Why Have Auctions Been Losing Market Shares to Bookbuilding in IPO Markets?

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Abstract

We analyze Taiwan's IPO auctions to shed light on the diminishing role of auctions in IPO markets. In contrast to Ljungqvist and Wilhelm's (2002) results for bookbuilding IPOs, we find that underpricing increases with institutional allocation in auctions. This implies that issuing firms in auctions with higher institutional allocations leave more money on the table. Retail investors earn zero abnormal returns, suggesting that auctions do not benefit them. Institutional investors earn positive abnormal returns, but receive much lower allocations than in countries with bookbuilding. The results suggest that under bookbuilding underwriters could compensate institutional investors with higher allocations and lower underpricing, simultaneously reducing money left on the table and increasing institutional investors' expected dollar profits. This would benefit issuing firms and institutional investors, while not harming retail investors. Our welfare analysis implies that auctions are an inferior IPO method.

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1. Introduction

Sherman (2002) and Ljungqvist, Jenkinson, and Wilhelm (2003) observe that bookbuilding is increasingly popular and that auctions are rarely used in IPO markets. As Sherman points out, many countries that experimented with IPO auctions in the 1990s or 1980s abandoned them within a few years. It is puzzling that auctions, although popular in many markets for items with uncertain valuation, are not popular with firms going public.

However, there is some renewed interest in IPO auctions for the following reasons. First, bookbuilding seems to have worked badly when it comes to internet IPOs in 1999 and 2000.[1] Several studies have suggested that auctions tend to lead to less average underpricing.[2] Second, the OpenIPO, an Internet-based auction introduced by WR Hambrecht in 1999, provides issuing firms in the U.S. an IPO method, alternative to the conventional bookbuilding. Third, the recent regulatory probes on questionable IPO allocation practices in the U.S. have lead some researchers and regulators to contemplate whether to require issuers to use an auction,[3] which would allocate IPO shares in an equal and impartial way. Hence, before any reforms in the IPO process are adopted, it is

[1] Loughran and Ritter (2002) report that the average IPO underpricing in the U.S. in 1999-2000 is 65%, which is much higher than the average underpricing of 7.4% during 1980-1989 and 14.8% during 1990-1998. Also, Ljungqvist and Wilhelm (2003) report, "Internet IPOs averaged a stunning 89 percent (median: 57 percent) during 1999 and 2000."

[2] See Amihud, Hauser, and Kirsh (2003), Derrien and Womack (2003), Biais and Faugeron-Crouzet (2002), Kandel, Sarig, and Wohl (1999), Pettway and Kaneko (1996), and Loughran, Ritter and Rydqvist (1994).

[3] See Ausubel (2002), Murray (2002), and Wingfield (2002).

important to understand the strength and the weakness of IPO auctions, relative to bookbuilding. While the strength of IPO auctions is obvious, their weakness is more subtle, as will be shown in this paper.

Bookbuilding's advantage is that underwriters learn the pre-market demand curve for IPO shares by soliciting indications of interest from institutional investors. Underwriters then use underpricing to compensate institutional investors for revealing private information (Benveniste and Spindt (1989)).[4] Sherman (2002) argues that, under an assumption that underwriters act in the best interest of the issuing firm, bookbuilding has an edge over auctions in IPO pricing. However, as mentioned earlier, several studies have found that auctions tend to lead to less average underpricing than other IPO methods. In light of Sherman's argument, what empirical evidence can be offered to suggest that issuing firms would leave more money on the table under auctions than under bookbuilding?

The bookbuilding method gives underwriters discretion in setting the offering price and allocating shares to investors. Ljungqvist and Wilhelm (2002), Aggarwal, Prabhala, and Puri (2002), and Cornelli and Goldreich (2001) document that allocation policies under bookbuilding favor institutional investors. Auctions, on the other hand, let bidding outcomes determine IPO price and share allocations. It is conceivable that retail investors, who did not obtain shares of hot IPOs under bookbuilding, would like to see changes in the IPO process that will give them a fair access to bid IPO shares. This raises a second empirical question: Would IPO auctions be more beneficial to retail investors?

[4] See also Benveniste and Wilhelm (1990), Spatt and Srivastava (1991), and Sherman and Titman (2002).

Benveniste and Spindt (1989) posit that there exist some pricing and allocation rules for underwriters to implement such that institutional investors could be better off under bookbuilding than under auctions. If institutional investors truthfully reveal information about IPO value, the tradeoff between a higher allocation of shares and a lower level of underpricing could increase institutional investors' expected dollar profits and reduce money left on the table as well. This raises the third empirical question: Do observed institutional allocations and the underpricing required by institutional investors in auctions make the tradeoff feasible?

In this paper we analyze IPO auctions held in Taiwan to provide answers to the aforementioned three empirical questions and to shed some light on why auctions have been losing market share to bookbuilding. According to Sherman (2002), Taiwan and Israel are the only two countries that use auctions as a primary IPO method. Since no bookbuilding IPOs have ever been conducted in Taiwan, we cannot directly compare auctions versus bookbuilding, as Derrien and Womack (2003) do with their French IPO sample. Instead, we draw implications from Taiwan's IPO auctions to suggest whether three key players in IPO markets—issuing firms, institutional investors, and retail investors—would be better off under bookbuilding.

Based on bidding data, we find that retail investors win significantly higher proportions of IPO shares in auctions yielding negative initial returns, suggesting that they are more likely to suffer a winner's curse (Rock (1986)). However, the positive returns they earn from auctions with high institutional allocations help them to offset these losses. Overall, we find that the allocation-weighted abnormal return for retail investors is close to zero. The evidence is consistent with Rock's (1986) winner's curse theory in which retail investors are uninformed and earn a riskless rate of return, on average.

In contrast, we find that institutional investors bid competitively to win shares of hot IPOs and that the more shares they win, the higher the initial returns they earn.[5] The allocation-weighted abnormal return for institutions is a significant 10.5%. The evidence strongly suggests that institutional investors are collectively better informed than retail investors.

Our analysis provides three implications for answering the questions raised earlier. First, IPO auctions are not beneficial to retail investors even though they have the same access as institutional investors. A simple reason is that information asymmetry can be very severe in IPO markets where retail investors are less efficient in collecting and processing relevant information. Consequently, retail investors are more likely to either overbid and suffer a winner's curse, or underbid and lose the opportunity in winning shares in hot IPOs.

The second implication is that the pricing efficiency of IPO auctions vis-à-vis bookbuilding depends on the structural link between underpricing and institutional allocations. Ljungqvist and Wilhelm (2002) show that underpricing in bookbuilding IPOs is inversely related to institutional allocations. They argue that as institutions contribute more positive information about IPO values, they would be rewarded with more shares, but the price discovery allows underwriters to more accurately price the

[5] Liu, Wei, and Liaw (2001) and Chen, Leung, and Liaw (2003) have examined the pricing performance of Taiwan IPO auctions. Both studies similarly show that underpricing is positively related to the percentage of shares won by institutional investors. We discuss in Appendix B some biases may results from the method used in these two studies to overcome the effects of the price limit in Taiwan markets on measuring IPO initial returns.

IPO. Interestingly, Taiwan's IPO auctions exhibit a positive relation between underpricing and institutional allocations. The two opposite relations suggest that as institutional allocations increase, the underpricing of IPO auctions increases, but the underpricing of bookbuilding decreases. Therefore, issuing firms in auctions with higher institutional allocations leave more money on the table, which could be reduced under bookbuilding.

The third implication is that even though institutional investors evidently have advantages over retail investors in auctions, institutional investors could be even better off under bookbuilding, as Benveniste and Spindt (1989) suggest. In Taiwan's IPO auctions, we observe that institutional investors seem to know in which auctions and at which prices they should bid to win shares. However, the average institutional allocation of 19% in Taiwan's IPO auctions is much lower than the norm of around 70% in countries using bookbuilding IPOs (Ljungqvist and Wilhelm (2002)). The 19% allocation and the 10.5% required underpricing by institutional investors implies that their expected dollar profits could be increased feasibly by the tradeoff of a higher allocation and a lower underpricing under bookbuilding. Institutional investors would be better off as long as the allocation increases at a rate greater than the rate at which the required underpricing decreases (see Hanley (1993)).

In sum, our results suggest that institutional investors and issuing firms that attract institutional interests could be better off under bookbuilding than under auctions. By being truthful, institutional investors help underwriters setting IPO price to reduce underpricing in some cases and overpricing in other cases. Retail investors would continue to face the winner curse problem and earn zero abnormal return under bookbuilding and, hence, are not worse off. The only party that would be worse off under bookbuilding is issuing firms that expect their shares to be fairly priced or overpriced in auctions.

The welfare analysis allows us to go a step further for analyzing a "horse race" between bookbuilding and auctions. Bookbuilding theory suggests that underpricing is necessary to compensate institutional investors for their information acquisition costs. If both auctions and bookbuilding are available, issuing firms that expect their shares to be undervalued more under auctions than under bookbuilding would choose bookbuilding. Conversely, firms that expect their shares to be fairly priced or overpriced in auctions would choose auctions.

The issuing firms' choices suggest that, compared to bookbuilding, auctions have the following weak points. First, institutional investors would prefer to participate in bookbuilding IPOs over auctioned IPOs. Second, institutional investors would not participate in auctions unless they see that profits are available. The lack of institutional interest could create bad information cascades, which could cause IPOs to fail (Welch (1992)). Third, because investors should not rationally expect positive excess returns in auctions, there would be less incentive for them to collect and analyze information. As a result, auctions may lead to substantial uncertainty and volatility in initial returns. Fourth, retail investors are more likely to overbid in auctions, so they are more likely to file complaints against issuers using auctions. These negative effects could hinder investors' participation in auctions and cause issuers to go with bookbuilding. This may explain why auctions have been losing market shares to bookbuilding even though auctions have been found to lead to less average underpricing.

The remaining of the paper is organized as follows. Section 2 describes our sample and the institutional features of the Taiwan's IPO auctions. Section 3 discusses three metrics used in evaluating the auction performance. Section 4 presents evidence regarding the extent of underpricing in Taiwan's IPO auctions. Section 5 addresses the question: Are auctions beneficial to retail investors? Section 6 infers the structural relation between underpricing and institutional allocations. Section 7 presents the institutional investors' required underpricing in auctions, and discusses whether the tradeoff of a higher allocation and a lower underpricing is feasible. Section 8 contains our concluding remarks in which we emphasize that, in comparing auctions to bookbuilding, we should not overlook the dark size of bookbuilding (see Loughran and Ritter (2002)).

2. The Sample

Our sample consists of all the 89 IPO auctions held in Taiwan over the 1995-2002 period. The sample starts in 1995, the year in which a firm could choose to auction its shares of common stock or follow the conventional fixed-price public offering in the IPO. Table 1 presents the annual frequency and percentage of issuing firms using auctions in our sample. The number of issuing firms using auctions increases from one in 1995 to 29 in 1998, and then gradually declines to only two in 2002. In terms of percentage, about 68% of issuing firms in 1997 choose auctions; but, it declines to less than 3% in 2001 and 2002. The numbers suggest that the auction method has gradually lost its appealing. This result is consistent with Chemmanur and Liu (2002), who predict that issuers are more likely to choose fixed-price public offering over auctions.

Taiwan's auctioned IPOs consist of competitive bidding for half of the IPO shares and fixed-price public offering for the remaining half of the shares. The public offering is usually limited to only one round lot (i.e., 1000 shares) per person. Under the bidding rules, no bidder shall be allowed to win more than three percent of the IPO shares (or six percent of the shares designated for auction). This feature encourages more bidders to participate and compete in auctions.

To formally initiate an auction, the lead underwriter must publicly announce the number of shares designated for auction, the auction base price (i.e., minimum acceptable price),[6] the dates of accepting bids, and the auction date (i.e., bid opening date). Sealed bids can be submitted within four days before the auction day. At 2:00 p.m. on the auction day, Chinese Securities Association aggregates all bids provided by the lead and co-lead underwriters and, then, announces the auction results, including the quantity-weighted average winning bid price and the auction clearing price. Orders with bid prices above the clearing price are fully filled. Orders at the clearing price are randomly filled, with winners randomly selected one at a time by the Association's computer until all shares are sold. Orders under the clearing price are left unfilled. Winning bidders pay what they bid.

After the auction, the remaining IPO shares are then offered to the general public for subscription at a fixed price. For undersubscribed auctions, the offering price for public

[6] The Securities and Futures Commission (SFC) in Taiwan sets a formula for the base price. It is the weighted average of four factors: (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% weight); (2) the net wealth (i.e., book equity value) per share (20% weight); (3) the estimated dividend per share in the current year divided by one-year deposit interest rate (20% weight); 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% weight). However, the base price announced to the public may deviate from the price set by the formula, contingent on a satisfactory explanation to the SFC.

subscription is fixed at the auction base price. For oversubscribed auctions, if the auction clearing price is equal to or more than 1.5 times of the auction base price, the offering price is fixed at 1.5 times of the auction base price;[7] otherwise, it is fixed at the quantity-weighted average winning bid price from bids equal to or less than 1.5 times of the base price.[8]

Table 2 reports the characteristics of the 89 discriminatory auctions in the sample. The average number of IPO shares designated for auction is about 12.2 million and the average base price is NT$44.57 per share.[9] The average auction attracts 954 bids from around 688 bidders. On average, the quantity-weighted average winning bid price is NT$79.41; and the offering price for public subscription is NT$63.45. These numbers suggest that investors are offered to subscribe 1,000 shares per person at more or less a 20 percent discount. The discount is largely to motivate small investors to become shareholders of the firms and, thus to increase ownership dispersion. If there is more demand for shares than the supply at the second-stage IPO, a random drawing is used to select winning investors.

Sherman (2002) notes two weak points concerning IPO auctions when compared with bookbuilding. One is higher information cost and the other is undersubscription.

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[7] Essentially, the auction base price and 1.5 times the base price serves as the minimum and maximum offering prices, respectively, in the second-stage IPO. The bidding results then determine where the actual offering price shall be in the offering price range. According to Chinese Securities Association Regulations Governing Underwriting and Resale of Securities by Securities Firms-Article 17, the specified multiple of the base price shall be resolved by negotiations between the underwriting syndicate and the issuing company, but shall not exceed a multiple of 1.5 (since September 30, 1999, the number 1.5 has been changed to 1.3). The multiple was always set at the upper limit in our sample of the auctioned IPOs.

[8] Liu, Wei, and Liaw (2001) and Chen, Leung, and Liaw (2003) state that the offering price is fixed at the quantity-weighted average winning bid price or the 1.5 times of the base price, whichever is less. The statement is too simple and, in many cases, is incorrect.

[9] During the sample period, the exchange rate ranges from about 27 to 35 NT$/US$.

Among the 89 auctions in our sample, three are undersubscribed. For an undersubscribed auction, the unsold shares together with the shares designated for the public subscription are then offered to the general public. If the shares are not fully subscribed in the second-stage public offering, the lead and co-lead underwriters must absorb all unsold shares at the offering price.

Oversubscription, defined as the total number of shares demanded by bidders divided by the number of shares sold in auction, ranges from 0.38 to 17.2 with an average of 3.67. The average oversubscription is lower than 5.1 reported by Kandel, Sarig, and Wohl (1999) for uniform-price auctions in Israel, and 6.6 reported by Cornelli and Goldreich (2001) in bookbuilding IPOs in U.K.

The second-stage public offering is conducted about two to three weeks after the auction. Exchange listing starts approximately two to four weeks after the second-stage public offering.[10] On average, it takes about 42 days from the auction to the first day of exchange listing in our sample.

Also reported in Table 2 are the subsample characteristics, based on institutional allocation, the percentage of shares won by institutional investors. Among the 89 auctions, ten have no institutional winner; and hence they are classified in the *zero institutional allocation* group. Of the remaining 79 auctions, we classify 29 auctions with institutions winning 20% or more of shares in the *high institutional allocation* group and

[10] According to Chinese Securities Association Regulations Governing Underwriting and Resale of Securities by Securities Firms, the time line from auction to exchange listing can be generally described as follows. Denoting T as the first day for accepting bids, T+ 3 is the deadline for submitting bids; T+8 the publication of the bids; T+14 the announcement of the second-stage fixed-price offering; T+16 to T+19 the public subscription period; T+22 the date of public lottery drawing; T+23 the date for lottery winner notification; T+26 to T+30 the date for subscription payments; T+35 the date of public announcement of exchange listing; and T+36 the date of listing. The time line was longer before November 1998.

the rest 50 auctions in the *low institutional allocation* group.[11] The average institutional IPO allocation across the 89 auctions is 19%, which is considerably lower than the norm of around 70% in countries using bookbuilding IPOs, as reported by Ljungqvist and Wilhelm (2002).

In our sample, firms with higher institutional IPO allocations tend to set a higher base price and put more shares for IPO auction, indicating a larger auction size. For example, the average auction size (base price times number of shares for auction) is NT$2,107 million for the high institutional allocation group, which is 8.6 times as large as the average size for the low institutional allocation group (NT$244 million); and 18 times as large as the average size for the zero institutional allocation group (NT$117 million). Also, auctions with higher institutional IPO allocations tend to attract more bidders. The average numbers of bidders participating in auctions are 819, 714, and 177 for the high, low, and zero institutional allocation groups, respectively. The average numbers of institutional investors submitting bids in auctions are 53, 25, and 2 for the high, low, and zero institutional allocation groups, respectively. Taken these numbers together, the results suggest that institutional investors are not very interested in small size offerings. Furthermore, most bidders are retail investors, and institutional investors represent only a small fraction of all bidders.

However, the average bid size by institutional investors is much larger than that of retail investors. As reported in Table 3, for the low institutional allocation group, the average bid size per institution is 183.4 lots (one lot=1,000 shares), which is about 4.7 times as large as the average bid size of 39.2 lots per retail investor. Interestingly, for the

[11] The 20% cutoff point is slightly higher than the average institutional allocation of 19%. The results are similar if the cutoff point is set at the average or the median.

high institutional allocation group, the average bid size per institution increases to 245.2 lots, while the average bid size per retail investor decreases to 31.8 lots. The quantity-weighted average winning bid price of institutions is slightly higher than that of retail investors, NT$108.28 vs. NT$108.19, for the high institutional allocation group. The reverse holds for the low institutional allocation group. The results suggest that institutional investors appear to be more aggressively bidding shares in some auctions, while less so in other auctions. In section 7, we will present a system of simultaneous equations to explore the relationships between institutional allocations, the difference in the bidding prices of the two types of investors, and institutional investors' initial returns.

3. The Evaluation Metrics

This section presents three metrics we use in assessing the pricing performance of the Taiwan's IPO auctions. Each metric measures how well competitive bidding in auction reveals the aftermarket value of the security. The differences among them are whether and how to adjust the effect of stock market movements on security prices.

The first metric is the holding period return, $R_{i,t}^{w} = (P_{i,t} - P_i^{w}) / P_i^{w}$, where $P_{i,t}$ is the closing price on the t^{th} day of exchange listing for security *i*; and P_i^{w} the quantity-weighted average winning bid price. This metric reflects the average rate of return of winning bids from the auction day to the day of evaluation.

The second metric is the market-adjusted return, $MAR_{i,t}^{w} = R_{i,t}^{w} - R_{m,t}$, where $R_{m,t}$ is the corresponding holding period return on the Taiwan value-weighted market index. The third one is the alpha in the following cross-sectional excess return regression:

$$R_{i,t}^{w} - R_{f,t} = \alpha + \beta(R_{m,t} - R_{f,t}) + e_{i,t},$$

for i=1,2, …, 89. We use the one-year deposit interest rate, which is used to establish the auction base price by the SFC formula (see footnote 6), to proxy for R_f. Note that both the second and third metrics assume that all IPO firms in the sample are in the same risk class. While the *MAR* approach assumes they have a beta equal to one, the cross-sectional excess return regression approach estimates the beta empirically. Both approaches follow the spirit of the Capital Asset Pricing Model (CAPM).

Conventionally, IPO initial returns are measured with the closing price on the first day of exchange listing, i.e., setting $t = 1$. However, the first day price may not fully reflect the value of IPO shares if post-IPO price changes are subject to regulatory limits. For instance, in France, if the post-IPO opening price is higher than the offering price by more than 10%, then trading is halted until the next business day.[12] To obviate problems arising from the price limit in France, Ljungqvist, Jenkinson, and Wilhelm (2003) and Ljungqvist and Wilhelm (2002) measure IPO initial returns from the offer price to the closing price on the fifth trading day following listing. Similarly, Amihud, Hauser, and Kirsh (2003) measure the initial IPO return six days after the exchange listing because, for some small-cap securities, "securities prices were more noisy and adjusted more slowly to information than in a continuous trading market."

The equity markets in Taiwan have a similar, but more severe problem due to the following two institutional constraints. First, there is a 7% daily price limit. The reference price for setting the price limit on a given day is usually the previous day's closing price. Second, the exchange regulations require that the offering price in the second-stage IPO be used as the reference price for setting the 7% price limit on the first

[12] See Derrien and Womack (2003, p.37) for a discussion on post-IPO price limits in France.

day of exchange listing. As we show in Table 2, on average, the offering price tends to be about 20% lower than the weighted average winning bid price. These two institutional constraints are likely to create gradual price adjustments in the post-IPO market.

To illustrate, Figure 1 shows the average daily closing market prices of the 89 IPOs from the first day of exchange listing (day 1) to day 50. The average closing price on day 1 is NT$66.41, which is 4.67 percent higher than the average offering price of NT$63.45. However, the average closing price on day 1 is 16.37 percent lower than the mean of the weighted average winning bid prices, NT$79.41. The average market price then gradually rises to NT$82.07 on day 10 and to NT$84.32 on day 20. Thereafter, the average market price remains around the NT$84 level.

To further show when the market fully reflects the value of the IPO shares, we examine daily market-adjusted returns (*MAR*) from day 1 of exchange listing to day 20, and report the results in Table 4.[13] We measure the return on day 1 from the weighted average winning bid price in auction to the closing market price on day 1. According to Table 4, the average *MAR* on day 1 is –10.8%, which is significantly negative. The negative abnormal return on day 1 is simply due to the two constraints mentioned above. The average *MAR's* from days 2 through 8 and then on day 10 are all significantly positive, consistent with gradual price adjustments. On days 17 and 19, significant negative *MAR's* are observed. Thereafter, no significant abnormal returns are observed. The results in Figure 1 and Table 4 suggest that the market seems fully adjust to the value

[13] The results based on the market model are very similar to those based on the market–adjusted return. However, one problem of using the market model in our case is that the estimated betas from the time-series market model with daily returns tend to be biased downward due to the effect of the price limit. For example, the average beta of the 89 IPOs in our sample estimated from days 31 through 180 (where day 1 is the first day of exchange listing) is about 0.751, which is much lower than 1.05, the beta obtained from the cross-sectional excess return regression.

of IPO shares around day 20. For this reason, we measure the initial return from an IPO auction as the percentage return from the quantity-weighted average winning bid to the closing market price on the 20th trading day after listing.[14]

The results in Table 4 and Figure 1 point out that the exchange regulations on the daily price limit and on the reference price for the first day of exchange listing seem to create "inefficiency." However, the gradual price adjustments in our case do not necessarily imply an inefficient market where investors could systematically earn abnormal returns. The reason is that whenever the market price hits the upper or the lower price limit, trading is halted, resulting in an illiquid market. In Appendix A, we use the trading activities of a sample IPO to illustrate the point.

Our approach of measuring IPO initial returns differs from that used by Liu, Wei, and Liaw (2001) and Chen, Leung, and Liaw (2003), who similarly examine the performance of Taiwan's IPO auctions. They use the "non-hit" price, the first closing market price in the post-IPO market that does not hit either the upper or lower price limit, to compute IPO initial returns. Their approach ignores any adjustments in the market value of the IPO shares after the "non-hit" price is observed. In Appendix B, we use daily market prices to show that there are significant price adjustments after the "non-hit" price is observed. The result suggests that the "non-hit" price may not fully reflect the value of IPO shares that bidders perceive in auctions. Consequently, using the "non-hit" price to measure the auction performance could lead to biased results.

[14] Although not reported in the paper, we re-do our analyses using the closing prices on the 10th and 30th days and obtain very similar results. The results are available upon request.

4. Auction Performance in Pricing IPO Shares

This section presents evidence regarding the extent of underpricing in the 89 IPO auctions. The assessment is based on three metrics discussed above. All three metrics are very consistent and lead to the same conclusion.

We report the auction performance for the whole sample in Panel A of Table 5. The average initial return is 2.39% (t=0.74). The result indicates that, on average, winning bidders earn about two percent from the auction day to the 20^{th} day of exchange listing. The t-value indicates that this average initial return is insignificantly different from zero.

Adjusting for the market movements does not change the inference. The average market adjusted return is 2.79% (t=1.02), while the alpha is 2.80% (t=0.32). Again, the t-values indicate that both metrics are insignificantly different from zero. Our finding of an average underpricing of slightly less than 3% is not much different from the 4.5% underpricing from Israeli uniform-price auctions, as reported by Kandel, Sarig and Wohl (1999).

The insignificant underpricing reported in Table 5 is, to some extent, attributable to large variation in initial returns. For example, the market-adjusted return ranges from -53.91% to 90.22%, with a standard deviation of 25.69%. About 45% of the auctions in our sample result in a negative *MAR*, suggesting that overbidding occurs quite frequently. The results imply that although the average underpricing is small, the auction outcome may not be very reliable in predicting the aftermarket price of each IPO. As will be shown, behind the low average underpricing, there is systematic cross-sectional variation related to institutional allocations, which could point to a weakness in Taiwan's IPO auctions.

In fact, Sherman (2002) points out that "Historically, auctions have been used in a wide variety of circumstances. They are popular for government bonds and are often used in privatizations. For IPOs, however, auctions are surprisingly rare. … Most of countries that experimented with auctions in the 1990s or 1980s abandoned them within a few years." To shed light on why IPO auctions are not popular, we turn next to the welfares of key players in auctions.

5. Are IPO Auctions Beneficial to Retail Investors?

Cornelli and Goldreich (2001) show that investment bankers favor institutional investors when allocating IPO shares in U.K. Similarly, Aggarwal, Prabhala, and Puri (2002) find that allocation policies in bookbuilding IPOs in U.S. favor institutional investors. Ljungqvist and Wilhelm (2002) further show that the practice of favoring institutional investors in IPO allocations holds worldwide.

In contrast, under competitive bidding, auctions allow all bidders on equal footing and let the bidding outcome determine share allocations. Would this IPO mechanism be beneficial to retail investors? This section presents some results, showing that it may not be.

We first examine the relation between auction pricing performance and the percentage of shares won by institutional investors in auctions, denoted by *Inst_alloc*. We report the IPO initial returns in Panels B through D of Table 5 for the zero, low, and high institutional allocation groups, respectively. The average *MAR* increases from

–4.31% (t=-0.71), to –2.28% (t=-0.68), and then to 13.98% (t=2.67) for the zero, low, and high institutional subsamples. The t-values indicate that the auctions in the zero and low institutional allocation subsamples lead to insignificant underpricing. But, significant underpricing exists in the auctions that have high institutional allocations. The pattern and the magnitudes are very similar for the initial returns based on the alphas. The pattern suggests that the higher the institutional allocations, the higher the initial returns. For auctions with no institutional winners, winning bidders lose an average of 4.3%, evident of retail investors suffering a winner's curse. On the other hand, for auctions that institutional investors win 20% or more of shares, the average initial return is about 14%. The difference is visible as illustrated in Figure 2, which shows the distributions of underpricing in auctions within each of the three allocation groups. The evidence strongly suggests that institutional investors are better informed than retail investors.

The median *MAR's* give another interesting contrast between institutional investors and retail investors. The median *MAR's* for the high, low, and zero institutional allocation groups are 5.09%, 0.03%, and -10.2%, respectively. These numbers suggests that overbidding in auctions occurs more than 50 percent of the times when only retail investors involve in setting the weighted average winning bid price. The results imply that the price setting process functions more poorly without institutional investors. When the price is set almost purely by retail investors, there are fewer bidders yet the auctions tend to be more overpriced.[15]

[15] As shown in Table 2, on average, there are only two institutional bidders in the zero institutional allocation group, which also has the lowest number of bidders among the three groups.

To further illustrate the difference between institutional and retail investors, we examine *Inst_Alloc* in four subsamples sorted by the levels of initial returns, and report the results in Table 6. The results clearly show that institutional allocations are related to the initial returns from auctions. Specifically, for 19 auctions with initial returns equal to or above 20%, the average *Inst_Alloc* is 26.7%. It declines significantly to 16.4% in auctions with initial returns between –20% and 0; and further declines to 11.6% in auctions with initial returns worse than –20%. The evidence suggests that institutions are selective in the sense that they tend to avoid overbidding in IPO auctions and that the higher returns they can earn in auctions, the more shares they obtain. In contrast, retail investors win significantly higher proportions of shares in auctions that yield negative returns. In particular, retail investors get about 88% of shares in those auctions that lose more than 20% in value. The findings suggest that retail investors are more likely to suffer a winner's curse in IPO auctions. Therefore, they are not better off under auctions than under bookbuilding under which they would also face the winner's curse problem (Rock (1986)). The findings imply that, even without favoritism, institutional investors have advantages in IPO auctions.

6. Would Issuing Firms Be Better off under Bookbuilding?

The information gathering is an essential part of bookbuilding. Ljungqvist and Wilhelm (2002) assume that institutions are the primary source of information extracted in the course of a bookbuilding effort. Underwriters then use pricing and allocation strategies to reward institutions. In discriminatory auctions, however, institutions must reward themselves with bidding strategies to win shares in IPOs that are likely to increase in value. The results in Tables 5 and 6 suggest that they seem successful in doing that, revealing a positive relation between underpricing and *Inst_Alloc*. In this section we discuss what this positive relation means for the welfare of issuing firms.

Following Ljungqvist and Wilhelm (2002), we study a structural relation between underpricing and *Inst_Alloc* in a system of two equations, treating both variables endogenous. As will be shown, important implications can be obtained by comparing the structural relation with that of bookbuilding IPOs documented by Ljungqvist and Wilhelm (2002).

We start with a simple system of two equations as follows:

$$Inst\_Alloc_i = a_0 + a_1 MAR_i + a_2 Size_i + a_3 BaseP_i + a_4 NHt_i \times R_{m(-1,-30)} + u_i \qquad (1)$$

$$R_i - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + e_i \qquad (2)$$

Eq.(2) is an extension of the cross-sectional excess return regression discussed in section 3 for obtaining the performance measure α. We add $Inst\_Alloc_i$ into the equation to study the structural link between underpricing and institutional allocations.

Eq.(1) describes $Inst\_Alloc_i$ as a function of the initial return, measured by the market-adjusted return, $MAR_i = R_i - R_m$; $Size_i$, defined as the logarithm of the product of the number of shares for auction times the auction base price; $BaseP_i$, the reciprocal of the auction base price; and $NHt_i \times R_{m(-1,-30)}$, the product of a non-high tech dummy variable, NHt_i, and the average daily return on the Taiwan Value Weighted Market Index over 30 days before to one day before the auction, $R_{m(-1,-30)}$.

We provide the rationale for eq.(1) as follows. First, if we presume that institutional investors are informed, they would win more shares in IPOs with higher initial returns. We include MAR_i in the equation because we find that it has a stronger effect on $Inst\_Alloc_i$ than $R_i - R_f$ does. Also, from Table 2, we know that auctions with larger size and higher base price tend to attract more institutional investors. It could be that IPOs of larger size and higher price would have higher liquidity in the secondary market and that institutions prefer liquidity. Moreover, auction size may have an impact on bidder behavior, particularly if retail investors are capacity-constrained.[16] In that case, institutional investors may have advantages in auctions with large size and high prices.

Lowry and Schwert (2002) and Derrien and Womack (2003), among others, have suggested that market returns before the IPO have an effect on IPO returns. It is possible that institutional investors and retail investors react differently to the effect. Empirically, we find that the interaction between non-high tech IPOs and previous market returns has a significant effect on institutional allocations, and thus include the variable, $NHt_i \times R_{m(-1,-30)}$, in the equation. Once we include this variable, the market return, $R_{m(-1,-30)}$, and a high tech dummy,[17] Ht_i, have no effect on $Inst\_Alloc_i$. Nor does the interaction between high tech IPOs and the market return, $Ht_i \times R_{m(-1,-30)}$.

We also tried many different formations for eq.(1) with different exogenous variables listed in Table 7. They includes $\sigma_{m(-1,-30)}$, the standard deviation of market returns over days –30 to –1; *Share%*, shares for auction divided by shares outstanding; *Elast*,[18] the gross elasticity of demand; *Tse*,[19] a dummy variable for IPOs listed on the

[16] See, e.g., Nyborg, Rydqvist, and Sundaresan (2002).

[17] We classify IPOs in the electronic and software industries as in the high tech category.

[18] Following Liu, Wei, and Liaw (2001), we estimate the gross elasticity of demand by

Taiwan Stock Exchange; *Age*, firm age at the IPO; *Days_to_List*, the number of days from auction to exchange listing; and year dummies. None of these variables have an effect on $Inst\_Alloc_i$.[20] We treat $Oversub_i$, the total demand for shares submitted by bidders divided by shares for auction, as endogenous, which also has no effect on $Inst\_Alloc_i$.

The system of eqs.(1) and (2) is estimated using the three-stage least squares (3sls) method. Notice first that MAR_i in eq.(1) is treated as endogenous, along with $Inst\_Alloc_i$ and R_i-R_f. With endogenous variables as explanatory variables, the OLS method could lead to biased results. The 3sls method provides consistent estimates as long as the equations are identified. A necessary condition for identification, according to Greene (2000), is that the number of exogenous variables excluded from an equation is at least as large as the number of endogenous variables included in that equation. Eqs. (1) and (2) satisfy this necessary condition. (See Ljungqvist and Wilhelm (2002) for a similar application of this necessary condition.) Notice also that all the exogenous variables listed in Table 7 were included as instrumental variables in the first-stage regressions. We report the 3sls results in Table 8.

$$ELAST_i = -\frac{(Q_i^c - Q_i^{\max})/[(Q_i^c + Q_i^{\max})/2]}{(P_i^c - P_i^{\max})/[(P_i^c + P_i^{\max})/2]},$$

where P_i^c and Q_i^c are auction *i*'s clearing price and cumulative quantity demanded at P_i^c and higher; and $P_i^{\max}$ and $Q_i^{\max}$ are the highest winning bid price and the quantity demanded at $P_i^{\max}$.

[19] Among the 89 IPOs, 50 are listed on the TSE. The remaining are listed on the ROC Over-the-Counter Securities Exchange (ROSE). Firms listed on the TSE are usually larger than those listed on the ROSE. For example, for a firm to be eligible for listing on the TSE, its paid-in capital shall be at least NT$600 million, compared to at least NT$100 million for listing on the ROSE. Both exchanges are fully automatic call markets.

[20] Our sample includes one auction for privatization. Our estimation results are almost the same if we discard it from analysis.

As expected, $Inst\_Alloc_i$ increases with MAR_i, suggesting that when they expect an IPO to appreciate more in value, institutional investors win more shares in the auction. The coefficient 0.325 (t-value=3.55) implies that an increase of 10% in the initial return would prompt institutional investors to win an additional 3.25% more of shares. In addition, $Inst\_Alloc_i$ also increases with auction size and auction base price, consistent with the notion that institutional investors prefer larger auctions and auctions with higher base prices.

The results for eq.(2) show that after controlling for the market effect, the auction initial return is positively related to $Inst\_Alloc_i$. With a coefficient of 0.904 (t-value=3.88), it implies that a 10% increase in $Inst\_Alloc_i$ would lead to a 9.04% increase in underpricing. The result suggests that institutions have very significant power on the outcomes of IPO auctions, even though they represent only a small fraction of all bidders in IPO auctions.

The intercept term is also significant with a coefficient of –0.142 (t-value= –2.77). These results imply that in an auction with no institutional winner (i.e., $Inst\_Alloc_i$=0), one would expect retail investors to lose 14.2%. The negative sign is consistent with that of –4.65% for α in the zero institutional allocation group reported in Table 5. But, the magnitude is larger.[21]

Our estimation suggests that we can put the structural relation between underpricing and *Inst_Alloc* as

$$Underpricing_i = -14.2\% + 0.904 Inst\_Alloc_i .$$

[21] The difference could be due to the fact that the result in Table 5 does not take into consideration the endogeneity of $Inst\_Alloc_i$ in pricing IPO shares in auctions.

In our whole sample, the mean of *Inst_Allo*c is 19%, implying a underpricing of about 3.0%. If we take *Inst_Allo*c =70%, the norm of institutional allocation in countries using bookbuilding IPOs reported by Ljungqvist and Wilhelm (2002), then underpricing would increase to about 49%! Although *Inst_Allo*c =70% could be extreme in Taiwan's IPO auctions, the example does illustrate that underpricing could be large for auctions that attract a great deal of institutional interest.

A relevant question is: If the bookbuilding method were used, could underpricing be reduced for those hot IPOs? The structural relation between underpricing and *Inst_Allo*c documented by Ljungqvist and Wilhelm (2002) could provide a hint for answering this question. The structural relation in bookbuilding IPOs is opposite to the positive relation in IPO auctions. In fact, Ljungqvist and Wilhelm (2002) show that the coefficient for *Inst_Allo*c is –0.42 in the structural relation, suggesting that a 10% increase in *Inst_Allo*c reduces underpricing by 4.2%. Thus, they argue that underwriters' discretion with which the more information extracted from institutional investors, the more shares are allocated to them is beneficial. It promotes price discovery, allowing underwriters to more accurately price the IPO.

The two opposite relations suggest that as institutional allocations increase, auctions (bookbuilding) lead issuing firms to leave more (less) money on the table. Thus, issuing firms that attract institutional interests could be better off under bookbuilding than under auctions.

Notice that the structural relation between underpricing and *Inst_Allo*c does not change materially when we add other variables into the model. Among the variables listed in Table 7, we find $NHt_i \times R_{m(-1,-30)}$, $Ht_i \times R_{m(-1,-30)}$, *Share%,* and *Elast* have a significant effect on the initial return, along with *Inst_Allo*c$_i$ and $R_m - R_f$. Hence, we estimate the following system of two equations and report the results in Table 8.

$$Inst\_Alloc_i = a_0 + a_1 MAR_i + a_2 Size_i + a_3 BaseP_i + a_4 NHt_i \times R_{m(-1,-30)} + u_i \quad (1)$$

$$R_i - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + \gamma_1 Ht_i \times R_{m(-1,-30)} + \gamma_2 NHt_i \times R_{m(-1,-30)} + \gamma_3 Share\%_i + \gamma_4 Elast_i + e_i \quad (2')$$

The variable *Inst_Allo*c$_i$ in eq.(2') is still very significant with a coefficient of 0.759 (t-value=3.26). The result suggests that the positive relation between underpricing and *Inst_Allo*c$_i$ is robust.

7. Institutional Investors' Required Underpricing

This section estimates how much underpricing institutional investors require in auctions. To address this question, we first examine the links between institutional allocations, institutional bids, and their initial returns in IPO auctions.

Since there is no favoritism for institutional investors in competitive bidding, they must bid higher, compared to retail investors' bids, in order to obtain more shares. If institutional investors are informed, they should just bid slightly higher than retail investors to ensure to win shares and still leave room for price appreciation. Hence, there must be a link between *Inst_Allo*c$_i$ and $P_{inst} - P_{retail}$, the logarithm of the difference between institutional investors' and retail investors' quantity-weighted average winning bid prices.

Let R_{inst} be the return based on the quantity-weighted average winning bid price of institutional investors only. We find no relation between institutional investors' excess return, $R_{inst} - R_f$, and $P_{inst} - P_{retail}$, implying that institutions do not systematically overbid (underbid) to damage (raise) their returns. The link to $R_{inst} - R_f$ is through *Inst_Allo*c$_i$. Hence, we report in Table 9 the following structural model of *Inst_Allo*c$_i$, $R_{inst} - R_f$, and $P_{inst} - P_{retail}$:

$$\begin{aligned} Inst\_Alloc_i &= a_0 + a_1 MAR_{inst} + a_2 Size_i + a_3 BaseP_i + a_4 NHt \times R_{m(-1,-30)} \\ &\quad + a_6 (P_{inst} - P_{retail}) + u_i \end{aligned} \qquad (1')$$

$$R_{inst} - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + e_i \qquad (2'')$$

$$P_{inst} - P_{retail} = c_0 + c_1 Inst\_Alloc_i + c_2 NHt_i \times R_{m(-1,-30)} + \delta_i \qquad (3)$$

The market-adjusted return in eq.(1') is defined as $MAR_{inst} = R_{inst} - R_m$. In this way, we focus on institutional behavior. Furthermore, the model allows us to infer institutional investors' required underpricing as a function of *Inst_Allo*c$_i$.

Since there are ten auctions with no institutional winner, the price difference, $P_{inst} - P_{retail}$, and the excess return, $R_{inst} - R_f$, are not available for those auctions. Hence, we employ data from the 79 auctions with *Inst_Allo*c$_i$ >0 to estimate the system of the three equations using the 3sls. According to Table 9, *Inst_Allo*c$_i$ has a positive effect on $P_{inst} - P_{retail}$, and vice versa. Hence, as expected, institutional investors bid higher than retail investors to obtain more shares. Furthermore, a positive relation between *Inst_Allo*c$_i$ and MAR_{inst} suggests that they also obtain more shares in IPO auctions from which they can earn higher returns.

The relation between $R_{inst} - R_f$ and *Inst_Allo*c$_i$ in Table 9 shows that the underpricing required by institutional investors can be expressed as

$$Underpricing_{inst} = -0.14 + 0.853 Inst\_Alloc_i .$$

This relation indicates that institutional investors tend to earn higher returns in auctions in which they win more shares. Our results imply that institutional investors seem to know in which auctions and at which prices they should bid to win shares. The coefficient of $Inst\_Alloc_i$ is almost the same when other variables are added into the equation, as shown in Table 9.

Note that not all institutional investors are well informed. When $Inst\_Alloc_i$ is less than 16.4%, $underpricing_{inst} < 0$, implying that those institutional investors who win shares in the auctions with $Inst\_Alloc_i$ <16.4% are likely to be not well informed. Conversely, retail investors who win shares in auctions with high *Inst_Allo*c would earn positive returns. The fact that the extent of underpricing of auctions depends on *Inst_Allo*c suggests that, collectively, institutional investors are better informed than retail investors.

How much difference would an average institutional investor and an average retail investor earn in IPO auctions? We answer this question with two scenarios. First, assume that the average retail investor bids at the quantity-weighted average winning bid price of retail investors and invests \$1 in every auction, while the average institutional investor bids at the quantity-weighted average winning bid price of institutional investors and invests \$1 in every auction with *Inst_Allo*c >0. Under this setting, the cross-sectional excess-return regressions yield[22]

$$R_{inst} - R_f = 0.041 + 1.055(R_m - R_f);$$

(1.37) (5.79) N=79; adj. R^2 =0.274

and,

[22] The t-values based on White's (1980) robust standard errors are below the estimates.

$$R_{retail} - R_f = 0.028 + 1.057(R_m - R_f);$$
$$(1.03) \quad (6.31) \qquad\qquad \text{N=89; adj. } R^2 = 0.283.$$

The alpha estimates suggest that the average institutional investor earns an abnormal return of 4.1%, which is 1.3% higher than 2.8% earned by the average retail investor. However, both estimates are insignificantly different from zero. The second scenario discussed below is more relevant to the difference between institutional investors and retail investors.

Since institutional investors are selective in allocating their bids, we should consider allocation-weighted returns in comparing institutional and retail investors. Hence, the second scenario is for the average institutional investor to invest $w_{inst,i} = \frac{79 Inst\_Alloc_i}{\sum Inst\_Alloc_i}$, instead of \$1, in each auction *i* with $Inst\_Alloc_i$>0. The weight is proportional to $Inst\_Alloc_i$; and its sum is equal to \$79, the same as in the first scenario.

The average retail investor is to invest $w_{retail,i} = \frac{89(1 - Inst\_Alloc_i)}{\sum (1 - Inst\_Alloc_i)}$ in each auction *i*. Note that $(1 - Inst\_Alloc_i)$ is the percentage of shares won by retail investors.

We calculate the allocation-weighted abnormal returns for the average investors as follows.

$$(R_{inst} - R_f) \times w_{inst} = 0.105 + 1.032(R_m - R_f) \times w_{inst};$$
$$(2.03) \quad (3.51) \qquad\qquad \text{N=79; adj. } R^2 = 0.230$$

and,

$$(R_{retail} - R_f) \times w_{retail} = 0.011 + 1.051(R_m - R_f) \times w_{retail};$$
$$(0.43) \quad (6.41) \qquad\qquad \text{N=89; adj. } R^2 = 0.283.$$

The allocation-weighted abnormal return for the average institutional investor is a significant 10.5%, while the allocation-weighted abnormal return for the average retail investor is only 1.1% and insignificantly different from zero. The difference of 9.4% is quite large. Also, the results are virtually the same if we calculate the allocation-weighted abnormal returns by $\sum \frac{w_{inst}}{79}(R_{inst} - R_m)$ and $\sum \frac{w_{retail}}{89}(R_{retail} - R_m)$. The results confirm our earlier findings that, on average, institutional investors do better than retail investors in IPO auctions.

Even though retail investors win a higher percentage of shares in auctions with negative returns, the positive returns they earn from auctions with high *Inst_Allo*c help them to even out overall. Assuming that retail investors are uninformed, the result that their allocation-weighted abnormal return is close to zero is consistent with Rock's (1986) winner's curse theory in which uninformed investors earn R_f, the riskless rate of return.

The allocation-weighted abnormal return of 10.5% for the average institutional investor can be used as a summary statistic for the positive relation between $underpricing_{inst}$ and $Inst\_Alloc_i$. Hence, we interpret the allocation-weighted abnormal return of 10.5% the institutional investors' required underpricing in auctions. The abnormal return could be a result of institutional investors' bid shading behavior to avoid a winner's curse or a result of institutional investors' information costs. (Sherman (2002) shows that underpricing in IPO auctions reflects information costs.)

Interestingly, even though institutional investors evidently have advantages over retail investors in Taiwan's IPO auctions, they could be even better off under bookbuilding. According to Benveniste and Spindt (1989), underwriters can induce institutional investors to truthfully reveal private information by pricing and allocation rules. By being truthful, institutional investors could be compensated with a larger portion of shares and a smaller initial return, which could increase their expected dollar profit. The fact that the average institutional allocation of 19% in Taiwan's IPO auctions is much lower than the norm in bookbuilding IPOs around the world makes the tradeoff feasible. As Hanley (1993) points out, "As long as the allocations increase at a rate greater than the rate at which returns decrease, the truth-tellers will be better off than the liars." Hence, as an example, if the average *Inst_Allo*c is doubled to 38%, the institutional investors' required underpricing could be lowered from 10.5% to 6%, which would still increase institutional investors' expected dollar profits. Therefore, institutional investors could be better off under bookbuilding.

With lower underpricing, issuing firms could be better off as well. Moreover, by being truthful, institutional investors could help underwriters setting IPO price to reduce underpricing in some cases and overpricing in other cases. Retail investors would continue to face the winner's curse problem and earn zero abnormal return and, hence, are not worse off under bookbuilding. The only party that could be worse off under bookbuilding is issuing firms that expect investors to fairly bid or overbid their IPOs in auctions.

Hence, if both auctions and bookbuilding are available, issuing firms that expect their shares to be undervalued more under auctions than under bookbuilding would choose bookbuilding. But, those firms that expect their shares to be fairly priced or overpriced in auctions would choose auctions. The issuing firms' choices suggest that institutional investors would prefer to participate in bookbuilding IPOs over auctioned IPOs. The lack of institutional interests could create bad information cascades, which could cause IPOs to fail (Welch (1992)). Furthermore, because investors should not rationally expect positive excess returns in auctions, there would be less incentive for them to collect and analyze information. As a result, auctions may lead to substantial volatility in initial returns. Being less informed, retail investors are more likely to overbid in auctions and see their investments in IPOs falling in value, so they are more likely to file complaints against auctions than against bookbuilding.[23] These negative effects could hinder investors' participation in auctions and cause issuers to go with bookbuilding. This may explain why auctions have been losing market shares to bookbuilding in IPO markets even though auctions have been found to lead to less average underpricing.

8. Concluding Remarks

Based on the bidding data of 89 discriminatory (pay-as-bid) IPO auctions held in Taiwan, we have addressed three empirical questions. First, would auctions that allow all bidders on equal footing be beneficial to retail investors? Our analysis shows that retail investors win significantly higher proportions of IPO shares in auctions with negative initial returns. At the same time, the more shares won by institutional investors, the higher initial returns they earn. While the allocation-weighted abnormal return for institutions is a significant 10.5%, the allocation-weighted abnormal return for retail investors is close to zero. The results suggest that retail investors are more likely to suffer a winner's curse, as Rock (1986) suggests. Therefore, retail investors are not better

[23] As Tinic (1988) points out, underpricing may act as insurance against securities litigation.

off under auctions than under bookbuilding under which they similarly face the winner's curse problem.

The second question is: What empirical evidence can be offered to suggest that auctions may lead issuing firm to leave more money on the table than bookbuilding? We find that the pricing efficiency of IPO auctions vis-à-vis bookbuilding depends on the structural link between underpricing and institutional allocations. While Ljungqvist and Wilhelm (2002) show that underpricing decreases with institutional allocations in bookbuilding IPOs, we find the opposite in IPO auctions. The results imply that issuing firms in auctions with higher institutional allocations leave more money on the table, which could be reduced under bookbuilding.

As shown in Table 2, issuing firms that attract institutional interests are usually large firms. Thus, our analysis is consistent with Kutsuna and Smith (2001), who find that large firms' issuing costs in IPOs were lowered when the issuing method was switched from auctions to bookbuilding in Japan.

The final question is: Would institutional investors be better off under bookbuilding? We find that even though they evidently have advantages over retail investors in auctions, institutional investors could be even better off under bookbuilding. The analysis is based on the average institutional allocation of 19% and their required underpricing of 10.5% in auctions. The numbers suggest that, under bookbuilding, institutional investors, by truthfully revealing private information to underwriters, could obtain higher expected dollar profits if underwriters reward them with a higher percentage of shares and a lower level of underpricing, as suggested by Benveniste and Spindt (1989).

Our welfare analysis suggests that IPO auctions are an inferior IPO method. No wonder that many countries that experimented with IPO auctions in the 1990s or 1980s abandoned them within a few years. Taiwan, one of the two countries still use auctions as a primary IPO method, may soon follow the trend. In fact, Chinese Securities Association (2002) has proposed to use bookbuilding to replace auctions in the IPO process (see also Lu and Chow (2002)).

Of course, we should not ignore the dark side of bookbuilding. Loughran and Ritter (2002) address the issue of why IPO underpricing has changed over time. They argue that, in the internet bubble period, "there was less focus on maximizing IPO proceeds due to both an increased emphasis on research coverage and allocations of hot IPOs to the personal brokerage accounts of issuing firm executives." Also, as Ritter and Welch (2002) point out, "If underwriters are given discretion in share allocations, the discretion will not automatically be used in the best interests of the issuing firms. Underwriters might intentionally leave more money on the table than necessary, and then allocate these shares to favored buy-side clients." Therefore, for bookbuilding to work, the dark side of bookbuilding should be kept in check.

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Appendix A. The Trading Activities of a Sample Stock

Table A.1 reports the trading activities of a sample stock, Ultima Electronics Corp., from the first day of exchange listing to day 20. This stock has the highest oversubscription, 17.2, and the second highest number of consecutive (15) days, from the first day of exchange listing, of hitting the upper price limit in our sample.[24] The company allocated 4,069,000 shares for auction on 12/17/96 with a book value per share of NT$11.99. The auction base price is NT$24 and the auction clearing price is NT$50.2. While its weighted average winning bid price is NT$51.14, the offering price for public subscription in the second-stage IPO is fixed at NT$36.

The stock opens and closes at the upper price limit of NT$38.5 with one lot of trading volume on day 1.[25] The same situation occurs for the next 11 days, except on day 9 with two lots of trading volume. On day 13, the trading volume jumps to 2,140 lots and the stock closes at NT$83.5, still maintaining the trend of hitting the upper price limit. The trend ends on day 16 at NT$94.5, an 84.5 percent higher than the weighted average winning bid price of NT$51.14. The trading activities of this firm demonstrate that institutional constraints create an illiquid market for "hot" IPO stocks in their early days of exchange listing. Therefore, to fairly evaluate the auction performance, we need to let the market fully adjust to the values of the stocks.

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[24] In our sample, the highest number of consecutive days of hitting the upper price limit is 21; and the highest number of consecutive days of hitting the lower price limit is 3.

[25] Note that the offering price of NT$36 is the reference price for day 1. A price 7% above the reference price should be NT$38.52. However, because of a 10-cent tick size, the upper price limit on day 1 is set at NT$38.5. According to the exchange regulations, the tick size shall be 1 cent for the market value of each share less than NT$5; 5 cents for NT$5 to less than NT$15; 10 cents for NT$15 to less than NT$50; 50 cents for NT$50 to less than NT$150; 1 dollar for NT$150 to less than NT$1,000; NT$5 for NT$1,000 and above.

Table A.1. Trading Activities of a Sample Stock from Day 1 of Exchange Listing to Day 20

This company, Ultima Electronics Corp., has the highest oversubscription, 17.2, and the second highest number of consecutive (15) days, from day 1 of exchange listing, of hitting the upper price limit in our sample. The company allocated 4,069,000 shares for auction on 12/17/96 with a book value per share of 11.99 NT$. The auction base price is 24 NT$ and the auction clearing price 50.2 NT$. While its quantity-weighted average winning bid price is 51.14 NT$, the offering price for public subscription in the second-stage IPO is fixed at 36 NT$.

Day of Exchange Listing	Calendar Day	Open	High	Low	Close	Trading Volume (lots)
1	2/24/97	38.5	38.5	38.5	38.5	1
2	2/25/97	41.1	41.1	41.1	41.1	1
3	2/26/97	43.9	43.9	43.9	43.9	1
4	2/27/97	46.9	46.9	46.9	46.9	1
5	2/28/97	50	50	50	50	1
6	3/1/97	53.5	53.5	53.5	53.5	1
7	3/3/97	57	57	57	57	1
8	3/4/97	60.5	60.5	60.5	60.5	1
9	3/5/97	64.5	64.5	64.5	64.5	2
10	3/6/97	69	69	69	69	1
11	3/7/97	73.5	73.5	73.5	73.5	1
12	3/8/97	78.5	78.5	78.5	78.5	1
13	3/10/97	83.5	83.5	80	83.5	2140
14	3/11/97	86.5	89	86	89	1261
15	3/12/97	95	95	95	95	1050
16	3/13/97	101.5	101.5	89	94.5	1844
17	3/14/97	93	94	89	90	647
18	3/15/97	89.5	89.5	87	88.5	718
19	3/17/97	89	94.5	89	94.5	841
20	3/18/97	97	97	89	91	1313

Appendix B. A Bias in Measuring IPO Initial Returns Using "Non-Hit" Price

Our finding of no significant underpricing differs from two previous studies that similarly examine Taiwan's IPO auctions. Liu, Wei, and Liaw (2001) show an underpricing of 7.8% in a sample of 52 auctions; and Chen, Leung, and Liaw (2003) examine 67 auctions and report an underpricing of 6.7 percent. Both studies recognize that, for some IPOs, it may take several days to reach their "equilibrium" values since the exchange rules in Taiwan impose a daily price limit of seven percent above or below a reference price. Hence, to compute the IPO initial return, both studies use the "non-hit" price, the first closing market price in the post-IPO market that does not reach the upper price limit. Their approach ignores any adjustments in the market value of the IPO shares after the "non-hit" price is observed, and could lead to a bias in measuring IPO initial returns.

To illustrate, we report in Table A.2 the average daily *MAR*'s from day 1, the first day the closing market price did not hit the price limit, through day 20. The return on day 1 is measured from the quantity-weighted average winning bid price from the IPO auction to the closing price on day 1. The average *MAR* on day 1 is 8.33% and significant at 1% level. Like Liu, Wei, and Liaw (2001) and Chen, Leung, and Liaw (2003), if we had measure the auction performance based on the "non-hit" price, we would have claimed that the average underpricing is significantly different from zero. In fact, the magnitude of *MAR* on day 1 is very close to the level of underpricing both studies suggested.

However, the *MAR*'s on days 2 through 4 and five other days are significantly negative, suggesting that the "non-hit" price does not fully reflect the value of IPO shares.

As a result, it is not a “good” price for measuring the pricing performance of IPO auctions.

Table A.2. Daily Market-Adjusted Returns of the 89 IPOs from the Day the "Non-Hit" Price Observed (Day 1) Through Day 20

The daily market-adjusted returns are measured by $MAR_{i,t} = R_{i,t} - R_{m,t}$, where $R_{i,t}$ is the return on stock *i* on day *t*; and $R_{m,t}$ is the corresponding return on the Taiwan value-weighted market index. Day 1 is the first day that the closing market price did not hit the price limit. The return on day 1 is measured from the quantity-weighted average winning bid price to the close market price on day 1.

Event Day	*Average MAR (%)*	*t*-value [a]	*Average Cumulative MAR (%)*	*t*-value [a]
1	8.33	3.39 ***	8.33	3.39 ***
2	-1.36	-3.12 ***	6.97	2.75 ***
3	-0.79	-1.92 *	6.18	2.34 **
4	-0.68	-1.82 *	5.50	2.00 **
5	-0.53	-1.26	4.97	1.73 *
6	0.08	0.23	5.05	1.73 *
7	-0.05	-0.14	5.01	1.73 *
8	-0.69	-2.02 **	4.32	1.49
9	-0.11	-0.33	4.21	1.45
10	-0.90	-1.84 *	3.31	1.10
11	-0.38	-1.27	2.92	0.97
12	-0.33	-1.18	2.60	0.86
13	-0.71	-2.03 **	1.88	0.63
14	-0.59	-1.73 *	1.30	0.43
15	-0.45	-1.19	0.84	0.27
16	0.29	0.93	1.13	0.36
17	0.11	0.39	1.24	0.39
18	-0.51	-1.71 *	0.73	0.23
19	-0.04	-0.14	0.69	0.21
20	0.28	1.01	0.98	0.30

[a] Daily cross-sectional standard errors are used in computing the t-values.

***, **, * significant at the 1%, 5%, and 10% level, respectively.

Table 1. The Annual Frequency and Percentage of Auctions in IPOs Held in Taiwan

Starting in 1995, the year in which a firm in Taiwan could choose to auction its shares of common stock or follow the conventional fixed-price offering in the IPO. The annual frequency and percentage of IPO auctions are based on the Chinese Securities Association's statistics, which count the number of firms using auctions by the bids opening date, instead of the first date of exchange listing.

Year	Auction Frequency	Percentage of Auctions in All IPOs
1995	1	1.75
1996	11	16.92
1997	19	67.86
1998	29	46.03
1999	15	13.27
2000	9	9.09
2001	3	2.75
2002	2	2.44
Total	89	6.92

Table 2. Characteristics of IPO Auctions

This table reports the means of each variable for the whole sample and the three subsamples based on *Inst_Alloc*, the proportion of shares won by institutional investors in auction.

Variable	Whole sample N=89	*Inst_Alloc*=0 N=10	0<*Inst_Alloc*<20% N=50	*Inst_Alloc*≥20% N=29
Shares designated for auction (million)	12.20	5.39	6.53	24.34
Shares for auction/shares outstanding (%)	6.53	7.43	6.15	6.86
Auction size (million NT$) (Base price times shares for auction)	836.98	117.31	244.25	2107.09
Base price (NT$), P_b (Minimum acceptable bid price)	44.57	21.04	36.93	65.84
Auction clearing price (NT$), P_c	76.79	32.02	69.27	105.19
Weighted Average Winning Price (NT$), P_w	79.41	33.70	71.87	108.19
Public subscription price (NT$), P_o	63.45	29.51	52.86	93.43
Number of bids	954.06	230.8	991.72	1138.52
Number of bidders	687.91	177.3	714.08	818.86
Bid size per bidder (lots)	49.54	76.96	44.66	48.51
Number of institutional bidders	31.44	1.9	24.72	53.21
Proportion of all bids in shares submitted by institutions (%)	21.95	3.75	15.43	38.21
Inst_Alloc (%) (Percentage of shares won by institutions)	18.95	0	10.37	40.28
Oversubcription (%)	366.77	212.93	436.93	298.86
Number of business days from auction to 1st day of exchange listing	42.09	45.40	42.04	41.03

Table 3. Characteristics of Institutional Investors and Retail Investors in IPO Auctions

This table reports the means of each variable for institutional investors and retail investors in the two subsamples with *Inst_Alloc>0*. The t-value tests whether the two means are equal in a given variable within a given allocation group.
The winning rate of institutions is defined as shares won by institutions divided by all shares submitted by institutions.
The winning rate of retail investors is similarly defined.

Variable	0<Inst_Alloc<20% N=50			Inst_Alloc≥20% N=29		
	Inst.	Retail	t-value	Inst.	Retail	t-value
Number of bidders	24.7	689.4	-6.45***	53.2	765.6	-4.14***
Number of bids	44.4	947.7	-6.17***	101.1	1037.4	-4.18***
Bid size per bidders (lots)	183.4	39.2	10.43***	245.2	31.8	6.70***
Winning rate (%)	31.9	37.9	-2.53**	48.2	45.2	1.10
Weighted average winning bid price (NT$)	71.62	71.89	-1.68*	108.28	108.19	0.33

***, **, * significant at the 1%, 5%, and 10% level, respectively.

Table 4. Daily Average Market-Adjusted Returns of the 89 IPOs from Day 1 of Exchange Listing Through Day 20

The daily market-adjusted returns are measured by $MAR_{i,t} = R_{i,t} - R_{m,t}$, where $R_{i,t}$ is the return on stock *i* on day *t*; and $R_{m,t}$ is the corresponding return on the Taiwan value-weighted market index. Day 1 is the first day of exchange list. The return on day 1 is from the quantity-weighted average winning bid price to the closing price on day 1.

Event Day	*Average MAR (%)*	*t*-value [a]	*Average Cumulative MAR (%)*	*t*-value [a]
1	-10.759	-5.584 ***	-10.759	-5.584 ***
2	3.847	7.587 ***	-6.912	-3.745 ***
3	2.670	4.855 ***	-4.243	-2.388 **
4	1.980	3.717 ***	-2.263	-1.302
5	1.221	2.207 **	-1.042	-0.574
6	1.149	2.447 **	0.107	0.056
7	0.999	2.318 **	1.106	0.559
8	1.120	2.569 **	2.227	1.078
9	0.436	1.046	2.662	1.227
10	0.754	2.000 **	3.416	1.487
11	0.240	0.604	3.657	1.536
12	0.367	0.911	4.023	1.658
13	0.007	0.013	4.030	1.537
14	-0.081	-0.244	3.949	1.499
15	-0.053	-0.157	3.895	1.449
16	0.020	0.055	3.915	1.411
17	-0.624	-1.669 *	3.292	1.181
18	-0.094	-0.280	3.198	1.121
19	-0.597	-2.179 **	2.601	0.910
20	-0.183	-0.446	2.417	0.859

[a] Daily cross-sectional standard errors are used in computing the t-values.

***, **, * significant at the 1%, 5%, and 10% level, respectively.

Table 5. The Initial Returns of the 89 IPO Auctions

This table reports the estimates of the three evaluation metrics: (1) holding period return $R_i = (P_{i,20} - P_i^w)/P_i^w$, (2) the market adjusted return $MAR_i = R_i - R_m$, and (3) the alpha from the cross-sectional regression $R_i - R_f = \alpha + \beta(R_m - R_f) + e_i$, i=1,2,…,89. $P_{i,20}$ and P_i^w are the closing price for stock *i* on the 20th day of exchange listing and its quantity-weighted average winning bid price, respectively; R_m is the holding period return on the Taiwan value-weighted market index, corresponding to R_i; and R_f the corresponding one-year deposit interest rate.

Evaluation Metric	Mean (%)	t-value [a]	Std (%)	Min (%)	Median (%)	Max (%)
Panel A: The whole sample, N=89						
R	2.39	0.74	30.47	-57.56	-1.58	89.31
MAR	2.79	1.02	25.69	-53.91	1.05	90.22
α	2.80	0.32				
Panel B: The zero institutional allocation group, N=10						
R	0.99	0.12	25.18	-38.39	-5.36	38.79
MAR	-4.31	-0.71	19.24	-24.62	-10.20	37.21
α	-4.65	-1.27				
Panel C: The low institutional allocation group, N=50						
R	-2.16	-0.53	28.80	-57.56	-2.71	77.94
MAR	-2.28	-0.68	23.47	-53.91	0.03	53.57
α	-2.20	-0.67				
Panel D: The high institutional allocation group, N=29						
R	10.71	1.70	33.97	-33.81	1.37	89.31
MAR	13.98	2.67**	28.25	-21.66	5.09	90.22
α	14.38	2.55**				

[a] The t-values are for H_o: Mean=0. Cross-sectional standard errors are used in *t*-values for *R* and *MAR*, and White's heteroskedasticity-consistent standard errors are used in t-values for α.

***, **, * significant at the 1%, 5%, and 10% level, respectively.

Table 6. Institutional Allocations in Winners and Losers

This table reports the summary statistics of *Inst_Alloc,* the percentage of shares won by institutional investors in auctions, conditional on the IPO initial return based on the MAR_i .

	Mean (%)	t-value[a]	Std (%)	Min (%)	Max (%)
Panel A: $MAR_i \geq 20\%$, N=19					
Inst_Alloc	26.72		19.67	0	61.95
MAR	40.95		19.16	21.71	90.22
Panel B: $0 \leq MAR_i < 20\%$, N=30					
Inst_Alloc	19.52	1.22	20.27	0	84.78
MAR	5.91		5.18	0.18	16.57
Panel C: $0 > MAR_i \geq -20\%$, N=27					
Inst_Alloc	16.37	2.02**	15.02	0	47.67
MAR	-11.07		6.38	-19.93	-0.12
Panel D: $MAR_i < -20\%$, N=13					
Inst_Alloc	11.60	2.56**	9.50	0	35.25
MAR	-31.38		10.47	-53.90	-21.09

[a] The t-values are for testing whether *Inst_Alloc* in the subsample of $MAR_i \geq 20\%$ is equal to *Inst_Alloc* in other subsamples.

***, **, * significant at the 1%, 5%, and 10% level, respectively.

Table 7. Definition of Variables

Variable name	Definition
Panel A: Endogenous variables	
$R_i - R_f$	IPO initial return from auction day to the 20th day of exchange listing; and R_f is the corresponding one-year deposit interest rate
$Inst\_Alloc_i$	The percentage of shares for auction won by institutional investors
$P_{inst} - P_{retail}$	The difference between institutional investors' and retail investors' quantity-weighted average winning bid prices
MAR_i	$R_i - R_m$
$Oversub_i$	Total demand for shares by bidders / shares for auction
Panel B: Exogenous variables	
$R_m - r_f$	HPR for the Taiwan VW Market Index from auction day to the 20th day of exchange listing
Ht	High tech dummy
Size	Log(base price x shares designated for auction)
BaseP	1/(auction base price)
$R_{m(-1,-30)}$	Average daily return on the Taiwan VW Market Index from 30 days before to one day before auction day
$NHt * R_{m(-1,-30)}$	Non-High tech dummy times $R_{m(-1,-30)}$
$Ht * R_{m(-1,-30)}$	High tech dummy times $R_{m(-1,-30)}$
$\sigma_{m(-1,-30)}$	Std dev of daily returns on the Taiwan VW Market Index from 30 days before to one day before auction day
Share%	Share for auction / shares outstanding
Elast	Gross elasticity of demand (see footnote 18)
Tse	Dummy for IPOs listed on the Taiwan Stock Exchange (see footnote 19)
Age	Firm age at IPO
Days_to_List	Days from auction to exchange listing
Year Dummies	Year dummies

Table 8. The Relation Between Institutional Allocations and Underpricing

$$Inst\_Alloc_i = a_0 + a_1 MAR_i + a_2 Size_i + a_3 BaseP_i + a_4 NHt_i \times R_{m(-1,-30)} + u_i \quad (1)$$

$$R_i - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + e_i \quad (2)$$

$$R_i - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + \gamma_1 Ht_i \times R_{m(-1,-30)} + \gamma_2 NHt_i \times R_{m(-1,-30)} + \gamma_3 Share\%_i + \gamma_4 Elast_i + e_i \quad (2')$$

The two systems of eqs.(1)-(2) and (1)-(2') are estimated separately using the 3sls. The endogenous variables are $R_i - R_f$, $Inst\_Alloc_i$, and MAR_i. All the exogenous variables listed in Table 7 were included in the first-stage regressions. The t-values are given below the coefficient estimates, and the 2sls adjusted R-squares are reported at the bottom of the table.

	Eqs. (1)-(2)		Eqs.(1)-(2')	
	$Inst\_Alloc_i$	$R_i - R_f$	$Inst\_Alloc_i$	$R_i - R_f$
Constant	-0.257 (-1.23)	-0.142*** (-2.77)	-0.285 (-1.33)	-0.278*** (-3.86)
$Inst\_Alloc_i$		0.904*** (3.88)		0.759*** (3.26)
MAR_i	0.325*** (3.55)		0.226** (2.33)	
Size	0.040** (2.57)		0.043*** (2.70)	
BaseP	-2.134** (-2.07)		-2.483** (-2.36)	
$NHt * R_{m(-1,-30)}$	0.165** (2.12)		0.214** (2.50)	-0.302** (-2.08)
$Ht * R_{m(-1,-30)}$				0.185* (1.90)
$R_m - r_f$		1.127*** (6.93)		1.077*** (6.98)
Share%				1.956** (2.25)
Elast				0.005** (2.12)
2sls Adj. R^2	0.367	0.349	0.367	0.449

***, **, * significant at the 1%, 5%, and 10% level, respectively.

Table 9. Institutional Allocations, Bids, and Initial Returns

$$Inst\_Alloc_i = a_0 + a_1 MAR_{inst} + a_2 Size_i + a_3 BaseP_i + a_4 NHt_i \times R_{m(-1,-30)} + a_6 (P_{inst} - P_{retail}) + u_i \quad (1')$$

$$R_{inst} - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + e_i \quad (2'')$$

$$P_{inst} - P_{retail} = c_0 + c_1 Inst\_Alloc_i + c_2 NHt_i \times R_{m(-1,-30)} + \delta_i \quad (3)$$

$$R_{inst} - R_f = \alpha_0 + \alpha_1 Inst\_Alloc_i + \beta(R_m - R_f) + \gamma_1 Ht_i \times R_{m(-1,-30)} + \gamma_2 NHt_i \times R_{m(-1,-30)} + \gamma_3 Share\%_i + \gamma_4 Elast_i + e_i \quad (2''')$$

The two systems of eqs.(1')-(2'')-(3) and (1')-(2''')-(3) are estimated separately using the 3sls. Since there are ten auctions with no institutional winner, we employ data from the remaining 79 auctions in estimation. While R_i in eq.(2) is the return based on the quantity-weighted average winning bid price of both institutional and retail investors, R_{inst} in eq.(2'') is the return based on the quantity-weighted average winning bid price of institutional investors only. The endogenous variables are $R_{inst} - R_f$, $Inst\_Alloc_i$, $MAR_{inst} = R_{inst} - R_m$, and $P_{inst} - P_{retail}$ (the logarithm of the difference between institutional investors' and retail investors' quantity-weighted average winning bid prices). All the exogenous variables listed in Table 7 were included in the first-stage regressions. The t-values are given below the coefficient estimates, and the 2sls adjusted R-squares are reported at the bottom of the table.

Table 9. (Continued)

	Eqs. (1)-(2)-(3)			Eqs.(1)-(2')-(3)		
	$Inst\_Alloc_i$	$R_{inst}-R_f$	$P_{inst}-P_{retail}$	$Inst\_Alloc_i$	$R_{inst}-R_f$	$P_{inst}-P_{retail}$
Constant	-0.151 (-0.81)	-0.140** (-2.40)	-0.013*** (-3.15)	-0.117 (-0.62)	-0.300*** (-3.99)	-0.013*** (-3.11)
$Inst\_Alloc_i$		0.853*** (3.55)	0.057*** (3.23)		0.872*** (3.42)	0.056*** (3.19)
$P_{inst}-P_{retail}$	4.936*** (3.44)			5.402*** (3.69)		
MAR_i	0.328*** (4.46)			0.271*** (3.55)		
Size	0.030** (2.15)			0.027* (1.92)		
BaseP	-0.829 (-0.76)			-0.969 (-0.90)		
$NHt*R_{m(-1,-30)}$	0.488*** (4.35)		-0.059*** (4.17)	0.597*** (5.01)	-0.551*** (-2.93)	-0.059*** (-4.17)
$Ht*R_{m(-1,-30)}$					0.189* (1.96)	
R_m-r_f		1.097*** (6.47)			1.002*** (6.43)	
Share%					2.219** (2.40)	
Elast					0.004* (1.70)	
2sls Adj. R^2	0.369	0.336	0.16	0.369	0.450	0.159

***, **, * significant at the 1%, 5%, and 10% level, respectively.

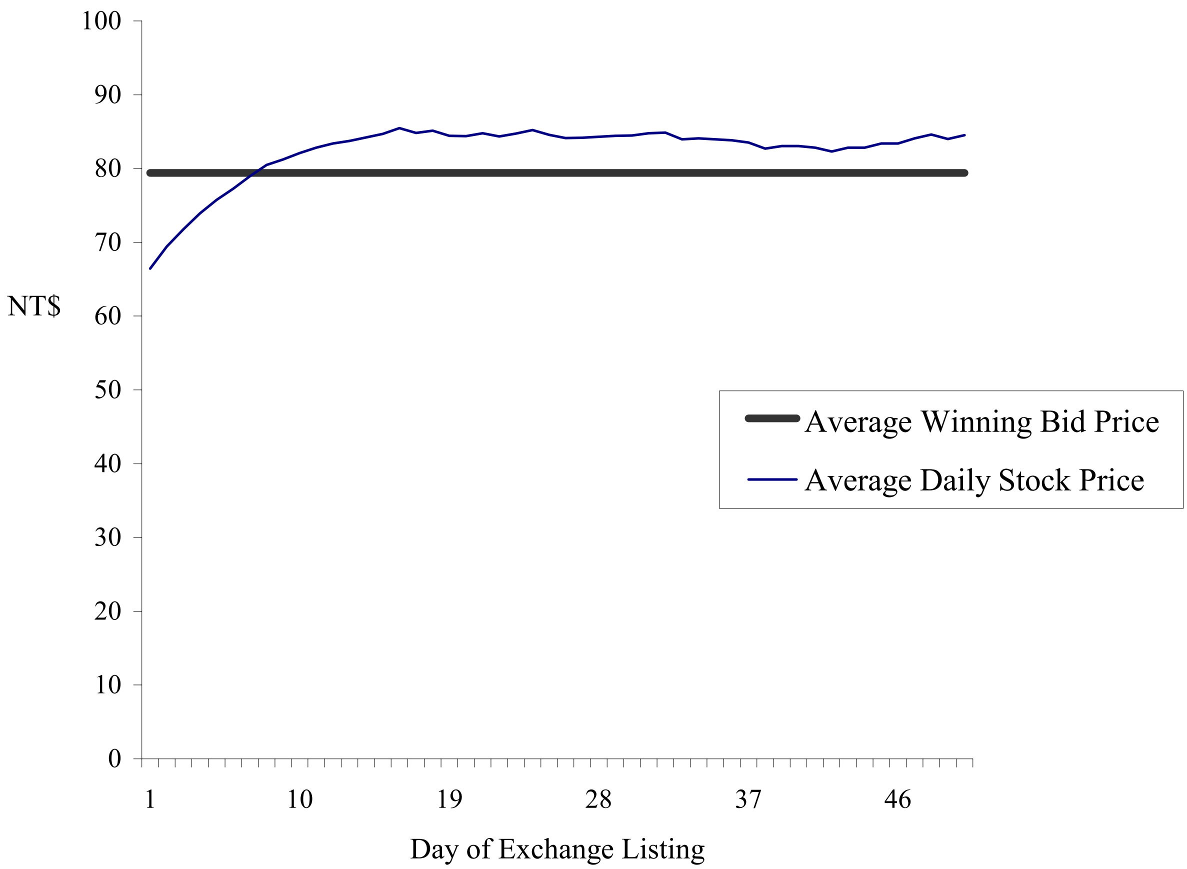

Figure 1. The Average Daily Stock Price of the 89 IPOs

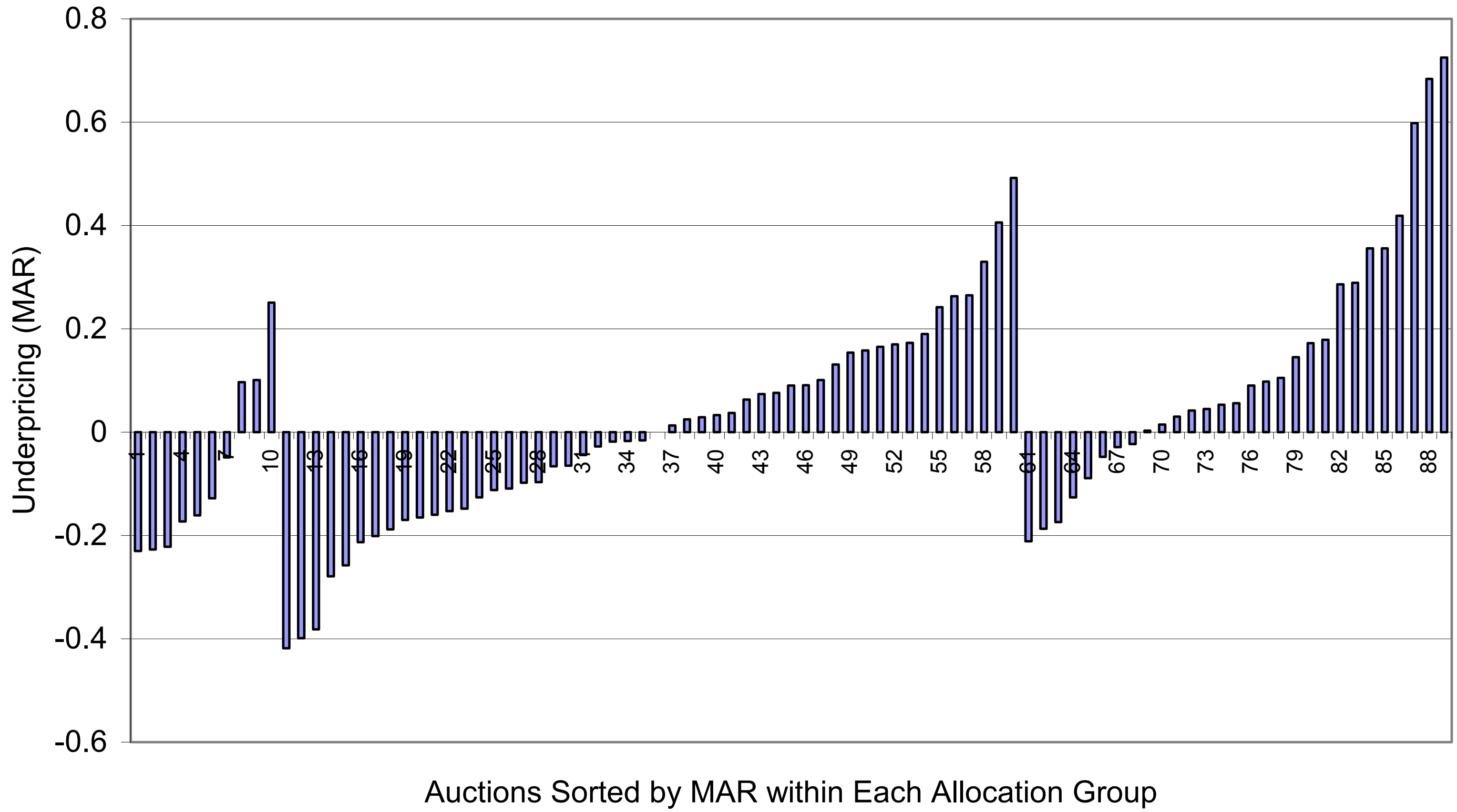

Figure 2. The Distributions of Underpricing in the Zero (auctions1-10), Low (auctions 11-60), and High (auctions 61-89) Institutional Allocation Groups