

Endogenous entry and partial adjustment in IPO auctions: Are institutional investors better informed?*

Yao-Min Chiang

Department of Finance, National Chengchi University
NO.64, Sec.2, ZhiNan Rd., Wenshan District, Taipei City 11605; Taiwan
+886 -2 -29393091 ext. 81140
ymchiang@nccu.edu.tw

Yiming Qian

Department of Finance, University of Iowa
S382 Pappajohn Business Building, 21 E. Market Street
Iowa City, IA 52242; USA
(+1 319) 335-0934
yiming-qian@uiowa.edu

Ann E. Sherman

Department of Finance, University of Notre Dame
Notre Dame, IN 46556; USA
(+1 574) 631-3373
asherman@nd.edu

September, 2008

* We would like to thank Robert Battalio, Walid Busaba, Tom Chemmanur, Phil Davis, David Goldreich, Satadru Hore, Ravi Jagannathan, Andrei Jirnyi, Tim Loughran, Paul Schultz, Sophie Shive, Andrei Shleifer, Ashish Tiwari, Tong Yao, Hayong Yun and seminar participants at the University of Notre Dame, Hong Kong University of Science and Technology, DePaul University and the 2007 Western Finance Association Meetings.

**Endogenous entry and partial adjustment in IPO auctions:
Are institutional investors better informed?**

Abstract

Using a unique dataset of complete bid information for every IPO auction in Taiwan during 1995-2000, we examine the behaviors and returns of two groups – institutional and retail investors – in a setting in which underwriters do not have pricing or allocation discretion. IPO auction theory with endogenous entry predicts that returns should be higher when more informed investors enter or bid higher prices. We find that institutional investor bidding patterns are generally consistent with the predictions of auction theory for informed bidders, while individual investor bidding patterns are not. Individual auction entry decisions are significantly influenced by the returns on recent past IPO auctions, and the unexpected entry of more individual investors or high bids placed by those investors lead to lower expected returns.

JEL Classifications: G24, G28, G32

Keywords: IPO, auction, institutional investor, individual investor, informed investor, IPO method, underwriter favoritism, underpricing, endogenous entry, partial adjustment, return chasing

There has been serious debate about initial public offering (IPO) methods in the United States (US) since the internet boom of the late 1990s and the subsequent scandals.¹ The bookbuilding method gives underwriters great control over both pricing and the allocation of shares. A classic line of IPO theory, beginning with Benveniste and Spindt (1989) and Benveniste and Wilhelm (1990), argues that such underwriter discretion is beneficial in that the underwriter can price the stock after receiving feedback information from all investors, using allocation discretion to encourage investors to provide information.

However, there is an inherent conflict of interest between the issuer and the underwriter, and the substantial power of the underwriter leaves the system vulnerable to abuse. Auctions are often hailed as the remedy to these problems because the auction method puts power over pricing into the hands of bidders, with little or no role for the underwriter in pricing and allocation. Nonetheless, as shown theoretically in Sherman (2005) and Jagannathan, Jirnyi and Sherman (2008), auctions are challenging for bidders, who need to not only evaluate the stock but also determine the optimal bids. If investors fail to follow the optimal strategies, they may receive insufficient returns and IPOs may be inefficiently priced.

Thus, whether it is best to place pricing entirely in the hands of investors depends in part on how sophisticated those investors are both at evaluating offerings and at understanding the IPO pricing process. Compared to the large literature devoted to the bookbuilding method, relatively little empirical work has been done on IPO auctions. This paper offers evidence of investors' bidding ability in IPO auctions. Specifically, we examine whether

¹ See Loughran and Ritter (2002, 2004) for discussions of the problems and changes that have occurred.

investor behaviors are consistent with the predictions of IPO auction theory, and whether there is evidence that investors are informed.

Sherman (2005) models IPO auctions with endogenous entry.² The theory predicts that rational investors will choose to acquire information and enter (place a bid in) an auction if they expect to recover their costs evaluating the shares – in other words, if they expect shares to be sufficiently underpriced.³ If they follow the optimal entry and bidding strategies, the entry of these informed bidders and the aggressiveness of their bids will be positively related to returns to winning IPO bidders. In this paper, we test these predictions, i.e., we empirically examine whether the bidders' entry decisions depend on information costs, and how IPO returns depend on the entry of bidders and the aggressiveness of their bids.

Our sample includes all 84 IPO auctions in Taiwan during 1995-2000, including complete bid data from the auctions. It is one of only a few reasonably large samples of IPO auctions in the world, since most of the more than 20 countries that have used this method have dropped it relatively quickly.⁴ The dataset also allows us to distinguish between the bids of institutional and individual investors and thus to examine potential differences between these two types of investors.

² Other IPO auction models include Spatt and Srivastava (1991), Biais and Faugeron-Crouzet (2002), Biais, Bossaerts and Rochet (2002) and Chemmanur and Liu (2003). These papers, however, do not examine bidders' entry decisions and the effects of unexpected entry.

³ As first pointed out by Kandel, Sarig and Wohl (1999), most of the explanations commonly given for underpricing apply to bookbuilding but not to standard sealed bid auctions, because most explanations rely on the choices and preferences of the issuer and/or underwriter, whereas allocation and pricing decisions in standard auctions are based on the bids of investors. Other models in which IPO underpricing is driven by costly evaluation include Sherman (1992, 2000), Chemmanur (1993), Booth and Chua (1996), Sherman and Titman (2002), and Busaba and Chang (2003), many of which build on the classic bookbuilding papers by Benveniste and Spindt (1989) and Benveniste and Wilhelm (1990). Yung (2005) models costly evaluation by both investors and the underwriter. Cornelli and Goldreich (2001, 2003) and Jenkinson and Jones (2004) offer evidence on whether bookbuilding allocations have been consistent with this explanation in practice. These papers all pertain to the bookbuilding method.

⁴ As shown in Jagannathan, Jirnyi and Sherman (2008), the only comparably large samples would be from France, Japan or the United Kingdom. Work has been done on auction data from these other countries but a similar level of detail regarding each bid has not been available.

We find that individual bidders' behavior and hence their effects on returns are very different from those of institutions. The bids of institutional investors are largely consistent with the predictions of auction theory regarding informed bidders. The unexpected entry of more institutional investors or high bids placed by these investors are related to higher expected returns, suggesting that institutional investors bid based on information. The bids of individual investors, on the other hand, exhibit evidence of return-chasing, and the unexpected entry of more individual investors or high bids placed by these investors are related to lower returns, a sign of systematic overbidding perhaps due to inadequate bid-shaving.

The evidence of institutional success in an IPO setting where the underwriter has no discretion over allocations suggests that institutional investors are better informed than individual investors (i.e., that their success is not driven by allocation favoritism). We further explore whether the performance of institutional investors depends on relationships with specific underwriters, who might perhaps whisper private information to their favored clients. If institutional performance depends on such relationships, two predictions follow. First, the more successful institutional investors will be those who tend to bid disproportionately in auctions underwritten by the same investment bank(s) with which they have relationship. Second, in an average auction, the institutional investors who have a previous relationship with the underwriter (where a relationship is defined based on whether the investor has participated in a previous auction underwritten by the same underwriter) will tend to perform better than those without a previous relationship with the underwriter. We find no evidence of either prediction.

Our findings add to the literature regarding institutional versus individual performance in IPOs. Past work has looked at the allocations of institutional investors in US bookbuilding

IPOs and documented evidence that institutions receive a larger percentage of shares in ‘good’ IPOs (in terms of initial or long-run returns). See Hanley and Wilhelm (1995), Aggarwal, Prabhala and Puri (2002), Boehmer, Boehmer and Fische (2006), and Field and Lowry (2007). We offer evidence of the success of institutional investors relative to retail investors in a setting where the underwriter has no discretion in terms of pricing and allocations. The data also allows us to explore the role of underwriter relationships. Our results suggest that institutional success in IPO auctions is due not to underwriter favoritism but to their being informed regarding the value of shares.

The evidence that institutions indeed have private information has implications for bookbuilding IPOs as well, by lending support to classic bookbuilding theories in which underwriters exercise their control of allocations to reward investors for information. Moreover, by offering evidence of different types of investors’ sophistication, our results may help to guide regulators in designing IPO auctions. For example, we find evidence of return-chasing and overbidding by individuals, which may lead to instability in IPO outcomes. Thus, countries should consider allowing issuers to restrict auction participation to only institutional investors, while individuals could participate separately in a non-auction tranche.

Last, by documenting a positive relationship between institutional bids and IPO returns, this paper is the first to document partial adjustment in IPO auctions, as predicted by information production models. The evidence tends to indicate that underpricing and partial adjustment in auctions, and thus perhaps in bookbuilding, are driven at least in part by information acquisition.⁵

Past empirical work on IPO auctions has examined the demand elasticity of bids

⁵ Auction data cannot definitively establish a sole determinant of IPO underpricing, of course, since underpricing explanations are not, in general, mutually exclusive.

(Kandel, Sarig and Wohl, 1999, and Liu, Wei and Liaw, 2001), and compared underpricing, other issuance costs and the promotion role played by underwriters under auctions and other methods (Derrien and Womack, 2003; Chambers, 2006; Kaneko and Pettway, 2003; Kutsuna and Smith, 2004; Kerrins, Kutsuna and Smith, 2007; and DeGeorge, Derrien and Womack, 2006). Consistent with previous studies, we also find that IPO auctions are on average underpriced. Our paper, however, is the first to test IPO auction theory, to document partial adjustment, and to document the differences between institutional and individual investors in IPO auctions.

The paper is organized as follows: Section I lays out the hypotheses that we will be testing. Section II describes the sample and the institutional features of IPO auctions in Taiwan. Section III presents our results on entry, while Section IV presents results on IPO underpricing (or initial returns). Section V explores the relationships between institutional bidders and underwriters, to determine if there is evidence of favoritism. Section VI discusses the implications of our results for various IPO methods, and Section VII is the conclusion.

I. Hypotheses

Sherman (2005) models both discriminatory and uniform price IPO auctions in an environment in which each investor decides whether to expend resources producing a more accurate valuation of the IPO shares and whether to enter the auction.⁶ Investors spend resources on evaluation and choose to enter only if they expect to recover their evaluation and

⁶ With a discriminatory auction, all winning bidders pay the price that they bid. For a uniform price auction, all bidders pay the same price. This price is often the market-clearing price – the highest price that allows all units to be sold, or a price that is strictly below market-clearing in order to ‘leave something on the table’. Both discriminatory and uniform price auctions have been used for IPOs in various countries. Although in this paper we use a discriminatory auction sample, the theory and hence our results also apply to uniform price auctions such as those done in the US.

entry costs on average. Based on the information they receive, investors follow mixed strategies in their bidding. They shave their bids relative to their true valuations to address the standard winner's curse problem in auctions, as well as to recover their information costs. Since entry is uncoordinated, there will be ex post fluctuations in entry, which lead to additional variation in returns.

Because investors enter only if they expect to recover their information costs, the model predicts that entry (the number of bidders) decreases with information uncertainty or costs of information production.⁷ By following the optimal entry and bidding strategies, investors expect to earn sufficiently large positive returns to recover their costs, which implies that IPO auctions are underpriced on average.⁸ Underpricing will be higher for firms with more uncertainty or higher information costs.⁹

The model also predicts that investors will shave their bids more when they receive more positive information, which implies that auction returns will display partial adjustment, similar to that for bookbuilding IPOs as documented by Hanley (1993). In other words, initial returns should be higher for offerings that end up priced higher than originally expected.

Intuitively, the reason that partial adjustment is the optimal strategy is because

⁷ Consistent with the theory, entry refers to the number of bidders, since the number of bidders is a measure of the number of investors that have received a signal regarding the offering (if investors are informed). The number of shares ordered by each investor may reflect other factors such as their portfolio size, liquidity and risk aversion, and thus may be a noisier indicator of the information produced by investors. For a robustness check, we also use shares ordered (normalized by shares auctioned) to measure entry. Results are robust.

⁸ French and McCormick (1984) make a similar argument in a non-IPO setting.

⁹ The model in Sherman (2005) abstracts from the question of optimal order size by limiting each investor to equal bid size. Chowdhry and Sherman (1996), however, have an IPO model that endogenizes the choice of order size. Investment size is limited by risk aversion and the desire for a diversified portfolio, but investment size also depends on the quality of the investor's information – it's optimal to place a larger bet only when one has stronger information. As information costs increase, investors will spend more but will also optimally cut back somewhat on the precision of the information that they purchase. Their investment size will thus optimally decrease due to having less precise information. With higher information costs and a smaller investment in shares, investors will require a higher rate of return to break even. Therefore, the negative relationship between rate of return and information costs holds with endogenous order size.

informed investors face less risk of being outbid when they receive a positive signal and thus are bidding a relatively high price. If everyone expected low or medium-value issues to be underpriced, it may be possible for uninformed investors to bid slightly more than the expected (underpriced) bids by informed investors, thus crowding them out. Even if high value offerings are expected to be underpriced, however, it would be extremely risky for the uninformed to try to outbid informed investors, because the uninformed, by definition, are less able to identify high value offerings and would run the risk of instead greatly overpaying for a low value offering. Thus the informed face the least amount of competition for high-value offerings, because they will only be outbid by other informed investors that have also received a high signal. Therefore, if underpricing is going to occur for some offerings (as it must, to induce investors to enter and spend resources evaluating), in equilibrium that underpricing will be concentrated in high-value offerings.

For bookbuilding, whether an offer is priced higher than expected is usually measured by whether the final offer price is above or below the midpoint of the initial price range. For an auction, we measure it by how far the average bid price is above the reservation price, which intuitively measures how optimistic the bidders are about the share value. Partial adjustment for auctions means that the bid premium (the ratio of average bid price over the reservation price) is positively related to initial returns. Finally, if there is unexpectedly high entry driven by positive information, the expected value of the shares is higher and thus, as discussed earlier, we expect more bid-shaving and higher returns.

Sherman (2005) models the behavior and impact of sophisticated, informed investors. Alternatively, there might be naïve bidders who do not follow the optimal entry and bidding strategies. Taiwan's auctions, like most IPO auctions around the world, are open to the

general public, meaning that there are millions of potential bidders that may not have knowledge of auction theory or experience with auction bidding.

An unsophisticated and uninformed bidder may do all kinds of strange things. However, anecdotal and experimental evidence suggests that they may tend to exhibit two common behaviors. First, they may chase returns. In other words, they may be more likely to enter the current auction if recent auctions exhibit good returns. Jagannathan, Jirnyi and Sherman (2008) find evidence of return-chasers in Singapore's IPO auctions.

Second, unsophisticated bidders may have difficulty shaving their bids adequately to adjust for the winner's curse and may therefore overbid systematically. Extensive experimental and other evidence indicates that bidders find it difficult to adequately adjust their bids for the winner's curse even in relatively simple settings. See, for example, Bazerman and Samuelson (1983), Kagel and Levin (1986), and Hendricks, Porter, and Boudreau (1987). Engelbrecht-Wiggins and Katok (2005) show that bidders have an even harder time calculating their bids in experimental auctions with endogenous entry. Finally, unexpected entry not based on information will lead to a higher clearing price and hence lower returns, all else equal.

One way to test for inadequate bid-shaving is to see if auctions have a negative expected return. However it is possible that the expected return will be positive for other reasons, for example to compensate for costly evaluation, and thus that inadequate bid-shaving might reduce but not totally eliminate underpricing. Suboptimal bid-shaving may be occurring even when initial returns are positive, on average.

We therefore focus on the relationship between the bid premium and the return, since optimal bidding would mean higher expected returns when higher bids are placed, as argued

above. If bidders are not adjusting for the winner's curse, however, higher bids will tend to be more 'out of line', leading to lower expected returns and hence a negative relationship. This inadequate bid-shaving will also affect other bidders, since it will raise the clearing price and therefore lower the average return of all winning bidders.

We organize the above arguments into two hypotheses regarding entry and three hypotheses regarding returns. The two hypotheses on entry are as follows.

Hypothesis 1 – If informed investors are following the optimal entry and bidding strategies predicted by the information production model (Sherman, 2005), then auction entry will be decreasing in information uncertainty or information cost.

Hypothesis 2 – Uninformed, unsophisticated bidders may chase returns, i.e., their entry to the current auction may be positively related to the returns on recent past auctions.

The hypotheses on returns (i.e., IPO underpricing) are as follows.

Hypothesis 3 – If informed investors are following the optimal entry and bidding strategies predicted by the information production model, then there will be positive initial returns (underpricing) on average. Auction returns will be positively related to information uncertainty and information cost.

Hypothesis 4 – Regarding the effect of the bid premium:

4.A. If informed investors are following the optimal entry and bidding strategies predicted by the information production model, then the auction returns of all bidders will be positively related to informed bidders' bid-premia.

4.B. If a group of bidders does not shave their bids adequately for the winner's curse, they will systematically overbid on average. This will lead to a negative relationship between the bid premia of those bidders and the returns of all bidders.

Hypothesis 5 – Regarding the effect of unexpected entry:

5.A. If unexpected variations in entry are driven by the entry of informed investors that have received positive signals, then unexpected entry will be positively related to auction returns.

5.B If unexpected variations in entry are driven by random fluctuations, then unexpected entry will be negatively related to auction returns.

Thus we will examine the data to see if bidder behavior is consistent with the predictions of the information production model, or alternatively if there are signs of unsophisticated, uninformed bidders. We also examine whether institutional and individual investors exhibit different behaviors.

II. Data

II. A. Institutional Features of Taiwan's IPO Auctions

Taiwan has one of the most active stock markets in the world. By the end of year 2000, there were 531 companies listed on the Taiwan Stock Exchange (TSE) with a total market capitalization of 8.2 trillion New Taiwan Dollars (NT\$), ranked No. 11 in the world according to the World Federation of Exchanges website.¹⁰ The total trading volume of the TSE in year 2000 was NT\$ 30.5 trillion, ranked No. 16 in the world. In addition, the Over the Counter (OTC) market in Taiwan listed 300 companies with a total market capitalization of NT\$ 1.1 trillion and had a total trading volume of NT\$ 4.5 trillion in year 2000.

II. A. 1. IPO Methods Used in Taiwan

Beginning in March 1995, IPO issuers in Taiwan have had three choices in IPO methods – 1) for the sale of secondary shares (i.e., shares from current shareholders rather than new shares issued by the company), they can use a sequential hybrid auction (first an

¹⁰ The end of 2000 exchange rate was US\$1 = NT\$33.

auction and then a fixed price public offer); 2) for selling primary (i.e., newly issued) shares, they can use a sequential hybrid bookbuilding method (bookbuilding and then fixed-price public offer); or 3) for any offering, they can use a pure fixed-price public offer.¹¹ During 1995-2000, there were 84 IPOs that used the hybrid auction method (22.8% of all IPOs in terms of number and 67.6% in terms of proceeds raised).¹²

Figure 1 shows the number of IPOs in Taiwan in the years 1995 through 2007, by offer type. The figure shows that auctions occurred from 1995 (when first allowed) through 2003, while bookbuilding was first used in 2004 and has since become very popular. Bookbuilding was not used during our sample period of 1995-2000. Regulatory restrictions limited bookbuilding to offerings involving primary shares, which were not common in Taiwan at the time. IPOs instead sold only secondary (previously issued) shares, reportedly because issuers felt that there was less regulatory scrutiny of secondary share issues. Around 2004, regulations changed to eliminate the regulatory disadvantage for bookbuilding, and to actually give it a regulatory advantage.¹³

¹¹ Hybrid methods with public offer tranches are now standard in most countries. The US is one of only a few countries that do not use the fixed price public offer method, either alone or as a hybrid with bookbuilding or auctions.

¹² Excluding the largest IPO, Chung Hwa Telecom, which used the hybrid auction method, auctions had a market share of 44.2% in terms of proceeds. Hsu and Hung (2005) compare issuers using auctions and fixed price public offers, finding that auction firms are larger in terms of assets and sales (with a median assets of NT\$2.20 billion and a median sales of NT\$1.8 billion, vs. 1.55 and 1.33 respectively for firms using pure fixed-price offering), and attempt to raise more money (a median IPO amount of NT\$ 523.12 million vs. 173.28) (see their Table 1). Our own research shows that on average, IPO auctions are associated with lower initial returns (7.3% vs. 34.7%) and higher one-year returns after the first non-hit day (6.1% vs. -1.0%). In our comparisons, we include pure fixed price public offers from 1996-2000 since the first IPO that used an auction began trading in 1996, although the auction bids were placed in December 1995.

¹³ The two key regulatory changes have been that bookbuilding can be used for either primary or secondary share issues, and that the bookbuilding and fixed price public offer tranches for hybrid bookbuilding can run simultaneously rather than consecutively. Ljungqvist, Jenkinson and Wilhelm (2003) discuss the differences between simultaneous and sequential hybrids, while Derrien and Womack (2003) show for French data that regulatory restrictions requiring bookbuilding hybrids to be sequential, thus forcing the price to be set many days in advance, were a key disadvantage for bookbuilding relative to French auctions, which did not face the same restrictions. Sequential hybrids (first the discriminatory auction, and then the fixed price tranche) are still required for auctions in Taiwan.

Our sample goes through the end of 2000. There were 6 auctions after the end of our sample period – 3 in 2001, 2 in 2002 and 1 in 2003. Bid data for these auctions are not available due to the new privacy policy of the Taiwan Securities Association.¹⁴

II. A. 2. The Auction Tranche

If a firm uses the hybrid auction method, half of the IPO shares are offered in the auction, with the other half to be sold in the subsequent fixed-price public offer. Any unsold shares in the auction will also be put into the public offer. In our sample, only three auctions were undersubscribed and the unsold shares were placed into the fixed-price tranche. If auctions bids are less than 10,000 lots, the auction fails and the IPO is not completed¹⁵.

IPO auctions are open to both individuals and institutions. A bidder is allowed to win no more than 6% of the auction shares, which for an average auction is NT\$58.0 million at the average winning price.¹⁶ Institutions bid in all but two of the auctions in our sample. In the fixed-price tranche, each investor can submit an order for exactly one round lot (1,000 shares) and will receive one round lot if they win any allocation. Institutions are not allowed to participate in the fixed-price offer.

IPO auctions in Taiwan are multiple-unit, multiple-bid discriminatory-price sealed-bid auctions. In other words, a bidder can submit multiple bids (different combinations of price and quantity) and they pay what they bid if they win. Under the auction procedure, the underwriter will publicly announce the number of shares to be sold, the reservation price (also

¹⁴ The last six IPO auctions in Taiwan, during 2001-2003, had a mean initial return of -0.6% and a mean one-year return of -3.5% after the first non-hit day. In comparison, there were 337 pure fixed-price offers during 2001-2003, with a mean initial return of 24.2% and a mean one-year return of -12.2% after the first non-hit day.

¹⁵ Although an auction cancellation due to insufficient bids did not occur in our sample, underwriters have reported being concerned about this possibility, particularly in cold markets. We were told that this is one reason why underwriters and issuers prefer the bookbuilding method since the 2004 regulatory changes.

¹⁶ All NT\$ values are in constant year 2000 NT\$'s. The end of 2000 exchange rate was US\$1 = NT\$33. Thus the limit on winning bids per bidder averaged around US\$1.75 million.

known as the reserve price or minimum acceptable bid), and the dates bidders can submit orders.¹⁷ The bid-tender period lasts for four business days (day 1 – day 4). At the time of submitting bids, investors need to pay a transaction fee of NT\$500 for each bid and a bid deposit that is no less than 20% of the bid size.

During the bid-tender period, underwriters are not allowed to open the sealed bids and are explicitly forbidden from revealing bid information in the auction (Taiwan Securities Association Rules Governing Underwriting and Resale of Securities by Securities Firms, Article 14). By 9:00am on the morning after the auction closes, the bid log is delivered to the Taiwan Securities Association, which opens the bids and determines allocations.

The clearing price is the maximum bid price that clears the supply. All bids that are strictly above the clearing price are filled in full, while bids at the clearing price are awarded by lottery. Bidding results are announced in newspapers on the next business day, including the clearing price, subscription ratio, and winning price and quantity for each winner. Information on losing bids is not made publicly available (but is available in our data).

II. A. 3. The Fixed Price Public Offer Tranche

After the auction, the remaining shares of the IPO are sold through the fixed price public offer tranche. If the auction is undersubscribed, the fixed price is set at the auction reservation price. For oversubscribed auctions, the fixed public offer price can never be more than 1.5 times the reservation price. If the clearing price in the auction is less than 1.5 times

¹⁷ As the guideline for setting the reservation price, the Security and Futures Commission (SFC) in Taiwan (the equivalent of SEC in the US) uses the following formula: the reservation price is the weighted average of four items, with weights in parentheses: (1) the average earnings per share in the past three years multiplied by the P/E ratio of comparable firms in the same industry (40%), (2) the net wealth (i.e. book equity value) per share (20%), (3) the estimated dividend per share in the current year divided by one year deposit interest rate (20%), and (4) the average dividend per share in the past three years divided by the dividend yield of comparable firms in the same industry (20%). The final reservation price can deviate from the price set by the formula, if the explanation to the SFC is satisfactory. For discussion of the usefulness of using multiples to set IPO offer price, see Kim and Ritter (1999) and Purananandam and Swaminathan (2004).

the reservation price, then the fixed price is set at the quantity-weighted average price of winning bids that are no higher than 1.5 times the reservation price.¹⁸ The average fixed-price tranche in our sample IPOs is 102 times subscribed (with a median of 64 times subscribed).¹⁹ Allocation is determined by lottery, when there is oversubscription.

As a hybrid, the IPO consists of two stages, but they are essentially two independent sales from the investors' point of view. First, due to the one-lot size constraint and frequent oversubscription in the fixed-price tranche, any investor who wishes to make a large investment will not rely on the second-stage sale. More importantly, there is little room for strategic interaction between the two stages.

The only way an investor might hope to make use of the two stages in this hybrid would be by withholding a bid in the first stage, the auction, in order to drive down the price in the second stage. However, it is highly unlikely that any one investor could significantly affect the offer price in the fixed price stage in this way. In our sample, the elimination of the largest bidder in each auction affects the auction clearing price by only -0.4% on average, with no change at all for 64 out of 84 auctions. The resulting average change in the offer price for the fixed-price tranche is -0.2%, with no change for 75 out of 84 auctions. The elimination of the highest bidder rather than the largest bidder has even less effect.

Moreover, even if one could affect the second stage price, the expected benefit of possibly winning at most one lot in that stage at a perhaps slightly lower price would be inadequate, relative to the returns given up earlier. If anything, the hybrid feature should bias us against finding uninformed investors participating in the auction tranche, because

¹⁸ Since the year 2000, the multiple 1.5 has been changed to 1.3, with the rules otherwise the same.

¹⁹ This high subscription level greatly lowers the expected return to participating in these tranches. For the fixed price portions of the IPOs that we are analyzing, the equally-weighted mean initial return to receiving shares in each offer is 31%, but the mean initial return to ordering shares (i.e. weighted for the probability of receiving shares) is only 0.3%, or 30 basis points.

uninformed investors have the option of self-selecting by instead ordering shares in the fixed price tranche. Given that there seems to be no strategic interaction between the two stages, our study focuses on auctions only.

II. A. 4. The Aftermarket

Shares are seldom able to trade freely during their first official day on the aftermarket, due to limits on daily price changes. In Taiwan, a daily return limit of 7% in each direction is imposed on all publicly traded stocks, including IPO shares, during our sample period. IPO shares frequently hit this limit for the first few days in a row. The first day when the stock price falls within the limit is known as the first non-hit day. The return based on that day's closing price is the initial return we use in this paper to measure IPO underpricing. (For robustness, we also examine returns for other holding periods, as will be discussed below.) This initial return is comparable to an IPO's first-day return in the US, where IPOs do not face daily price limits. In our sample, the 'honeymoon period' (the time from the first trading day to the first non-hit day) has a mean (median) of 5.4 (3) trading days and ranges between 1 and 28 trading days.

II. B. The Sample

Our sample includes a complete list of the 84 initial public offerings that used the hybrid auction method in Taiwan during 1995-2000. We obtain detailed bidding information on each auction from the Taiwan Securities Association, including bidder IDs and the bid price and quantity of every bid by each bidder. The format of the bidder ID tells us whether the bidder is an institutional or individual investor. The dataset also includes information on the auction size, the reservation price, the clearing price, the auction proceeds, and the offer price for the subsequent fixed price tranche.

Background information about the IPO firms such as assets, venture capital ownership and earnings are collected from the firms' prospectuses, which are available from the Taiwan Securities & Futures Information Center database. Stock returns for individual stocks and the market are from the Taiwan Economic Journal (TEJ).

Of the 84 auctions in our sample, three are undersubscribed, including Chung Hwa Telecom in 2000, the largest IPO ever in Taiwan. Two auctions drew no institutional bidders at all, and another seven had no winning institutional bidders.

Table 1 presents the descriptive statistics for our IPO sample.²⁰ Panel A displays the statistics for the entire sample. During 1995-2000, about half of the IPO firms listed on the TSE rather than on the over the counter (OTC) market, and about half of the firms are categorized by the exchanges as being in the electronics sector (commonly referred as high-tech industry). Prior to the IPO, the average firm has an asset value of NT\$10.4 billion (US\$314.6 million), a VC ownership of 13.5%, a P/E ratio of 18.3. In an average IPO auction, the firm aims to sell 6.5% of shares outstanding and receives NT\$880.6 million (US\$26.7 million) in auction proceeds.

Panel B of Table 1 displays IPO background information by year. The number of IPO auctions increases from 1995 through 1998, and then decreases. More and more IPO firms are from the high-tech industry over our sample period, which coincides with the internet boom. Related to that, a smaller percentage of IPO firms are listed on the TSE instead of the OTC market over the years. Otherwise there are no obvious time trends for these IPO firms.

²⁰ When we refer to IPOs from here on, we are referring only to those that used the hybrid auction method, unless otherwise noted.

III. Results on Entry into IPO Auctions

Table 2 presents summary statistics of bidders' bidding activities. Panel A shows by year the summary statistics of all bids. In an average auction, there are 708.8 bidders who submit 986.7 bids (bidders may submit multiple bids). There is substantial variation for both numbers, however. The standard deviation is 843.3 for the number of bidders and 1,205.0 for the number of bids. The variation is similarly large for each year in the sample period. All but three of the auctions in our sample are oversubscribed, with an average subscription ratio of 3.8. However even this variable has a wide range of variation, with a minimum of 0.4 (i.e. 60% undersubscribed), a maximum of 17.2, and a standard deviation of 2.9. It is evident that entry into IPO auctions is not stable. Overlooking this fact and assuming otherwise may lead to inaccurate predictions regarding auction results.

We use bid premium to measure the aggressiveness of bids or the level of optimism of bidders regarding the share value. The bid premium, computed as the quantity-weighted average bid price over the reservation price, has an overall mean of 1.6 (for all bids, not just winning bids). The bid premium seems to increase over the sample period, although the increase is not monotonic and does not coincide with an increase in the number of bidders or the subscription ratio. The average percentage of winning bidders (bids) is 38.1% (36.6%) across auctions.

Panel B compares the bidding activities by institutional and individual bidders. We see that most bidders in these auctions are individuals. In an average auction, there are 676.8 individual bidders whose total bidding quantity is about three times the auction size, whereas there are 32.0 institutional bidders whose total bidding quantity is about 76% of the auction size. As a group, individuals receive 80.9% of the shares. Institutional and individual bidders

do not differ significantly in their average bid premium or percent of winning bidders (bids).

Next, we examine the factors that influence bidders' entry decisions. Hypothesis 1 predicts that entry will be higher when information uncertainty or information costs are lower. Hypothesis 2, on the other hand, predicts that entry may be positively related to returns on recent past auctions. Consistent with the theory, we measure entry into an auction by the natural logarithm of the number of bidders. As a robustness check, we also use the natural logarithm of the subscription ratio (i.e. total shares ordered relative to shares auctioned). Results are similar.

We use two sets of variables to measure information uncertainty or information costs: six variables that are firm-specific and one that is market-wide. To measure uncertainty about the market in general, we use the market volatility (standard deviation of daily market returns) during the three months prior to the auction. Higher volatility means higher risk/information costs. To measure the firm-specific information uncertainty/information cost, we use the natural logarithm of firm assets, VC ownership in the firm, P/E ratio (reservation price over last year's earnings per share) and percentage of shares auctioned, as well as dummies for whether the firm is high-tech and whether it will be listed on the TSE.

We conjecture that the information costs and/or uncertainty about the firm decreases with more assets in place, a larger stake held by venture capitalists, and the fact that the firm is listed on the prestigious TSE (rather than on the OTC). We expect that information costs and/or uncertainty increase with P/E, % of shares auctioned, and the fact that the firm is categorized by the exchange as in the high-tech sector. The % of shares auctioned measures the number of shares being auctioned relative to total shares outstanding. A larger percentage means that current insiders are retaining a smaller proportion of the firm, which could signal

lower quality or more risk. It should be noted that different from conventional P/E ratio, the price we use here is not a market price but the reservation price, which is set largely by formula, as discussed in Section II.A.2.

To explore return-chasing behavior, we calculate *recent auction return* as the weighted-average initial return of IPO auctions with weights based on $(720 - N)$, where N is the number of days between a previous auction's first non-hit day and the current auction's auction day. Auctions more than 720 days earlier receive zero weight. Thus we assign more weight to more recent IPOs.²¹ We also try three alternative weighting schemes on previous IPOs to compute *recent auction return*: weighting based on $1/N$ or $1/\sqrt{N}$ (where again N is the number of days since the previous auction's first non-hit day); or including only the most recent three auctions with weights of 3/6 for the most recent IPO, 2/6 for the next and 1/6 for the earliest. Main results are all robust.

Table 3 presents the results of our entry regressions. In Column (1) the dependent variable is $\log(\text{number of all bidders})$, in Column (2) the dependent variable is $\log(\text{number of institutional bidders})$, and in Column (3) the dependent variable is $\log(\text{number of individual bidders})$. Not surprisingly, regression results for individual bidders are similar to those for all bidders, since individuals constitute about 94% of all bidders.

Consistent with Hypothesis 1, we find that entry into the auctions decreases with market volatility and increases with assets for both institutional and individual bidders. On the other hand, we do not find evidence that entry significantly depends on VC ownership, P/E or % of shares auctioned, and entry is significantly greater for high-tech firms. The coefficient on TSE dummy is significantly positive, as predicted, for institutional investors but is

²¹ We lose the first two auctions in our sample for including the variable *recent auction return*. The second auction is lost because its auction date occurred before the first IPO shares began to trade.

insignificant for individual investors. Thus all of the significant results have the sign predicted except for the high-tech dummy. It appears that investors are more attracted to high-tech firms during the high-tech boom in spite of their presumed higher risk.

We find that *recent auction return* has a significant positive influence on individual investors' entry decisions, which is evidence of return-chasing. In terms of the economic significance of the return-chasing phenomenon, if the value of *recent auction return* goes from the 25th to the 75th percentile, with other explanatory variables at their mean values, then the expected number of individual bidders increases by 194.7 (28.8% of the mean number of individual bidders for the sample, 676.8). In contrast, the institutional investor entry decision is insignificantly related to *recent auction return* (with a regression coefficient that is both statistically and economically insignificant), suggesting that they are not return-chasers.²²

For the regressions in Table 3 and subsequent regressions, we re-run them excluding the IPO of Chung Hwa Telecom in 2000, which is not only the largest IPO auction but the largest IPO of any kind, ever, in Taiwan and thus might be an outlier. Our results are robust to excluding this particularly large offering.

IV. Results on Auction Returns (IPO Underpricing)

In this section, we examine bidder returns from IPO auctions (or, underpricing of these IPOs). Table 4 presents summary statistics of the bidding results. Panels A and B report statistics at the auction level, i.e., with each observation being one auction; Panels C and D

²² As Hypothesis 5B points out, higher entry that is not driven by positive information about the share value (e.g., due to return-chasing) will lead to lower expected returns for all winning bidders, all else equal. Although not modeled by existing auction theory, it seems reasonable to think that if sophisticated investors anticipate return-chasers, they might want to adjust downward their own entry to offset the effects from the return-chasers. However, we do not find evidence that institutions are systematically attempting to offset the return-chasing of individuals, since their entry is not significantly related to *recent auction return*.

report statistics at the bidder level, i.e., with each observation being one bidder in an auction. Panels A and C show by year the bidding results of all bidders; Panels B and D compare institutional and individual bidders.

We compute the raw (adjusted) initial return for each auction as the closing price on the first non-hit day over the quantity-weighted average of the winning price (adjusted for the TSE index return). In addition to the initial return, we also use auction returns based on the closing price on the 10th trading day after the first non-hit day, or the closing price on the 20th trading day of the stock (regardless of the first non-hit date). Result patterns are similar to those for the initial returns.²³

In Panel A, the mean (median) raw return across auctions is 7.3% (3.5%), and the market-adjusted return has an even higher mean (median) of 8.3% (8.9%). Winning bidders therefore on average receive underpriced shares and earn positive returns. However, even for the average winning bidder, there is large variation in her return across auctions: the standard deviation for the raw (adjusted) initial return is 24.3% (21.6%). Examining the returns by year also discloses substantial variation.

Further evidence of the riskiness of participating in the auctions can be seen from the fact that, for an average auction, only 56.0% (57.0%) of winning bids (bidders) are ‘in the money’ on the first non-hit day, meaning that the closing price on the first non-hit day is above the (bidder's quantity-weighted average) bidding price. There is a lot of variation in this ratio across auctions and from year to year, with the median for the year ranging from

²³ Using all three sets of return measures, we observe underpricing for the IPO firms (i.e., positive average returns for bidders) in our sample, and we find that institutions on average experience higher returns. We also ran regressions similar to those in Tables 5 and 6 using the alternative two return measures. Result patterns were similar to those for initial returns but with somewhat less significance, presumably due to the noise introduced by aftermarket trading. One difference we find between the initial returns and the alternative return measures is that the initial returns to the first non-hit day are higher on average, suggesting prices drop after the first non-hit day. This is consistent with the findings of Lin, Lee and Liu (2003).

100% in 1996 to 0% in 2000 (where the median of 0% means that in at least half of the auctions in 2000, all winning bidders lost money if they sold on the first non-hit day).

In Panel B of Table 4, we compare the returns between institutional and individual bidders. It is apparent that the average institutional winning bidder performs better than the average individual winning bidder. Institutions enjoy a higher mean (median) raw return by 1.5% (0.7%), and a higher mean (median) adjusted return by 2.1% (1.4%). All of these differences in returns are significant at the 5% level. Across auctions, the mean and median percentages of in-the-money bidders (bids) are higher for institutional than for individual bidders (bids), albeit the differences are mostly insignificant. We observed in Panel B of Table 2 that the average bid premium of all bids offered by institutions is similar to that by individuals and their winning chances are about the same, but now we see that institutions earn higher returns from the auctions. In other words, institutions' unconditional average bidding prices are similar to individuals' but their average winning prices are lower than individuals'. This indicates that institutions bid more smartly than individuals.

Panels C and D of Table 4 present summary statistics of returns at the bidder level.²⁴ With hundreds of bidders in each auction, there are many more observations for this analysis. The basic patterns are similar to those in Panels A and B, where each observation is one auction. That is, bidders on average earn positive returns, but there is substantial variation from bidder to bidder and (for the average bidder) from year to year. In addition, institutional bidders on average perform better than individual bidders. At the bidder level, the differences in returns are even more striking: institutions have a higher mean (median) raw return by 6.0% (4.6%), and a higher mean (median) adjusted return by 6.0% (5.4%), all differences

²⁴ Multiple bids are allowed, so this is the quantity-weighted average return on all winning bids by that bidder.

significant at the 1% level.

Next, we test Hypotheses 3, 4 and 5 by running regressions of auction returns (raw and adjusted) on measures of information uncertainty/information costs, bid premium and unexpected entry. We measure unexpected entry as the residuals from the entry regressions in Table 3. We have already seen some evidence in Table 4 that institutions bid more smartly than individuals, and therefore we measure bid premium and unexpected entry separately for institutions and individuals.

In addition, we examine the direct impact of recent auction returns. If there is return-chasing behavior among bidders, and these bidders tend to overbid (i.e. to not shave their bids adequately), we would expect the return on the current IPO auction to be negatively related to recent auction returns. We also include year dummies as control variables.

Unexpected entries of institutions and individuals are generated regressors from our entry regression. Pagan (1984) shows that when using the residual from another regression as an explanatory variable, the OLS estimator is consistent. However, this is an asymptotic property. OLS estimates of standard errors may still be of problem in a limited sample due to the measurement error. To address this, we employ a bootstrapping method to estimate the return regression. Specifically, for each return equation, we repeat the following procedure 1,000 times. Each time, we randomly select 65 auctions out of 84, run the entry regression and compute the unexpected entry. We then run the return regression for the same 65 auctions and obtain a set of estimates. We repeat this till we have 1000 sets of estimates of the same return equation. The means of these estimates are our coefficients, and t-statistics are calculated based on the standard deviation of the 1,000 estimates. We report bootstrapping results and OLS results are similar.

Regression results at the auction level are reported in Table 5. Results are reported for the average return on all bidders and separately for the average returns to institutional and individual investors. Returns are positively related to unexpected entry and the average bid premium of institutions, as predicted in Hypotheses 4A and 5A for informed bidders, but negatively related to unexpected entry and the average bid premium of individuals, as predicted in Hypotheses 4B and 5B for unsophisticated uninformed bidders.

Based on the hypotheses, the positive coefficients for institutions' unexpected entry and bid premium suggest that institutional bidders are informed and sophisticated bidders. In contrast, the negative coefficients on unexpected entry and bid premium of individuals suggest that individuals are not informed and are not bidding optimally. The coefficient on *recent auction return* is insignificant when the dependent variable is the raw return and is significantly negative when the dependent variable is the market-adjusted return, which shows that return-chasing is not a superior strategy in practice.

Regarding the information cost/uncertainty variables, the results are mixed. The high-tech dummy, TSE dummy and % of shares auctioned are significant with the predicted signs of H3. Market volatility is not always significant but has the predicted sign when significant. On the other hand, VC ownership is not significant, and assets and P/E are both significant but with signs that are the reverse of the predictions of Hypothesis 3.

Table 6 reports the results of return regressions at the bidder level. Because this is a discriminatory auction, various winning bidders genuinely receive varying (sometimes widely varying) returns, as we saw in Table 4. The auction level data in Table 5 treat bidders as if they each receive the weighted average return in each auction, which is not accurate. In Table 6 we look at the full range of returns to all winning bidders, which leads to a greatly increased

sample size. We adjust for auction clustering as well as heteroskedasticity when calculating t-statistics.

As shown in Table 6, the key results at the bidder level are the same as those at the auction level. The return is positively related to the unexpected entry and bidding premium of institutions, and negatively related to the unexpected entry and bidding premium of individuals, indicating that institutions are informed and sophisticated bidders, while individuals are not.

The impact of these variables is substantial. We gauge the economic significance of these variables by computing the change in expected returns when each of these explanatory variables increases by one standard deviation. Regarding entry, a one standard deviation increase in unexpected entry of institutions increases the expected raw (market-adjusted) return to individual investors by 6.9% (5.8%); a one standard deviation increase in unexpected entry of individuals decreases the expected raw (market-adjusted) return to individual investors by 6.1% (6.4%). As for bid premia, a one standard deviation increase in the bid premium of institutions increases the expected raw (market-adjusted) returns to individuals by 22.7% (18.8%); and a one standard deviation increase in bid premium of individuals decreases the expected raw (market-adjusted) returns to individuals by 20.8% (18.3%). The effects of these variables on institutional returns are of similar magnitudes or even larger.

At the bidder level regressions, we again find that the coefficient on *recent auction return* is insignificant when the dependent variable is the raw return and is significantly negative when the dependent variable is the market-adjusted return, suggesting that return-chasing does not pay. We again find mixed evidence for Hypothesis 3. Returns are positively related to market volatility, % of shares auctioned and the high-tech dummy, and negatively

related to the TSE dummy, consistent with H3. On the other hand, VC ownership is insignificant, and returns are positively related to assets and negatively related to P/E ratio, all of which are inconsistent with H3.

One possible reason for the opposite sign for the P/E variable is that, unlike conventional P/E ratios that are based on forward-looking market prices, the reservation price used here is backward-looking, depending on historical earnings and dividend policy (see section II.A). For example, 40% of the price calculation is based on average earnings over the past three years, which would mean that rapidly growing young companies would tend to have a lower P/E than mature companies with flat earnings, which is the opposite of the conventional perception that high P/Es are related to younger, riskier growth companies. Thus, given the way that the ‘price’ is calculated, the results on P/E do not necessarily go against Hypothesis 3.

Regarding the effects of assets, we observe that entry is significantly higher for companies with more assets (Table 3), as predicted by Hypothesis 1, and yet returns are still significantly higher for these companies. It appears that investors are not giving enough attention to an easily-observable piece of public information that could help them to make better bidding decisions, as found by Field and Lowry (2007) for US IPOs.

We also examine whether there are differences between small and large individual investors. We define individual investors as large if their average dollar bid size across auctions is among the top 10% of individual bidders. (Results are robust if we define small and large individual bidders based on their maximum bid size across auctions.) These bidders’ average bid size is NT\$13.0 million (in comparison, the average bid size is NT\$ 23.2 million for institutions and NT\$ 1.0 million for small investors). Such large individual bidders should

have both the resources and the incentive to scrutinize offerings and calculate the optimal bidding strategy.

We repeat our entry and return regressions with three groups of investors rather than two – institutional investors, large individual investors and small individual investors. Results for small individual investors are similar to those for all individual investors. For large individual investors, there is weak evidence of return chasing and no evidence that these investors are informed (specifically, we find that returns are negatively but insignificantly related to the unexpected entry and bid premia of large individual investors).

V. The Role of the Underwriter

We have presented evidence that institutional bidders are more successful than individuals in bidding, in a sample of IPO auctions in which underwriters have no pricing or allocation discretion. This suggests that institutional investors have better information than individual investors about IPOs. However, the possibility remains that the source of their information might still come from the underwriters. Perhaps, although underwriters have no pricing or allocation discretion in IPO auctions, they might still help their favorite clients by whispering information into their ears. In this section, we explore this possibility.

It should first be noted that any such help would be a violation of Taiwan's regulations, since underwriters are required to disclose the same information to all investors. The prospectus is available to all, and any public meetings (similar to road shows in the US) must be open to all potential investors (Taiwan Securities Association Rules Governing Underwriting and Resale of Securities by Securities Firms, Article 10).

Nevertheless, to help an investor bid more successfully and thus earn a higher return in

an IPO auction, there are two types of information that underwriters might provide: information regarding the value of the shares, and/or details of the bids placed in the auction. For an underwriter to attempt to leak bid information would be both illegal and logistically challenging. As we discussed in Section II.A, underwriters are expressly prohibited from revealing any information about the demand schedule and are not supposed to even know the schedule – bids are to be turned over to the Taiwan Securities Association to be compiled after the auction closes.

Moreover, there would be practical problems with trying to reveal the demand schedule in time for favored bidders to place their bids. Auctions are open for a set number of days, announced in advance, and early bids are not favored over late bids. Thus, there is every incentive for investors to wait until the last day to place their bids, in case market conditions change in the meantime. If an underwriter tried to illegally leak bidding information from early in the auction, it might well turn out to be misleading, since most bids tend to come in just before the auction closes.

The remaining possibility is that underwriters know undisclosed information about the stock's value and pass that information on only to favored institutional investors. This would allow institutional investors to seem better at identifying good stocks, without having any actual ability. To explore this, we examine whether returns to institutional investors depend on their relationships with specific underwriters.

If institutional investor returns are due to favored relationships with underwriters, we have the following two predictions.

Hypothesis 6 – The more successful institutional investors should be those who tend to bid in auctions underwritten by the same investment bank.

Hypothesis 7 – In an average auction, the institutional investors who have a previous relationship with the underwriter will tend to perform better than those without a previous relationship with the underwriter.

Our definition of a relationship for Hypothesis 7 is based on whether the investor has participated in a previous auction underwritten by the same underwriter.

To investigate Hypothesis 6, we divide the institutional investors into two groups based on their average returns across auctions: more successful institutions, whose average return is above the median, and the remaining less successful institutions. We then examine the number of different underwriters they use. If the prediction holds, then we expect to see that the more successful institutional investors on average use fewer underwriters, holding constant the number of auctions in which they participate.

Table 7 displays the average number of different lead-underwriters for these two groups of institutional investors, by the number of auctions they participate in (for number of auction from 2 through 6).^{25, 26} In the first four columns of the table, the division of more and less successful institutional bidders is based on their equal-weighted average return; in the next four columns, the division of the two groups is based on value-weighted average return. Throughout the table, there is no significant difference in the average number of underwriters between institutions with above and below-median returns with one exception, where the more successful group on average uses more underwriters, which is inconsistent with Hypothesis 6. Therefore we do not find evidence supporting Hypothesis 6.

²⁵ We do not display a row with number of auction equal to one because, by construction, one-time bidders are associated with only one lead underwriter.

²⁶ The number of observations for the more and less successful institutional investors are different for each row in Table 7 because the division is based on the median of the whole sample (regardless the number of auctions the investor participates in). For every group of investors whose number of auctions is larger than one, there are fewer less successful investors since many less successful bidders are one-time bidders.

To investigate Hypothesis 7, we classify an institutional investor in an auction as having a previous relationship with the underwriter if the investor has bid in a previous auction that was lead-managed by the same underwriter.²⁷ We then examine the bidding activities and bidding results for those with and without relationships. Table 8 presents the comparison. In an average auction, most institutional investors have no previous relationship with the underwriter (both the number and the subscription ratio of no-relation institutional investors are more than twice those of with-relation institutional investors); and the no-relationship group wins about three times as many shares as the with-relationship group. Moreover, there is no significant difference between the percentage of winning bidders, percentage of winning bidders in the money, or their raw or adjusted returns. In other words, there is no evidence that a previous relationship with the underwriter leads to more successful bidding results.

In summary, both the institutional setup and our empirical investigation suggest that the success of institutional investors in Taiwan's IPO auctions is unlikely to be due to favoritism by underwriters. The evidence is therefore consistent with the hypothesis that institutions produce private information and are able to bid based on auction theory, i.e., shave bids adequately.

VI. Implications for IPO methods

Our results indicate that institutional investors' bidding patterns are generally consistent with the predictions of IPO auction theory for rational informed bidders. Such success requires two types of skills at the same time: the ability to judge firm quality and the

²⁷ To build a history, we exclude the first three auctions in our sample. Results are similar if we exclude only the first auction.

expertise to shave bids adequately. Evidence of the first skill has implications for IPOs in general, particularly for a method such as bookbuilding that relies heavily on investor feedback.

In a setting in which underwriters are not allowed to discriminate in favor of certain investors, our results suggest that institutional investors are better able to judge firm quality. Thus we offer empirical support for the idea that sophisticated professional investors make use of their professional expertise and extensive resources when evaluating young companies, and are thus able to contribute valuable pricing information, a notion that is central to information production models of bookbuilding.

Models of bookbuilding also suggest that underwriters will use allocations to encourage regular investors. Cornelli and Goldreich (2001) provide evidence consistent with this, and document that there are a substantial number of regular investors in their sample of bookbuilding offerings: 19.0% of investors placed orders in at least 10 of their 39 offerings (based on their Table III). Jenkinson and Jones (2004) also document that 18.9% of investors participated in at least 4 of their sample of 27 bookbuilding IPOs (see their Table 2). In contrast, the auctions in our sample are heavily dominated by first or second-time bidders, with only a small proportion of regular investors. The proportion of all bidders that bid in at least 8 of our 84 auctions is only 2.8% for individuals and 4.8% for institutions. The proportion of all bidders that bid only once is 74.8% for individual investors and 66.5% for institutional investors.

Our results also have implications regarding the design of IPO auctions. Auction theory indicates that multi-unit common value auctions with endogenous entry are challenging for investors. In our sample, individual investors as a group do not appear to

implement optimal entry and bidding strategies, instead exhibiting return-chasing and over-bidding. According to Jagannathan, Jirnyi and Sherman (2008), the presence of investors who chase returns and overbid makes entry less attractive for more sophisticated investors, discouraging them from devoting time and effort to evaluating the stock and preparing a bid. If too many sophisticated investors are discouraged from devoting time to IPO auctions, the price discovery process will be less efficient and auctions may be more risky. Regulators therefore might want to consider allowing issuers to restrict auction participation to only institutional investors, while individuals can participate through a fixed-price tranche.

Last, our results shed light on the causes of underpricing and partial adjustment both under auctions and under the US bookbuilding method. Many of the theories that predict underpricing and partial adjustment under bookbuilding cannot explain such patterns for auctions, because the theories rely on the preferences and choices of issuers and/or underwriters, but underpricing as compensation for investor time and attention can explain these patterns for both auctions and bookbuilding. The consistency of Taiwan's IPO auction data with this explanation, at least for institutional investors, makes it more likely that the need to compensate investors for their efforts is one of the factors driving underpricing under both auctions and bookbuilding.

VII. Conclusion

Using data on more than 80,000 bids (including over 17,000 winning bids) from 84 Taiwanese auctions during 1995-2000, we have explored the determinants of entry and the effects of entry and bid premia on returns. Consistent with the information production IPO auction model (Sherman, 2005), we find that auctions are underpriced, and that institutional

investor returns display partial adjustment. When the unexpected entry or bid premium of institutional investors is high, returns to all winning bidders tend to be significantly higher, indicating that institutional entry and bidding are driven by information.

For individual investors, we find evidence of return-chasing – they are more likely to enter an auction if returns on recent auctions have been high. Moreover, when the unexpected entry or bid premium of individual investors is high, then returns to winning bidders tend to be significantly lower. This is the pattern that we would expect to find if individual investors, as a group, are not shaving their bids sufficiently, and if their entry is not driven by information regarding the value of the offering.

Finally, we examine underwriter data to see whether the success of institutional investors is attributable to their relationship with specific underwriters. We find no evidence that institutional investors with previous relationship with the underwriter are more successful than those without. Moreover, given the regulatory restrictions that would make it difficult and risky for underwriters to favor certain investors, it appears unlikely that the success of institutional investors is due to underwriter favoritism.

The evidence indicates that institutional investors as a group are informed, consistent with information production theories of IPOs. Our results also raise questions about whether individual investors, as a group, have the sophistication to participate in pricing highly risky securities such as IPOs.

References

- Aggarwal, Reena, N. Prabhala and Manju Puri, 2002, Institutional Allocation in Initial Public Offerings: Empirical Evidence, *Journal of Finance* 57, 1421-1442.
- Bazerman, M.H., and W.F. Samuelson, 1983, I Won the Auction But Don't Want the Prize, *Journal of Conflict Resolution*, 27, 618-634.
- Benveniste, Lawrence and Paul Spindt, 1989, How Investment Bankers Determine the Offer Price and Allocation of New Issues, *Journal of Financial Economics* 24, 343-361.
- Benveniste, Lawrence and William Wilhelm, 1990, A Comparative Analysis of IPO Proceeds under Alternative Regulatory Regimes, *Journal of Financial Economics* 28, 173-207.
- Biais, Bruno and Anne Marie Faugeron-Crouzet, 2002, IPO Auctions: English, Dutch,...French and Internet, *Journal of Financial Intermediation* 11, 9-36.
- Biais, Bruno, Peter Bossaerts and Jean-Charles Rochet, 2002, An Optimal IPO Mechanism, *Review of Economic Studies* 69, 117-146.
- Boehmer, Ekkehart, Beatrice Boehmer and Raymond Fishe, 2006, Do Institutions Receive Favorable Allocations in IPOs with Better Long Run Returns? *Journal of Financial and Quantitative Analysis* 41, 809-828
- Booth, James R. and Lena Chua, 1996, Ownership Dispersion, Costly Information, and IPO Underpricing, *Journal of Financial Economics* 41, 291-310.
- Brau, James and Stanley Fawcett, 2006, Initial Public Offerings: An Analysis of Theory and Practice, *Journal of Finance* 61:1, 399-436.
- Busaba, Walid and Chun Chang, 2002, Bookbuilding vs. Fixed Price Revisited: The Effect of Aftermarket Trading, Unpublished paper, University of Western Ontario.
- Chambers, David, 2006, Gentlemanly Capitalism Revisited: A Case Study Of The Underpricing Of Initial Public Offerings On The London Stock Exchange 1946-86, Unpublished paper, University of Oxford.
- Chemmanur, Thomas, 1993, The Pricing of Initial Public Offerings: A Dynamic Model with Information Production, *Journal of Finance* 48, 285-304
- Chemmanur, Thomas and Huanliang Mark Liu, 2003, How Should A Firm Go Public? A Dynamic Model of the Choice Between Fixed Price Offerings and Auctions in IPOs Privatizations, Unpublished paper, Boston College.
- Chowdhry, Bhagwan and Ann Sherman, 1996, The Winner's Curse and International Methods of Allocating Initial Public Offerings, *Pacific-Basin Finance Journal* 4, 15-30.

Cornelli, Francesca and David Goldreich, 2001, Bookbuilding and Strategic Allocation, *Journal of Finance* 56, 2337 - 2369.

Cornelli, Francesca and David Goldreich, 2003, Bookbuilding: How Informative is the Order Book? *Journal of Finance* 58, 1415-1444.

Cornelli, Francesca, Goldreich, David and Alexander Ljungqvist, 2005, Investor Sentiment and Pre-IPO Markets, *Journal of Finance* 61, 1187-1216.

Degeorge, François, François Derrien and Kent Womack, 2006, Analyst Hype in IPOs: Explaining the Popularity of Bookbuilding, *Review of Financial Studies*, forthcoming.

Derrien, François and Kent Womack, 2003, Auctions vs. Book-Building and the Control of Underpricing in Hot IPO Markets, *Review of Financial Studies* 16, 31-61.

Engelbrecht-Wiggans, Richard and Elena Katok, 2005, Experiments on auction valuation and endogenous entry. In Morgan, J. (Ed.), *Behavioral and Experimental Economics*, 171-196. Stamford, CT: Elsevier Science Ltd.

Field, Laura and Michelle Lowry, 2007, Institutional Versus Individual Investment in IPOs: The Importance of Firm Fundamentals, *Journal of Financial and Quantitative Analysis*, forthcoming.

French, Kenneth and Robert McCormick, 1984, Sealed Bids, Sunk Costs and the Process of Competition, *Journal of Business* 57, 417-441.

Goldreich, David, 2007, Underpricing in Discriminatory and Uniform-Price Treasury Auctions, *Journal of Financial and Quantitative Analysis*, 42(2), 443-466.

Hanley, Kathleen, 1993, Underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of Financial Economics* 34, 231-250.

Hanley, Kathleen and William J. Wilhelm, 1995, Evidence on the strategic allocation of initial public offerings, *Journal of Financial Economics* 37, 239-257.

Hendricks, Kenneth, Robert Porter, and Bryan Boudreau, 1987, Information and Returns in OCS Auctions, 1954-1969, *Journal of Industrial Economics*, 35:4, 517-542

Hsu, Yenshan and Chung-Wen Hung, 2005, Why Have IPO Auctions Lost Market Share to Fixed-price Offers? : Evidence from Taiwan, Unpublished paper, National Chengchi University.

Hsu, Yenshan and Cheng-yi Shiu, 2004, Information Content of Investors' Bids in IPO Auctions: Evidence from Taiwan, *Journal of Financial Studies* 12, No. 1, 27-50.

Jagannathan, Ravi and Ann Sherman, 2005, Reforming the Bookbuilding Process for IPOs, *Journal of Applied Corporate Finance* 17, 67-72.

Jagannathan, Ravi, Andrei Jirnyi and Ann Sherman, 2008, Why Have IPO Auctions Failed the Market Test?, Unpublished paper, Northwestern University.

Jenkinson, T. and H. Jones, 2004, Bids and allocations in European IPO bookbuilding. *Journal of Finance* 59, 2309-2338.

Kagel, J.H., and D. Levin, 1986, The Winner's Curse and Public Information in Common Value Auctions, *American Economic Review*, 76, 894-920.

Kandel, Shmuel, Oded Sarig and Avi Wohl, 1999, The Demand for Stock: An Analysis of IPO Auctions, *Review of Financial Studies* 12, 227-247.

Kaneko, Takashi and Richard Pettway, 2001, Auctions versus Bookbuilding Underwriting of Japanese IPOs: OTC, Mothers and NASDAQ-Japan Issues, Unpublished paper, University of Missouri.

Kerins, Francis, Kenji Kutsuna and Richard Smith, 2007, "Why Are IPOs Underpriced? Evidence from Japan's Hybrid Auction-Method Offerings," *Journal of Financial Economics* 85, 637-666.

Kim, Moonchul and Jay R. Ritter, 1999, Valuing IPOs, *Journal of Financial Economics* 53(3), 409-437.

Kutsuna, Kenji and Richard Smith, 2004, "Why Does Bookbuilding Drive Out Auction Methods of IPO Issuance? Evidence from Japan," *Review of Financial Studies* 17, # 4, 1129-1166.

Lin, Ji-Chai, Yi-Tsung Lee, and Yu-Jane Liu, 2003, Why Have Auctions Been Losing Market Shares to Bookbuilding in IPO Markets?, Unpublished paper, Louisiana State University.

Liu, Y.-J., Wei, K. C. J., Liaw, G., 2001. On the demand elasticity of initial public offerings: an analysis of discriminatory auctions. *International Review of Finance* 2, 151-178.

Liu, Laura, Ann E. Sherman and Yong Zhang, 2008, The Role of the Media in Initial Public Offerings, Unpublished paper, Hong Kong University of Science and Technology.

Ljungqvist, Alexander, 2004, "IPO Underpricing: A Survey". *Handbook In Corporate Finance: Empirical Corporate Finance*, B. Espen Eckbo, ed.

Ljungqvist, Alexander, Tim Jenkinson and William J. Wilhelm, Jr., 2003. Global Integration in Primary Equity Markets: The Role of U.S. Banks and U.S. Investors, *Review of Financial Studies* 16(1), 63-99.

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* 15, 413-444.

Loughran, Tim and Jay R. Ritter, 2004, Why has IPO underpricing changed over time?, *Financial Management* 33, #3, 5-37

- Pagan, Adrian, 1984, Econometric Issues in the Analysis of Regressions with Generated Regressors, *International Economic Review* 25(1), pages 221-247.
- Purnanandam, Amiyatosh K. and Bhaskaran Swaminathan, 2004, Are IPOs Really Underpriced? *Review of Financial Studies* 17(3), 811-848.
- Ritter, Jay and Ivo Welch, 2002, Review of IPO activity, pricing, and allocations. *Journal of Finance* 57(4), 1795-1829.
- Rock, K. (1986). Why New Issues are Underpriced? *Journal of Financial Economics* 15, 187-212.
- Sherman, Ann, 1992, The Pricing of Best Efforts New Issues, *Journal of Finance* 47, 781-790.
- Sherman, Ann, 2000, IPOs and Long Term Relationships: An Advantage of Bookbuilding, *Review of Financial Studies* 13, 697-714.
- Sherman, Ann, 2005, Global Trends in IPO Methods: Bookbuilding versus Auctions With Endogenous Entry, *Journal of Financial Economics* 78 (3), 615-649.
- Sherman, A. and Titman, S., 2002. Building the IPO order book: underpricing and participation limits with costly information, *Journal of Financial Economics* 65, 3-29.
- Spatt, C. and S. Srivastava, 1991, Preplay communication, participation restrictions, and efficiency in initial public offerings, *Review of Financial Studies* 4, 709-726.
- Vickrey, William, 1961, Counterspeculation, Auctions and Competitive Sealed Tenders, *Journal of Finance*. 16:1, 8-37.
- White, Halbert, 1980, A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, *Econometrica* 48, 817-838.
- Yung, Chris, 2005, IPOs with Buy- and Sell-Side Information Production: The Dark Side of Open Sales, *Review of Financial Studies* 18, 327-347.

Figure 1. Numbers of IPOs per year in Taiwan by method

The figure shows the number of IPOs per year in Taiwan, based on the issue method. Note that our sample covers only the auctions that occurred from 1995-2000, while this figure shows the numbers for all methods through the end of 2007.

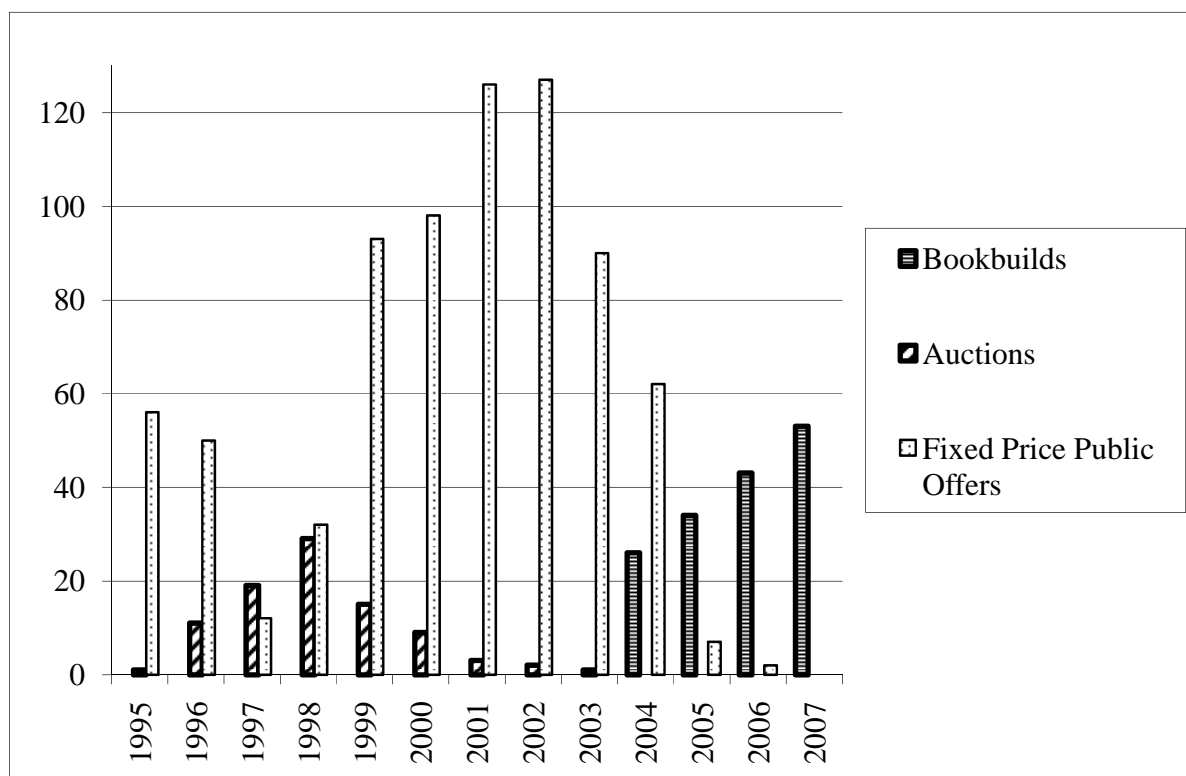


Table 1. Summary statistics of IPOs

The sample includes 84 IPO-auctions in Taiwan during 1995-2000. Firms are listed either on the Taiwan Stock Exchange (TSE) or on the over the counter (OTC) market. A firm is known to be in high-tech industry if it is categorized as in electronic sector by its exchange. *Assets* and *auction proceeds* are in millions of constant year 2000 New Taiwan Dollars (NT\$). The exchange rate at the end of year 2000 is US\$1 = NT\$32.99. *VC ownership* is the percentage of shares held by venture capitalists prior to the IPO. *P/E* is the ratio of the reservation price of the auction to the annual earnings per share prior to the IPO. *% of shares auctioned* is the number of shares to be auctioned divided by the total number of shares outstanding. Panel B shows by year the mean, median (in parentheses) and standard deviation (in square brackets) of each variable.

Panel A: Overall sample

	N	Mean	Median	Std. Dev.	Minimum	Maximum
% of IPOs on TSE	84	55.95				
% of IPOs in high tech industry	84	53.57				
Assets (in NT\$MM)	84	10,382.46	1,936.35	49,900.46	342.18	443,128.69
Auction proceeds (in NT\$MM)	84	880.58	417.72	2522.74	20.69	22,745.12
VC ownership (%)	84	13.46	6.82	16.24	0	69.44
P/E	84	18.34	16.24	13.26	4.76	102.58
% of shares auctioned	84	6.51	6.65	2.88	0.92	10.00

Panel B: By year

Year	1995	1996	1997	1998	1999	2000
% of IPOs on TSE	100.00	81.82	68.42	55.17	33.33	33.33
% of IPOs high-tech	0.00	27.27	31.58	58.62	73.33	88.89
Assets (in NT\$MM)	3,172.47 (3,172.47)	15,990.71 (3,261.28)	2,475.15 (1,913.09)	3,510.58 (1,959.62)	6,009.9 (1,769.97)	50,452.59 (1,551.92)
		[35,577.25]	[1,698.23]	[5,115.89]	[12,155.08]	[147,254.59]
Auction proceeds (in NT\$MM)	235.71 (235.71)	829.94 (573.97)	714.19 (438.50)	608.55 (292.87)	534.39 (466.99)	2,818.88 (234.19)
		[715.40]	[798.39]	[895.59]	[440.25]	[7,481.14]
VC ownership (%)	1.61 (1.61)	9.96 (4.12)	10.51 (2.23)	15.68 (10.92)	17.97 (9.67)	10.62 (5.67)
		[13.26]	[15.34]	[15.62]	[22.54]	[11.11]
P/E	8.80 (8.80)	17.43 (17.68)	19.50 (18.37)	15.18 (14.31)	24.85 (14.93)	17.36 (17.39)
		[7.92]	[5.96]	[5.54]	[28.20]	[5.88]
% of shares auctioned	9.93 (9.93)	8.55 (9.00)	8.08 (9.29)	6.13 (5.00)	4.89 (4.50)	4.26 (3.75)
		[1.66]	[2.60]	[2.83]	[2.57]	[1.83]
N	1	11	19	29	15	9

Table 2. Summary statistics of bids

The sample includes 84 IPO-auctions in Taiwan during 1995-2000. Panel A reports by year the means, medians (in parentheses) and standard deviations (in square brackets) of bidding variables across auctions. *Subscription ratio* is the ratio of total bidding quantity over the number of shares to be auctioned. *Bid premium* is the quantity-weighted average bidding price of all bids (including losing bids) relative to the reservation price. A bidder is a winning bidder if any of her bids won. Panel B compares the bids between institutional and individual bidders. % of allocation to institutions (individuals) is the percentage of shares won by institutions (individuals) in the auction. We use paired t-test for differences in means, and Wilcoxon signed rank test for differences in medians between groups. ***,**, and * denote the difference is significant at the 1, 5, and 10 percent level, respectively.

Panel A: All bids by year

Year	All	1995	1996	1997	1998	1999	2000
Number of bidders	708.76 (442.00) [843.34]	237.00 (237.00)	1,645.09 (952.00) [1,306.53]	787.42 (523.00) [628.92]	400.97 (268.00) [414.19]	486.60 (611.00) [365.28]	812.78 (278.00) [1,350.90]
Number of bids	986.65 (600.00) [1,205.04]	298.00 (298.00)	2,398.00 (1,402.00) [1,955.44]	1,091.16 (727.00) [872.55]	561.66 (373.00) [604.45]	650.07 (790.00) [507.89]	1,048.00 (365.00) [1,774.12]
Subscription ratio	3.77 (2.97) [2.92]	2.54 (2.54)	6.18 (5.35) [4.71]	4.19 (2.68) [3.27]	3.17 (2.85) [2.12]	3.33 (3.60) [2.00]	2.72 (2.72) [1.58]
Bid premium	1.59 (1.51) [0.42]	1.20 (1.20)	1.33 (1.36) [0.21]	1.62 (1.58) [0.20]	1.48 (1.50) [0.15]	1.75 (1.63) [0.47]	1.94 (1.44) [0.91]
% of winning bids	36.61 (24.56) [26.90]	14.43 (14.43)	24.29 (13.31) [27.84]	34.46 (30.96) [23.84]	38.92 (28.86) [24.68]	39.03 (24.53) [29.28]	47.20 (42.21) [34.53]
% of winning bidders	38.06 (27.28) [26.59]	17.72 (17.72)	25.58 (13.35) [27.68]	35.53 (27.49) [24.07]	40.79 (32.43) [24.18]	40.41 (27.41) [28.59]	48.18 (41.03) [34.15]
N	84	1	11	19	29	15	9

Table 2 (continued)**Panel B: Bids by bidder category**

	Institutions	Individuals	Difference
Number of bidders	31.95 (20.50) [37.05]	676.81 (407.05) [816.10]	-644.86 *** -387 ***
Number of bids	59.88 (36.50) [83.71]	926.77 (544.00) [1,140.07]	-866.89 *** -507.50 ***
Subscription ratio	0.76 (0.53) [0.67]	3.01 (2.36) [2.58]	-2.25 *** -1.83 ***
Bid premium	1.58 (1.51) [0.44]	1.59 (1.52) [0.41]	-0.01 -0.01
% of winning bids	35.82 (25.66) [30.41]	36.43 (25.33) [27.08]	-0.61 0.33
% of winning bidders	39.09 (28.58) [30.68]	37.77 (27.05) [26.76]	1.32 1.53
% of allocation	19.13 (13.69) [18.19]	80.87 (86.31) [18.19]	-61.74 *** -72.62 ***

Table 3. Entry regressions

The dependent variable is natural logarithm of the number of bidders in an auction. $\ln(\text{assets})$ is the natural logarithm of assets. VC ownership is the percentage of shares held by venture capitalists prior to the IPO. P/E is the ratio of the reservation price of the auction to the annual earnings per share prior to the IPO. High-tech dummy equals one if the firm is categorized as in electronic sector by its exchange and zero otherwise. TSE dummy equals one if the firm is listed on Taiwan Stock Exchange and zero otherwise. $\% \text{ of shares auctioned}$ is the number of shares to be auctioned divided by the total number of shares outstanding. Market volatility is the standard deviation of daily market returns during the three months prior to the auction day. $\text{Recent auction return}$ is the weighted average initial return of IPO auctions for which returns have been observed, with weights based on $(720 - N)$ (zero weight if $720 - N < 0$), where N is the number of days between a previous auction's first non-hit day and the current auction's auction day. t -statistics are adjusted using White's correction for heteroskedasticity. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

	Ln(# of bidders)			Ln(# of institutional bidders)			Ln(# of individual bidders)		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	3.351	(3.63)	***	-1.041	(-0.80)		3.384	(3.66)	***
Ln(assets)	0.412	(5.71)	***	0.530	(5.32)	***	0.406	(5.56)	***
VC ownership	0.459	(0.81)		0.968	(1.09)		0.430	(0.77)	
P/E	0.002	(0.36)		-0.006	(-0.72)		0.002	(0.44)	
High-tech dummy	0.689	(4.53)	***	0.770	(3.53)	***	0.687	(4.52)	***
TSE dummy	0.290	(1.19)		0.554	(2.16)	**	0.279	(1.13)	
% of shares auctioned	0.759	(0.20)		3.976	(0.85)		0.500	(0.13)	
Market volatility	-114.084	(-4.38)	***	-85.795	(-2.03)	**	-116.056	(-4.51)	***
Recent auction return	3.261	(4.75)	***	0.080	(0.07)		3.360	(4.91)	***
R ²	67.52%			53.53%			67.75%		
N	82			82			82		

Table 4. Summary statistics of returns (or bidding results)

Panels A and B treat each auction as one observation. Panel A reports by year the mean, median (in parentheses) and standard deviation (in square brackets) of each variable. *% of in-the-money bids* is the percentage of winning bids whose bidding prices are lower than the closing price of the first non-hit day. *% of in-the-money bidders* is the percentage of winning bidders whose quantity-weighted winning prices are lower than the closing price of the first non-hit day. *Raw return* is calculated as the closing price of the first non-hit day over the quantity-weighted average of the winning price, minus one. *Adjusted return* is raw return minus the TSE index return between the trading day after the auction day and the first non-hit day. Panel B compares bidding results of institutional and individual bidders. Panels C and D treat each bidder in an auction as one observation. In Panel B, we use paired t-test for differences in means, and Wilcoxon signed rank test for differences in medians between groups. In Panel D, we use t-test for differences in means, and Wilcoxon rank sum test for differences in medians between groups. ***,**, and * denote the difference is significant at the 1, 5, and 10 percent level, respectively.

Panel A: All bidders by year – Auction level

Year	All	1995	1996	1997	1998	1999	2000
Raw return (%)	7.25 (3.52) [24.28]	6.82 (6.82)	35.46 (23.75) [26.07]	0.72 (2.67) [15.49]	4.21 (0.99) [20.76]	11.98 (4.57) [26.48]	-11.51 (-9.73) [18.08]
Adjusted return (%)	8.34 (8.88) [21.57]	9.08 (9.08)	24.03 (14.86) [25.05]	0.54 (-2.12) [14.8]	10.17 (10.78) [19.88]	5.31 (-3.18) [26.1]	4.68 (2.90) [21.17]
% of in-the-money bids	55.97 (74.70) [43.59]	90.70 (90.70)	99.30 (100.00) [1.66]	50.02 (62.11) [42.00]	50.29 (62.96) [43.52]	66.15 (87.50) [40.20]	13.08 (0.00) [33.00]
% of in-the-money bidders	56.95 (80.00) [44.13]	90.48 (90.48)	99.35 (100.00) [1.83]	52.63 (67.18) [43.27]	51.18 (65.65) [44.19]	66.36 (91.79) [41.32]	13.45 (0.00) [33.03]
N	84	1	11	19	29	15	9

Panel B: Bidders by category – Auction level

	Institutional bidders	Individual bidders	Difference
Raw return (%)	8.7 (3.88) [24.89]	7.19 (3.22) [24.4]	1.51 ** 0.66 ***
Adjusted return (%)	10.39 (10.31) [21.79]	8.28 (8.87) [21.64]	2.11 ** 1.44 ***
% of in-the-money bids	60.14 (90.91) [46.45]	55.65 (72.69) [43.46]	4.49 18.22
% of in-the-money bidders	61.42 (100) [47.1]	56.58 (78.03) [43.99]	4.84 21.97 *
N	84	84	

Table 4 (continued)**Panel C: All bidders by year – Bidder level**

	All years	1995	1996	1997	1998	1999	2000
Raw return (%)	5.84 (0.36) [23.07]	11.78 (14.68) [6.82]	33.00 (23.53) [27.30]	3.22 (2.80) [15.49]	6.19 (2.32) [20.75]	6.87 (4.40) [21.76]	-8.96 (-8.64) [7.94]
Adjusted return (%)	13.02 (13.63) [19.74]	14.04 (16.94) [6.82]	22.18 (12.78) [25.94]	2.78 (3.35) [13.37]	12.16 (9.82) [20.35]	0.11 (-3.91) [19.85]	20.74 (23.78) [10.99]
% of in-the-money bids	49.76	90.70	99.00	57.17	59.29	67.55	1.66
% of in-the-money bidders	50.28	90.48	98.96	58.76	59.09	67.99	2.01
N	17,008	42	2,975	3,943	3,329	1,743	4,976

Panel D: Bidders by category – Bidder level

	Institutional bidders	Individual bidders	Difference
Raw return (%)	11.53 (4.61) [26.10]	5.50 (0.00) [22.83]	6.03 *** 4.61 ***
Adjusted return (%)	18.66 (18.67) [22.72]	12.67 (13.28) [19.49]	5.99 *** 5.39 ***
% of in-the-money bids	52.66	49.51	
% of in-the-money bidders	64.09	49.44	
N	969	16,039	

Table 5. Return regressions at the auction level

The dependent variable is the raw (adjusted) initial return for each auction, calculated as the closing price on the first non-hit day over the quantity-weighted average winning price minus one (adjusted for TSE index return over the period [auction day+1, first non-hit day]). $\ln(\text{assets})$ is the natural logarithm of assets. VC ownership is the percentage of shares held by venture capitalists prior to the IPO. P/E is the ratio of the reservation price of the auction to the annual earnings per share prior to the IPO. High-tech dummy equals one if the firm is categorized as in electronic sector by the exchange and zero otherwise. TSE dummy equals one if the firm is listed on Taiwan Stock Exchange and zero otherwise. $\% \text{ of shares auctioned}$ is the number of shares to be auctioned divided by the total number of shares outstanding. Market volatility is the standard deviation of daily market returns during the three months prior to the auction day. Unexpected entry of institutions (individuals) is measured as the residual from the entry regression for institutions (individuals) in Table 3. Bid premium of institutions (individuals) is the quantity-weighted average bidding price of all institutional (individual) bids (including losing bids) relative to the reservation price. $\text{Recent auction return}$ is the weighted average initial return of IPO auctions for which returns have been observed, with weights based on $(720 - N)$ (zero weight if $720 - N < 0$), where N is the number of days between a previous auction's first non-hit day and the current auction's auction day. $\text{Recent auction adjusted return}$ is adjusted against TSE index return. Estimates and t-statistics (in parentheses) of the regressions are based on a bootstrapping method. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

	All bidders				Institutional bidders				Individual bidders			
	Raw Return		Adjusted Return		Raw Return		Adjusted Return		Raw Return		Adjusted Return	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	-1.101	(-2.43) **	-0.542	(-1.39)	-1.053	(-2.17) **	-0.482	(-1.16)	-1.086	(-2.42) **	-0.528	(-1.36)
$\ln(\text{assets})$	0.051	(2.77) ***	0.049	(2.61) ***	0.051	(2.57) **	0.049	(2.40) **	0.051	(2.78) ***	0.048	(2.60) ***
VC ownership	-0.062	(-0.73)	0.086	(0.94)	-0.060	(-0.61)	0.109	(1.03)	-0.066	(-0.77)	0.082	(0.90)
P/E	-0.003	(-2.55) **	-0.003	(-2.13) **	-0.003	(-1.58)	-0.003	(-1.60)	-0.003	(-2.61) ***	-0.003	(-2.17) **
High-tech dummy	0.186	(5.64) ***	0.159	(4.80) ***	0.193	(5.37) ***	0.165	(4.55) ***	0.187	(5.68) ***	0.160	(4.84) ***
TSE dummy	-0.125	(-2.92) ***	-0.115	(-2.61) ***	-0.134	(-3.11) ***	-0.121	(-2.72) ***	-0.124	(-2.90) ***	-0.114	(-2.59) ***
% of shares auctioned	2.559	(2.70) ***	2.297	(2.53) **	2.485	(2.38) **	2.123	(2.14) **	2.494	(2.66) ***	2.228	(2.49) **
Market volatility	19.428	(1.70) *	6.293	(0.65)	17.461	(1.42)	4.405	(0.44)	18.903	(1.67) *	5.890	(0.62)
Unexpected entry of institutions	0.093	(3.74) ***	0.082	(2.86) ***	0.102	(3.49) ***	0.097	(2.79) ***	0.090	(3.65) ***	0.080	(2.79) ***
Bid premium of institutions	0.452	(2.48) **	0.370	(2.01) **	0.537	(2.24) **	0.470	(2.01) **	0.456	(2.49) **	0.373	(2.02) **
Unexpected entry of individuals	-0.085	(-1.82) *	-0.076	(-1.75) *	-0.087	(-1.78) *	-0.084	(-1.82) *	-0.083	(-1.77) *	-0.075	(-1.70) *
Bid premium of individuals	-0.421	(-2.74) ***	-0.368	(-2.16) **	-0.512	(-2.45) **	-0.479	(-2.13) **	-0.425	(-2.74) ***	-0.372	(-2.17) **
Recent auction return	0.343	(0.99)			0.286	(0.76)			0.315	(0.91)		
Recent auction adjusted return			-0.813	(-2.55) **			-0.814	(-2.43) **			-0.833	(-2.60) ***
Year dummy	yes		yes		yes		yes		yes		yes	
R ²	56.31%		41.95%		55.28%		39.16%		56.57%		42.32%	
N	80		80		75		75		80		80	

Table 6. Return regressions at the bidder level

The dependent variable is the raw (adjusted) initial return for each bidder in an auction, calculated as the closing price on the first non-hit day over the bidder's quantity-weighted average winning price minus one (adjusted for TSE index return over the period [auction day+1, first non-hit day]). $Ln(\text{assets})$ is the natural logarithm of assets. $VC \text{ ownership}$ is the percentage of shares held by venture capitalists prior to the IPO. P/E is the ratio of the reservation price of the auction to the annual earnings per share prior to the IPO. $High\text{-tech dummy}$ equals one if the firm is categorized as in electronic sector by the exchange and zero otherwise. $TSE \text{ dummy}$ equals one if the firm is listed on Taiwan Stock Exchange and zero otherwise. $\% \text{ of shares auctioned}$ is the number of shares to be auctioned divided by the total number of shares outstanding. $Market \text{ volatility}$ is the standard deviation of daily market returns during the three months prior to the auction day. $Unexpected \text{ entry}$ of institutions (individuals) is measured as the residual from the entry regression for institutions (individuals) in Table 3. $Bid \text{ premium}$ of institutions (individuals) is the quantity-weighted average bidding price of all institutional (individual) bids (including losing bids) relative to the reservation price. $Recent \text{ auction return}$ is the weighted average initial return of IPO auctions for which returns have been observed, with weights based on $(720 - N)$ (zero weight if $720 - N < 0$), where N is the number of days between a previous auction's first non-hit day and the current auction's auction day. $Recent \text{ auction adjusted return}$ is adjusted against TSE index return. Estimates and t-statistics (in parentheses) of the regressions are based on a bootstrapping method. ***, **, and * denote significance at the 1, 5, and 10 percent level, respectively.

	All bidders				Institutional bidders				Individual bidders			
	Raw Return Coeff.	t-stat	Adjusted Return Coeff.	t-stat	Raw Return Coeff.	t-stat	Adjusted Return Coeff.	t-stat	Raw Return Coeff.	t-stat	Adjusted Return Coeff.	t-stat
Intercept	-1.339	(-3.75) ***	-0.668	(-2.01) **	-1.894	(-3.63) ***	-1.160	(-2.43) **	-1.278	(-3.64) ***	-0.602	(-1.85) *
Ln(assets)	0.063	(3.61) ***	0.062	(3.50) ***	0.083	(3.79) ***	0.087	(3.73) ***	0.061	(3.48) ***	0.060	(3.43) ***
VC ownership	-0.079	(-0.81)	0.122	(1.22)	-0.046	(-0.42)	0.177	(1.24)	-0.078	(-0.81)	0.119	(1.23)
P/E	-0.004	(-2.77) ***	-0.004	(-2.20) **	-0.004	(-1.23)	-0.004	(-1.12)	-0.004	(-2.67) ***	-0.004	(-2.07) **
High-tech dummy	0.212	(5.33) ***	0.188	(4.89) ***	0.269	(5.42) ***	0.293	(5.27) ***	0.208	(5.19) ***	0.182	(4.77) ***
TSE dummy	-0.192	(-4.02) ***	-0.160	(-3.54) ***	-0.225	(-3.53) ***	-0.209	(-3.09) ***	-0.188	(-3.94) ***	-0.153	(-3.43) ***
% of shares auctioned	2.641	(3.03) ***	2.099	(2.32) **	3.101	(2.43) **	2.275	(1.74) *	2.554	(3.02) ***	2.028	(2.32) **
Market volatility	30.095	(2.97) ***	9.037	(1.01)	46.118	(2.74) ***	23.573	(1.44)	28.042	(2.86) ***	6.761	(0.79)
Unexpected entry of institutions	0.102	(3.26) ***	0.090	(2.92) ***	0.135	(4.51) ***	0.169	(4.59) ***	0.098	(3.04) ***	0.083	(2.65) ***
Bid premium of institutions	0.621	(2.55) **	0.516	(2.29) **	1.044	(3.05) ***	1.128	(3.09) ***	0.612	(2.53) **	0.506	(2.27) **
Unexpected entry of individuals	-0.128	(-2.28) **	-0.133	(-2.74) ***	-0.148	(-2.65) ***	-0.147	(-2.85) ***	-0.126	(-2.21) **	-0.132	(-2.69) ***
Bid premium of individuals	-0.576	(-2.52) **	-0.509	(-2.31) **	-0.970	(-3.08) ***	-1.132	(-3.06) ***	-0.570	(-2.49) **	-0.500	(-2.30) **
Recent auction return	0.220	(0.65)			0.297	(0.66)			0.214	(0.62)		
Recent auction adjusted return			-0.739	(-2.57) **			-1.201	(-2.54) **			-0.724	(-2.54) **
Year dummy	yes		yes		yes		yes		yes		yes	
R ²	64.98%		54.24%		72.55%		62.83%		64.75%		54.50%	
N	16,791		16,791		969		969		15,822		15,822	

Table 7. Number of underwriters and the success of institutional bidders

The sample includes 84 IPO-auctions in Taiwan during 1995-2000. We examine only institutional bidders. An institutional bidder is categorized as more successful if its average return across auctions is above the median of all institutional bidders regardless their number of auctions. *# of underwriters* is the average number of unique lead underwriters whose auctions the bidder has participated in. ***, **, and * denote the difference from the other group is significant at the 1, 5, and 10 percent levels, respectively.

	Equal-weighted average return				Value-weighted average return			
	More successful institutional bidders		Less successful institutional bidders		More successful institutional bidders		Less successful institutional bidders	
# of auctions	N	# of underwriters	N	# of underwriters	N	# of underwriters	N	# of underwriters
2	45	1.31	26	1.31	52	1.31	19	1.32
3	30	1.40	12	1.42	38	1.37	4	1.75
4	32	1.41	10	1.20	35	1.37	7	1.29
5	25	1.64	4	1.50	28	1.61	1	2.00
6	26	1.92	5	1.20 *	30	1.83	1	1.00
2 or 3	75	1.35	38	1.34	90	1.33	23	1.39
> 3	147	2.14	31	1.90	168	2.15	10	1.30 ***

Table 8. Underwriter relationship, bidding activities and bidding results

The sample includes 81 IPO-auctions in Taiwan during 1995-2000 (we exclude the first 3 auctions to build a relationship history). We examine only institutional bidders. The table presents the mean of each variable. An institutional bidder is said to have a previous relationship with the lead underwriter if it has participated in a previous auction for which the same investment bank was also the lead underwriter. *Subscription ratio* is the ratio of total bidding quantity of a group of bidders over the number of shares to be auctioned. *% of allocation* is the percentage of shares won by a group of bidders relative to the number of shares sold in the auction. A bidder is a winning bidder if any of her bids won (given that multiple bids at different prices are allowed). *% of in-the-money bidders* is the percentage of winning bidders whose quantity-weighted winning prices are lower than the closing price of the first non-hit day. *Raw return* is calculated as the closing price of the first non-hit day over the quantity-weighted average winning price, minus one. *Adjusted return* is raw return minus the TSE index return between the trading day after the auction day and the first non-hit day. We use paired t-test for differences in means between the groups. ***, **, and * denote the difference is significant at the 1, 5, and 10 percent levels, respectively.

	Institutional bidders with a previous relationship with the underwriter	Institutional bidders with no previous relationship with the underwriter
# of bidders per auction	11.13	26.72 ***
Subscription ratio	24.69%	63.17% ***
% of allocation	5.14%	16.85% ***
% of winning bidders	32.20%	42.75%
% of in-the-money bidders	63.35%	60.86%
Raw return	7.41%	8.73%
Abnormal return	7.83%	10.54%
# of auction-observations	81	81