price range revised and

still priced out of range have an even higher level of divergence of opinion, hence a greater level of underpricing. With the inclusion of the firm-specific proxies of divergence of opinion, the adjusted R^2 increase to 0.34 in Regression (2) from 0.28 in Regression (1). Regression (3) in Table IV is just a slight variation from Regression (2). Here we use the magnitude of the price revision (**Revision-Magnitude**) in lieu of **Revised** and **Out-of-Range**. The coefficient for **Revision-Magnitude** is positive and statistically significant at the 0.01 level. This suggests that issues with large magnitude of price revisions experience greater level of underpricing, consistent with model prediction. With the inclusion of this variable, the adjusted R^2 improves further, to 0.39.

In Regression (4), **VIX-30days**, **NASDAQ-30days**, and **Underpricing-30days** have significantly positive coefficients, after controlling for issue characteristics. These results suggest that when the market-wide divergence of opinion is high, underpricing is expected to be high. The coefficients of these three variables continue to be positive and statistically significant at the 0.01 level after the inclusion of firm-specific proxies of divergence of opinion in Regressions (5) and (6). All the coefficients for firm-specific proxies are also statistically significant at the 0.01 level in Regressions (5) and (6). The explanatory power of Regression (6) is much improved, with an adjusted R^2 of 0.44. Overall, Table IV presents very strong results supporting our model prediction that higher level of divergence of opinion leads to greater underpricing.

IV. Summary and Conclusions

In this paper, we propose a new, though non-mutually exclusive explanation of IPO underpricing that is universal to all share allocation mechanisms and financial markets in the world. We argue that IPO underpricing is a natural by-product of divergence of opinion and ownership dispersion constraints associated with going public. If there is no wealth or ownership constraint, offer price will be set at a level that the investor with the highest valuation will be willing to bear, and this investor will likely buy the entire issue. However, to achieve stock exchange listing requirements, shares have to be more widely distributed at the IPO, which means the offer price has to be set at or below the market-clearing price. If

at least one investor with a valuation higher than the offer price is partially rationed, excess demand for the shares is created and the issue is oversubscribed at the offer price. In the secondary market, optimistic investors who are rationed at the IPO will bid up the share price and result in a price run-up. This explains why IPOs are in general underpriced. As the level of divergence of opinion increases, the aggregate demand curve for the new issue gets steeper; the level of underpricing also increases. The model does not rely on any assumptions on information asymmetry among investors or agency problems between issuing firms or investment bankers. It is a model capable of explaining underpricing in all primary markets, and regardless of whether bookbuilding, fixed price or auction method is used for the IPO.

We develop some empirical implications and use several proxies of divergence of opinion to explain initial underpricing. Using a sample of U.S. IPOs, we find that firms with negative earnings prior to going public and high-tech firms with lots of growth opportunities proxy for higher level of divergence of opinion, and hence experience greater underpricing. Issuing firms planning to use their IPO proceeds to repay or reduce debt experience less underpricing, consistent with a lower level of divergence of opinion about value for these firms. IPOs that investment bankers have difficulty estimating demand, as evidenced by price revisions, have higher level of divergence of opinion and hence experience greater underpricing. We also examine several market-wide proxies for divergence of opinion and find that they explain underpricing. As market volatility indices, cumulative NASDAQ returns, and average underpricing 30 calendar days prior to the IPO date increase, IPO underpricing also increases.

The empirical results presented in this paper strongly support the theoretical model that, in the presence of ownership dispersion constraints, higher level of divergence of opinion results in greater underpricing. As divergence of opinion among investors and ownership dispersion constraints exist in every financial market, this is the first paper capable of explaining IPO underpricing across all share allocation procedures. It fills the gap in existing explanations of IPO underpricing that focus on either one market and/or a particular issuing procedure.

References

Amihud, Yakov, Shmuel Hauser and Amir Kirsh, 2003. Allocations, Adverse Selection and Cascades in IPOs: Evidence from the Tel Aviv Stock Exchange. *Journal of Financial Economics* 68, 137-58

Aussenegg, W., P. Pichler and A. Stomper, 2003. IPO pricing with bookbuilding and a when-issued market. Boston College, working paper.

Bagwell, L., 1991. Shareholder heterogeneity: Evidence and implications. *American Economic Review* 81, 218-221.

Bagwell, L., 1992. Dutch auction repurchases: An analysis of shareholder heterogeneity. *Journal of Finance* 47, 71-105.

Barry, Chris, 1989. Initial public offerings underpricing: The issuer's view—A comment. *Journal of Finance* 44, 1099-1103.

Baron, D., 1982. A model of the demand for investment banking advising and distribution services for new issues. *Journal of Finance* 37, 955-976.

Beatty, Randolph P. and Jay Ritter, 1986. Investment banking, reputation and underpricing of initial public offerings. *Journal of Financial Economics* 15, 213-232.

Beatty, Randolph P., and Ivo Welch, 1996. Issuer expenses and legal liability in initial public offerings. *Journal of Law and Economics* 39, 545-602.

Benveniste, Lawrence M. and Paul A. Spindt, 1989. How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics* 24, 343-362.

Booth, James R. and Lena Chua, 1996. Ownership dispersion, costly information, and IPO underpricing. *Journal of Financial Economics* 41, 291-310.

Booth, James R. and Richard Smith, 1986. Capital raising, underwriting and the certification hypothesis. *Journal of Financial Economics* 15, 261-281.

Bradley, D.J. and B.D. Jordan, 2002. Partial Adjustment to Public Information and IPO Underpricing. *Journal of Financial and Quantitative Analysis* 37:4, 595-617.

Brealey, R. A. and Myers, S.C., 1996. Principles of Corporate Finance. 5th Edition, Irwin McGraw-Hill.

Brennan, M. and J. Franks, 1997. Underpricing, ownership and control in initial public offerings of equity securities in the UK. *Journal of Financial Economics* 45, 391-413.

Cammack, E., 1991. Evidence on building strategies and the information contained in Treasury bill auctions. *Journal of Political Economy* 9, 100-130.

Carter, Richard B., Frederick H. Dark and Ajai K. Singh, 1998. Underwriter reputation, initial returns, and the long-run performance of IPO stocks. *Journal of Finance* 53, 285-311.

Carter, Richard and Steven Manaster, 1990. Initial public offerings and underwriter reputation. *Journal of Finance* 45, 1045-1067.

Cooney, John W., Ajai K. Singh, Richard B. Carter, and Frederick H. Dark, 2001. IPO initial returns and underwriter reputation: Has the inverse relationship flipped in the 1900s? Unpublished University of Kentucky, Case Western Reserve, and Iowa State working paper.

Cornelli, F., and D. Goldreich, 2003. Bookbuilding: How informative is the order book? *Journal of Financ*e 58, 1415-1443.

D'Avolio, Gene, 2002. The market for borrowing stock. *Journal of Financial Economics* 66, 271-306.

Datta, Sudip, Mai Iskandar-Datta, and Ajay Patel, 1997. The pricing of initial public offers of corporate straight debt. *Journal of Finance* 52, 379-396.

Derrien, F. and K.L. Womack, 2003. Auctions vs. bookbuilding and the control of underpricing in hot IPO markets. *Review of Financial Studies* 16, 31-61.

Duffie, D., Garleanu,N., and Pedersen, L.H., 2002. Securities lending, shorting and pricing. *Journal of Financial Economics* 66, 307-339.

Dunbar C. and S. Foerster, 2002. Second Time Lucky? Underwriter Switching and the Performance of Withdrawn IPOs that Return to the Market. Working Paper, University of Western Ontario.

Ederington, Louis H., 1974. The Yield Spread of New Issues of Corporate Bonds. *Journal of Finance* 29, 1531-1543.

Ellis, K., R. Michaely, and M.O'Hara, 2000. When the underwriter is the market maker: An examination of aftermarket trading in IPOs. *Journal of Finance* 55, 1039-1074.

Fama, Eugene F., and French, Kenneth R., 2004. New Lists: Fundamentals and survival rates? *Journal of Financial Economics*, forthcoming.

Geczy, C., Musto, D., and Reed, A., 2002. Stocks are special too: an analysis of the equity lending market. *Journal of Financial Economics* 66, 241-269.

Habib, Michel, and Alexander Ljungqvist, 2001. Underpricing and entrepreneurial wealth losses in IPOs: theory and evidence. *Review of Financial Studies* 14, 433-458.

Harris, M. and A. Raviv, 1993. Differences of opinion make a horse race. *Review of Financial Studies* 6, 473-506.

Hong, H. and Stein, J.C., 2003. Differences of opinion, short-sales constraints, and market crashes. *Review of Financial Studies* 16, 487-525.

Houge, Todd, Tim Loughran, Gerry Suchanek, Xuemin Yan, 2001. Divergence of Opinion, Uncertainty, and the Quality of Initial Public Offerings. *Financial Management* 30:4, 5-23.

Jenkinson, Tim and Alexander Ljungqvist, 2001. Going Public: The Theory and Evidence on How Companies Raise Equity Finance (2 nod edition). Oxford University Press.

Kandel, E. and N.D. Pearson, 1995. Differential interpretation of public signals and trade in speculative markets. *Journal of Political Economy* 103, 831-872.

Kandel, Shmuel, Oded Sarig, and Avi Wohl, 1999. The demand for stocks: An analysis of IPO auctions. *Review of Financial Studies* 12, 227-247.

Kaneko, T. and Pettway, R., 2002. Auctions versus Book Building of Japanese IPOs. *Pacific-Basin Finance Journal*, forthcoming.

Keynes, J.M., 1937. The General Theory of Employment. *Quarterly Journal of Economics* 51, 209-223.

Knight, F.H., 1921. Risk, Uncertainty and Profit. Chicago/London: University of Chicago Press (Reprinted in 1971).

Kutsuna, K. and Smith, R., 2003. Why Does Book Building Drive Out Auction Methods of IPO Issuance? Evidence from Japan. *Review of Financial Studies*, forthcoming.

Leland, Hayne, and David Pyle, 1977. Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance* 32, 371-387.

Liaw, G., Liu, Y. and Wei, J., 2000. On the demand elasticity of initial public offerings: an analysis of discriminatory auctions. Hong Kong University of Science and Technology, working paper.

Lipman, Frederick D., 1994. Going Public: Everything you need to know to successfully turn a private enterprise into a publicly traded company. Prima Publishing.

Loughran, Tim, and Jay R. Ritter, 2002. Why Don't Issuers Get Upset About Leaving Money on the Table in IPOs? *Review of Financial Studies*, Vol. 15, No. 2, 413-443.

Loughran, Tim, and Jay R. Ritter, 2003. Why has IPO underpricing increased over time? Unpublished University of Florida working paper.

Lowry, Michelle, and G. William Schwert, 2002. IPO market cycles: Bubbles or sequential learning? *Journal of Finance* 57, forthcoming

Lowry, Michelle, and G. William Schwert, 2004. Is the IPO Pricing Process Efficient? *Journal of Financial Economics* 71, 3-26 .

Mauer, D.C. and L.W. Senbet, 1992. The Effect of the Secondary Market on the Pricing of Initial Public Offerings: Theory and Evidence. *Journal of Financial and Quantitative Analysis* 27, 55-79.

Miller, M.E., 1977. Risk, uncertainty, and divergence of opinion. *Journal of Finance* 32, No. 4, 1151-1168.

Morris, S., 1996. Speculative investor behavior and learning. *Quarterly Journal of Economics* 111, No. 4, 1111-1133.

Ritter, Jay R., 2003. Investment banking and securities issuance. North-Holland *Handbook of the Economics of Finance* edited by G. Constantinides, M. Harris, and R. Stulz.

Ritter, Jay R. and Ivo Welch, 2002. A Review of IPO Activity, Pricing, and Allocations. *Journal of Finance* 57, 1795-1828.

Rock, Kevin, 1986. Why new issues are underpriced *Journal of Financial Economics* 15, 187-212.

Schwert, 2003. Anomalies and Market Efficiency. Chapter 15, *Handbook of the Economics of Finance*, eds. George Constantinides, Milton Harris, and René Stulz, North-Holland, 937-972.

Shleifer, Andrei, 1986. Do demand curves for stocks slope down? *Journal of Finance* 41, 579-590.

Spindt, P. and R. Stolz, 1992. Are U.S. Treasury bills underpriced in the primary market? *Journal of Banking and Finance* 16, 891-908.

Stulz, R.M., 1988. Managerial control of voting rights: financing policies and the market for corporate control. *Journal of Financial Economic*s 20, 25–54.

Tobin, J., 1958. Liquidity preference as behavior towards risk. *Review of Economic Studies*, 26, 65-86.

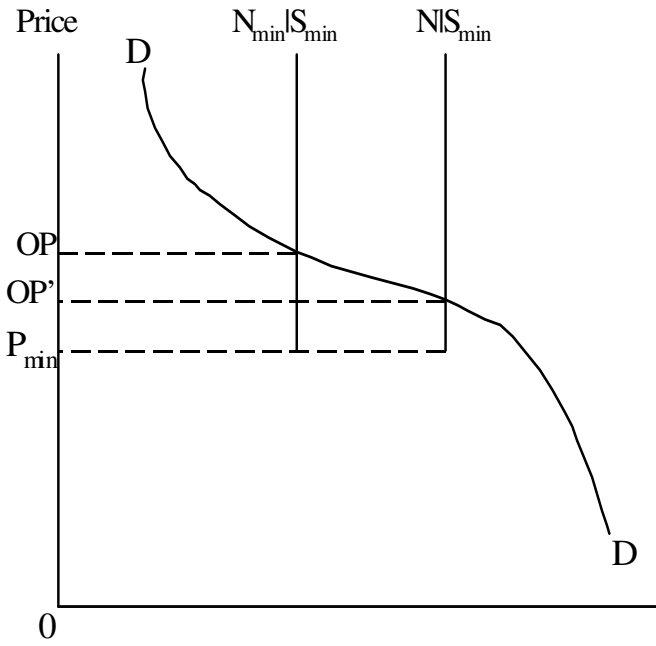
Varian, H.R., 1989. Differences of opinion in financial markets. C.C. Stone (ed.), *Financial Risk: Theory, Evidence and Implications: Proceedings of the 1th Annual Economic Policy Conference of the Federal Reserve Bank of St. Louis*, Kluwer Academic, Boston.

Weinstein, Mark I., 1978. The Seasoning Process of New Corporate Bond Issues. *Journal of Finance* 33, 1343-54.

Williams, J.B., 1938. The theory of investment value. Amsterdam: North Holland Publishing Co.

Figure 1

Accumulation Constrained Aggregate Demand and Supply Curves



P_{min} is the minimum price acceptable by the issuer

OP is the offer price if shares can be offered to the minimum number of investors

OP' is the offer price if shares have to be offered to more than the minimum number of investors

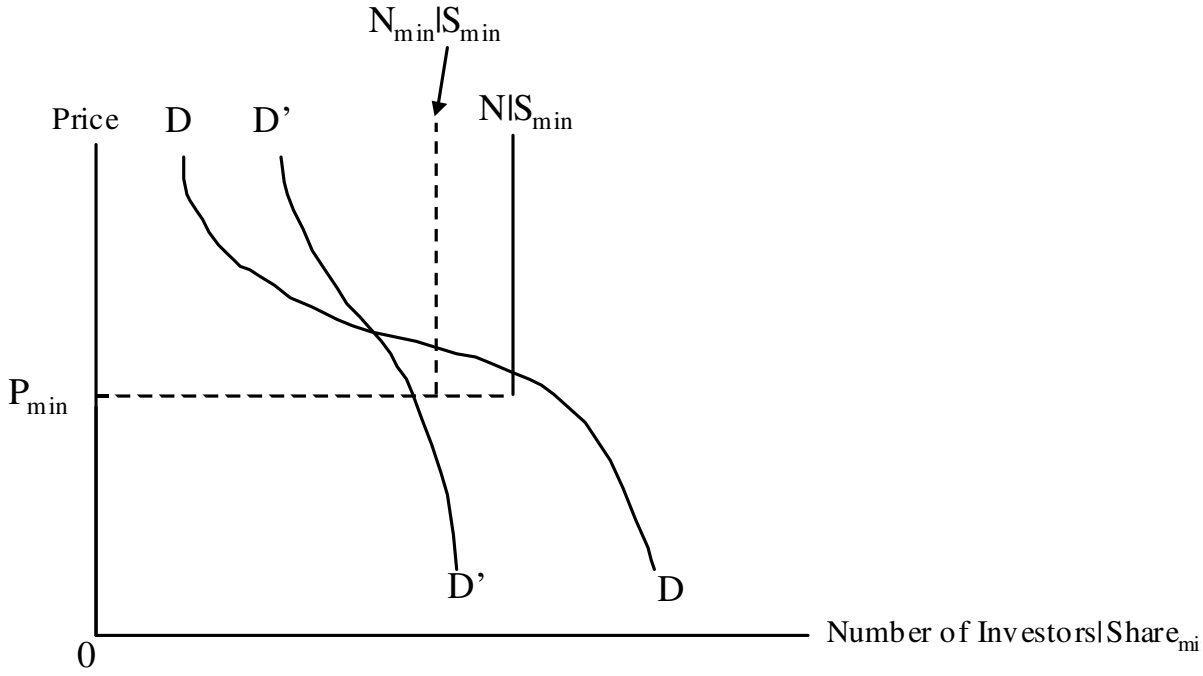
DD is the aggregate demand curve

$N_{min}|S_{min}$ is the supply curve for minimum number of investors

$N|S_{min}$ is the supply curve for more than the minimum number of investors (necessary to ensure continued listing)

Figure 2

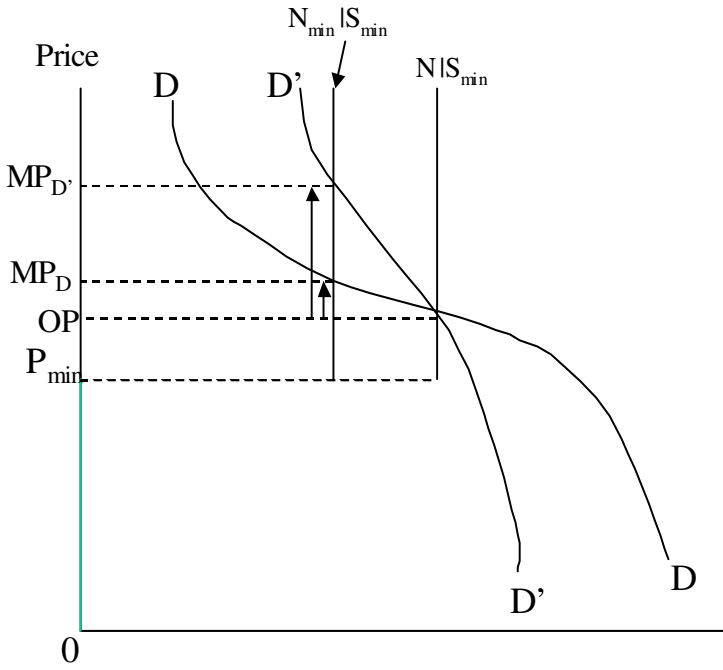
Are there sufficient number of investors to go public?



D'D' represents insufficient demand for the firm to go public. The supply curve, either $N_{min}|S_{min}$ or $N|S_{min}$ (supply curve necessary to ensure continued listing) does not intersect D'D' at a price equal to or above P_{min} for the firm to go public.

Figure 3

Impact of Divergence of Opinion on Initial Underpricing



P_{min} is the minimum price acceptable by the issuer

OP is the offer price with accumulation constraint

MP_D is the secondary market price for DD demand curve (low divergence of opinion)

$MP_{D'}$ is the secondary market price for D'D' demand curve (high divergence of opinion)

$N_{min}|S_{min}$ is the supply curve for the minimum number of investors

$N|S_{min}$ is the supply curve for more than the minimum number of investors (necessary to ensure continued listing)

Table I

Summary statistics of the firm characteristics and the average underpricing each year from 1988-2000

The data is from Thomson Financial Securities. Underpricing is defined as the percentage change between the offer price and the first day closing market price of the IPO. Due to missing data, total number of observations available for underpricing, firms with earnings data, and firms with use of proceeds data are 4,114, 3,406, and 4,045 respectively. The underwriter's rank is obtained from Loughran and Ritter (2003).

Year	N	Average Proceeds ($m)	Average Offer Price ($)	Average Underwriter Rank	Proportion VC-Backed	Proportion of Firms with Loss	Proportion of Tech Firms	Proportion for Repay Debt Purpose	Proportion with Revised Price Range	Proportion Priced Out of Range	Average Under-pricing (%)
1988	104	36.823	10.93	7.41	0.36	0.18	0.33	0.41	0.07	0.30	6.36
1989	112	52.123	11.87	7.77	0.38	0.23	0.39	0.29	0.25	0.18	7.81
1990	103	40.117	11.11	7.39	0.48	0.19	0.40	0.37	0.28	0.26	10.92
1991	259	52.121	12.13	7.71	0.53	0.27	0.30	0.40	0.26	0.24	12.71
1992	360	52.580	11.64	7.31	0.48	0.35	0.35	0.32	0.40	0.27	10.55
1993	467	48.065	11.90	7.04	0.47	0.32	0.33	0.39	0.31	0.27	13.18
1994	372	42.712	10.91	6.61	0.34	0.29	0.35	0.38	0.32	0.31	9.11
1995	412	62.628	12.34	7.12	0.42	0.31	0.53	0.33	0.30	0.34	21.55
1996	643	57.115	12.29	7.11	0.41	0.44	0.49	0.39	0.31	0.30	16.54
1997	436	61.843	11.71	6.95	0.29	0.41	0.44	0.42	0.33	0.32	13.61
1998	260	114.41	12.39	7.33	0.30	0.48	0.45	0.44	0.35	0.31	22.34
1999	446	120.56	14.56	8.14	0.59	0.79	0.66	0.17	0.44	0.41	74.08
2000	348	146.84	14.60	8.26	0.68	0.81	0.66	0.05	0.44	0.43	58.14
All	4,322	71.419	12.37	7.34	0.45	0.44	0.46	0.33	0.34	0.32	24.37

Table II
Summary statistics of firms going public from 1988-2000 characterized by various measures of divergence of opinion.

The data is from Thomson Financial Securities. T-test is the test of mean differences of issue characteristics between firms with negative versus positive earnings, tech versus non-tech firms, firms whose intended use of proceeds is to repay debt versus for other purposes, firms with versus without price revision, and firms with final offer price out of filing price range versus in range. Standard deviations are in parentheses. * and ** denotes statistically significant at the 0.01 and 0.05 level respectively.

	Firms with positive earnings N=1904	Firms with Loss N=1506	T-test	Non-tech Firms N=2352	Tech Firms N=1970	T-test	Repay Debt Purpose N=1349	Other Purpose N=2696	T-test	Price Range Not Revised N=2869	Price Range Revised N=1453	T-test	Priced In Range N=2954	Priced Out of Range N=1368	T-test
VC-Backed (%)	31.9 (46.6)	62.7 (48.4)	18.85*	34.0 (47.4)	57.5 (49.4)	15.92*	33.2 (47.1)	51.0 (50.0)	10.88*	41.5 (49.3)	50.1 (50.0)	5.93*	41.8 (49.3)	51.0 (50.0)	5.69*
Proceeds ($m)	67.4 (215.5)	73.9 (301.5)	0.73	82.2 (308.3)	58.5 (126.3)	3.19*	67.5 (152.9)	68.1 (278.6)	0.07	70.2 (264.8)	73.8 (193.4)	0.46	66.1 (255.5)	82.9 (213.7)	2.11**
Offer Price ($)	12.26 (4.64)	12.51 (5.10)	1.51	12.34 (4.84)	12.40 (4.85)	0.36	12.53 (4.43)	12.14 (4.97)	2.39**	12.13 (4.45)	12.85 (5.52)	4.61*	11.66 (4.45)	13.90 (5.30)	14.5*
Underwriter Rank	7.3 (2.1)	7.5 (2.2)	3.22*	7.2 (2.2)	7.5 (2.0)	3.48*	7.4 (2.0)	7.2 (2.2)	2.06**	7.2 (2.2)	7.6 (2.1)	4.75*	7.0 (2.3)	8.0 (1.5)	13.8*
% High-ranked	60.6 (48.9)	70.8 (45.5)	6.28*	62.4 (48.4)	67.8 (46.7)	3.68*	62.8 (48.4)	64.4 (47.9)	1.05	61.6 (48.6)	71.2 (45.3)	6.28*	59.1 (49.2)	77.3 (41.9)	11.9*
Overhang	4.2 (5.7)	5.1 (6.6)	4.52*	3.7 (3.2)	5.4 (8.0)	8.90*	3.8 (4.2)	4.9 (6.8)	5.06*	4.2 (5.3)	5.2 (7.0)	4.93*	4.0 (4.4)	5.5 (8.3)	7.10*

Table III
Tests of mean differences in underpricing for IPOs with high versus low levels of divergence of opinion (Sample period from 1988-2000)

The data is from Thomson Financial Securities. T-test is the test of mean differences in underpricing between firms with negative versus positive earnings, tech versus non-tech firms, firms whose intended use of proceeds is to repay debt versus for other purposes, firms with versus without price revision, and firms with final offer price out of filing price range versus in filing price range. Standard deviations are in parentheses. *, ** and *** denote statistically significant at the 0.01, 0.05, and 0.10 levels respectively.

	Average Underpricing (%)		
	1988-2000	1988-1998	1999-2000
Panel A:			
Firms without Loss	16.16	13.70	46.58
	(29.00)	(19.67)	(74.14)
Firms with Loss	38.50	15.34	76.49
	(70.05)	(26.51)	(97.41)
T-test	12.32*	1.78***	3.34*
Panel B:			
Non-tech Firms	13.76	10.65	37.47
	(27.03)	(17.11)	(58.63)
Tech Firms	36.70	19.63	81.71
	(64.57)	(29.59)	(100.36)
T-test	15.23*	11.06*	6.54*
Panel C:			
Repay Debt Purpose	12.38	11.09	31.85
	(24.44)	(17.25)	(69.16)
Other Purposes	29.96	16.70	72.56
	(55.85)	(26.83)	(91.94)
T-test	10.80*	6.48*	3.82*
Panel D:			
Price Range Not Revised	17.61	13.02	41.98
	(32.52)	(19.75)	(62.47)
Price Range Revised	37.54	17.30	98.19
	(70.04)	(29.98)	(109.69)
T-test	12.45*	4.90*	8.99*
Panel E:			
Priced In Range	17.80	13.02	42.91
	(36.9)	(22.08)	(72.22)
Priced Out of Range	38.57	17.63	100.16
	(67.16)	(26.44)	(103.27)
T-Test	12.75*	5.17*	9.11*

Table IV
OLS Regressions of Underpricing on Different Proxies of Divergence of Opinion

The data is from Thomson Financial Securities from 1988-2000. Underpricing is defined as (first day closing market price - offer price) / offer price. Year trend is a variable taking on values of 1 to 13 for years 1988 to 2000; VC-Backed is a binary variable which takes on a value of 1 if the IPO is backed by venture capitalists; High Ranked takes on a value of 1 is the underwriter ranking equals to 8 or above, zero otherwise; Overhang measures the ratio of retained shares to public float; Revision-Magnitude is the absolute value of ((Offer price – Midprice) / Midprice) where Midprice is the average of the high and low prices in the preliminary price range; Revised takes on a value of one if the filing price range is amended, and a value of zero otherwise; Out-of-range takes on a value of 1 if the final offer price is out of range, and zero if the final offer price is in the range; VIX-30days is the median VIX 30days prior to the IPO date. VIX is calculated by taking a weighted average of the implied volatility from eight calls and puts on the S&P 100 index, with thirty calendar days to expiration. NASDAQ-30days is the cumulative daily returns of NASDAQ stocks 30 days prior to the IPO date. Underpricing-30days is the average underpricing for the firms going public in the 30 days before the IPO date. T-statistics are in parentheses and they are corrected for heterokedasticity using White test. *, ** and *** denote statistically significant at the 0.01, 0.05, and 0.10 levels respectively.

	Dependent Variable: Underpricing					
	(1)	(2)	(3)	(4)	(5)	(6)
	N=3,569	N=3,058	N=3,058	N=3,513	N=3,010	N=3,010
Constant	-0.39	-0.35	-0.37	-0.25	-0.27	-0.29
	(-11.78)*	(-10.24)*	(-11.45)*	(-6.01)*	(-6.07)*	(-6.98)*
Year Trend	0.05	0.03	0.03	0.02	0.01	0.01
	(17.42)*	(13.40)*	(12.84)*	(4.87)*	(2.76)*	(2.36)**
VC-Backed	0.14	0.06	0.04	0.10	0.04	0.03
	(8.98)*	(4.15)*	(2.68)*	(6.67)*	(2.95)*	(1.75)***
Ln(Proceeds)	-0.16	-0.13	-0.10	-0.17	-0.14	-0.11
	(-8.89)*	(-6.55)*	(-7.13)*	(-9.15)*	(-7.07)*	(-7.86)*
Offer Price	0.06	0.05	0.04	0.05	0.05	0.04
	(10.46)*	(8.55)*	(10.73)*	(9.75)*	(8.15)*-	(10.03)*
High Ranked	-0.01	-0.03	-0.05	0.00	0.02	-0.04
	(-0.38)	(-1.80)***	(-2.62)*	(0.22)	(-1.30)	(-2.06)**
Overhang	0.01	0.01	0.01	0.01	0.01	0.01
	(4.84)*	(4.26)*	(3.78)*	(5.03)*	(4.45)*	(3.97)*
Firms with Loss		0.08	0.06		0.04	0.03
		(4.83)*	(4.09)*		(2.86)*	(2.30)**
Tech Firms		0.11	0.09		0.10	0.09
		(7.78)*	(6.81)*		(7.45)*	(6.60)*
Repay Debt Purpose		-0.09	-0.08		-0.07	-0.06
		(-7.71)*	(-6.43)*		(-5.73)*	(-4.83)*
Revised		0.07			0.07	
		(3.89)*			(4.10)*	
Out-of-Range		0.03			0.04	
		(2.14)**			(2.81)*	
Revised*Out-of-Range		0.22			0.17	
		(4.46)*			(3.69)*	
Revision-Magnitude			0.83			0.74
			(6.55)*			(5.93)*
VIX-30Days				0.01	0.01	0.01
				(3.17)*	(3.72)*	(3.60)*
NASDAQ-30days				0.73	0.55	0.50
				(4.50)*	(3.45)*	(3.30)*
Underpricing-30days				0.51	0.44	0.39
				(7.26)*	(5.85)*	(5.76)*
Adjusted R^2	0.28	0.34	0.39	0.36	0.40	0.44